APPENDIX D

HEC-ResSim SIMULATIONS

Modified RIOP Consultation Modeling

No Action (RIOP) and Recommended Plan (Modified RIOP) Comparison

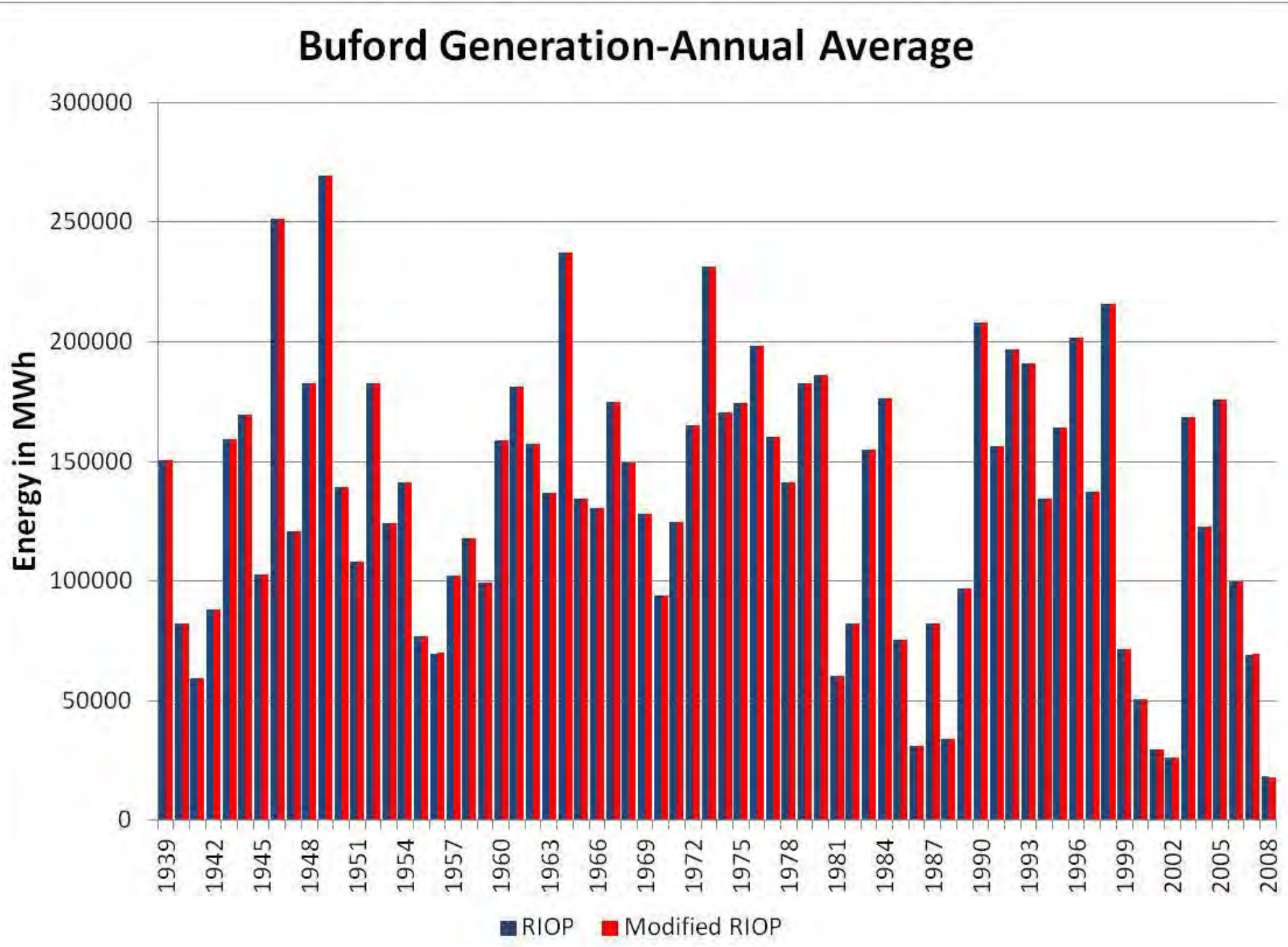
May 2012

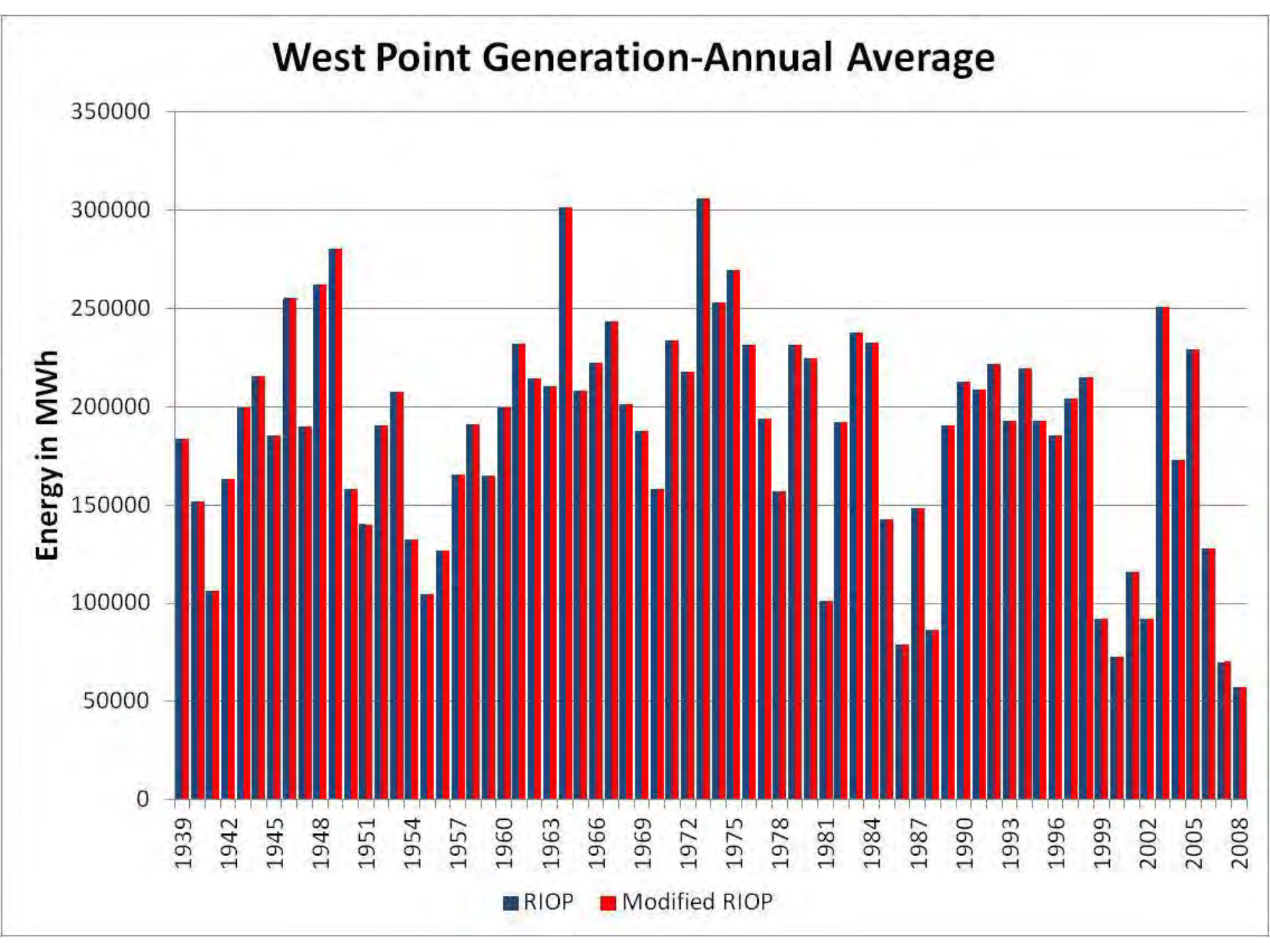
Comparisons

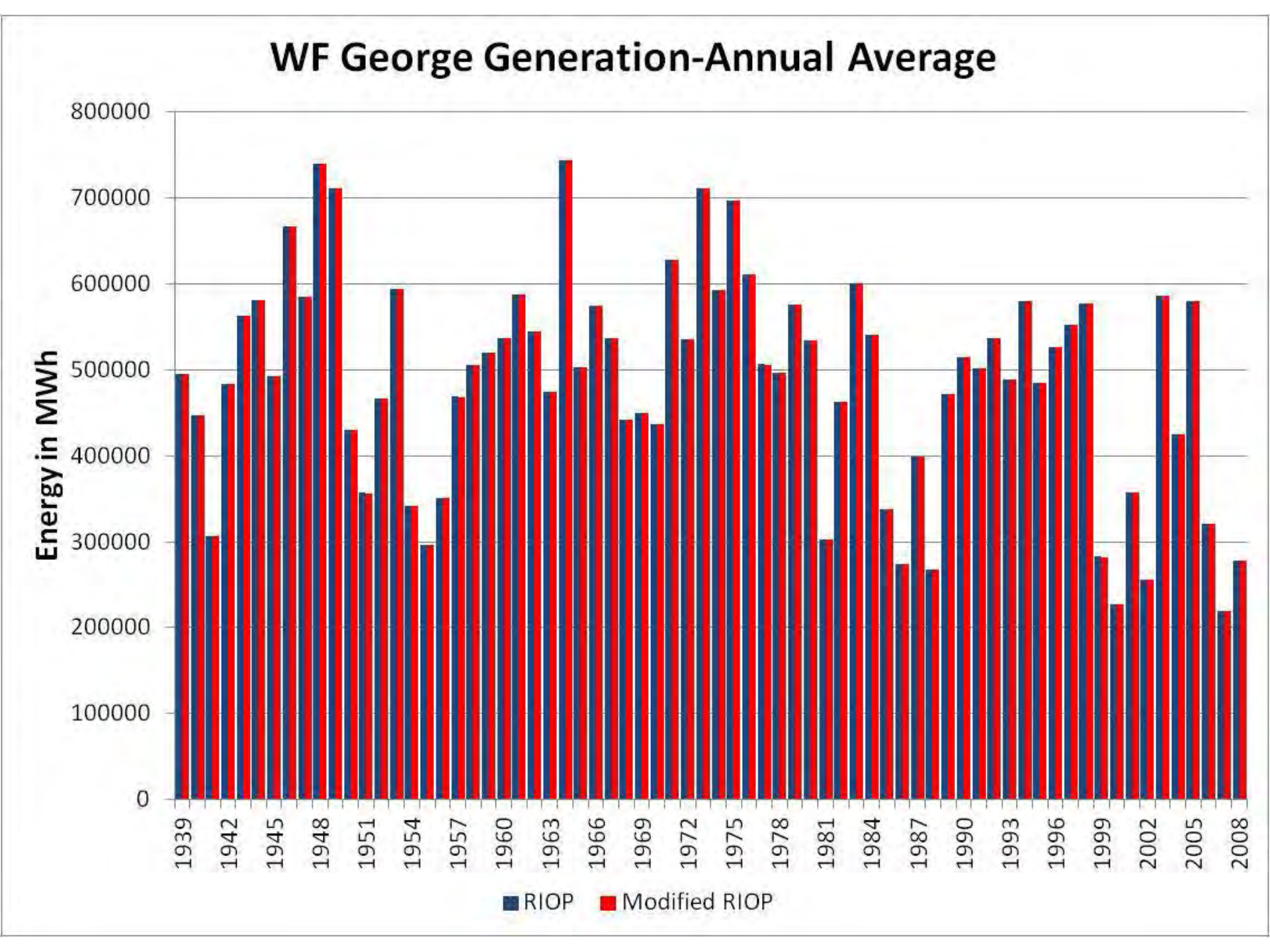
No Action (RIOP)
Recommended Plan – (Modified RIOP)

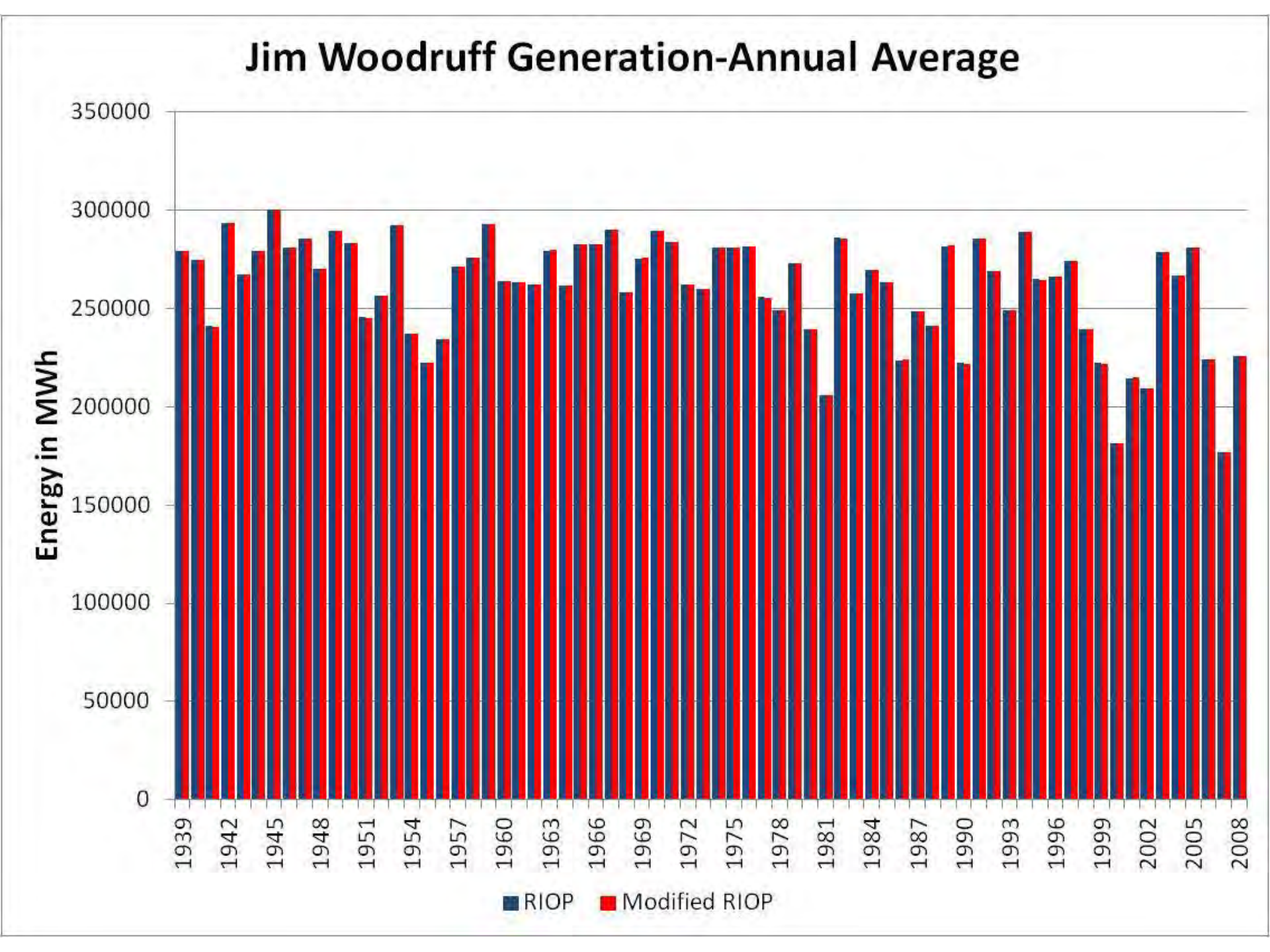
- Generation
  - Total Annual
  - Average Monthly Total
- Reservoir Elevations
  - Range
  - Average, Maximum, Minimum
  - Duration: Annual, Monthly
- Flow
  - Average Daily: Atlanta, Columbus, George Andrews, Chattahoochee Gage
  - Minimum Daily: Atlanta, Columbus, George Andrews, Chattahoochee Gage
  - Annual Duration: Atlanta, Columbus, George Andrews, Chattahoochee Gage
  - Yearly Average Duration: Atlanta, Columbus, George Andrews, Chattahoochee Gage
  - Monthly Duration: Chattahoochee Gage
- Drought Operations

Annual Generation

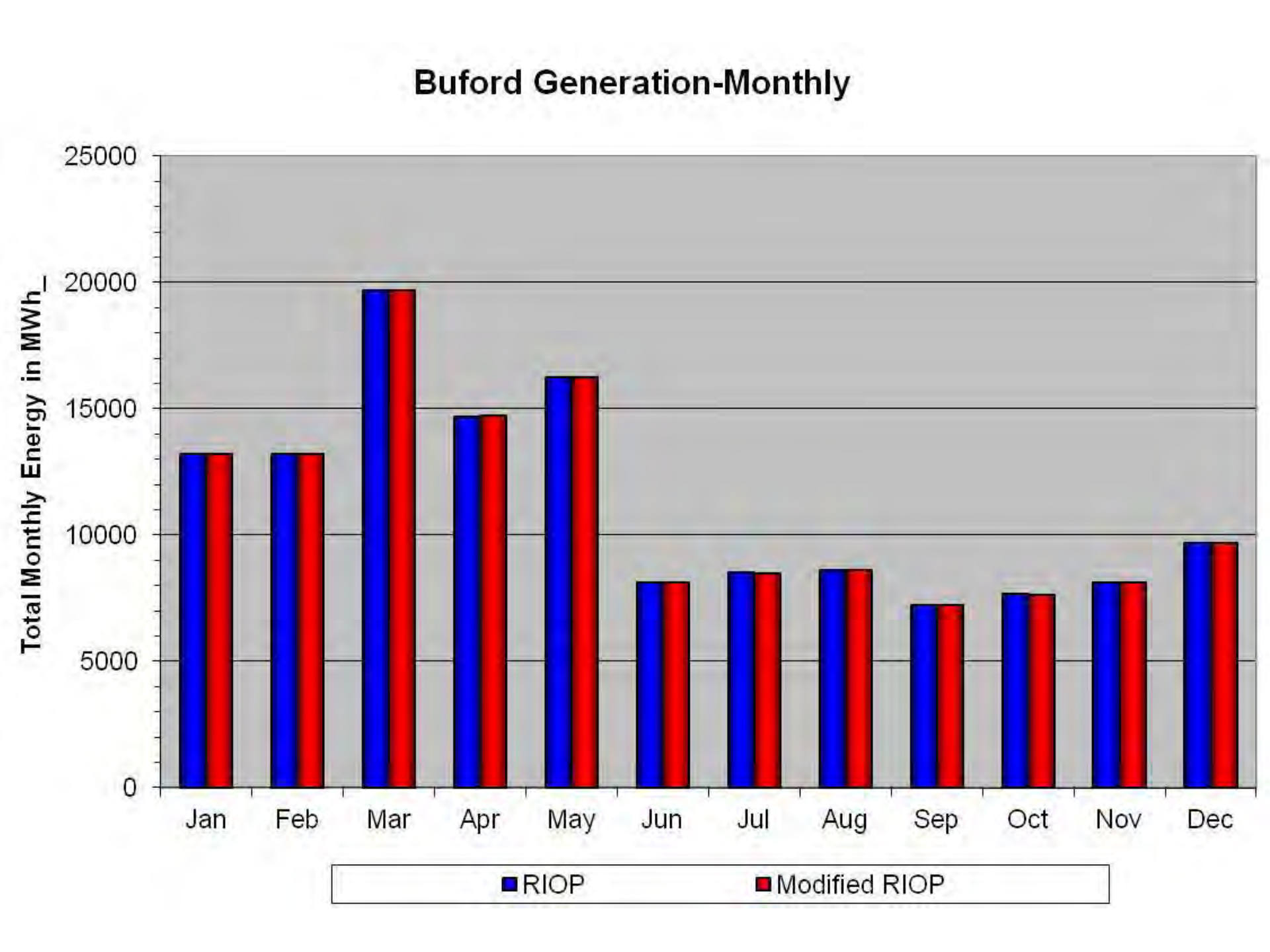

Buford Generation-Annual Average
Energy in MWh
300000
250000
200000
150000
100000
50000
0
1939
1942
1945
1948
1951
1954
1957
1960
1963
1966
1969
1972
1975
1978
1981
1984
1987
1990
1993
1996
1999
2002
2005
2008
RIOP
Modified RIOP

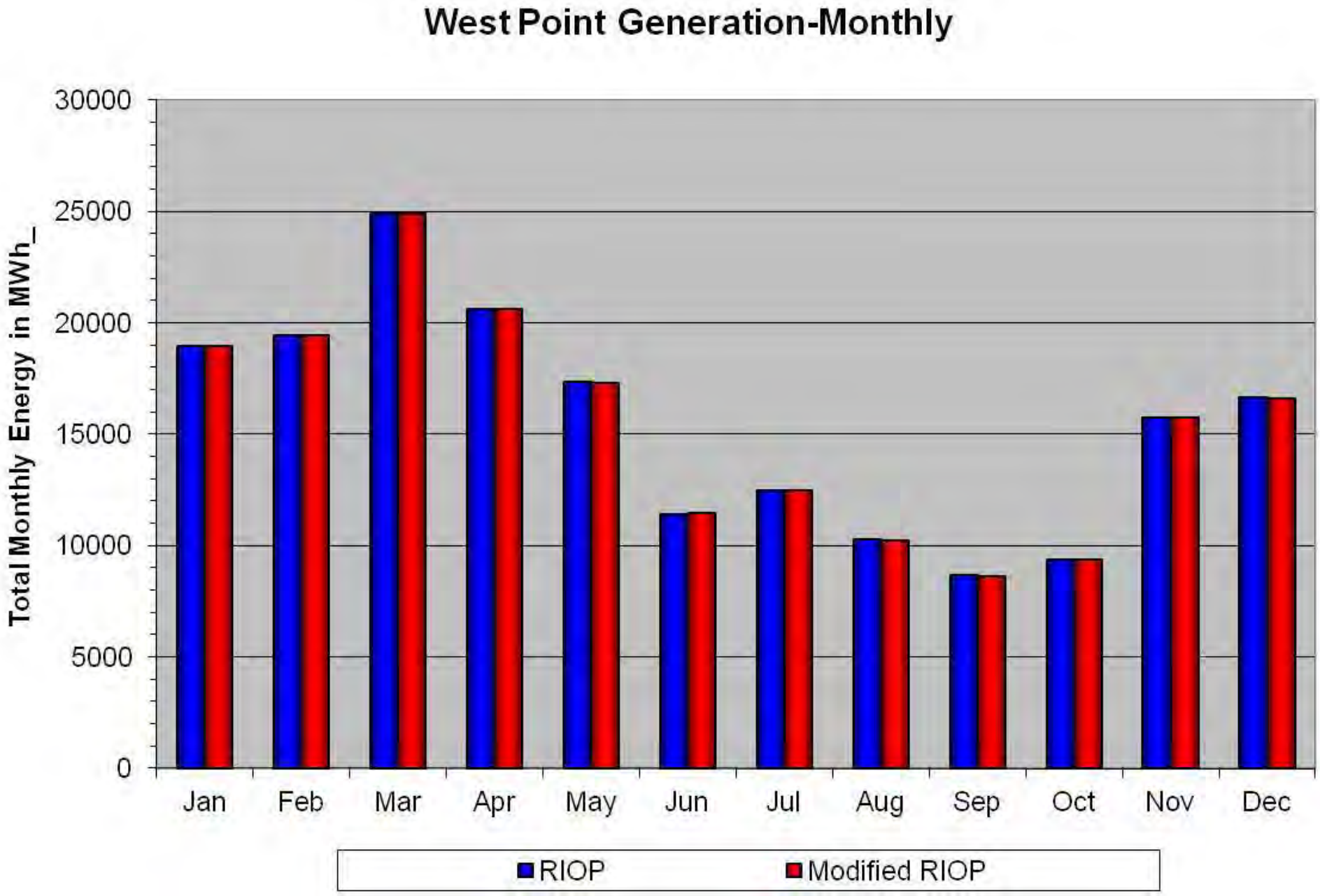

West Point Generation-Annual Average
Energy in MWh
350000
300000
250000
200000
150000
100000
50000
0
1939
1942
1945
1948
1951
1954
1957
1960
1963
1966
1969
1972
1975
1978
1981
1984
1987
1990
1993
1996
1999
2002
2005
2008
RIOP
Modified RIOP

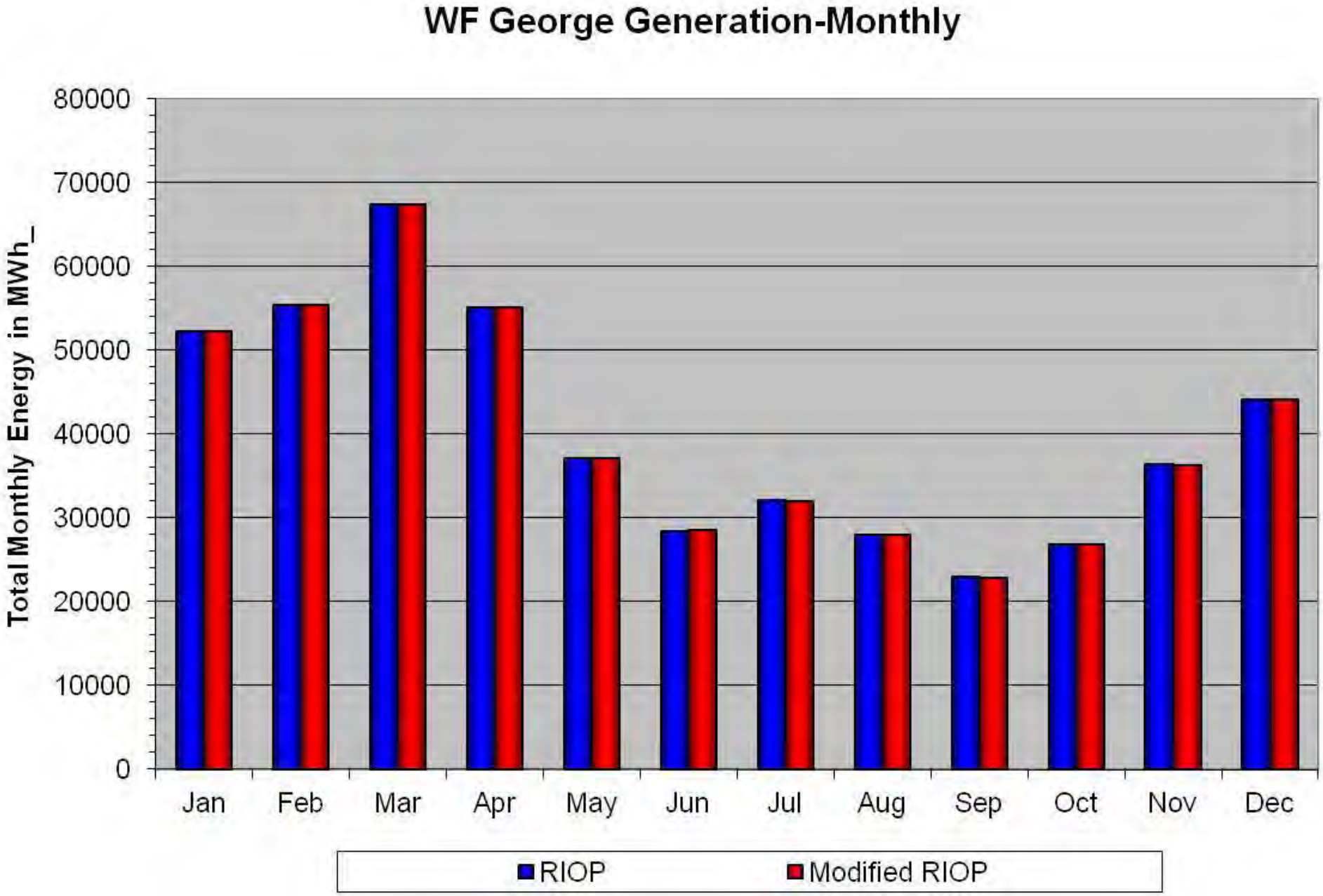

WF George Generation-Annual Average
Energy in MWh
800000
700000
600000
500000
400000
300000
200000
100000
0
1939
1942
1945
1948
1951
1954
1957
1960
1963
1966
1969
1972
1975
1978
1981
1984
1987
1990
1993
1996
1999
2002
2005
2008
RIOP
Modified RIOP

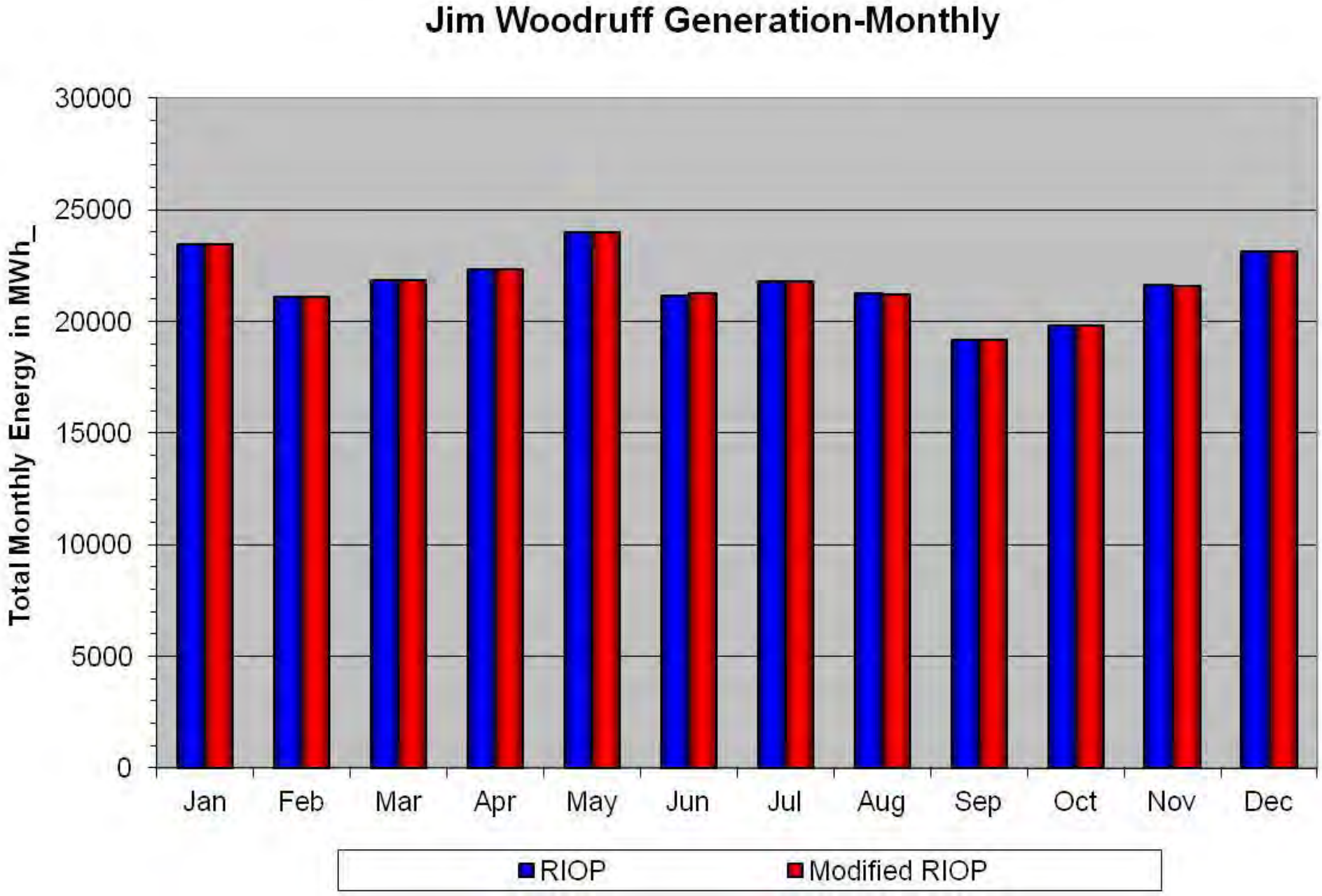

Jim Woodruff Generation-Annual Average
Energy in MWh
350000
300000
250000
200000
150000
100000
50000
0
1939
1942
1945
1948
1951
1954
1957
1960
1963
1966
1969
1972
1975
1978
1981
1984
1987
1990
1993
1996
1999
2002
2005
2008
RIOP
Modified RIOP

Monthly Generation


Buford Generation-Monthly
Total Monthly Energy in MWh_
25000
20000
15000
10000
5000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
RIOP
Modified RIOP

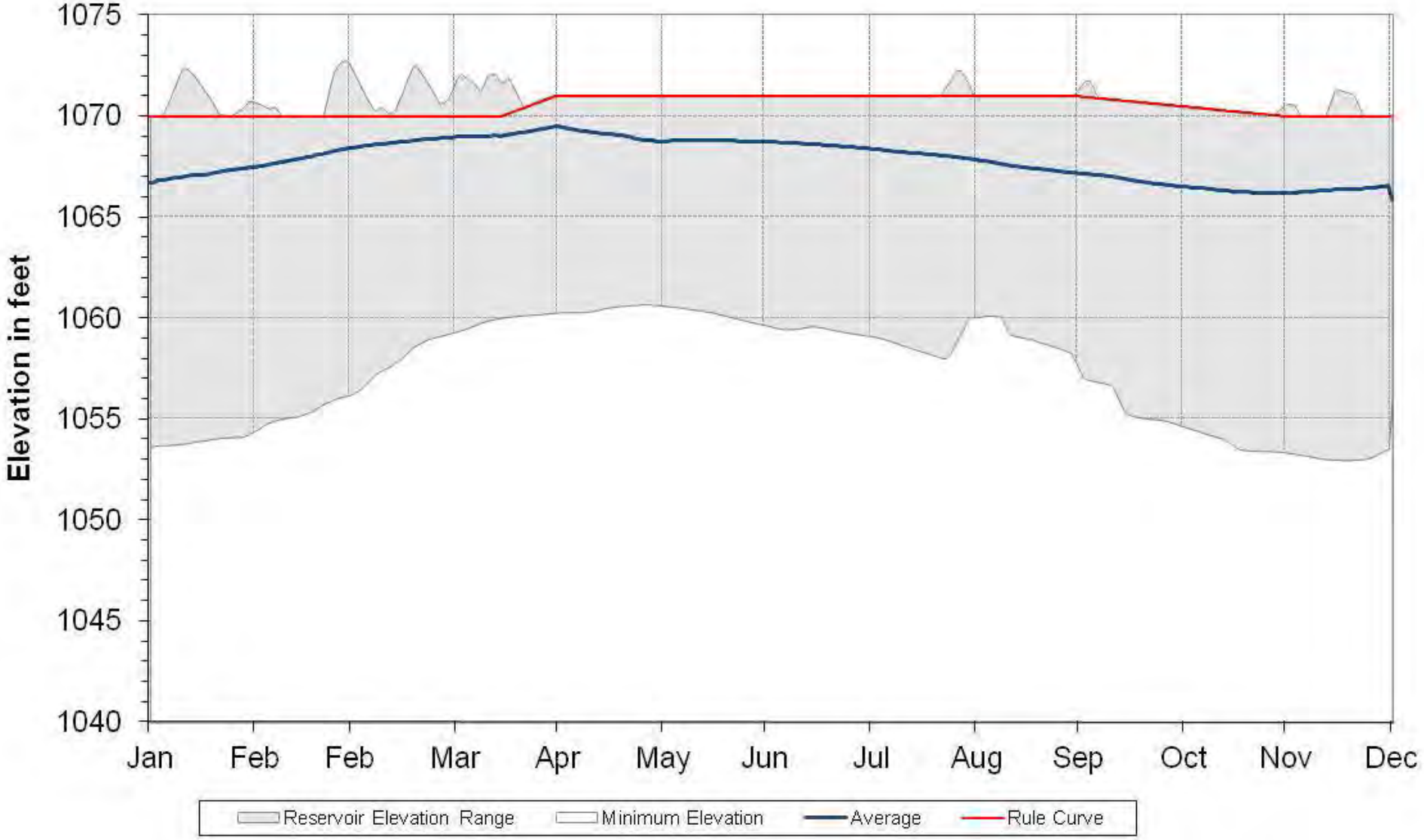

West Point Generation-Monthly
Total Monthly Energy in MWh_
30000
25000
20000
15000
10000
5000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
RIOP
Modified RIOP


WF George Generation-Monthly
Total Monthly Energy in MWh_
80000
70000
60000
50000
40000
30000
20000
10000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
RIOP
Modified RIOP

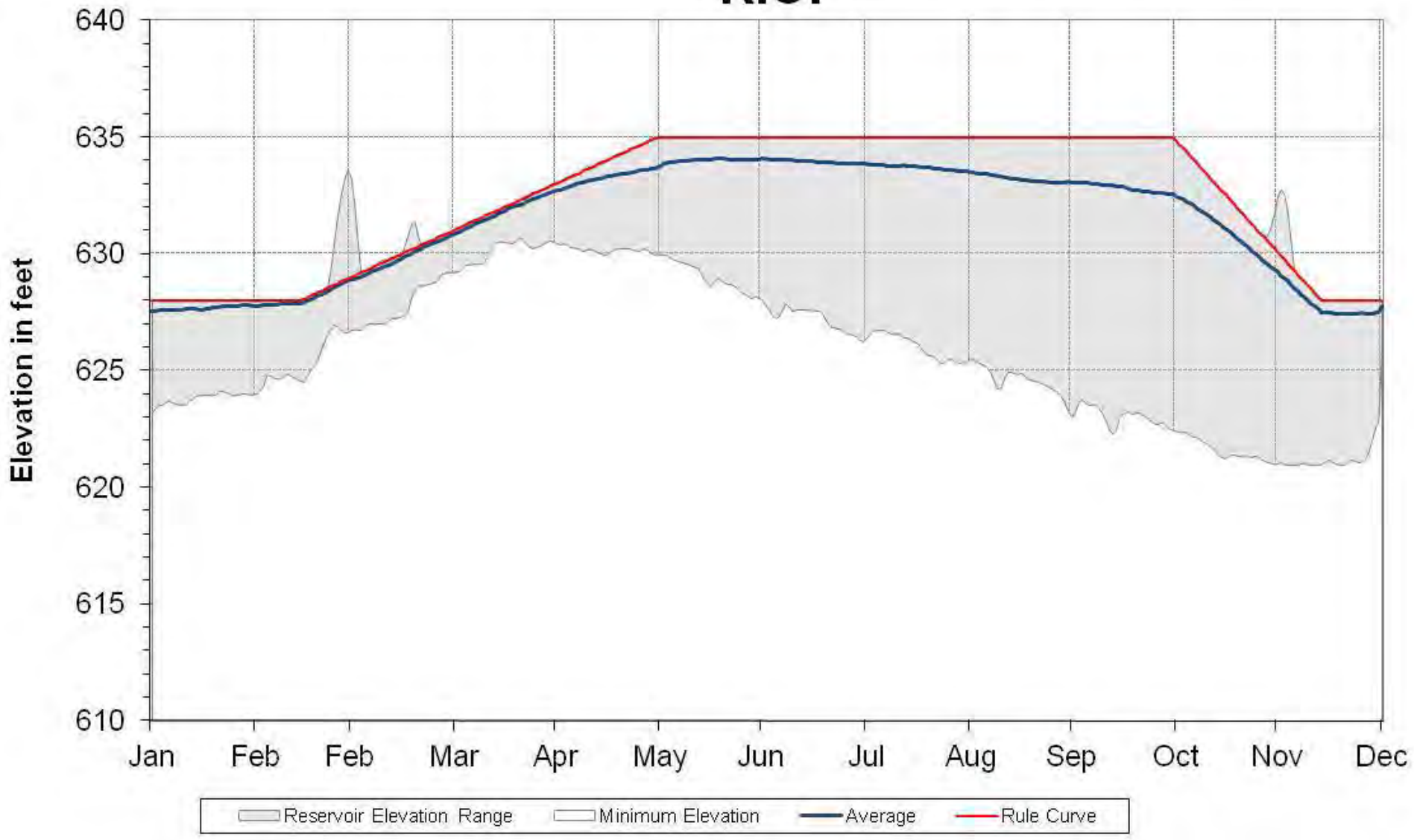

Jim Woodruff Generation-Monthly
Total Monthly Energy in MWh_
30000
25000
20000
15000
10000
5000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
RIOP
Modified RIOP

Pool Elevation Range

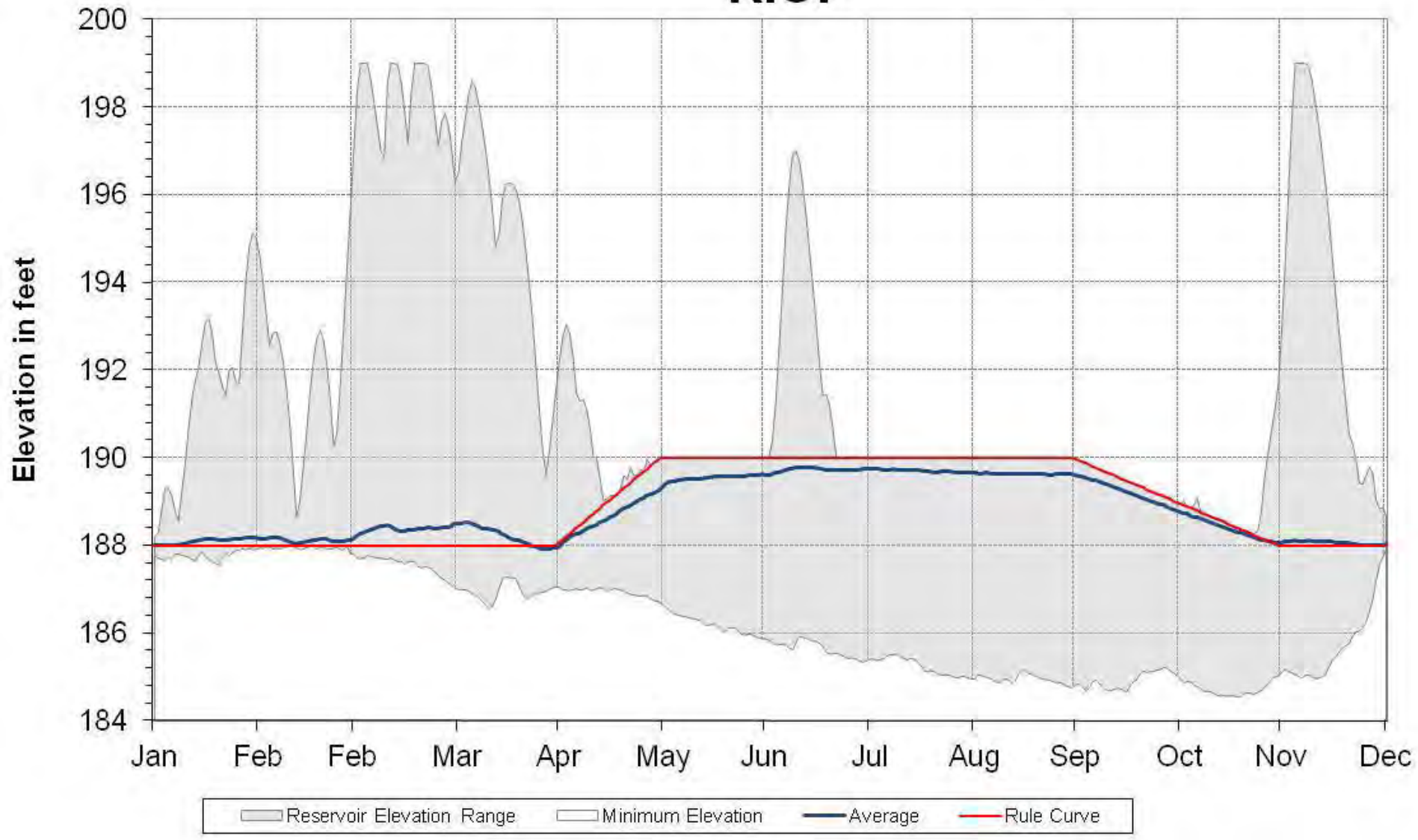
Buford Pool Elevation-Range Modified RIOP



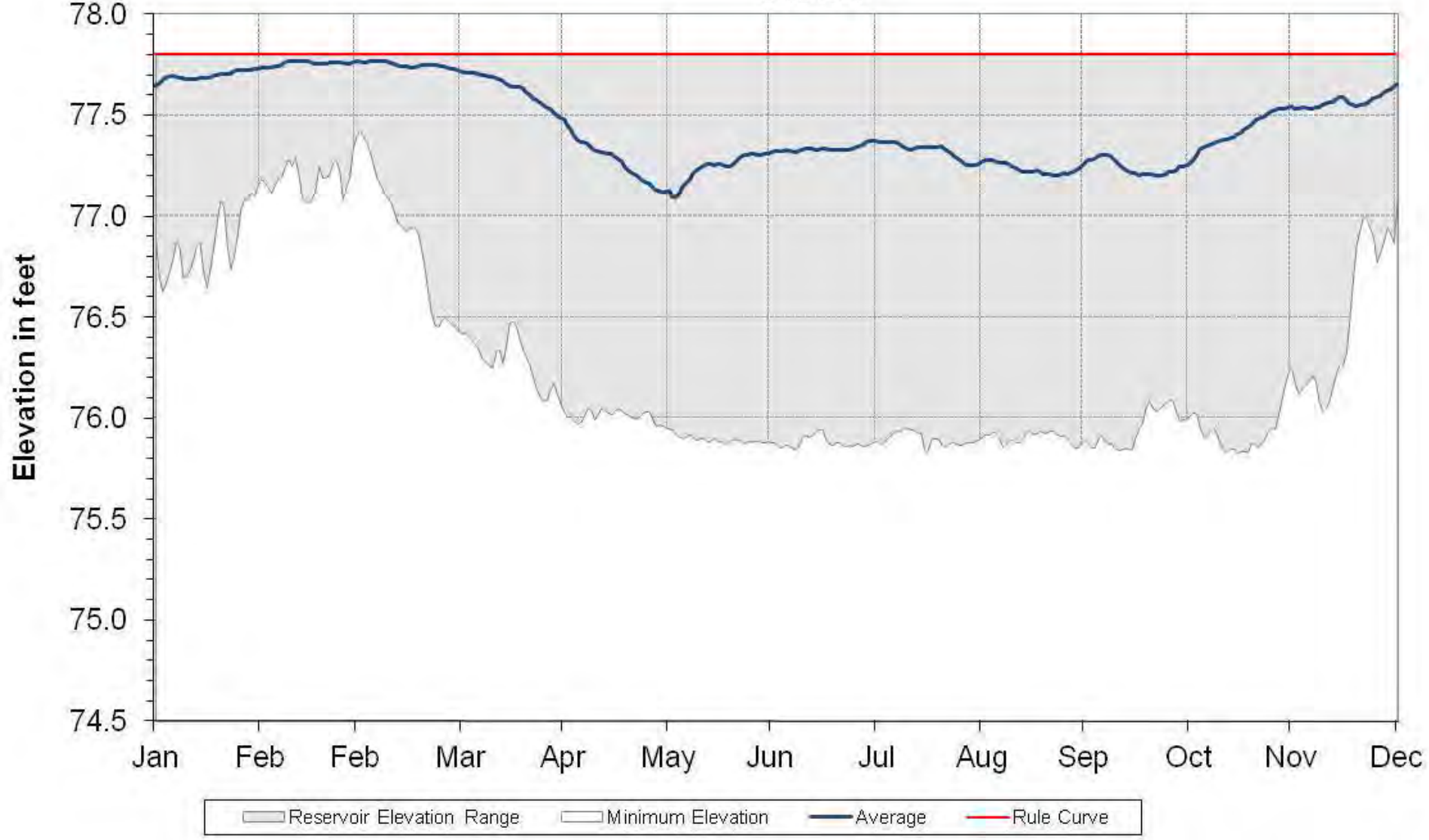
West Point Pool Elevation-Range Modified RIOP



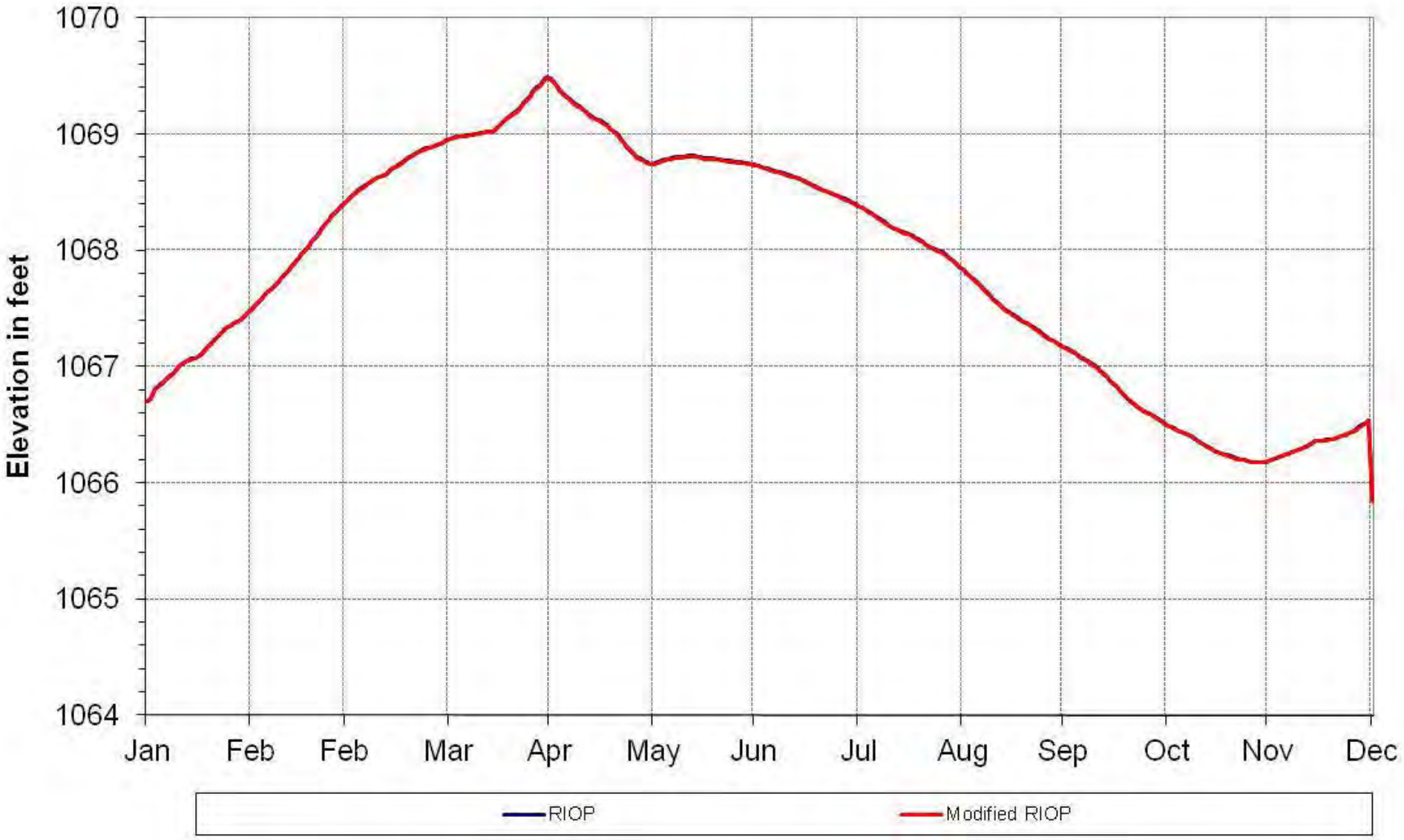
WF George Pool Elevation-Range Modified RIOP



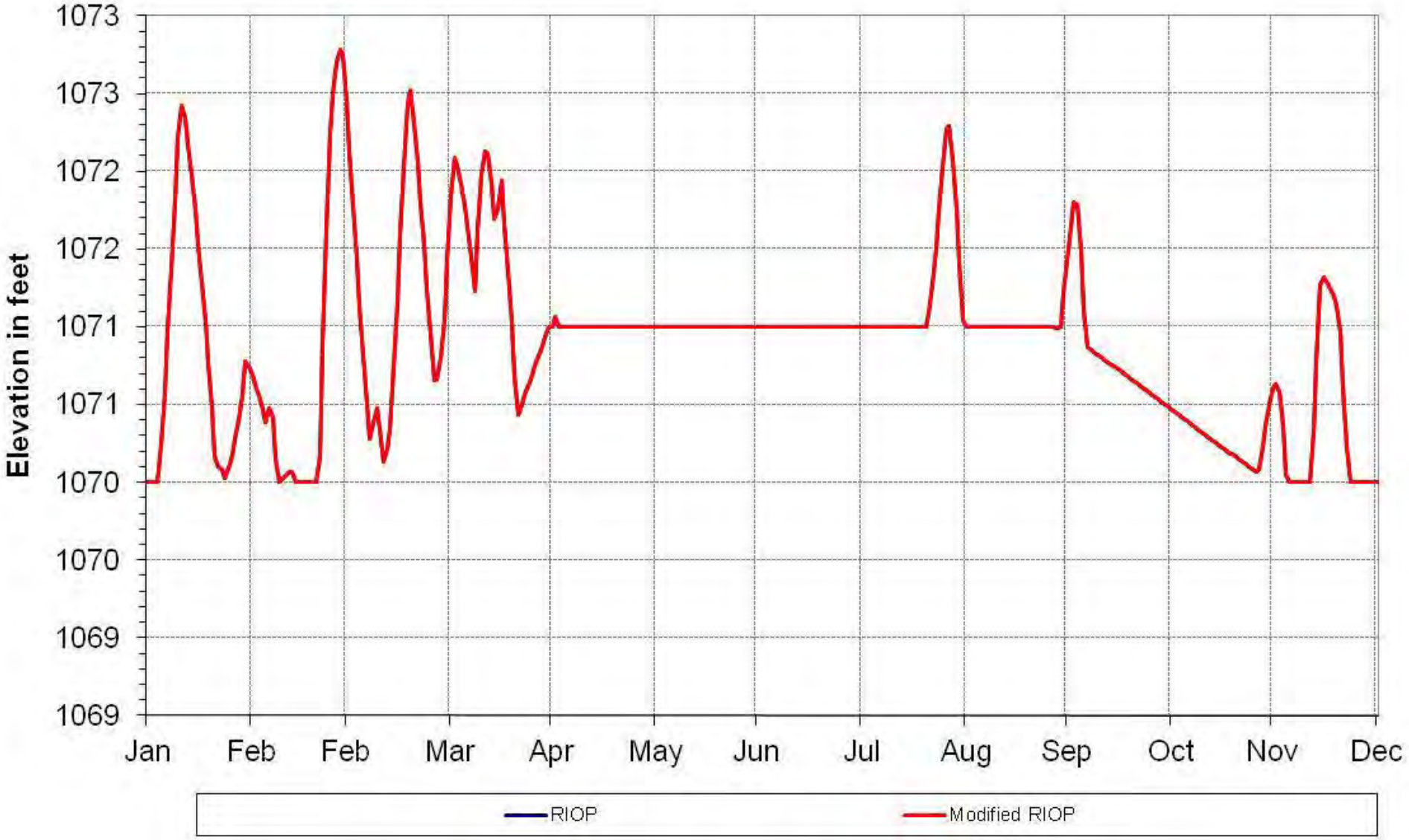
Jim Woodruff Pool Elevation-Range Modified RIOP



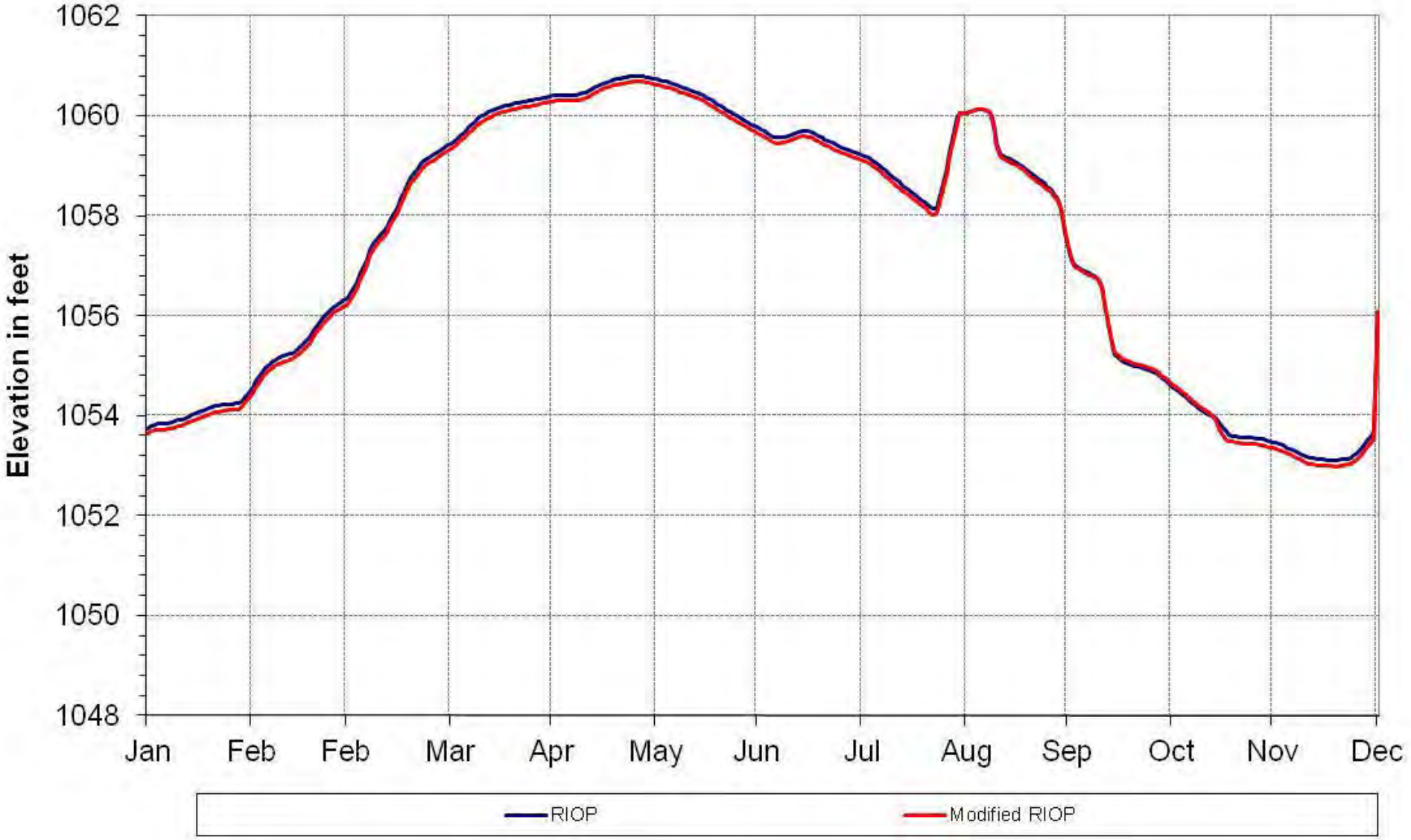
Buford Pool Elevation-Daily Average



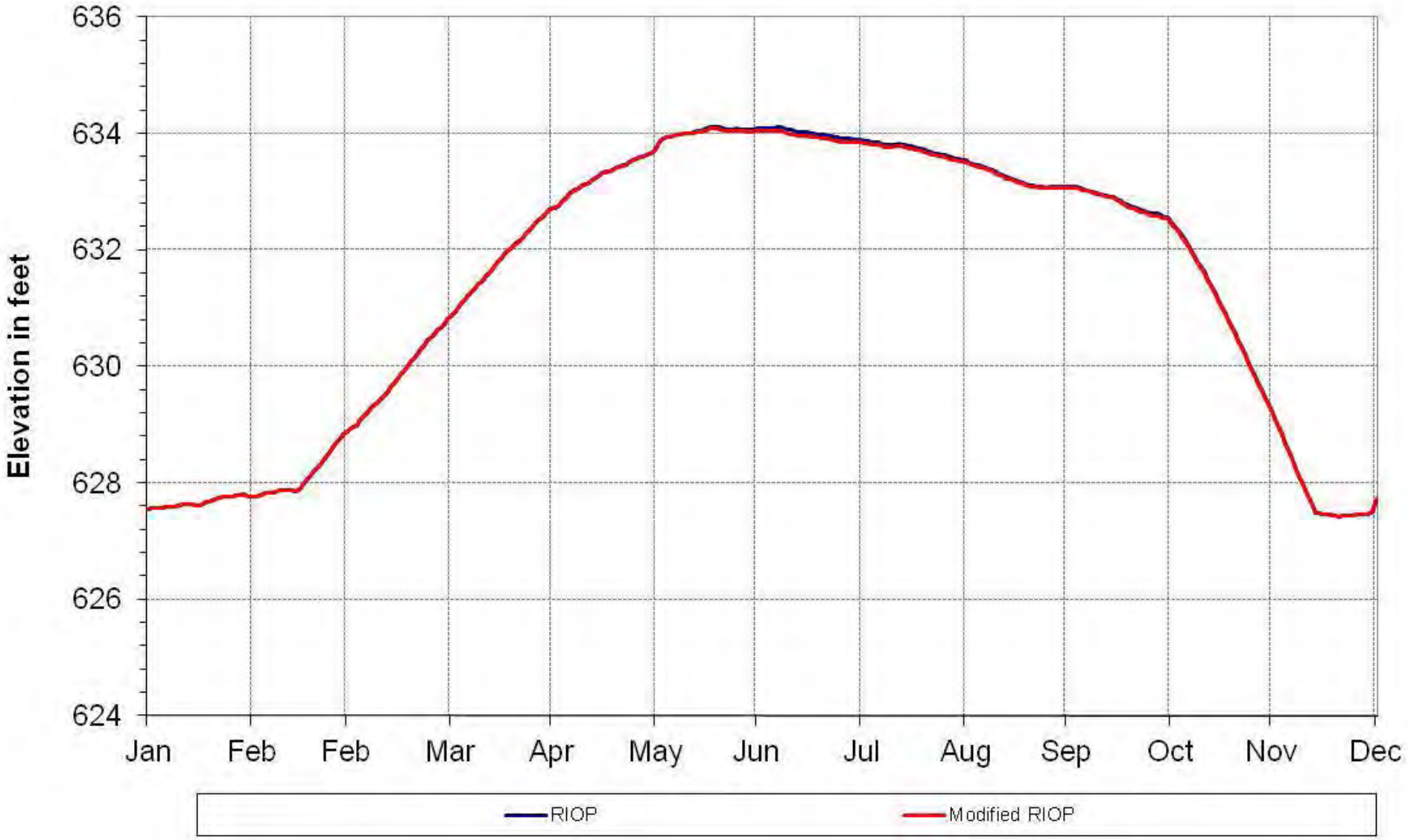
Buford Pool Elevation-Daily Maximum



Buford Pool Elevation-Daily Minimum

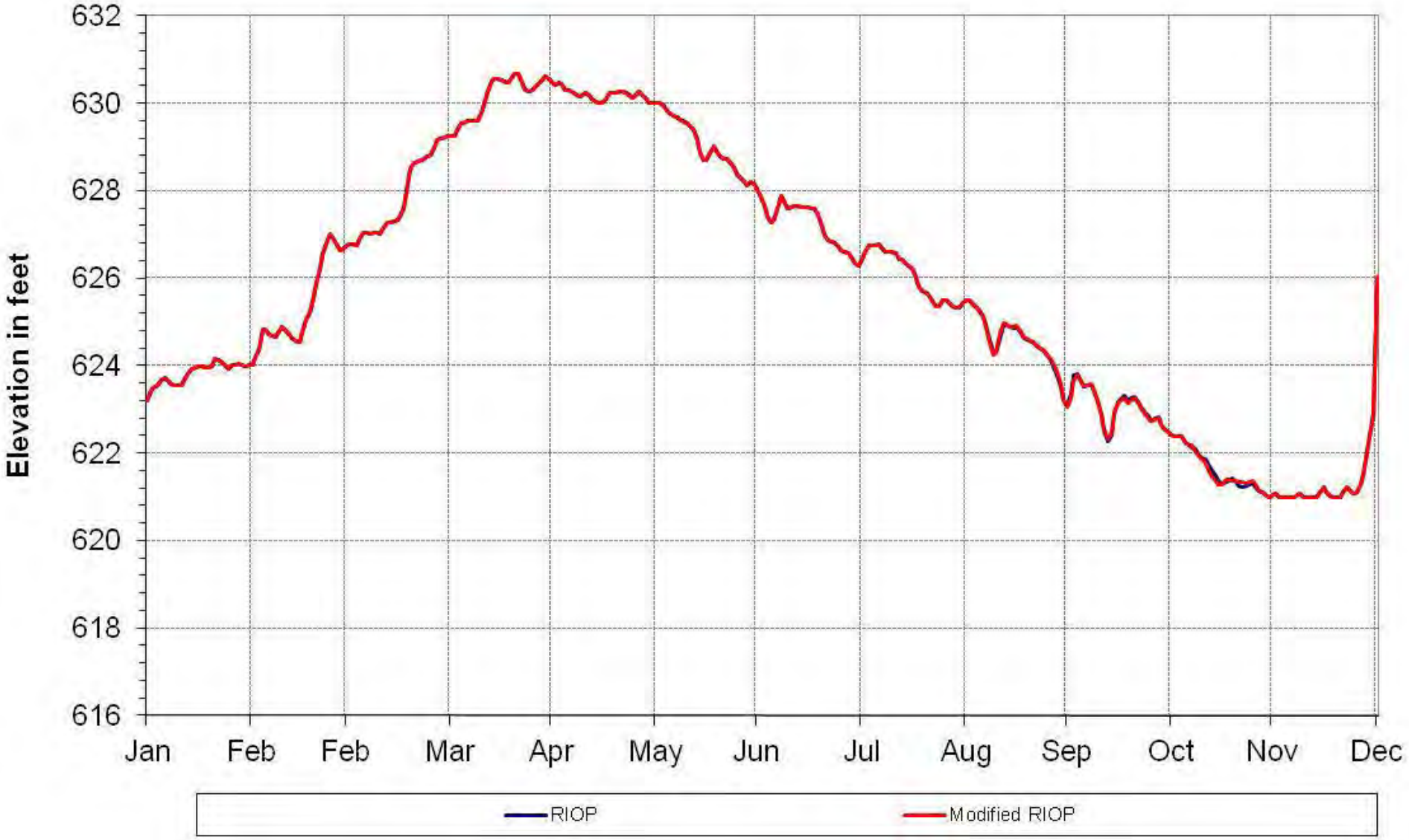


West Point Pool Elevation-Daily Average

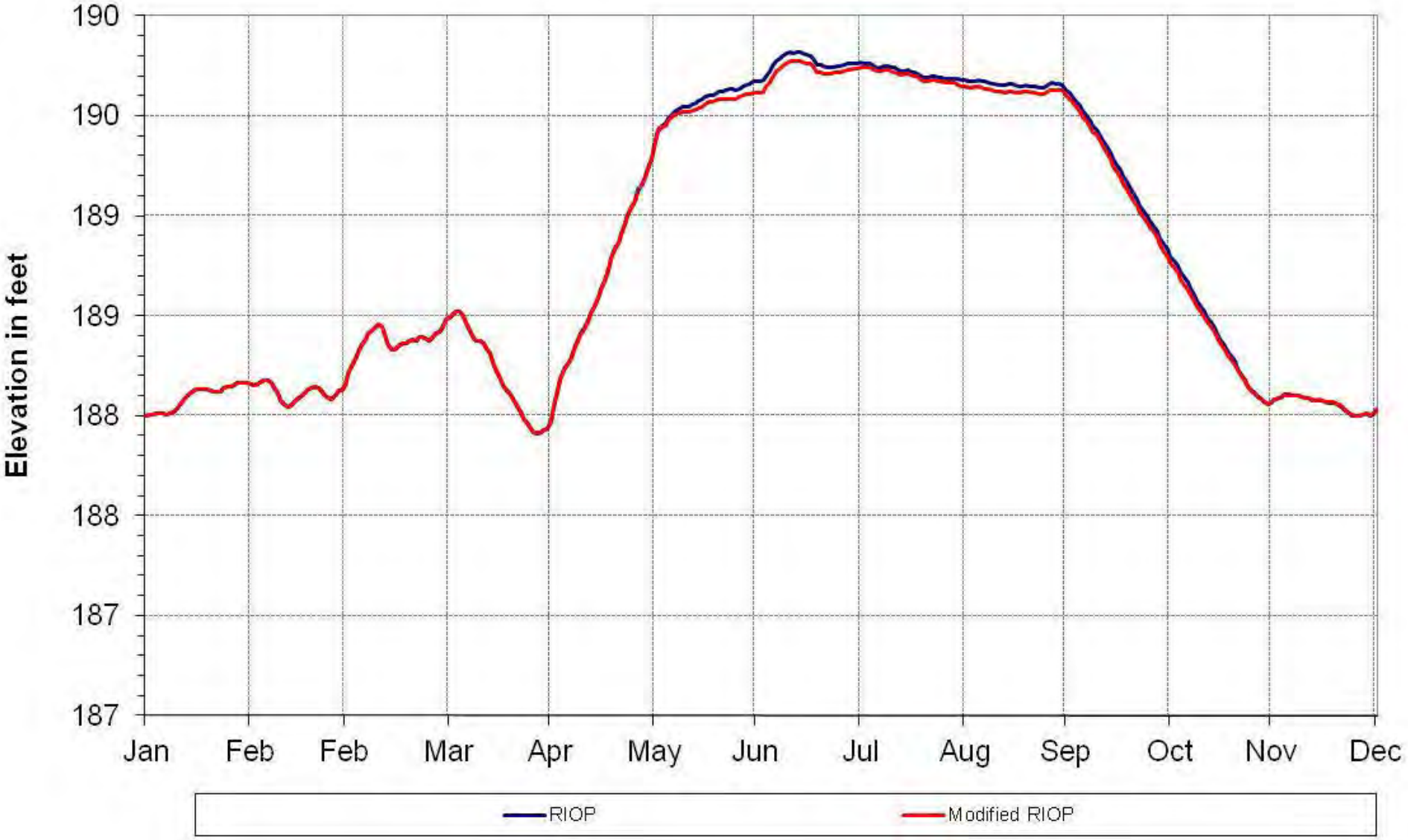


West Point Pool Elevation-Daily Maximum

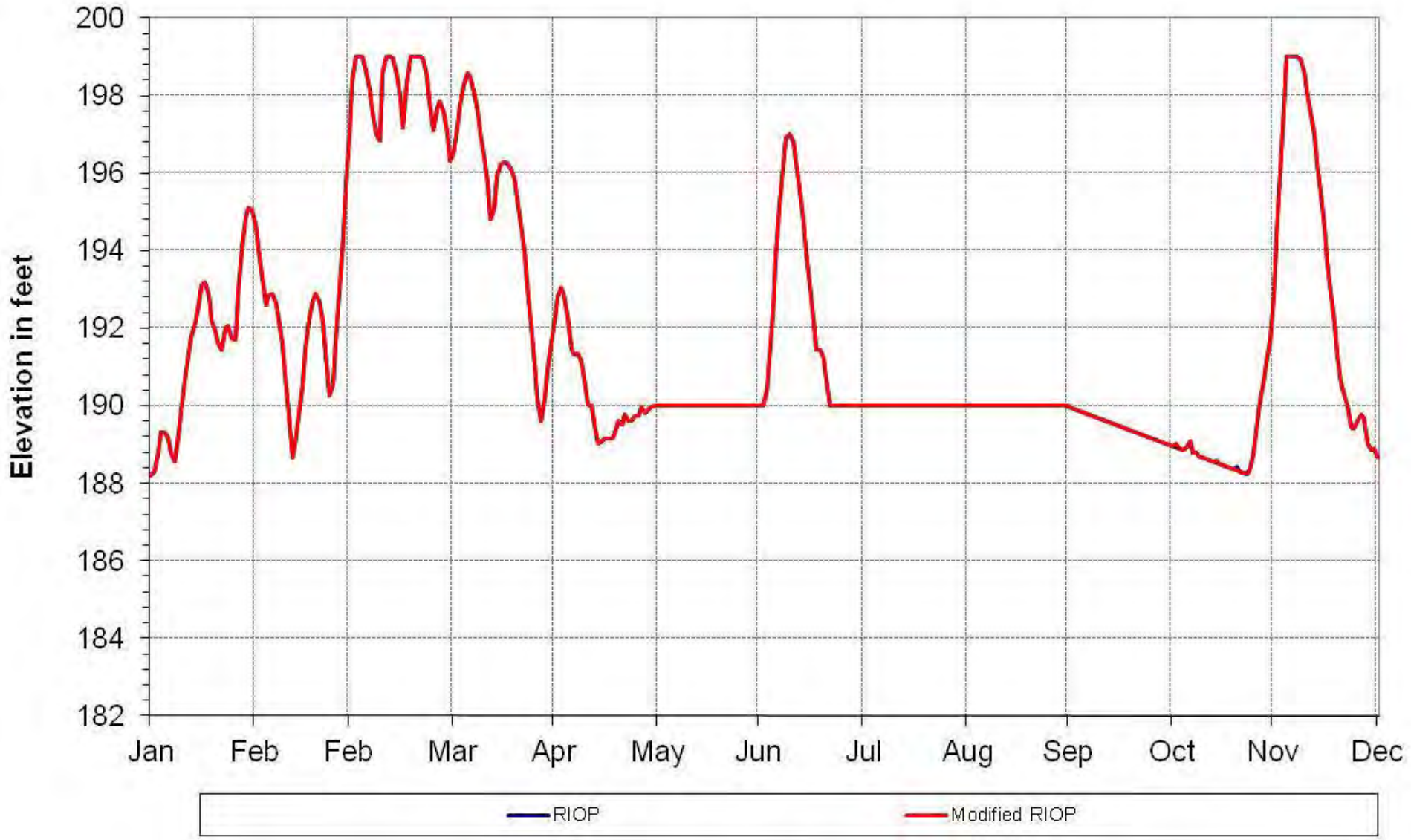
West Point Pool Elevation-Daily Minimum



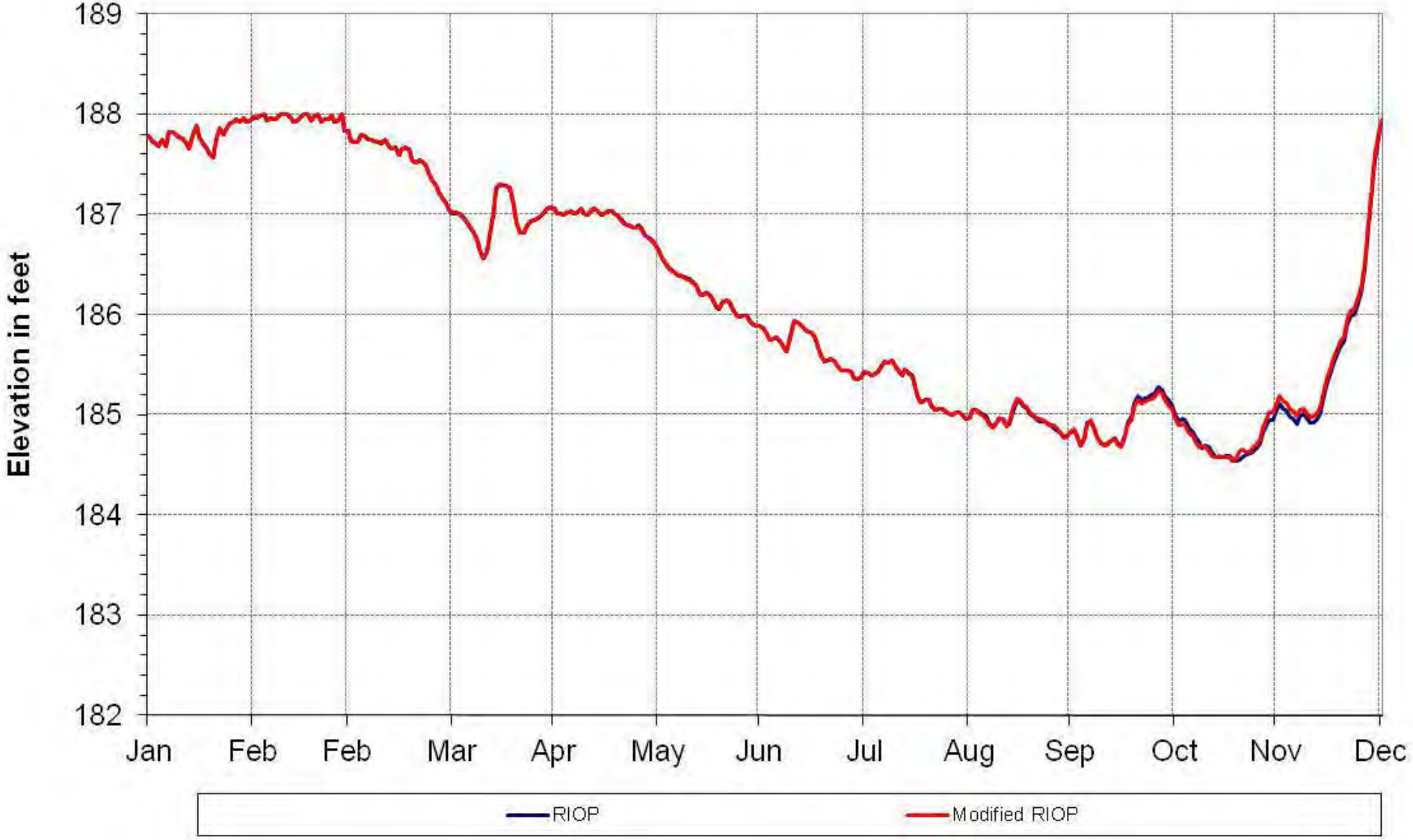
WF George Pool Elevation-Daily Average



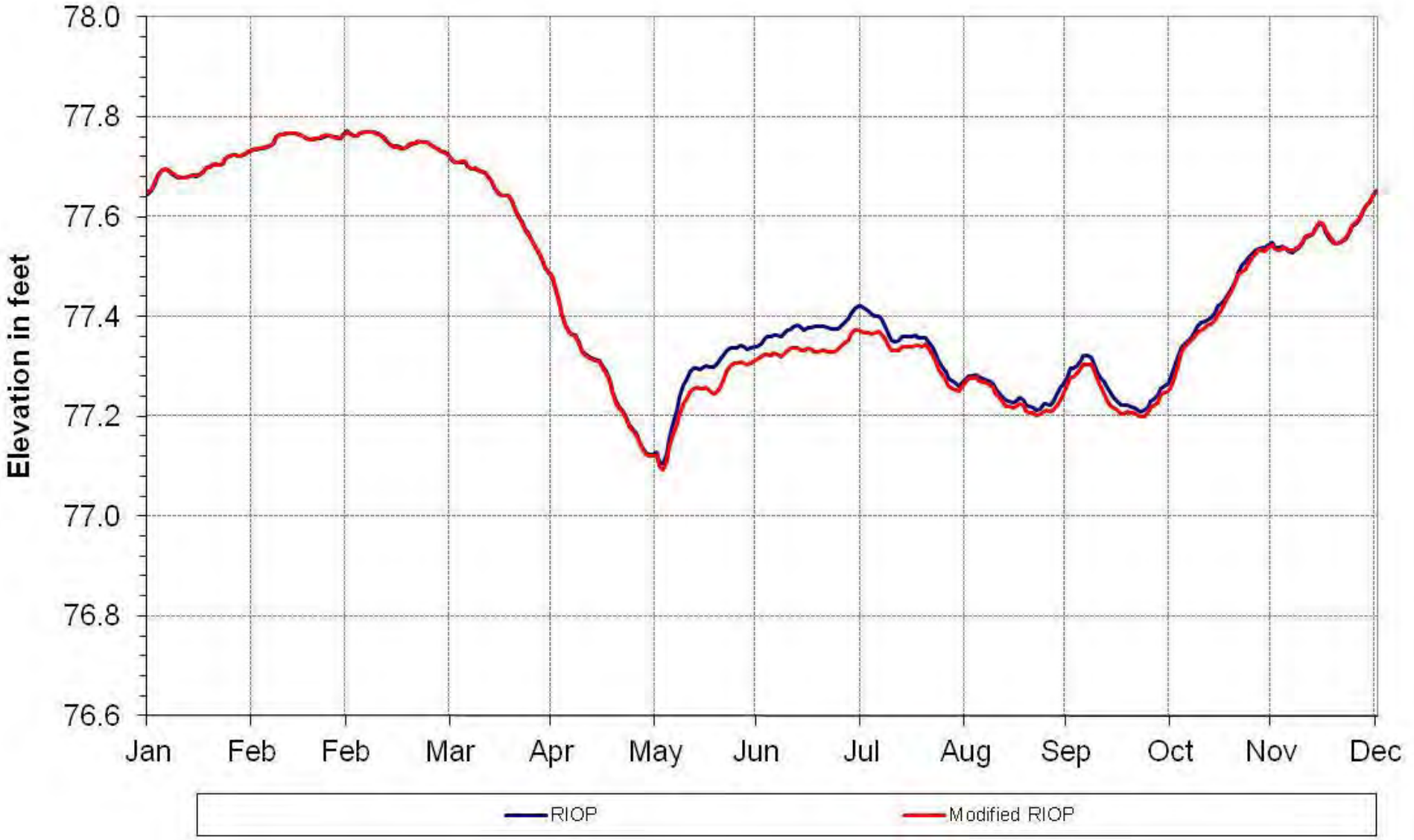
WF George Pool Elevation-Daily Maximum



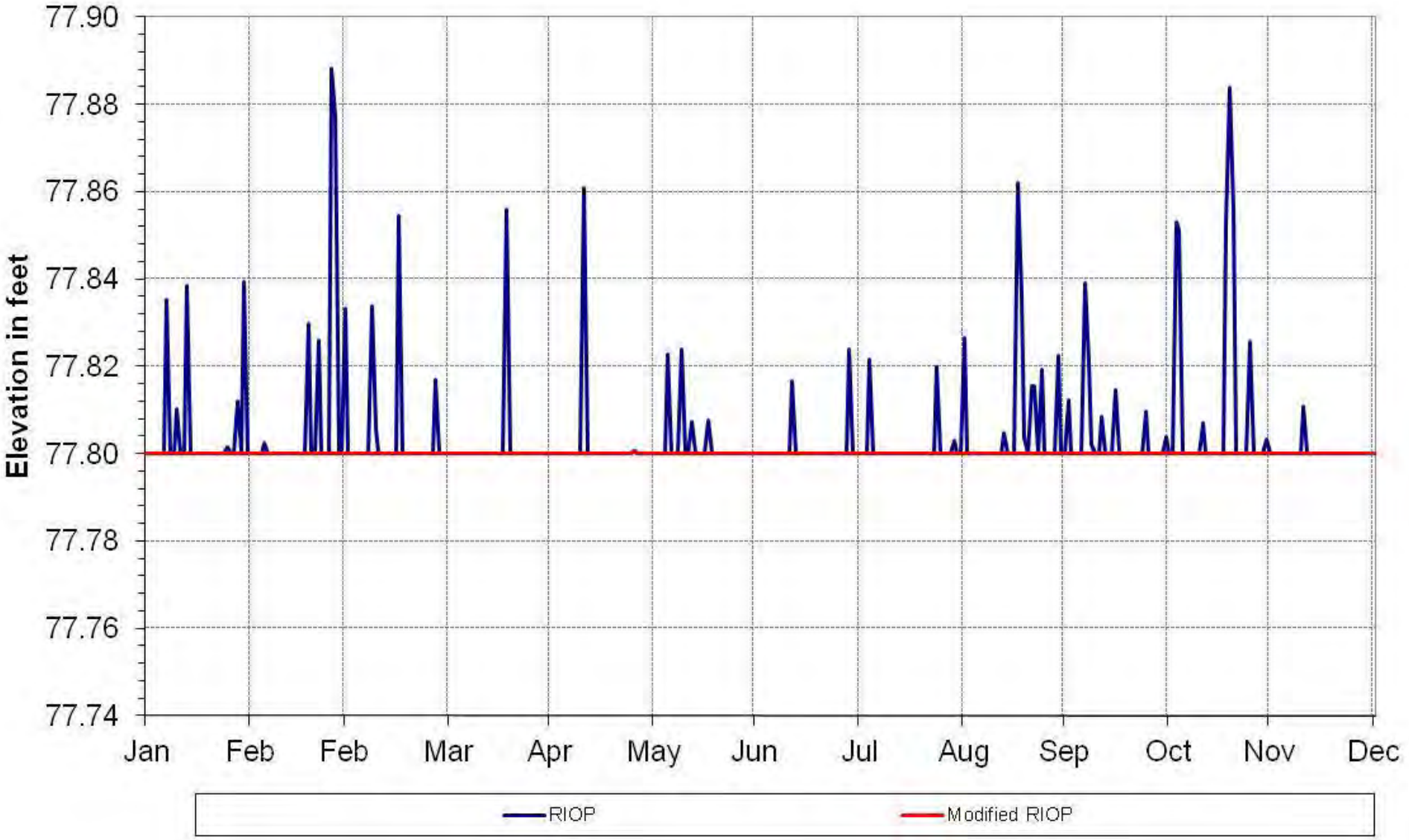
WF George Pool Elevation-Daily Minimum



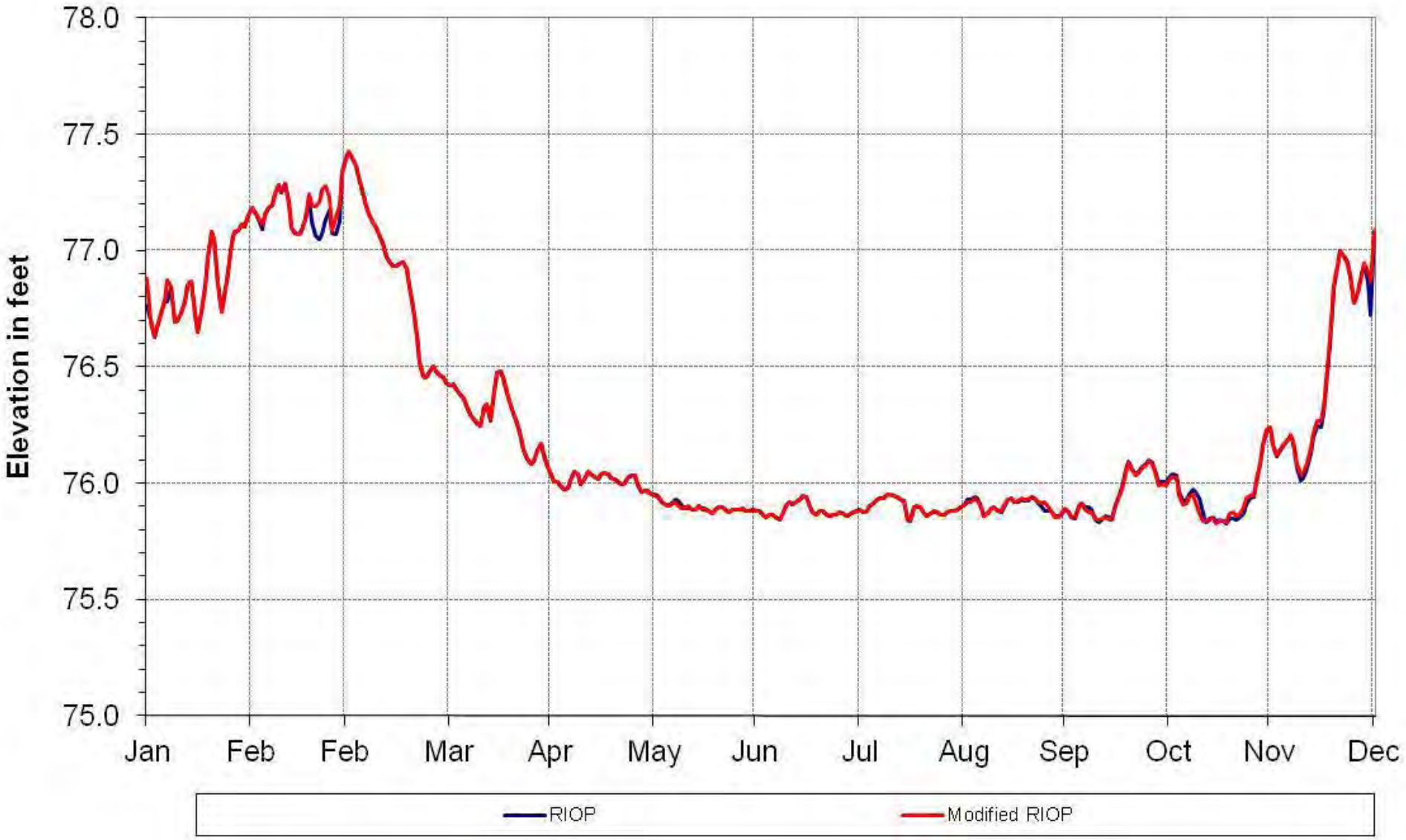
Jim Woodruff Pool Elevation-Daily Average



Jim Woodruff Pool Elevation-Daily Maximum

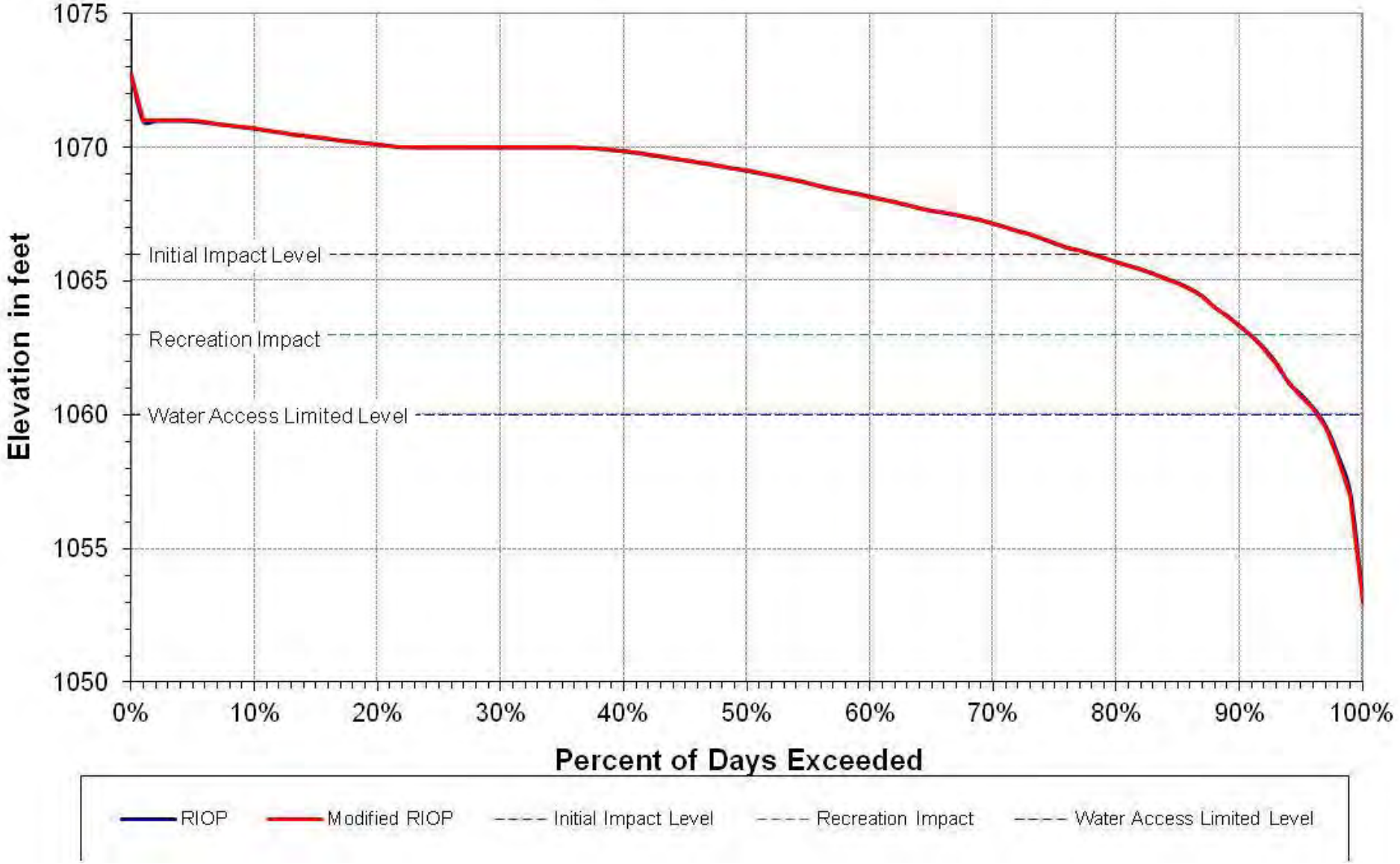


Jim Woodruff Pool Elevation-Daily Minimum

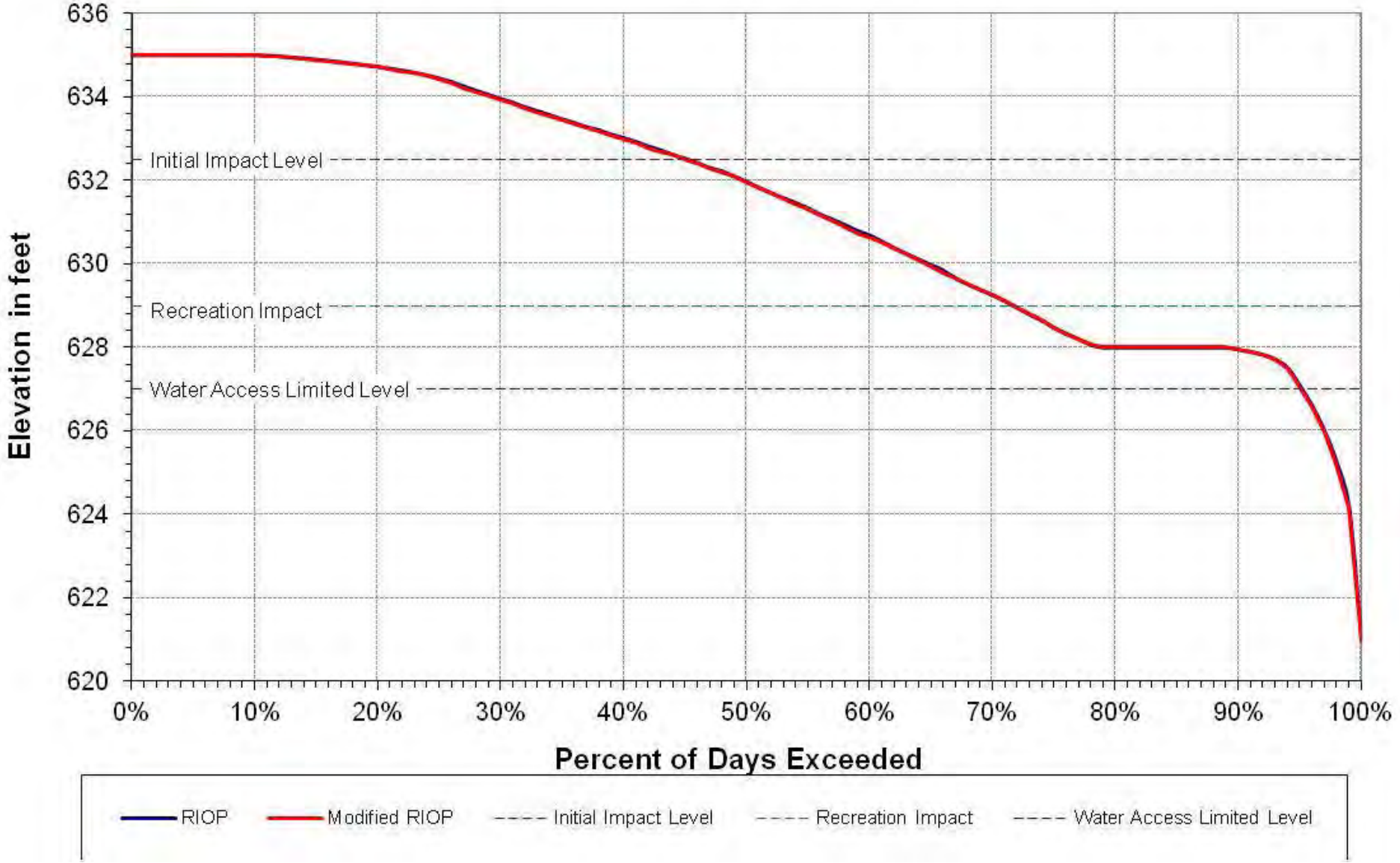


Pool Elevation Duration

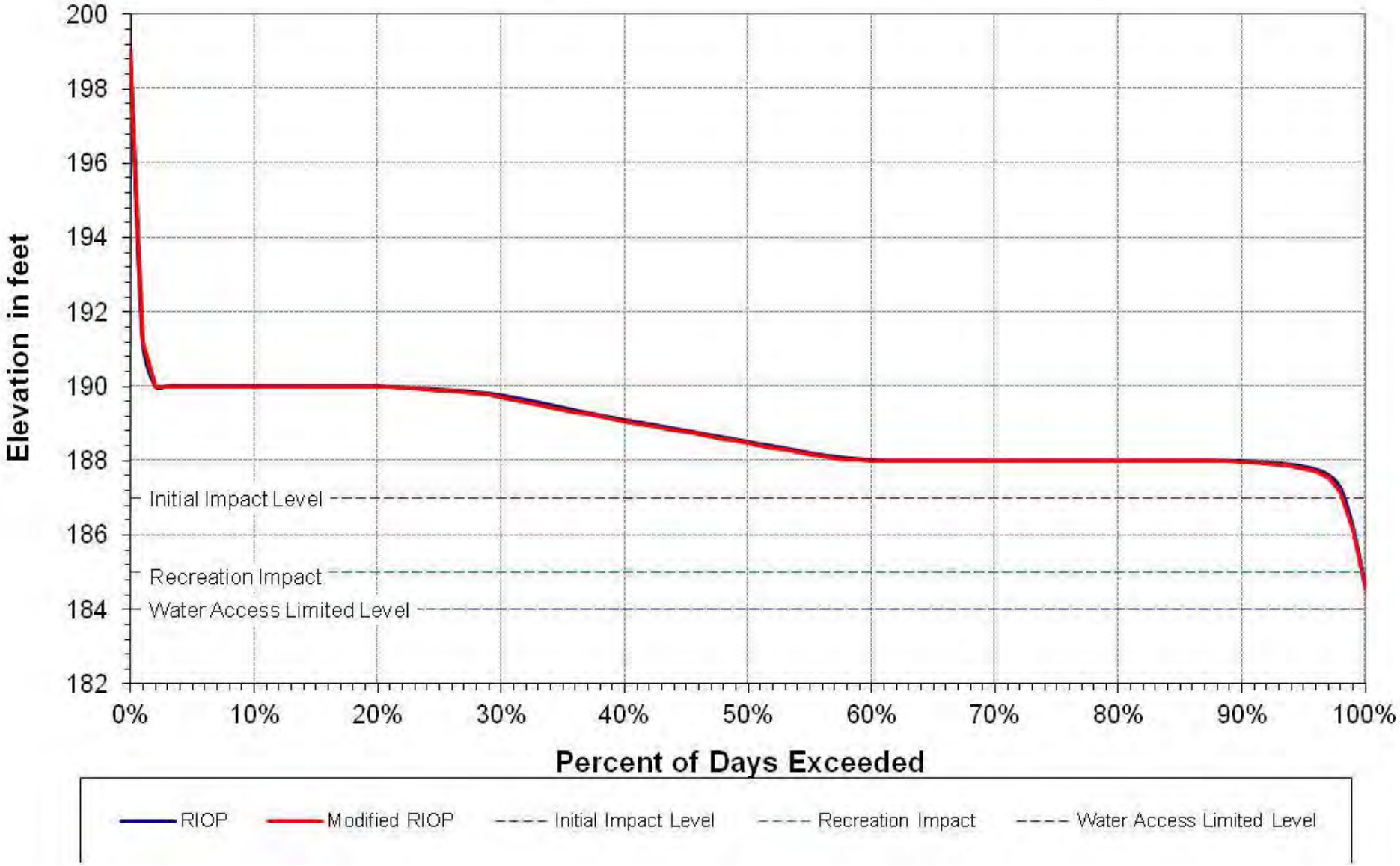
Buford Pool Elevation-Annual



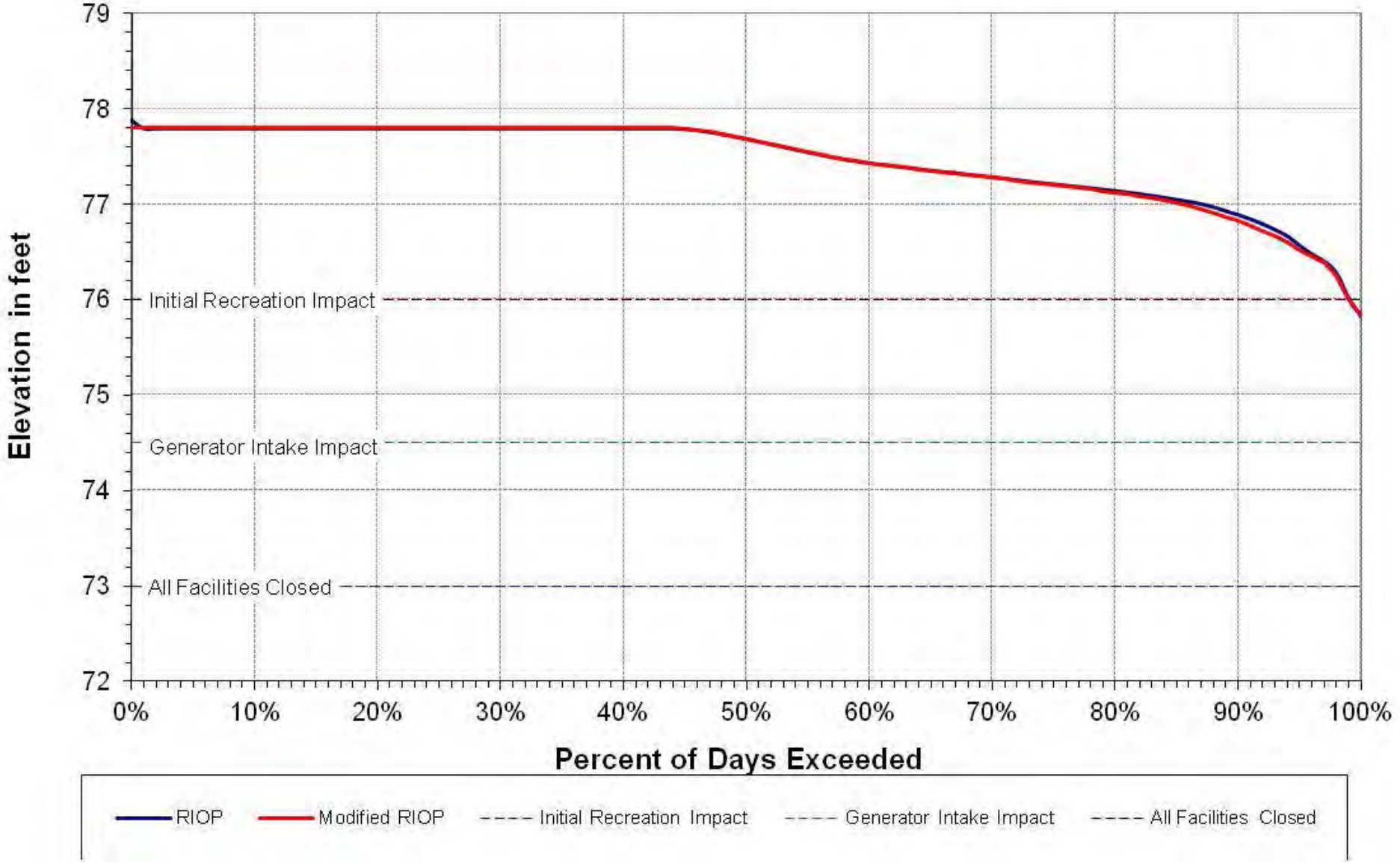
West Point Pool Elevation-Annual



WF George Pool Elevation-Annual

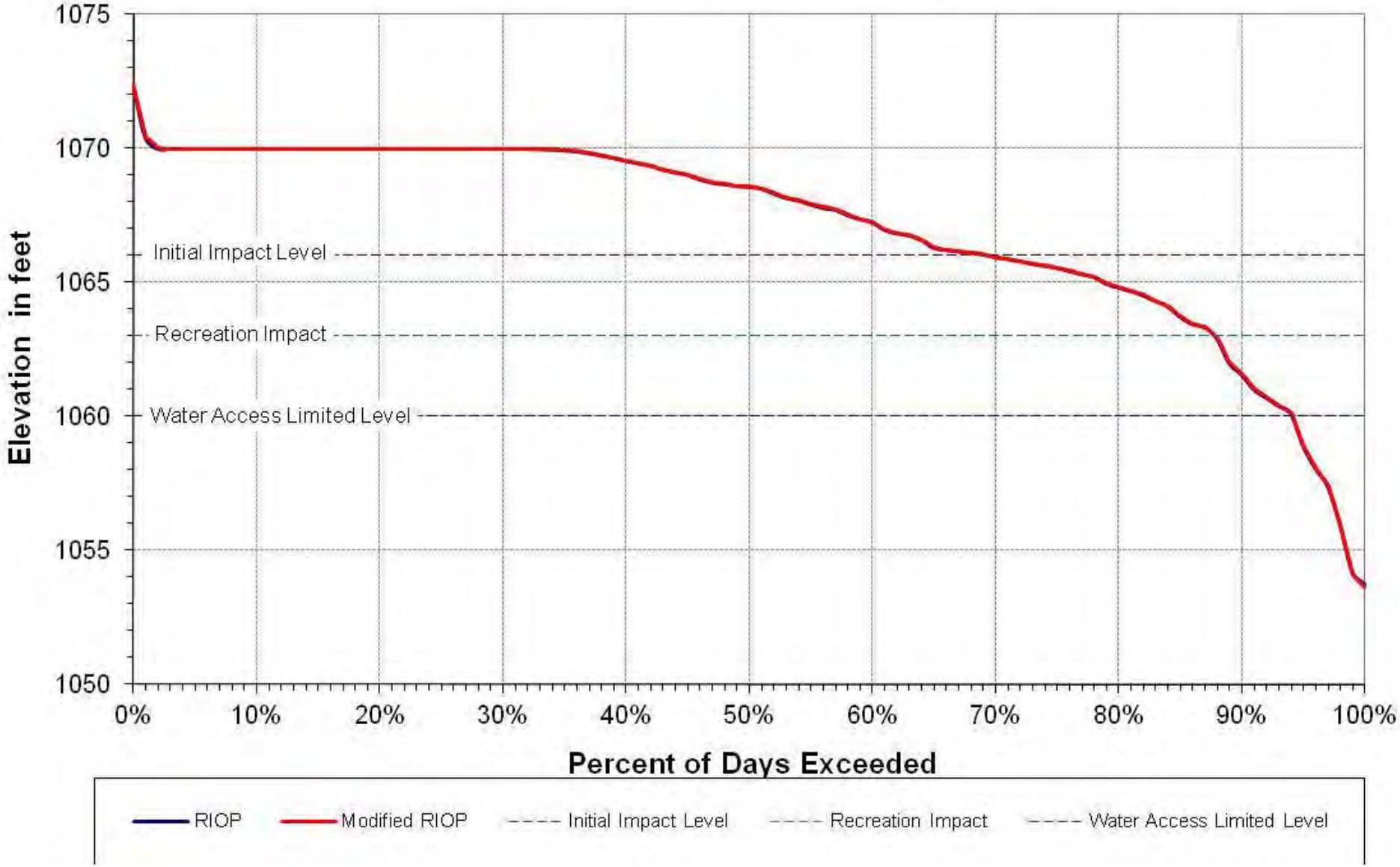


Jim Woodruff Pool Elevation-Annual

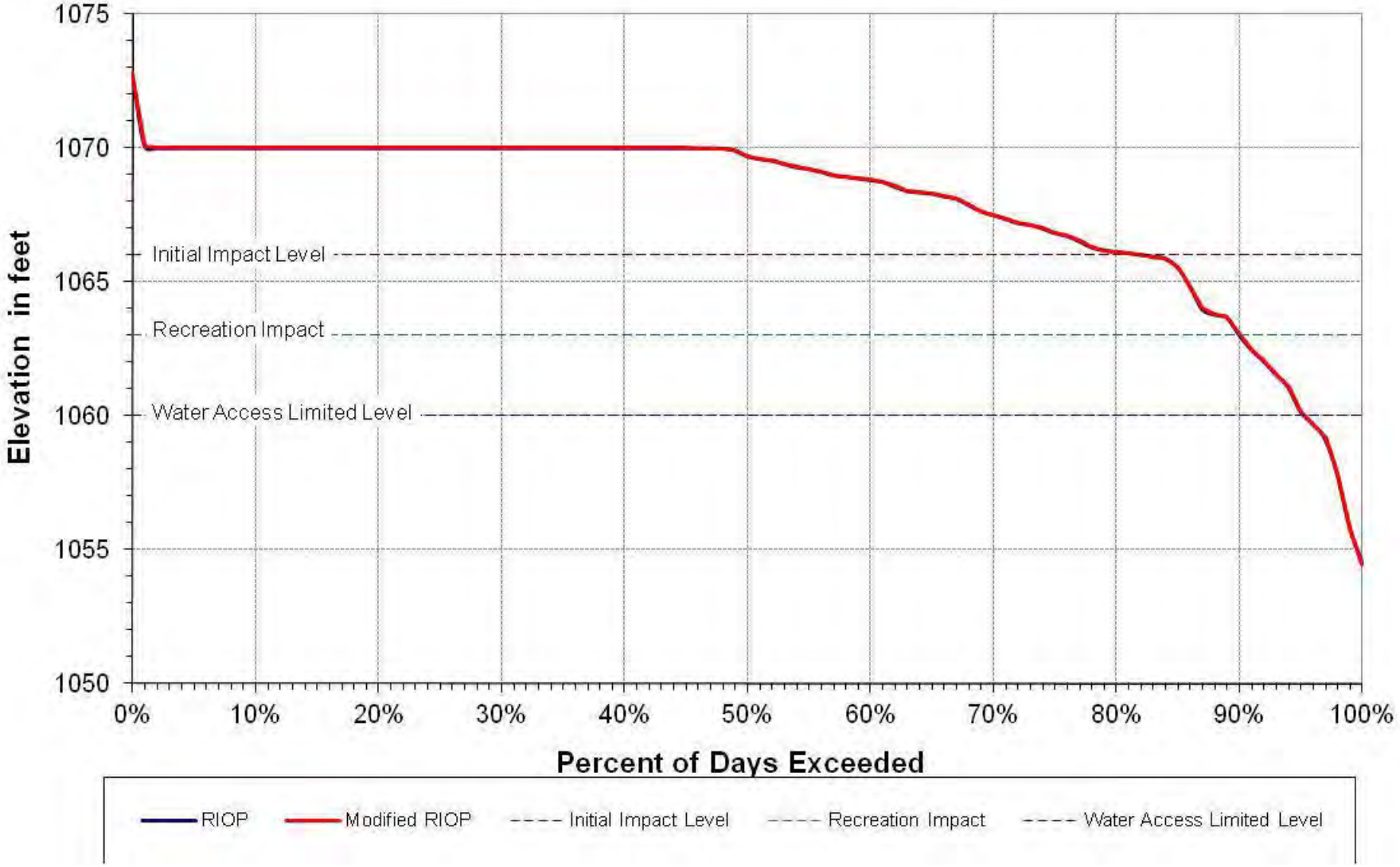


Buford Pool Monthly Duration

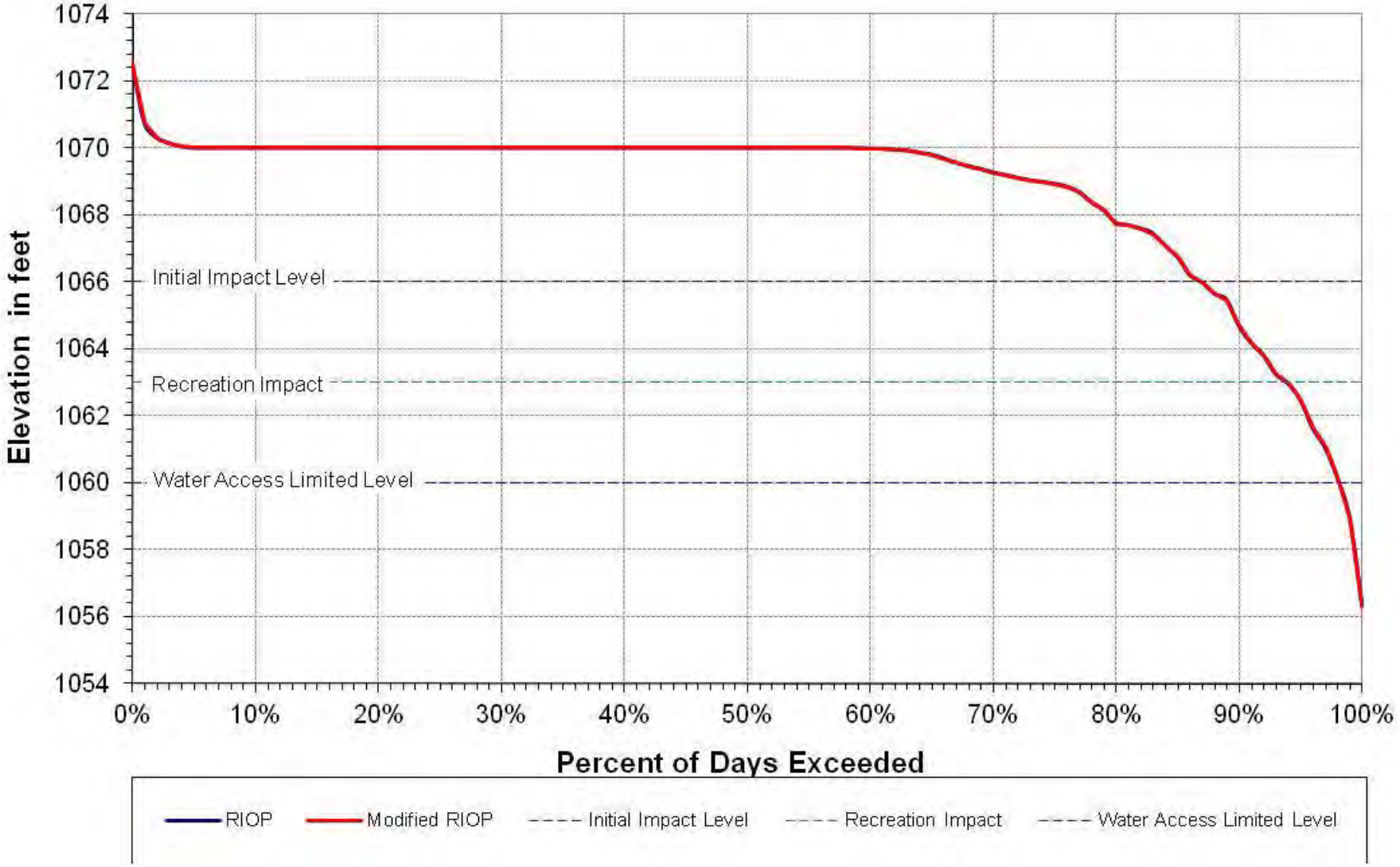
Buford Pool Elevation-Jan



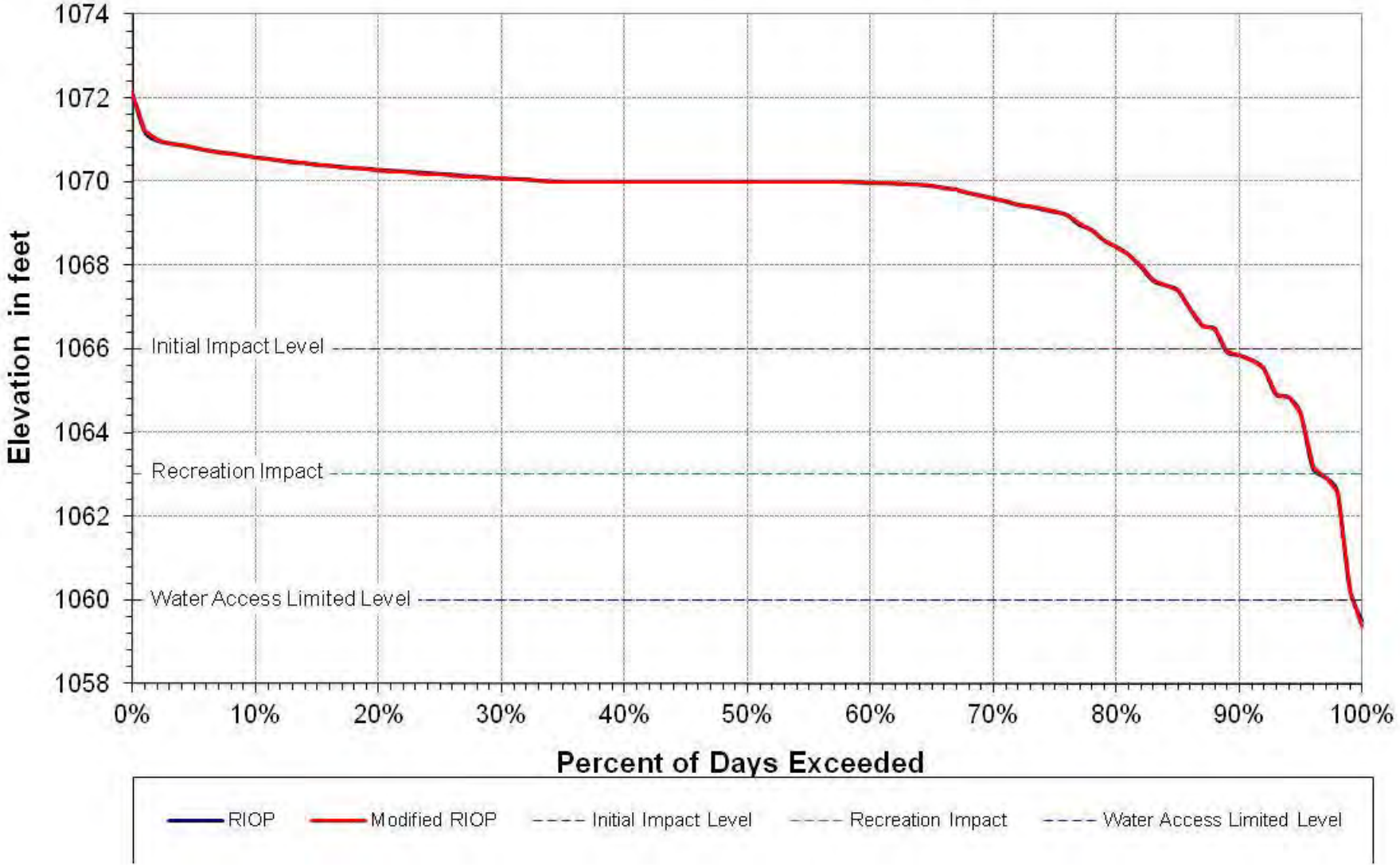
Buford Pool Elevation-Feb



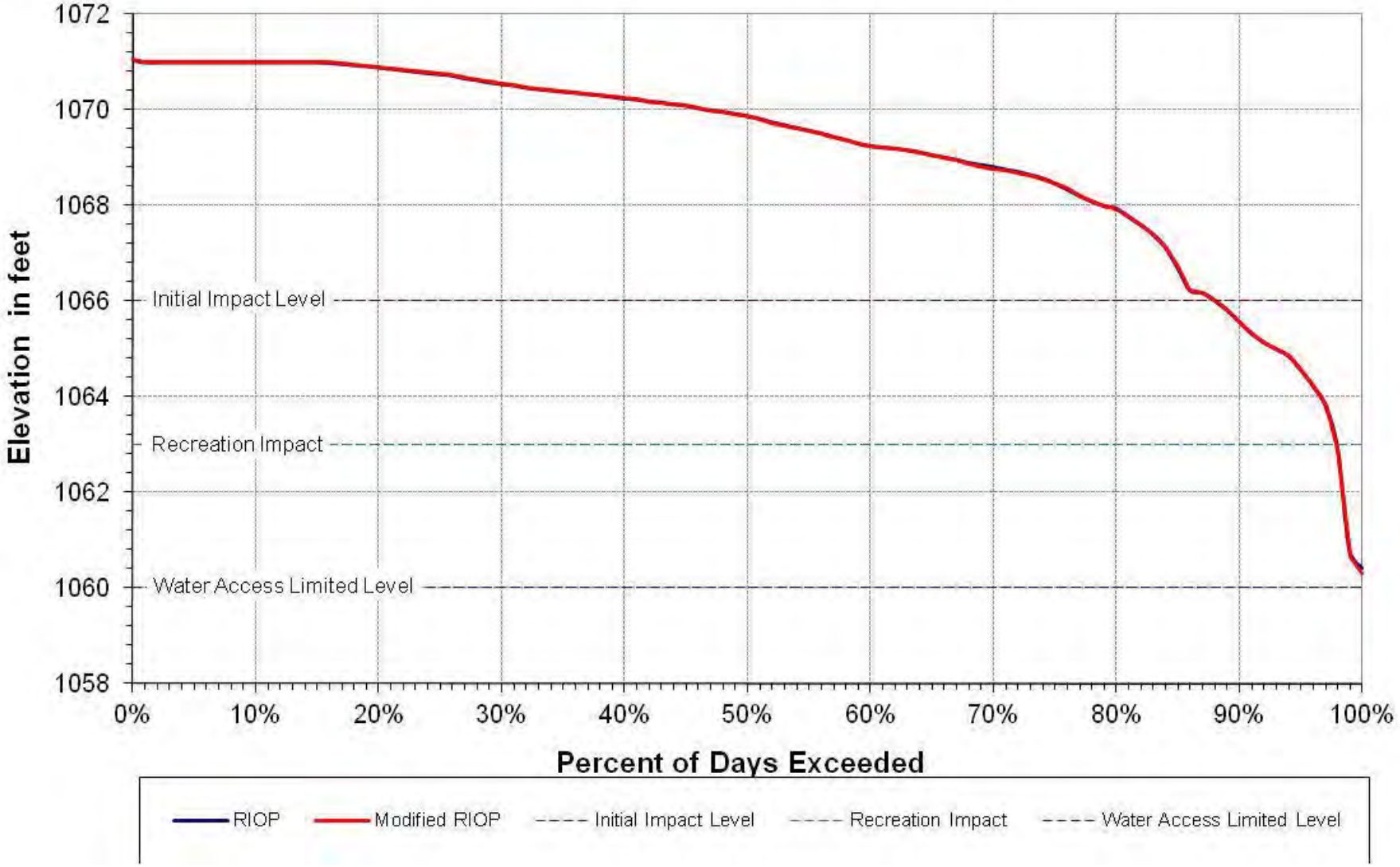
Buford Pool Elevation-Mar



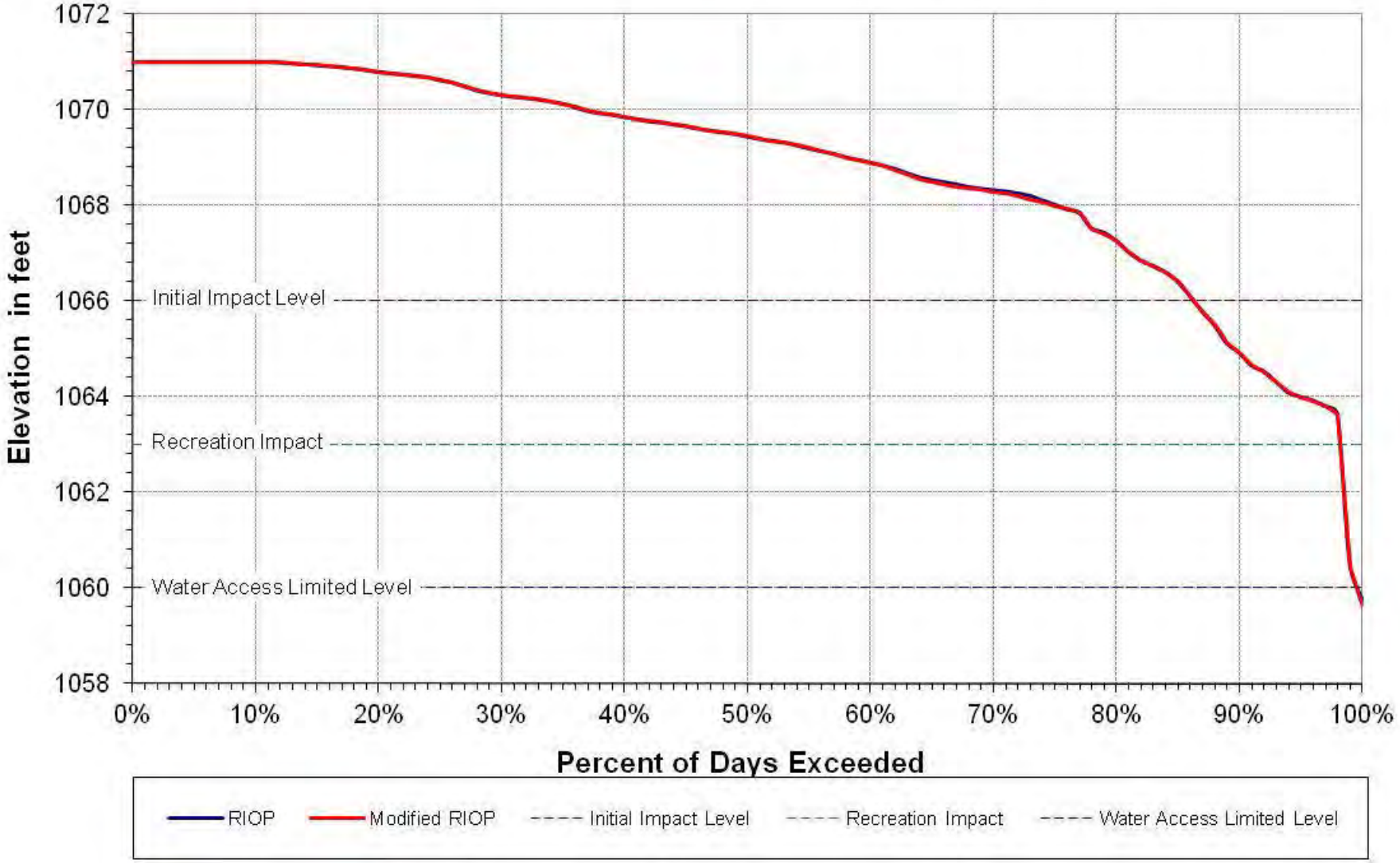
Buford Pool Elevation-Apr



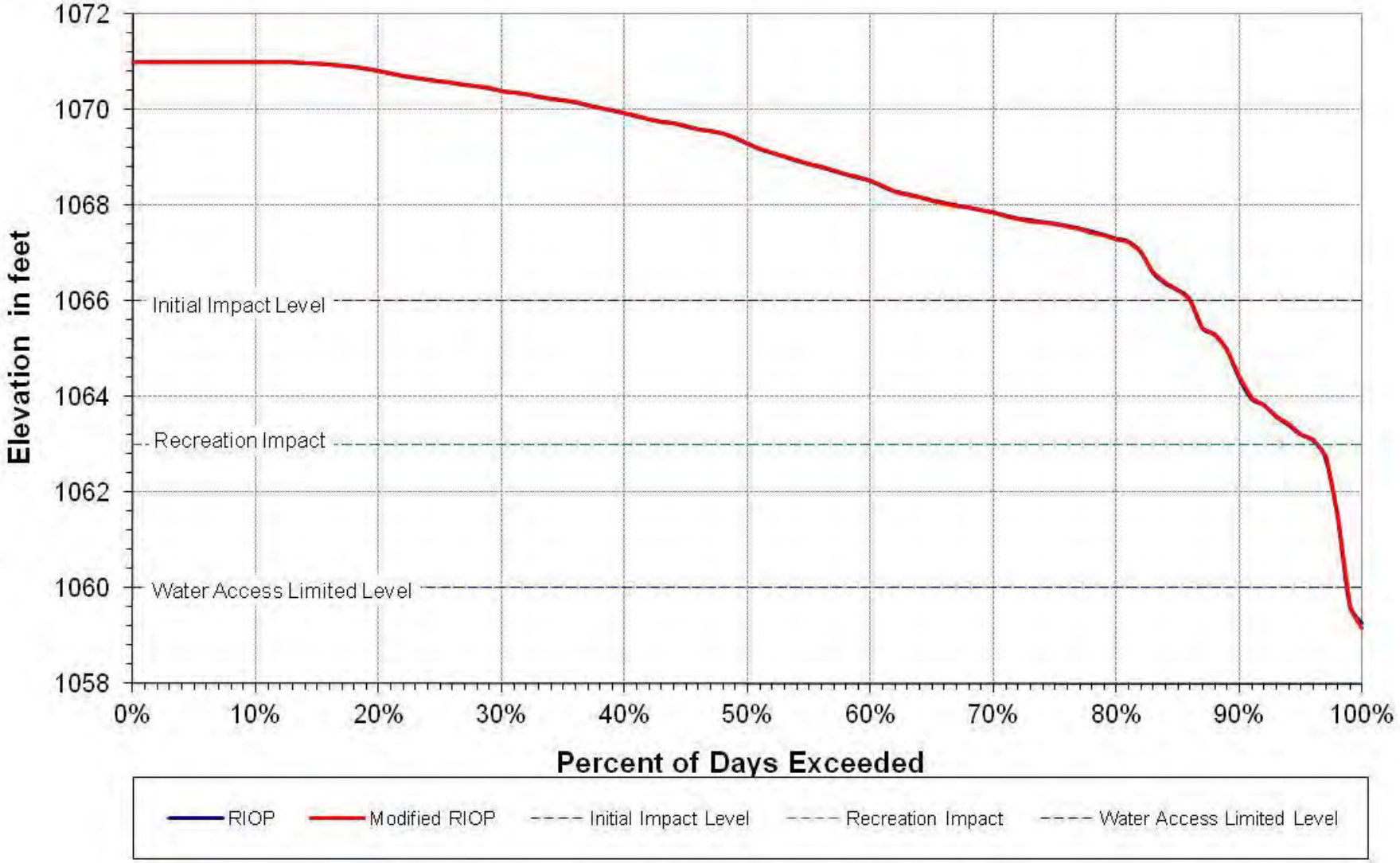
Buford Pool Elevation-May



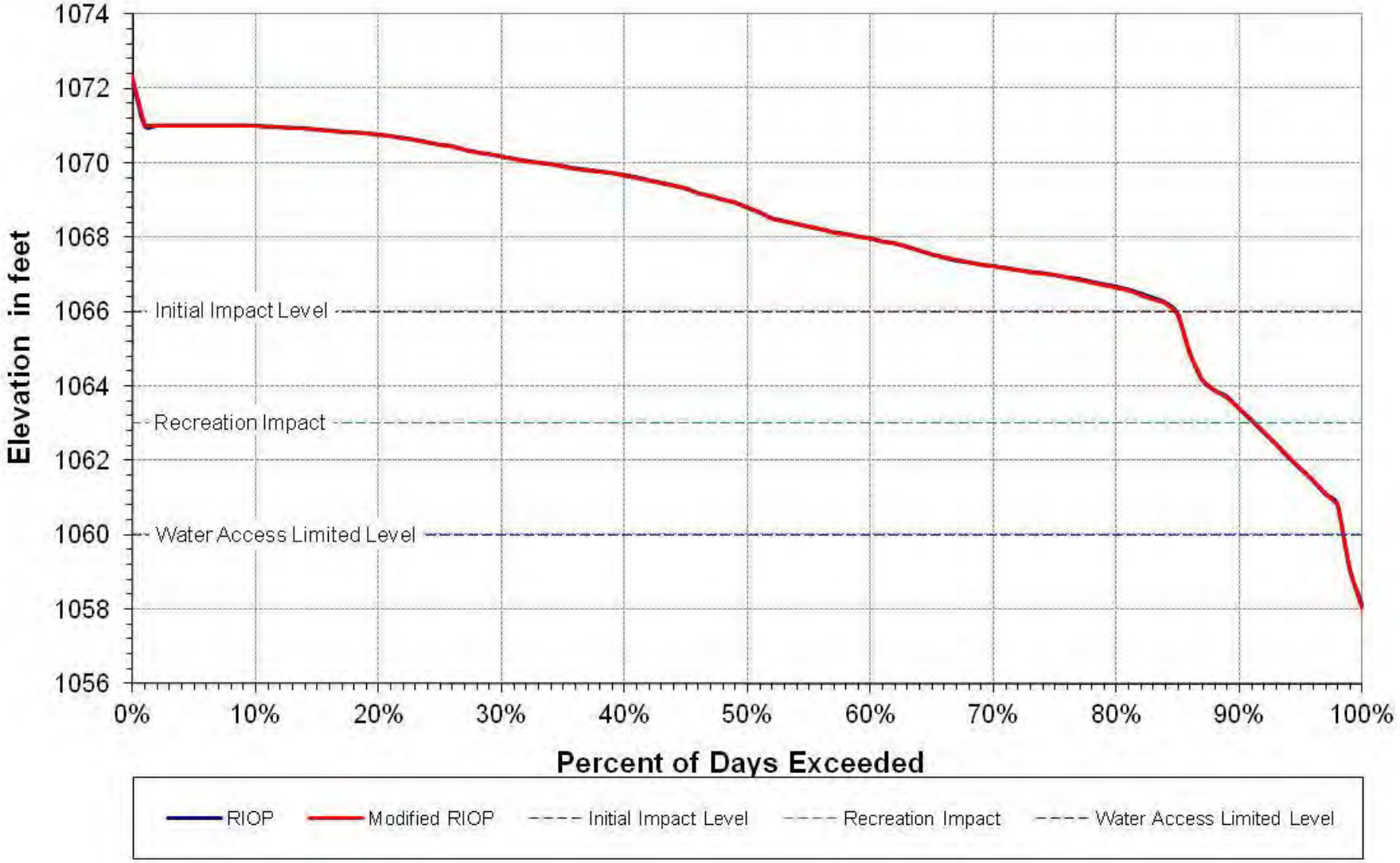
Buford Pool Elevation-Jun



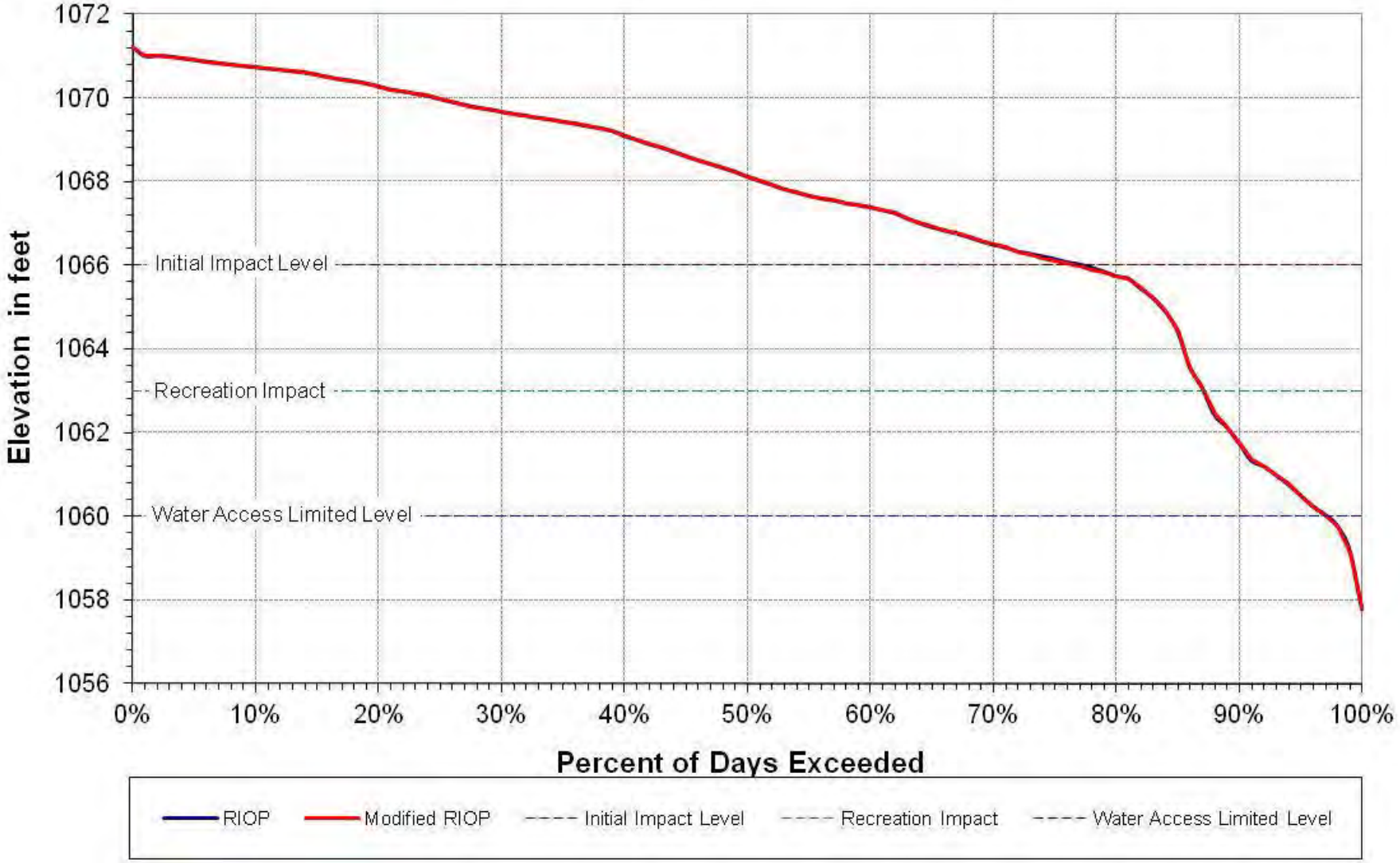
Buford Pool Elevation-Jul



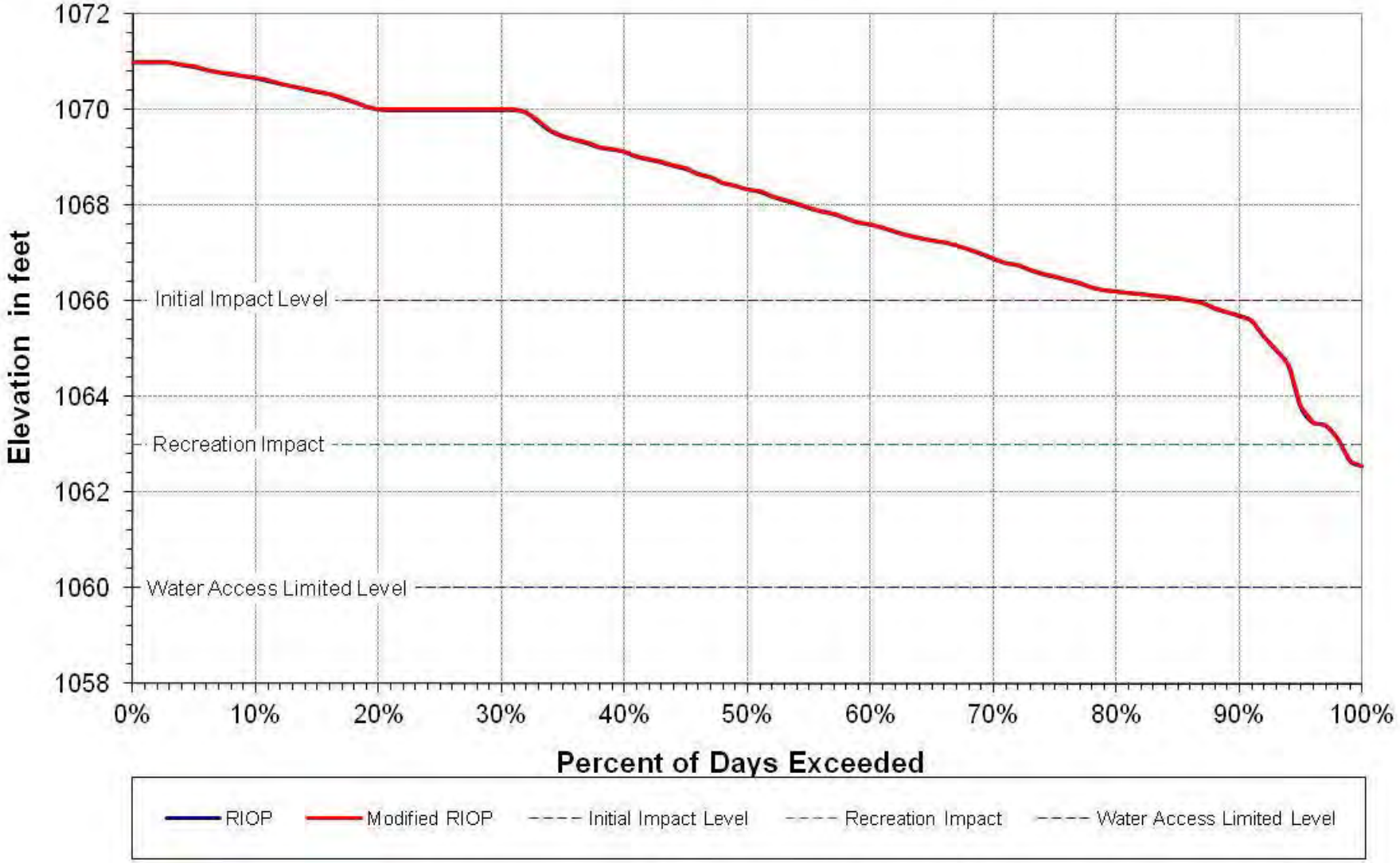
Buford Pool Elevation-Aug



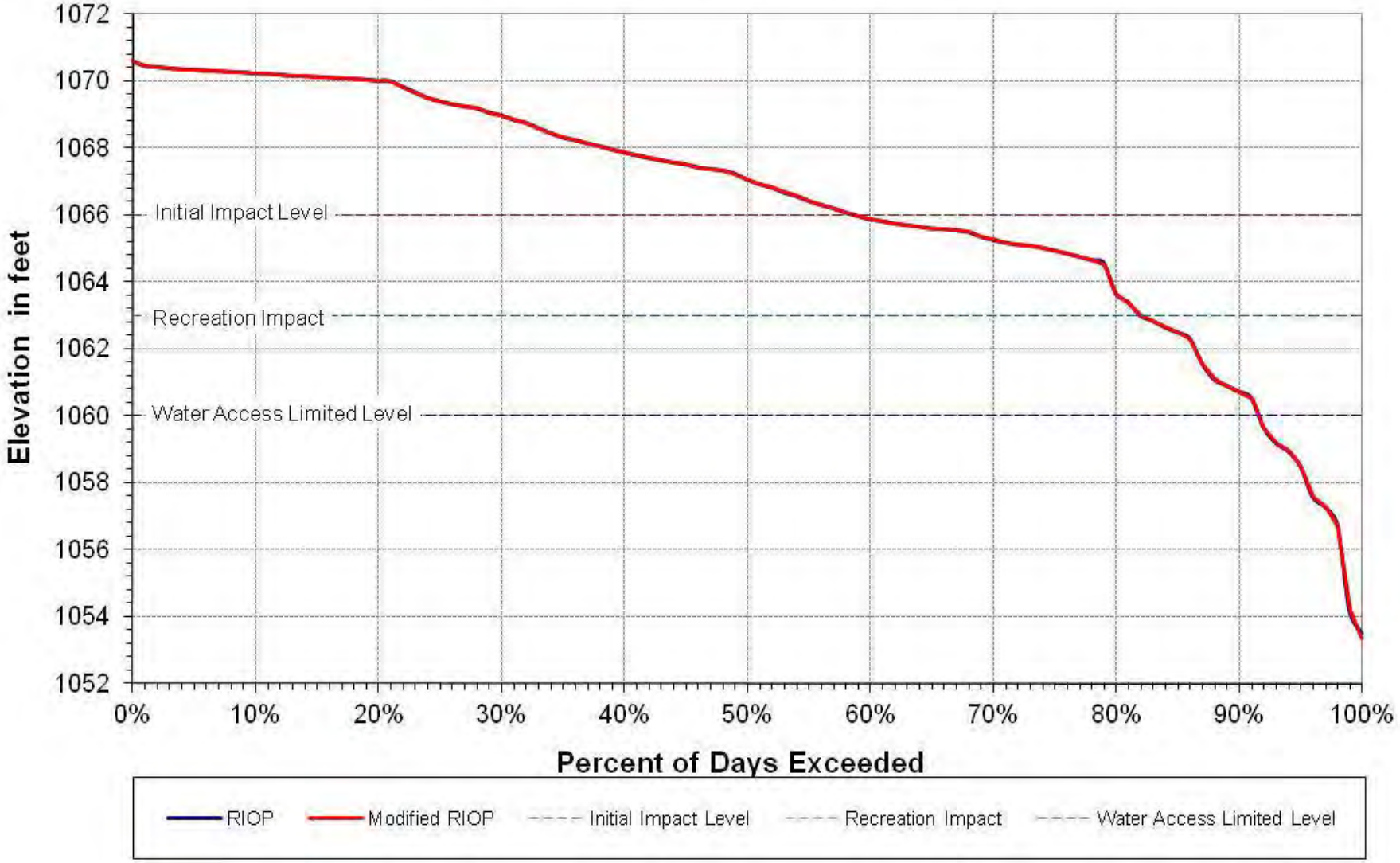
Buford Pool Elevation-Sep



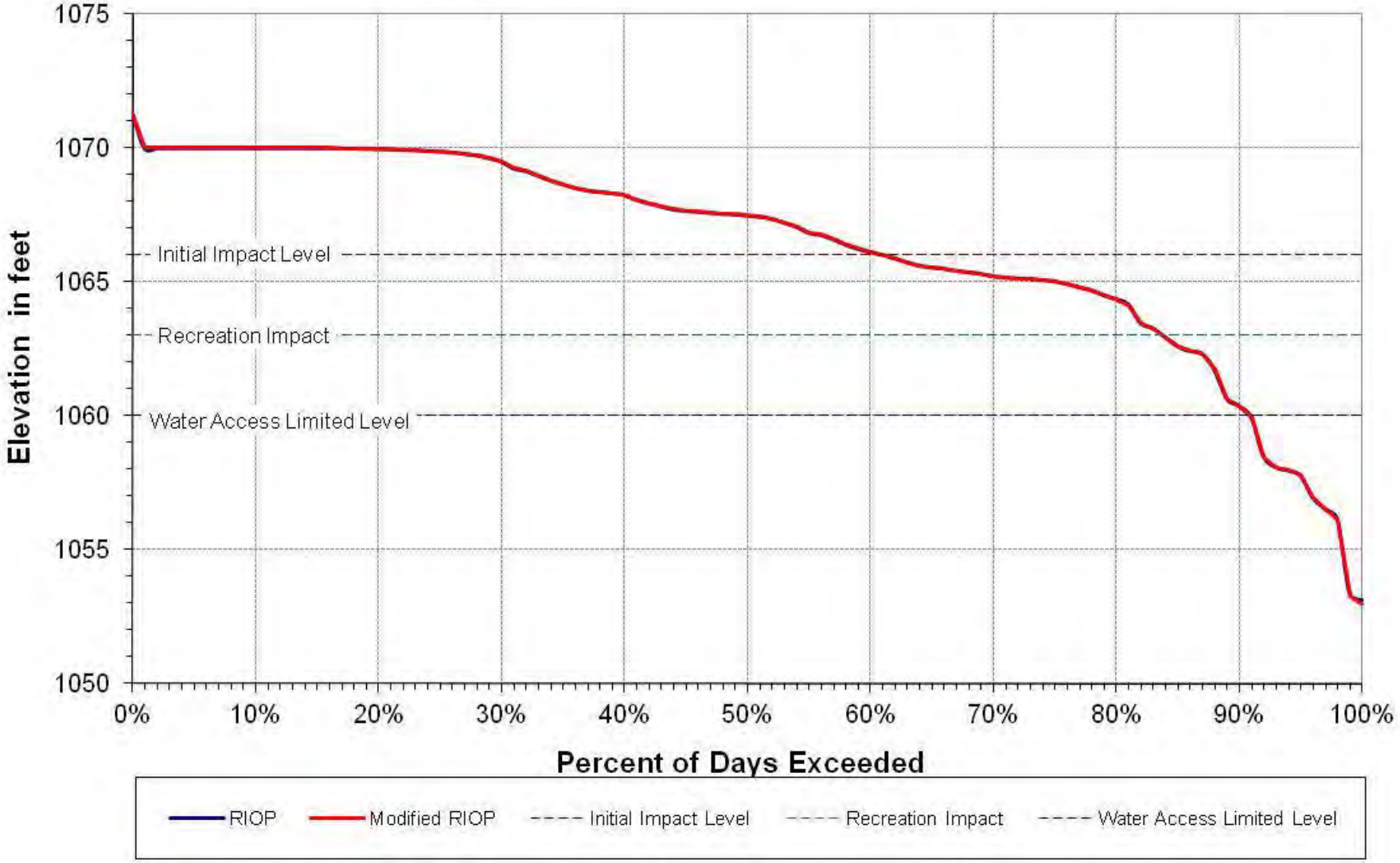
Buford Pool Elevation-Oct



Buford Pool Elevation-Nov

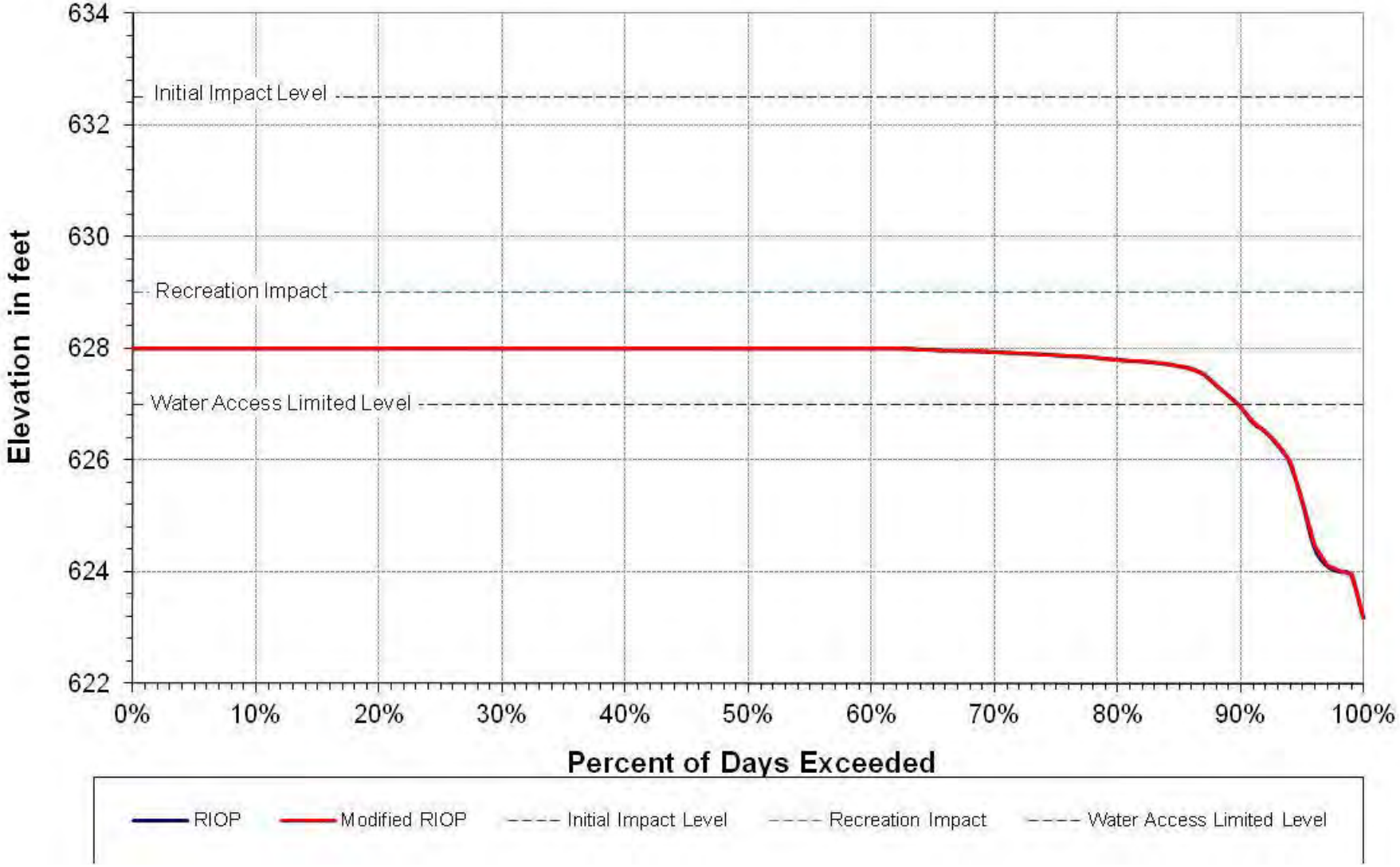


Buford Pool Elevation-Dec

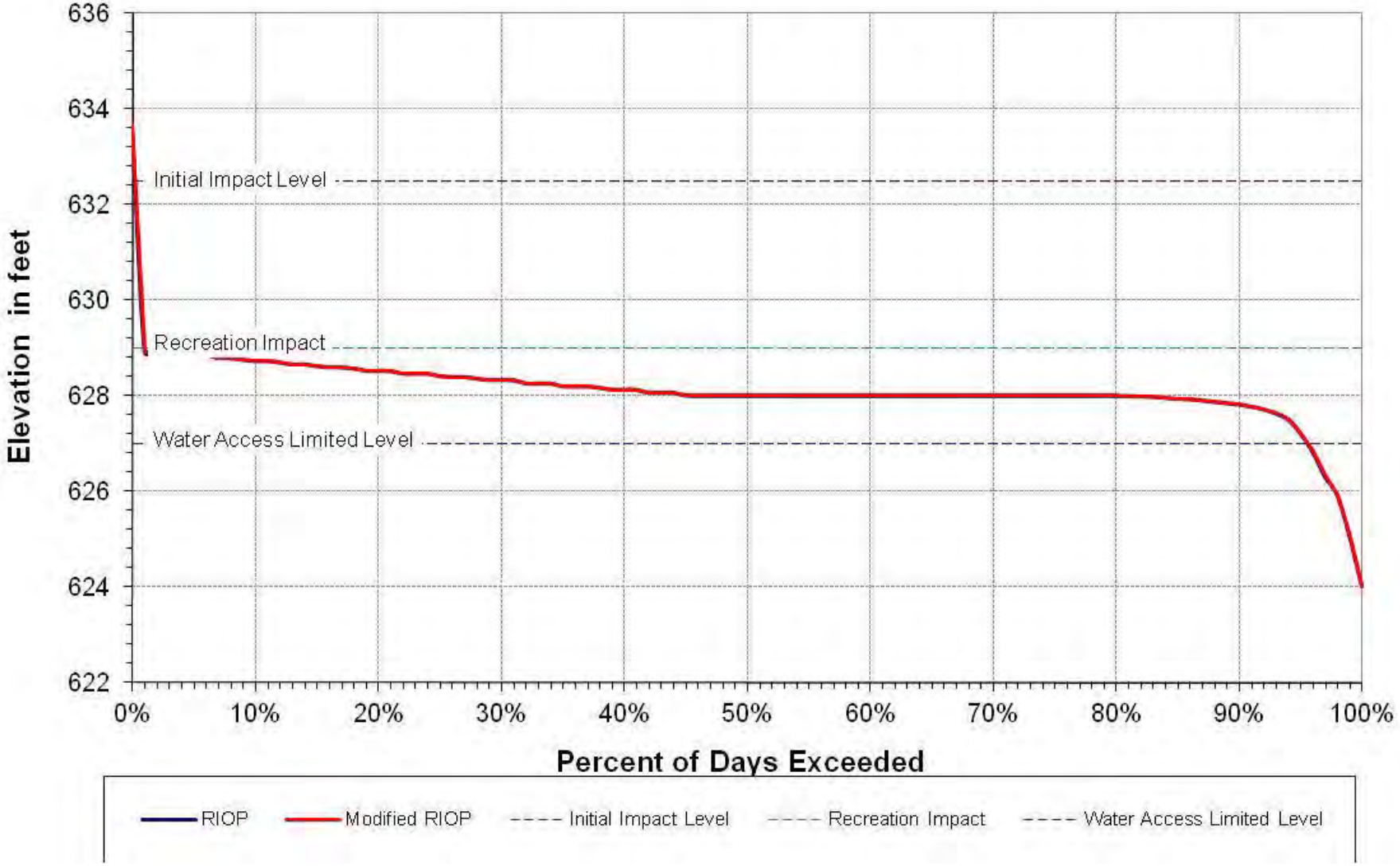


West Point Pool Monthly Duration

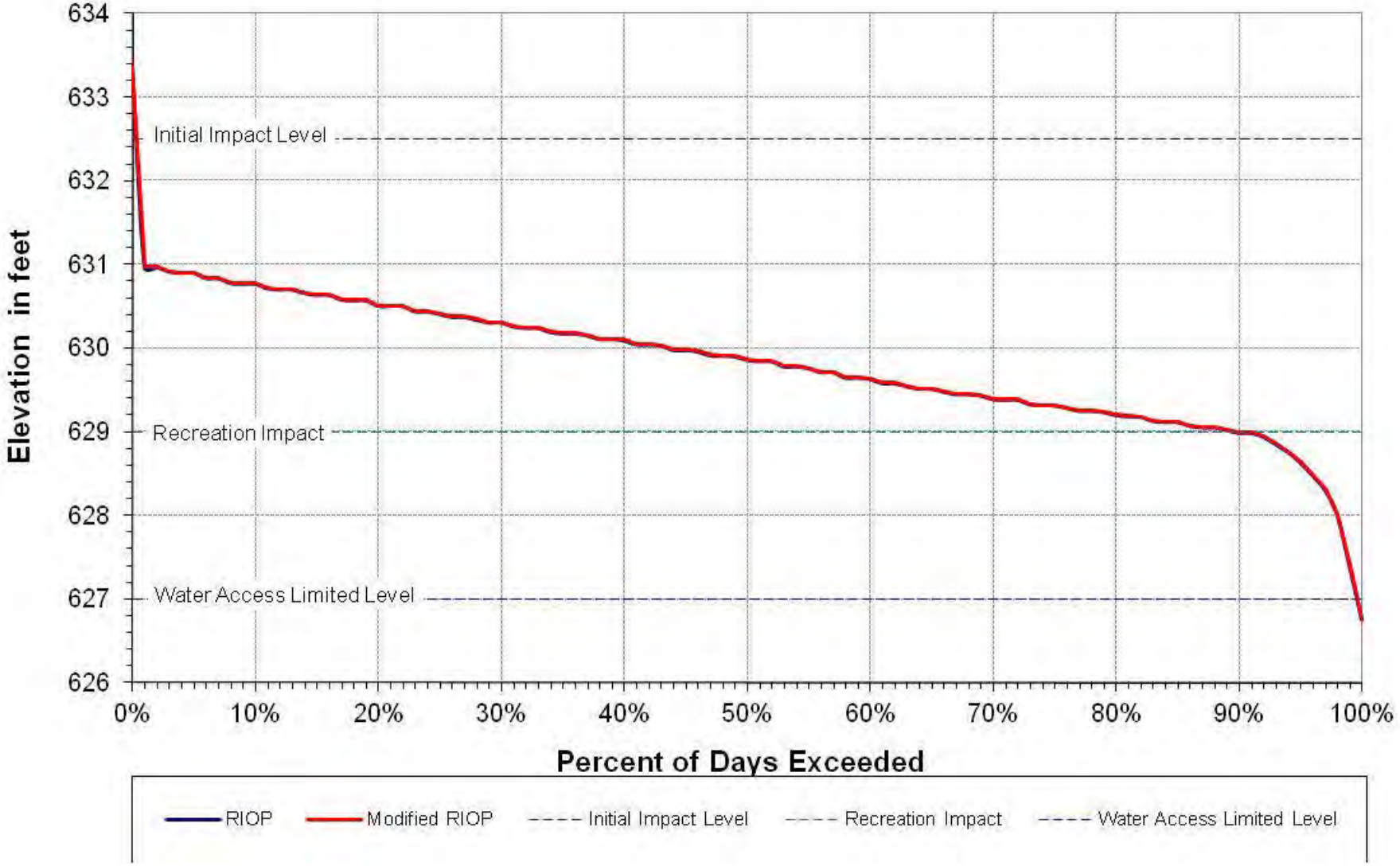
West Point Pool Elevation-Jan



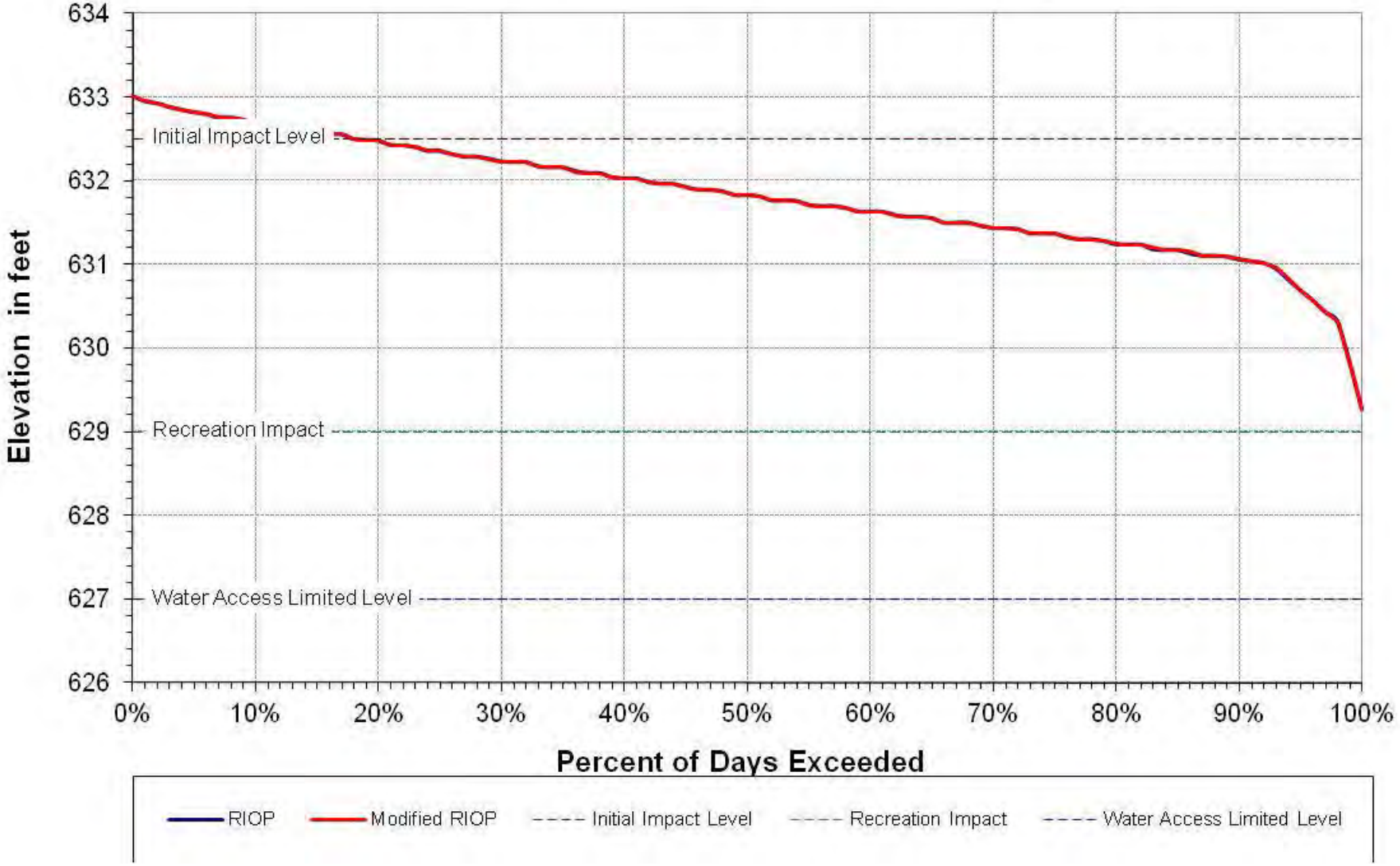
West Point Pool Elevation-Feb



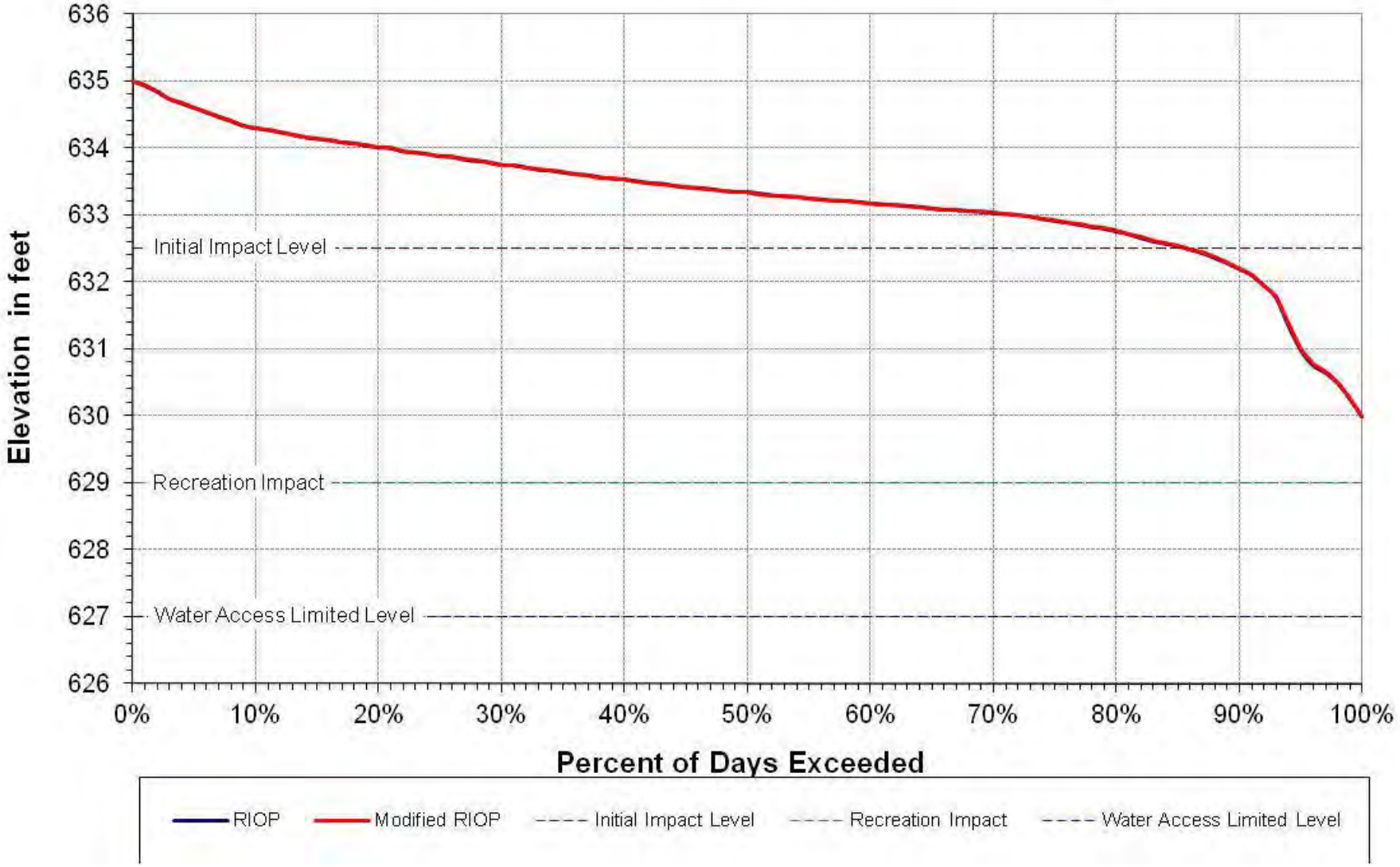
West Point Pool Elevation-Mar



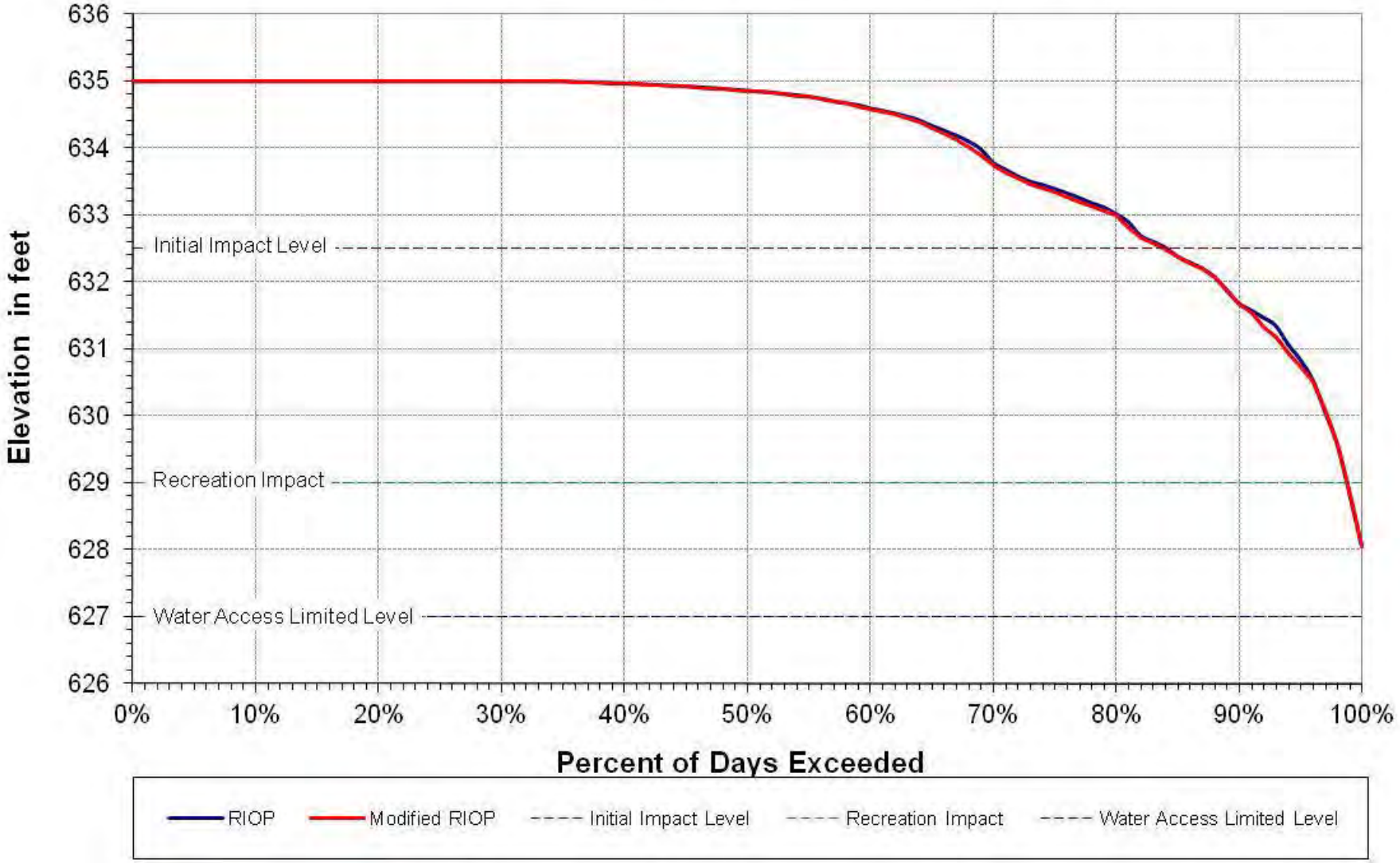
West Point Pool Elevation-Apr



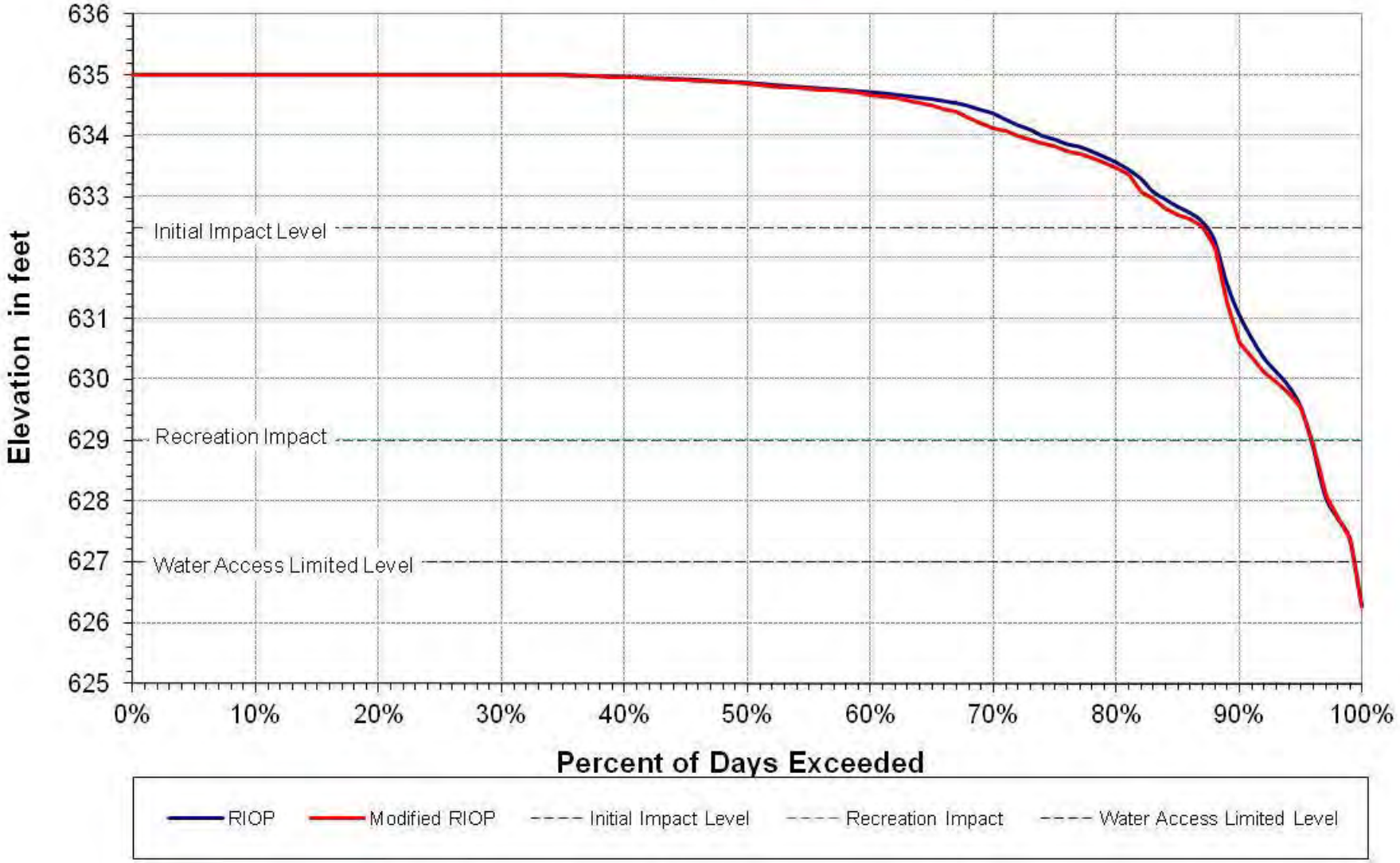
West Point Pool Elevation-May



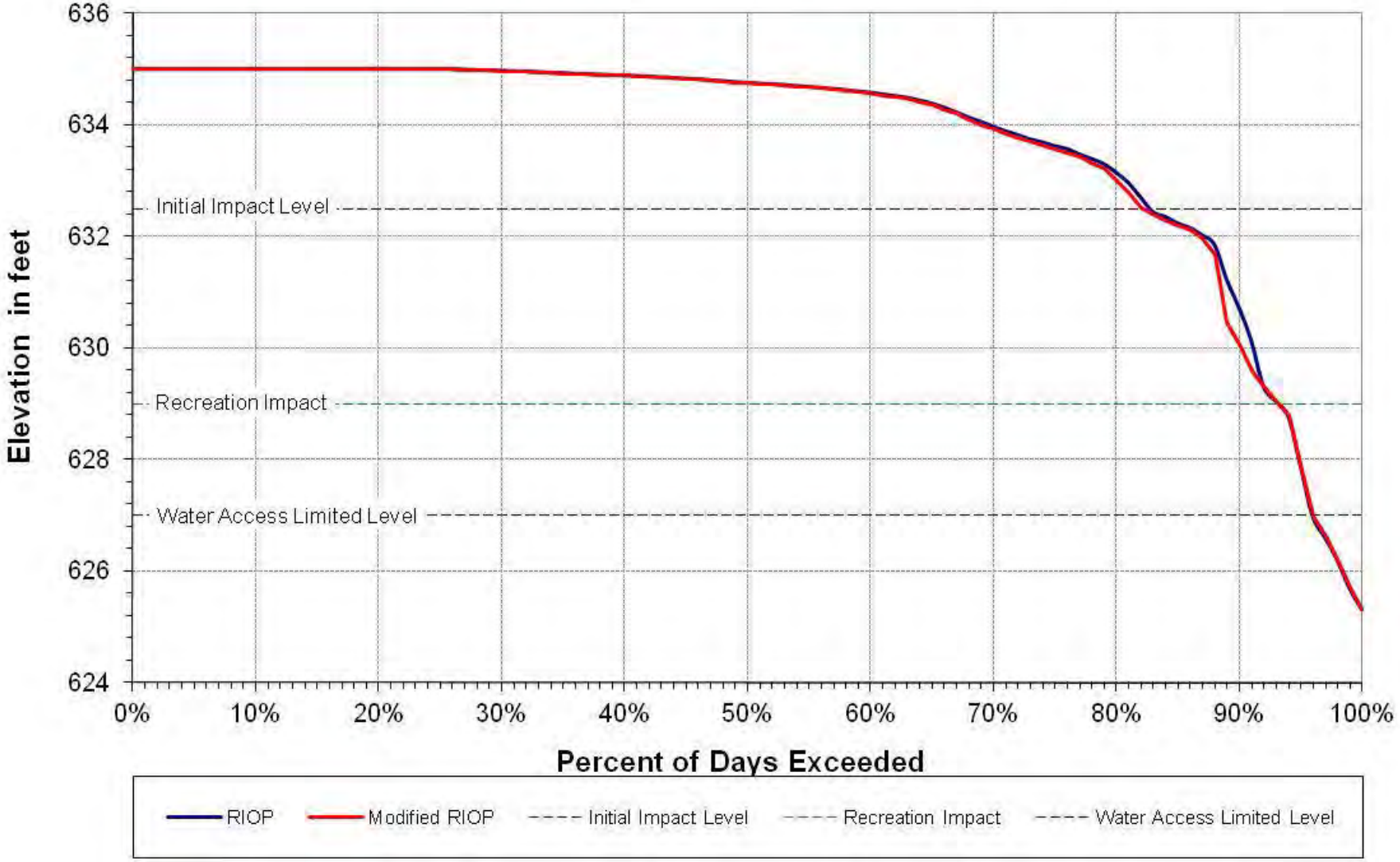
West Point Pool Elevation-Jun



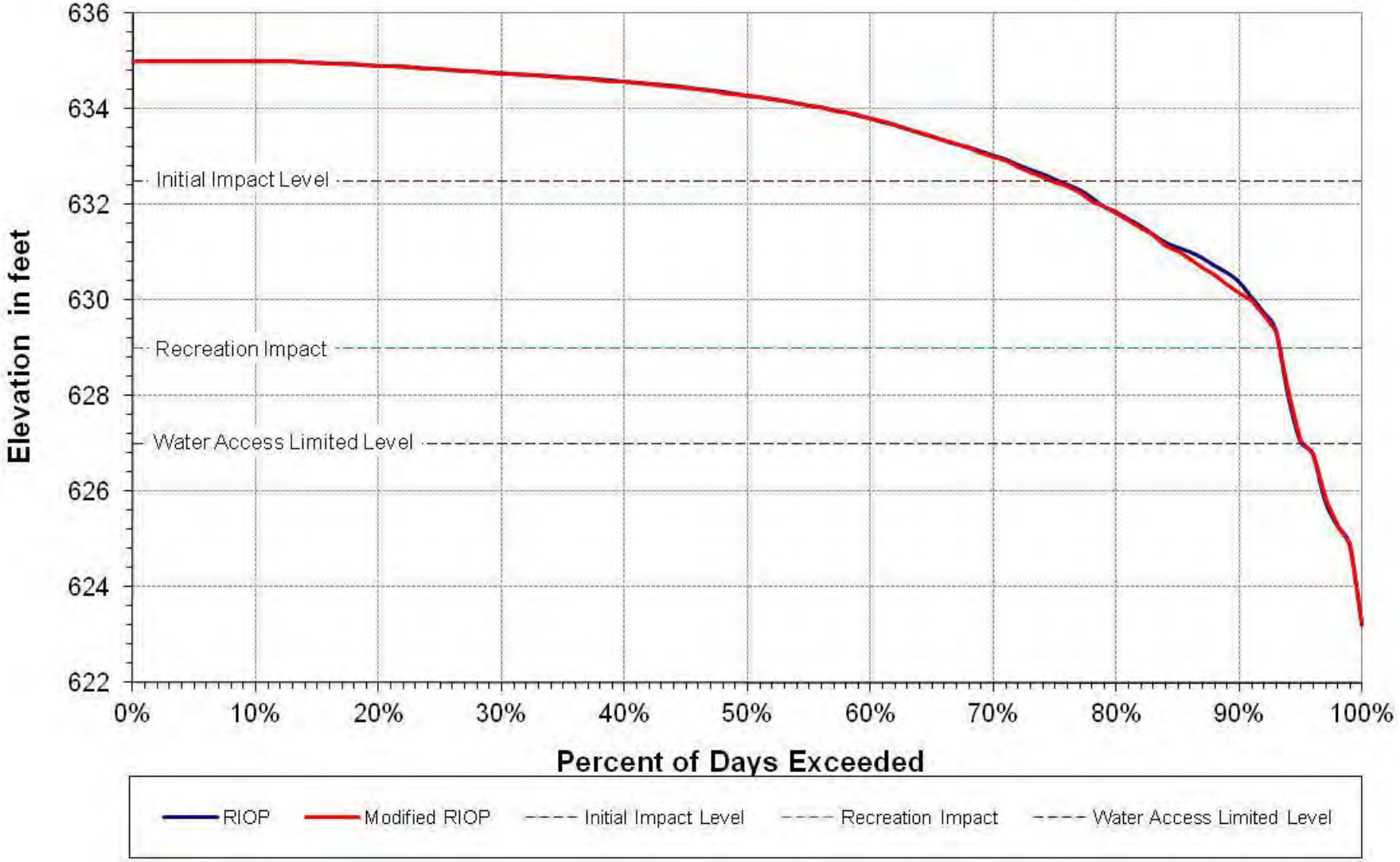
West Point Pool Elevation-Jul



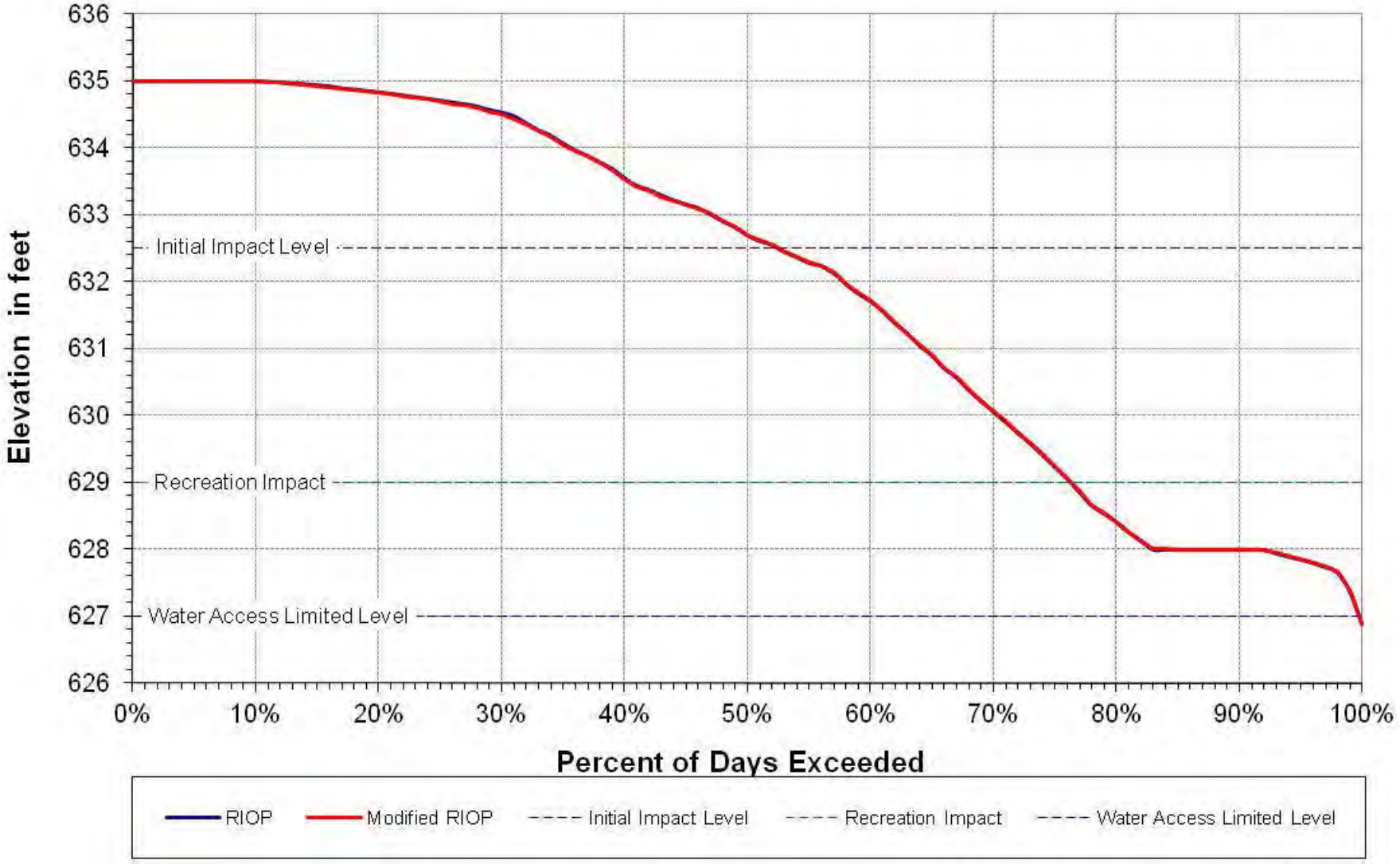
West Point Pool Elevation-Aug



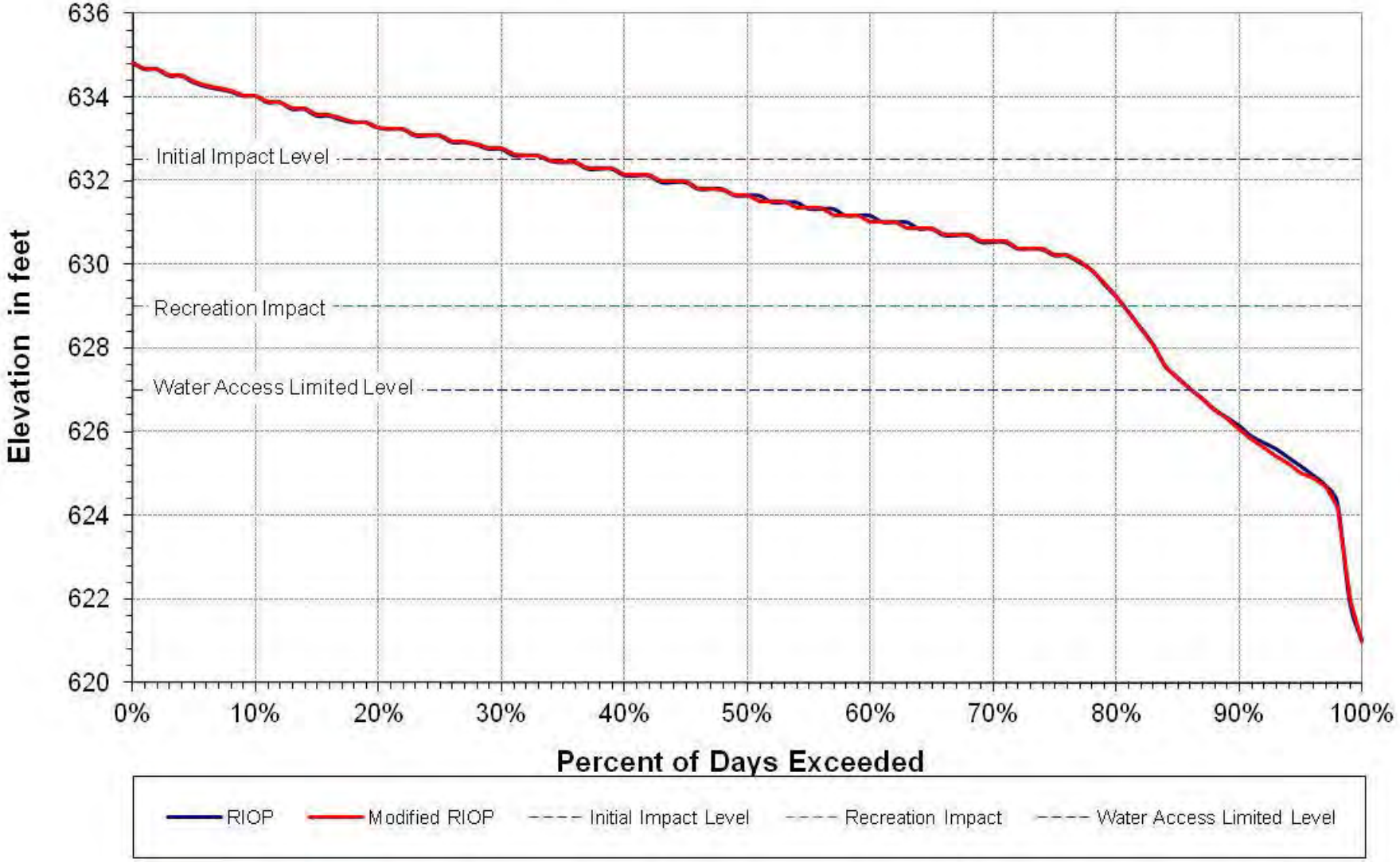
West Point Pool Elevation-Sep

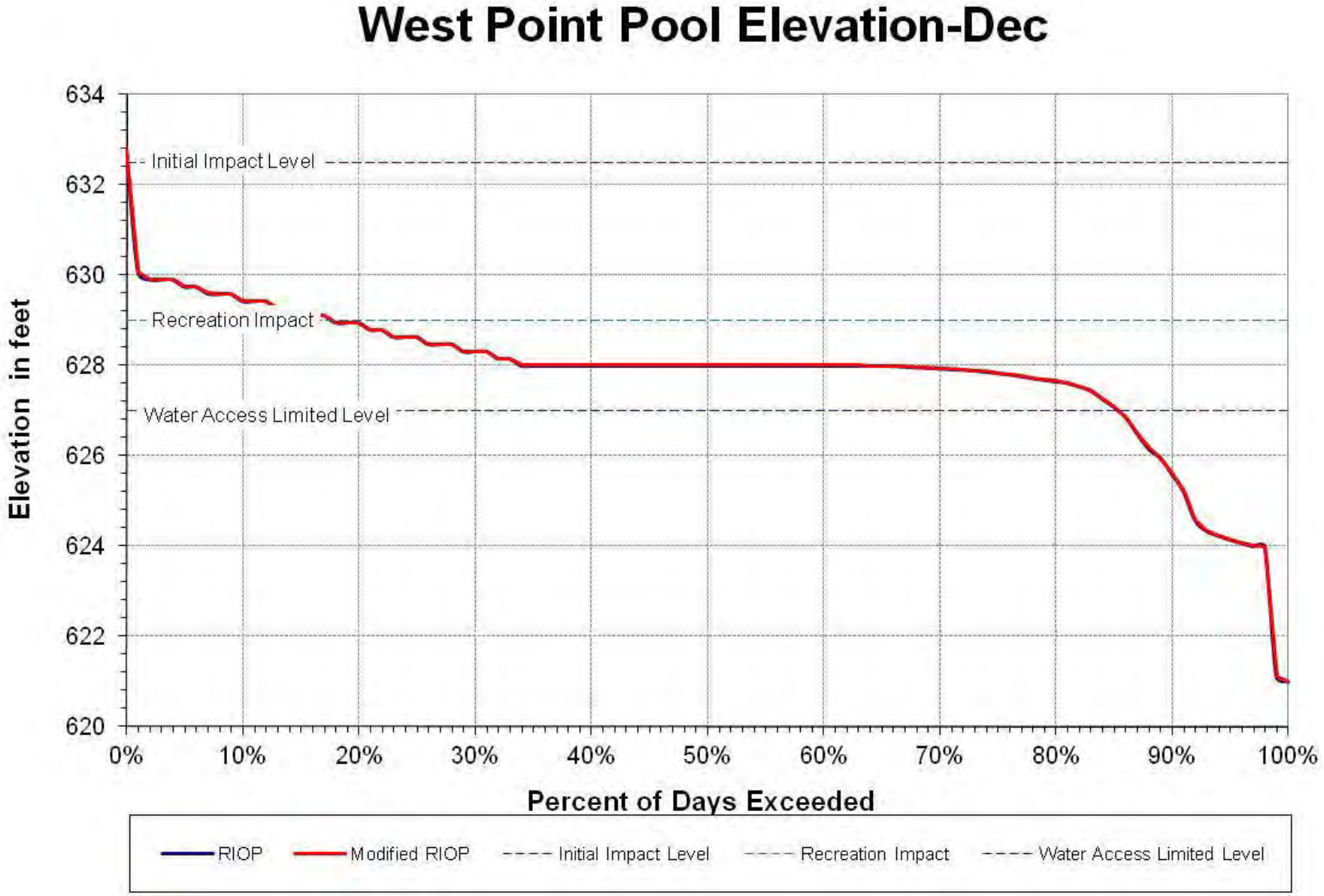


West Point Pool Elevation-Oct



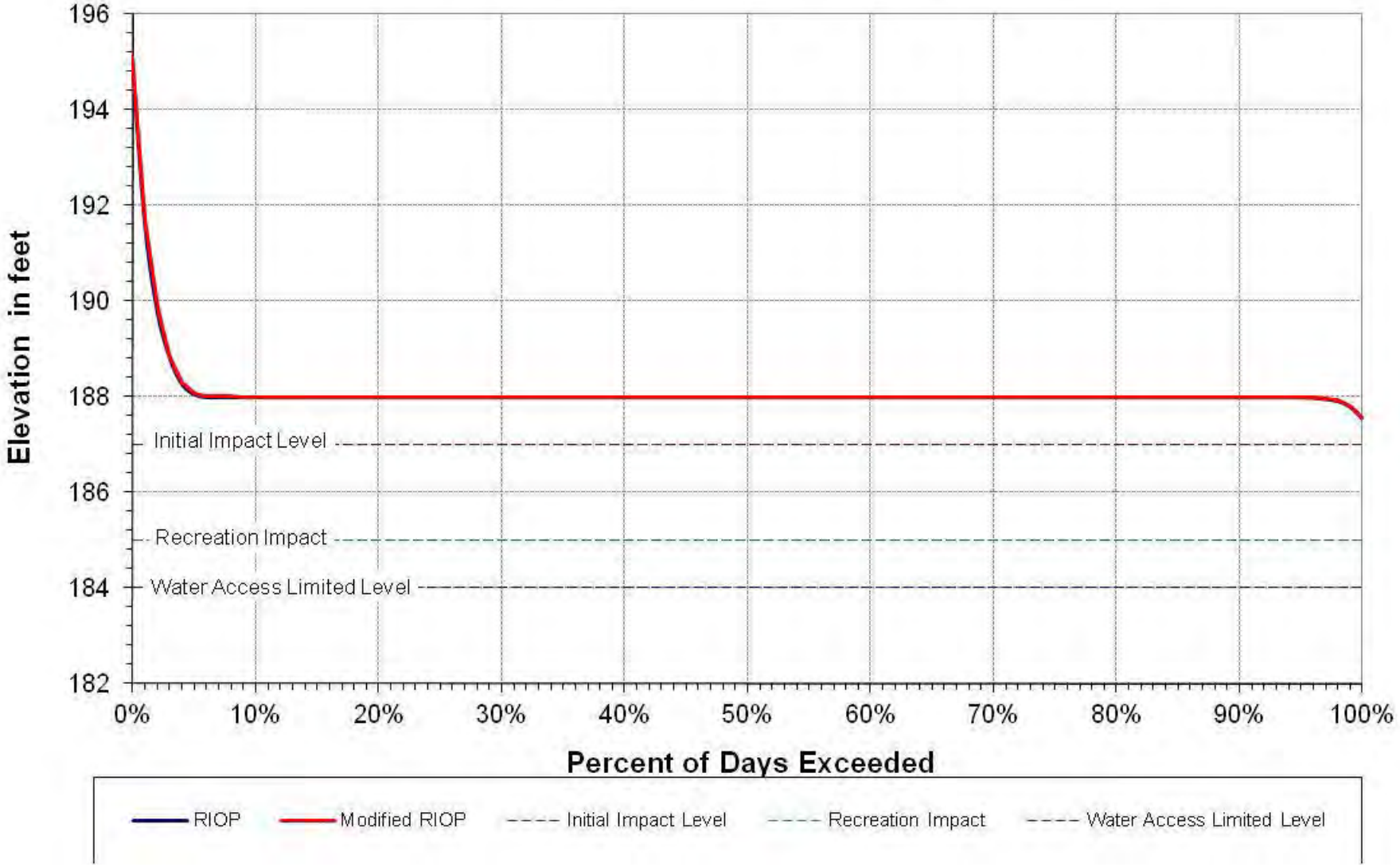
West Point Pool Elevation-Nov



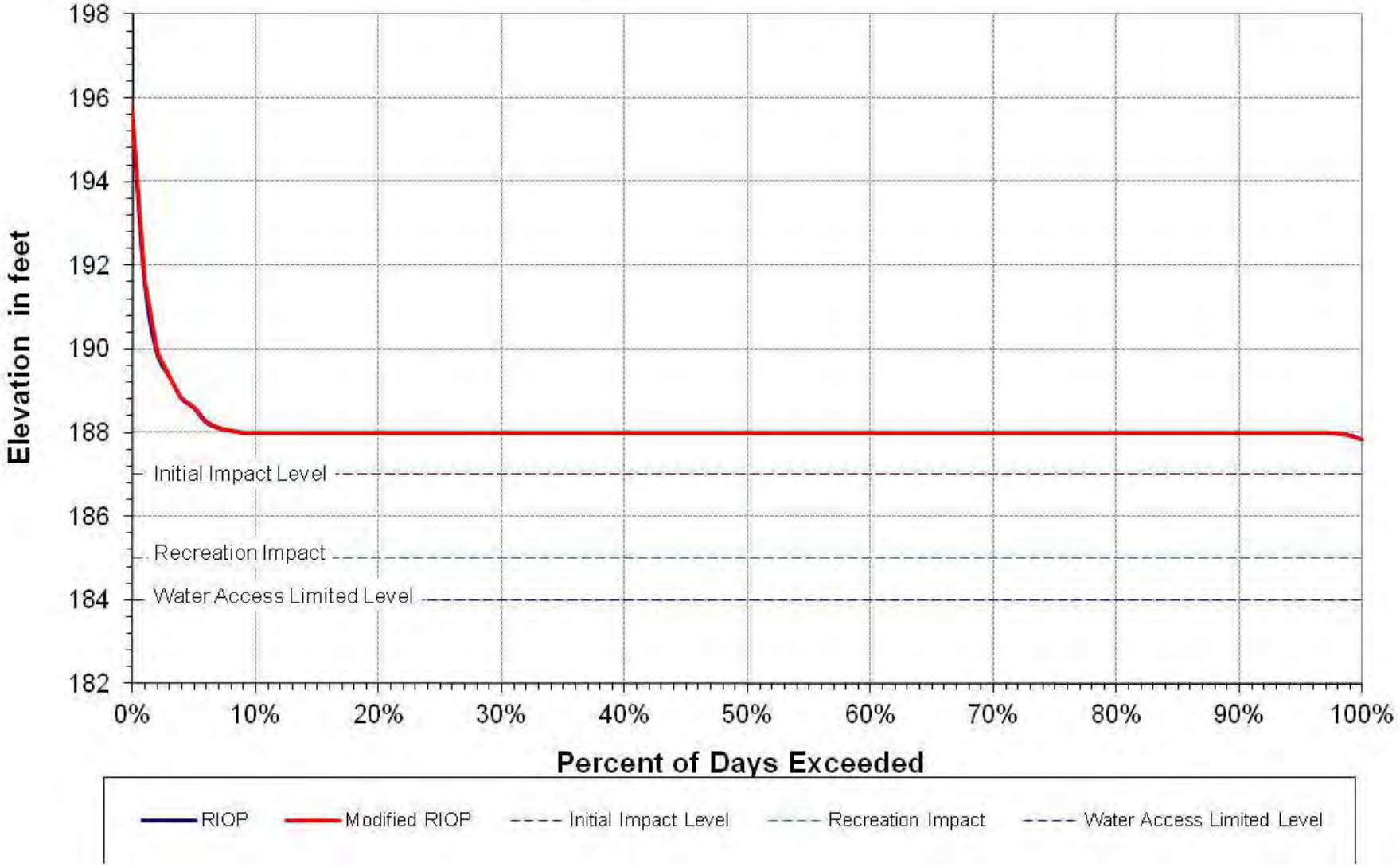

West Point Pool Elevation-Dec
Elevation in feet
634
632
630
628
626
624
622
620
Initial Impact Level
Recreation Impact
Water Access Limited Level
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Exceeded
RIOP
Modified RIOP
Initial Impact Level
Recreation Impact
Water Access Limited Level

Walter F George Pool Monthly Duration

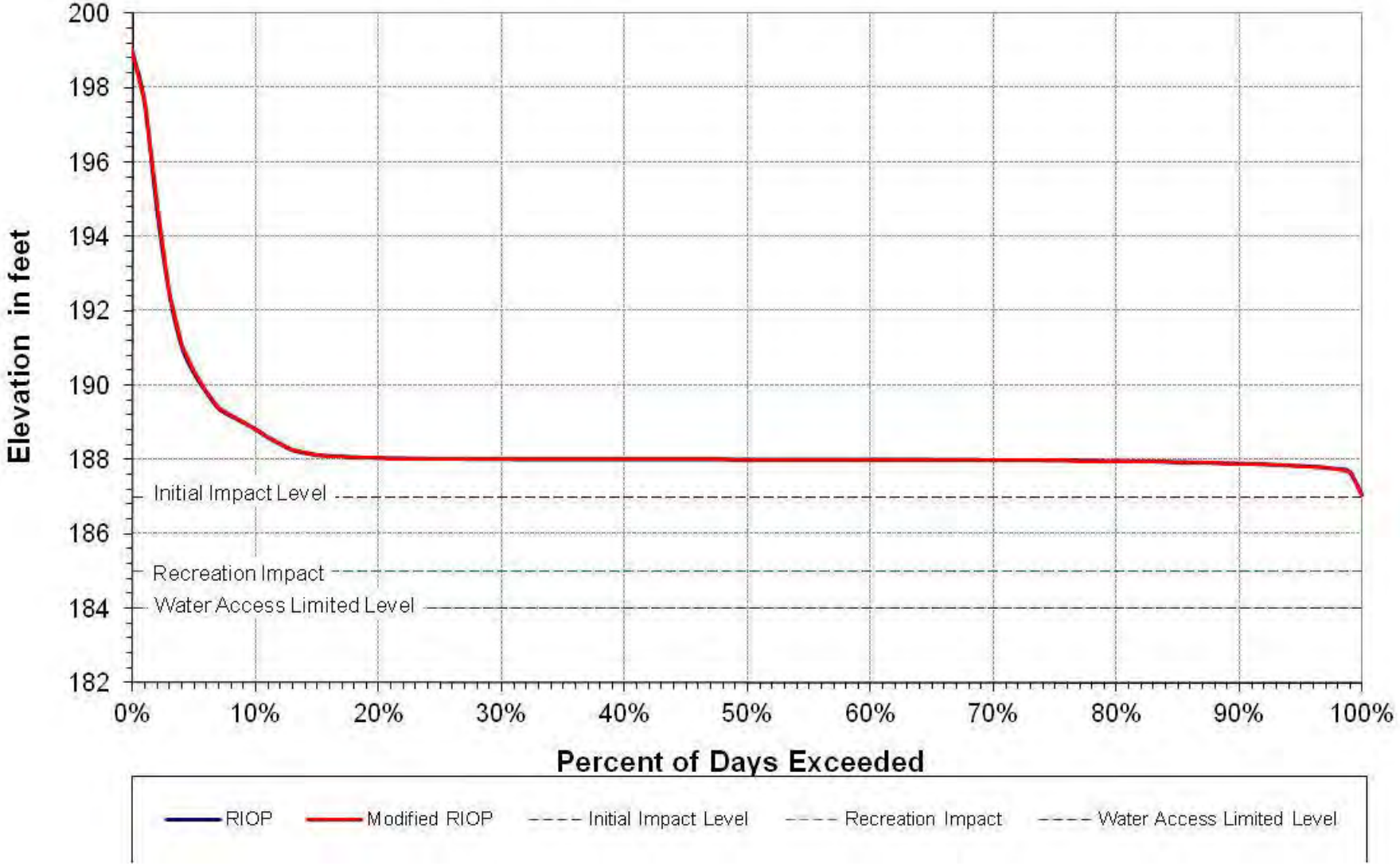
WF George Pool Elevation-Jan



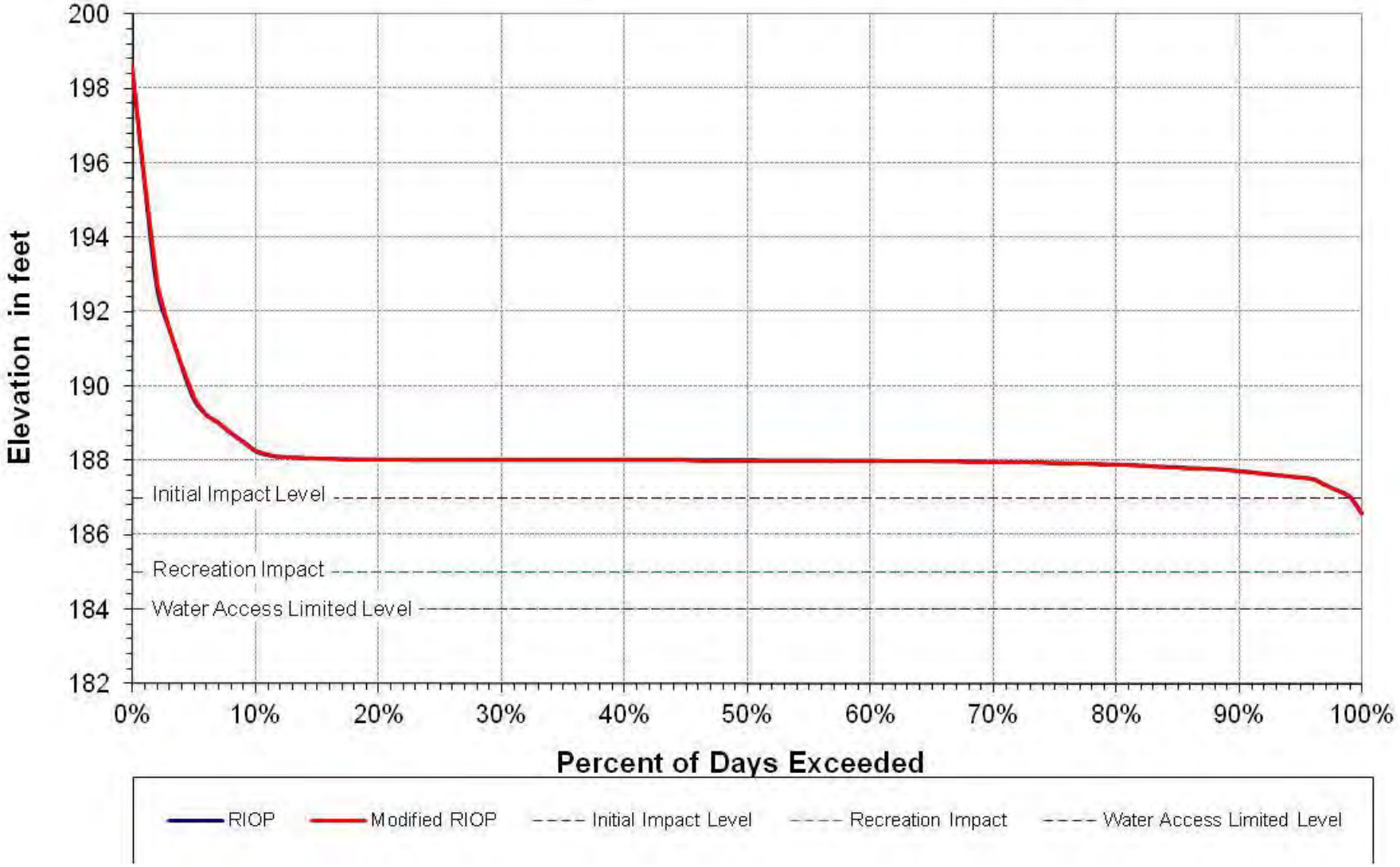
WF George Pool Elevation-Feb



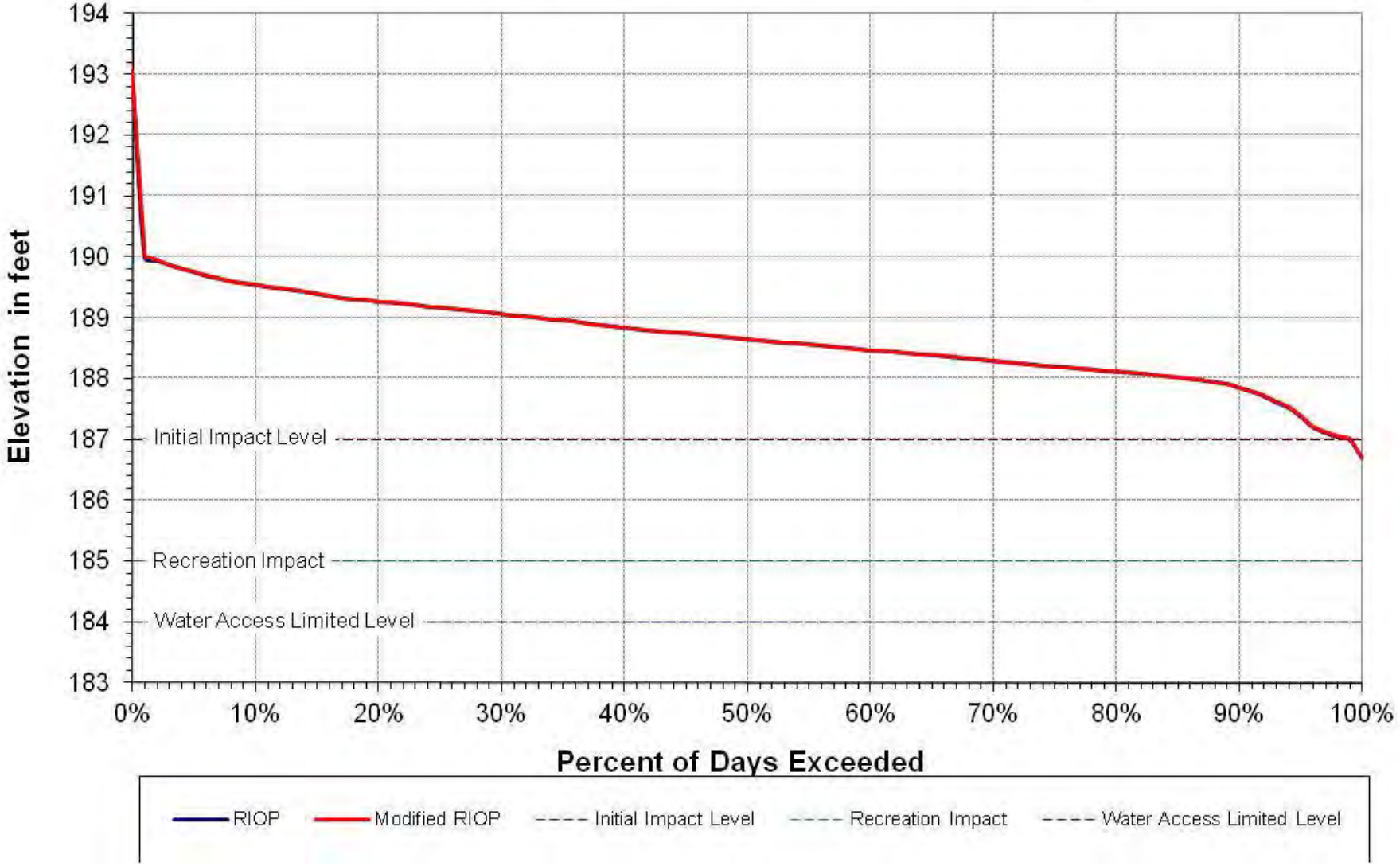
WF George Pool Elevation-Mar



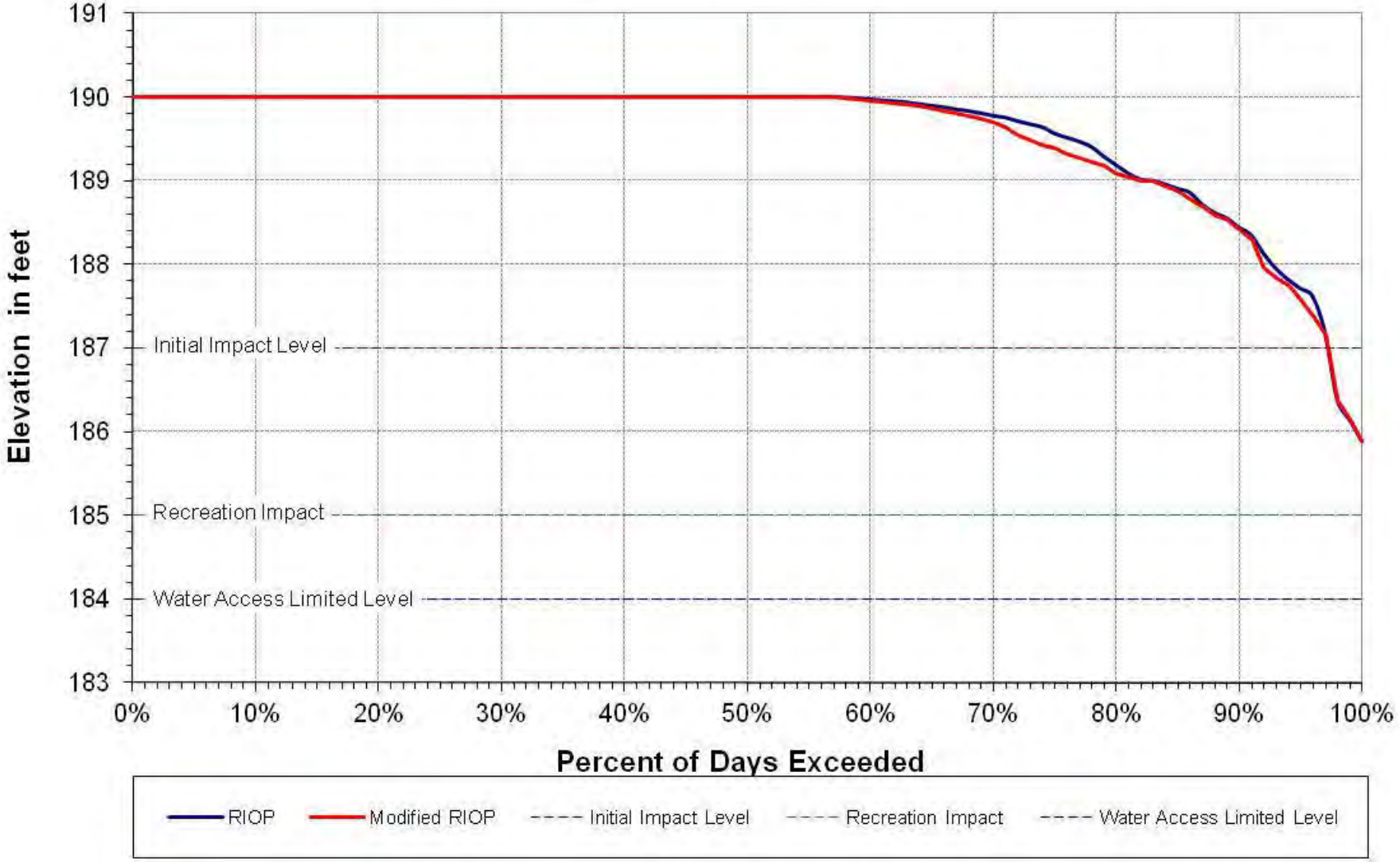
WF George Pool Elevation-Apr



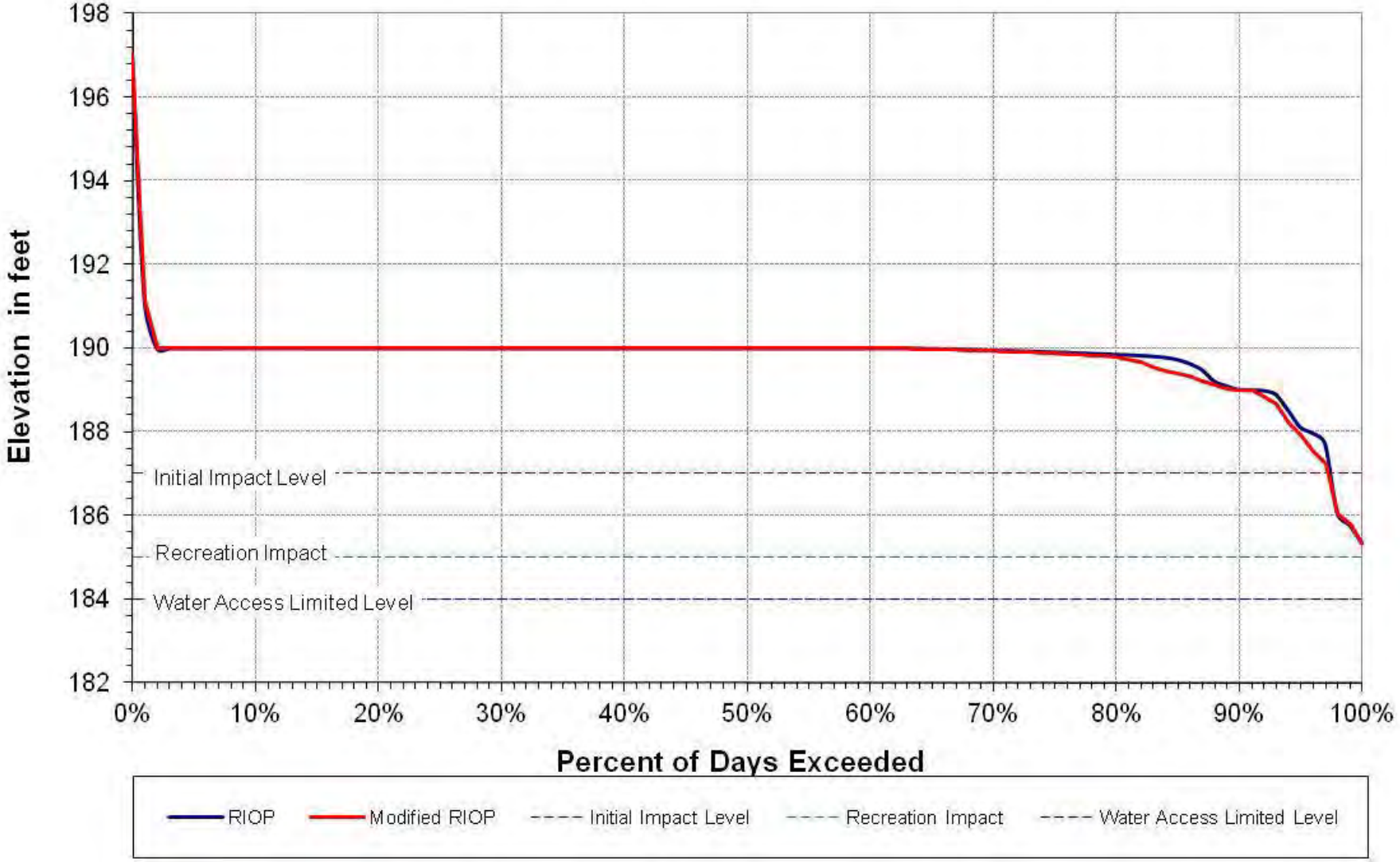
WF George Pool Elevation-May



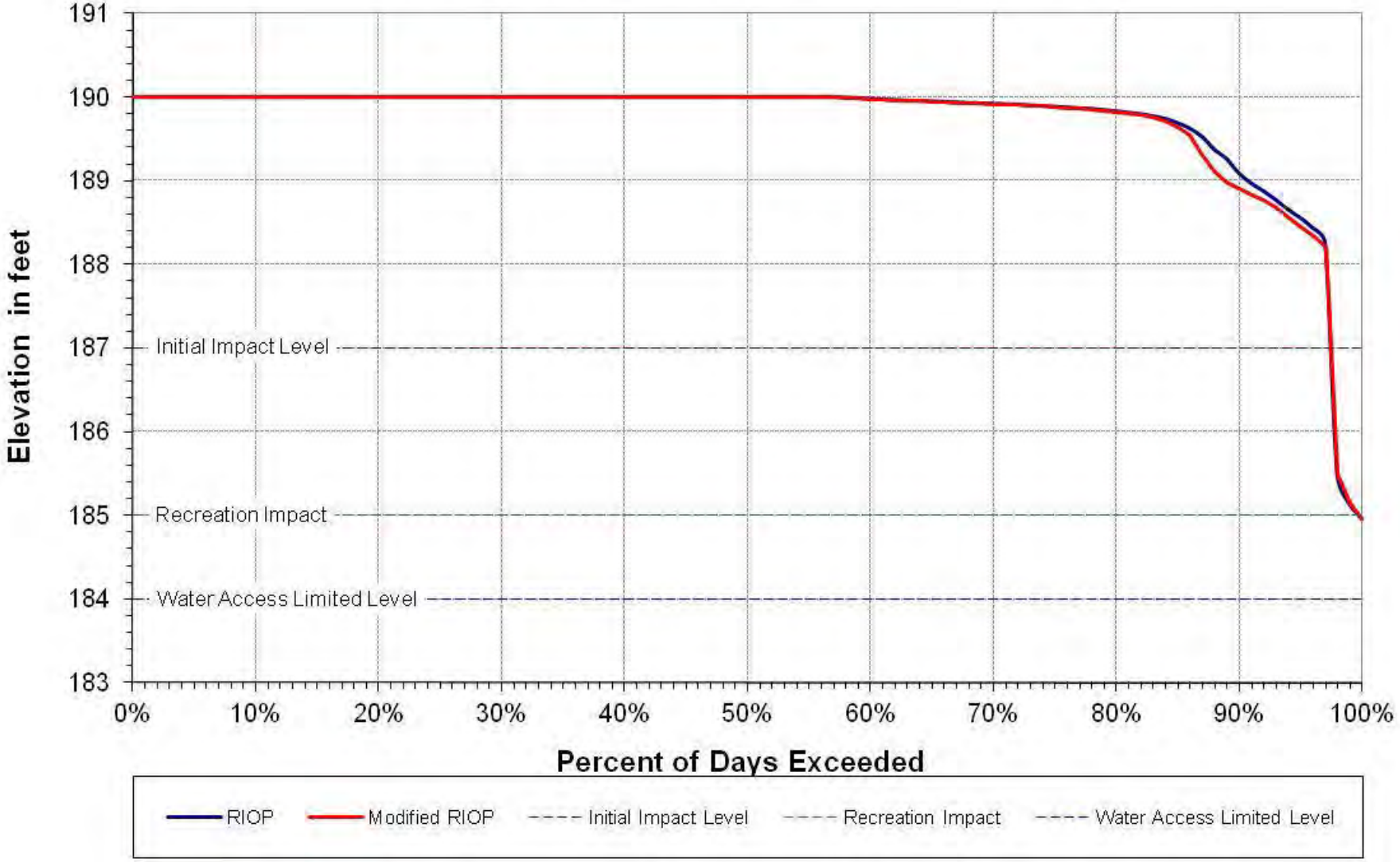
WF George Pool Elevation-Jun



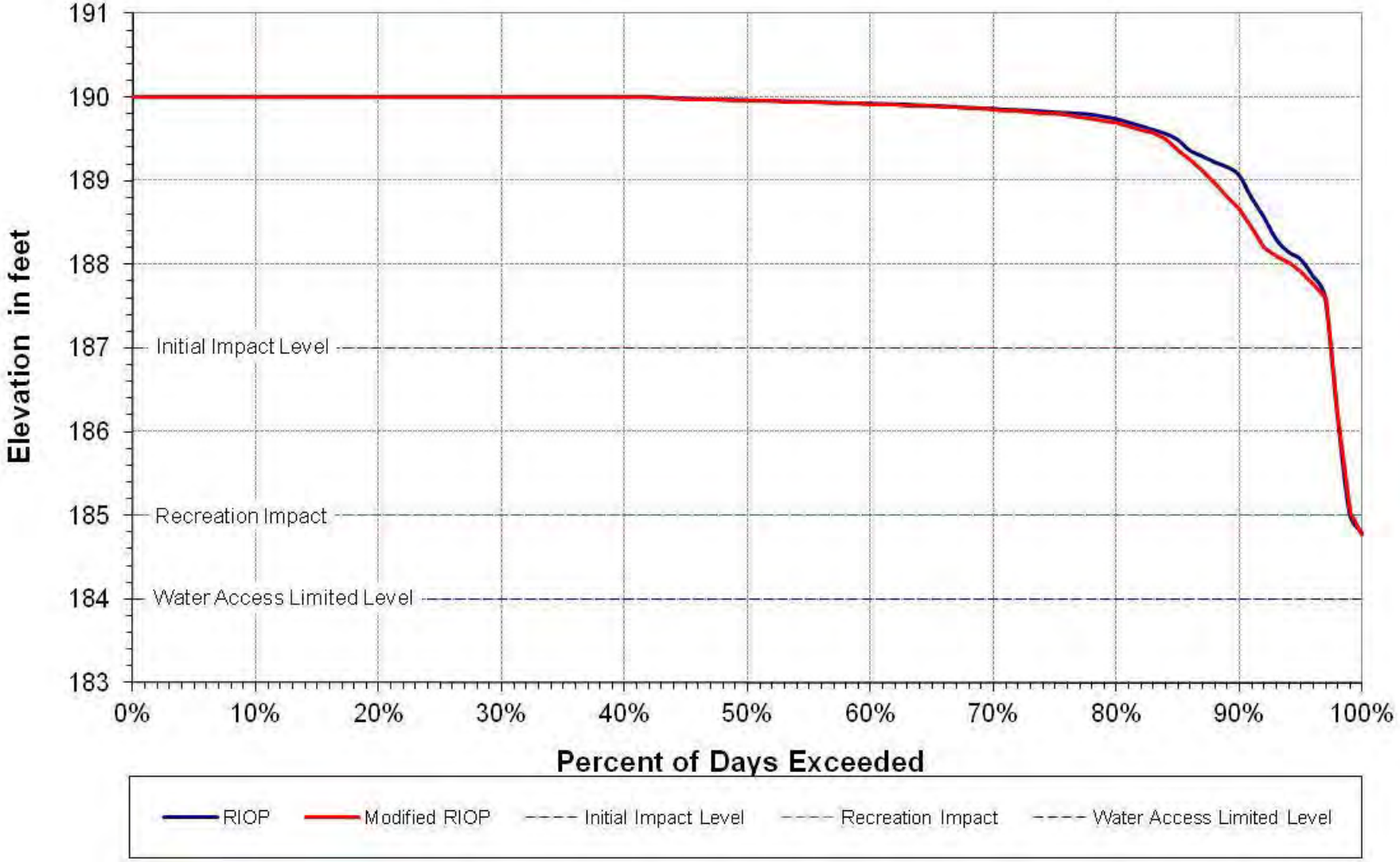
WF George Pool Elevation-Jul



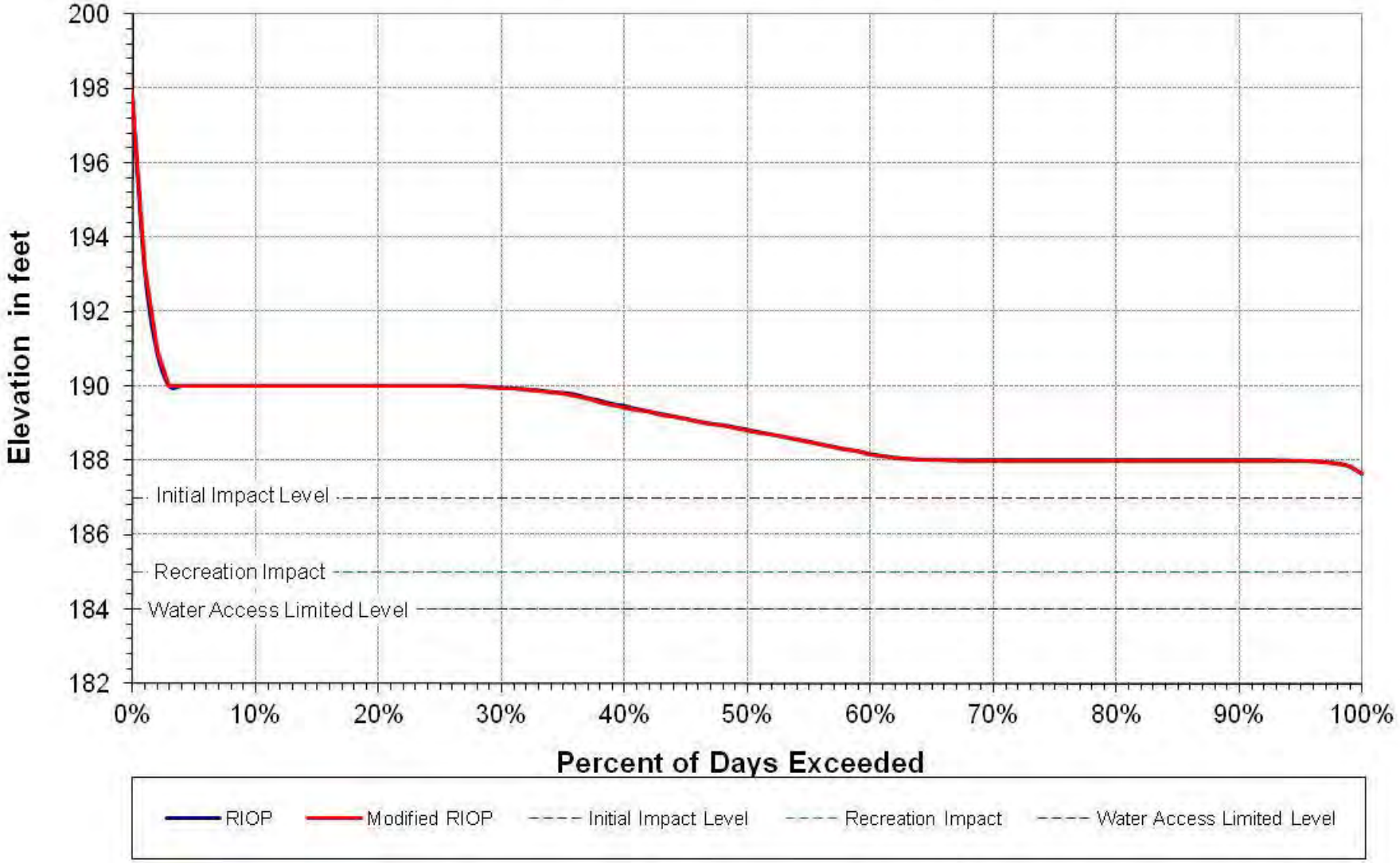
WF George Pool Elevation-Aug



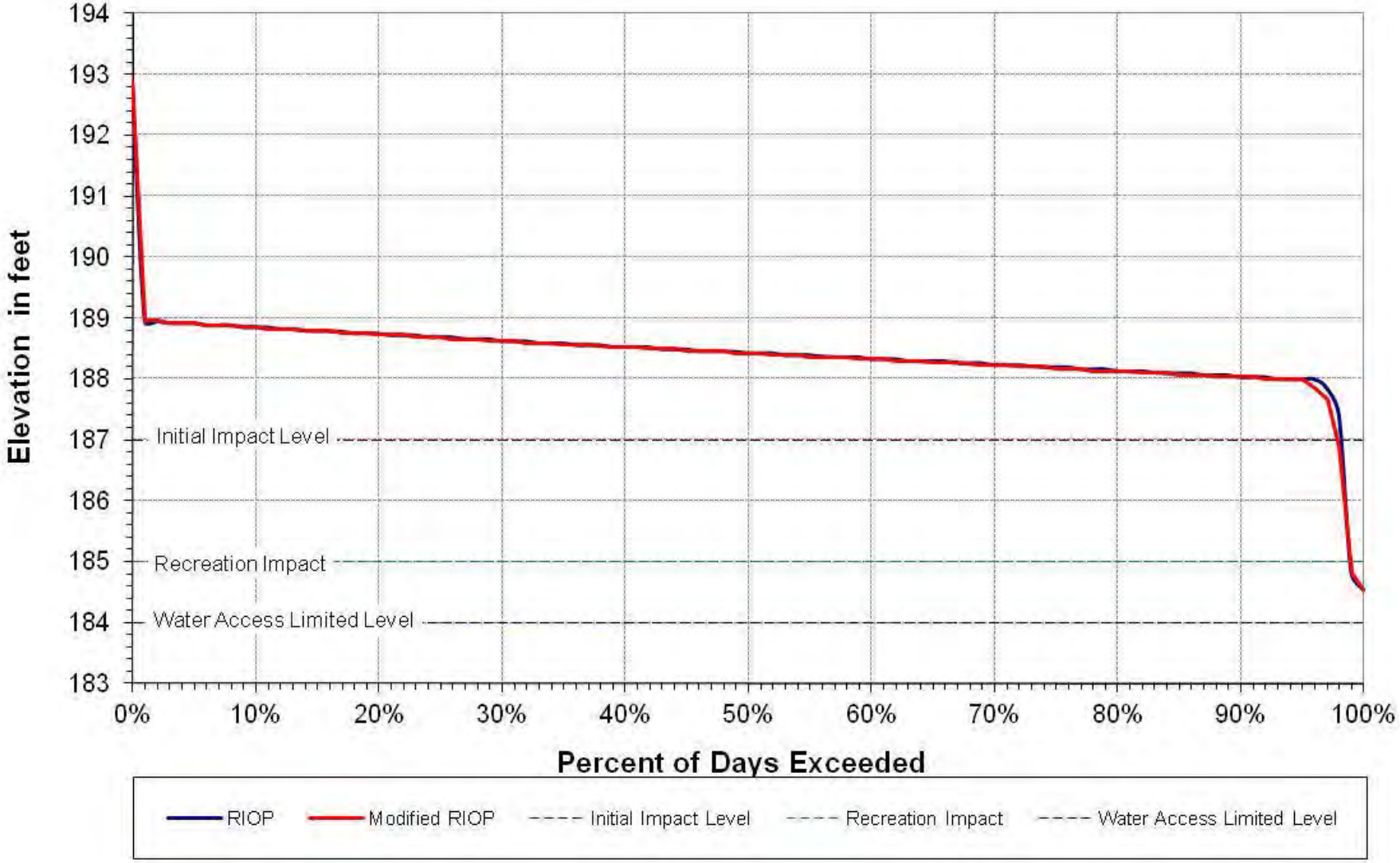
WF George Pool Elevation-Sep



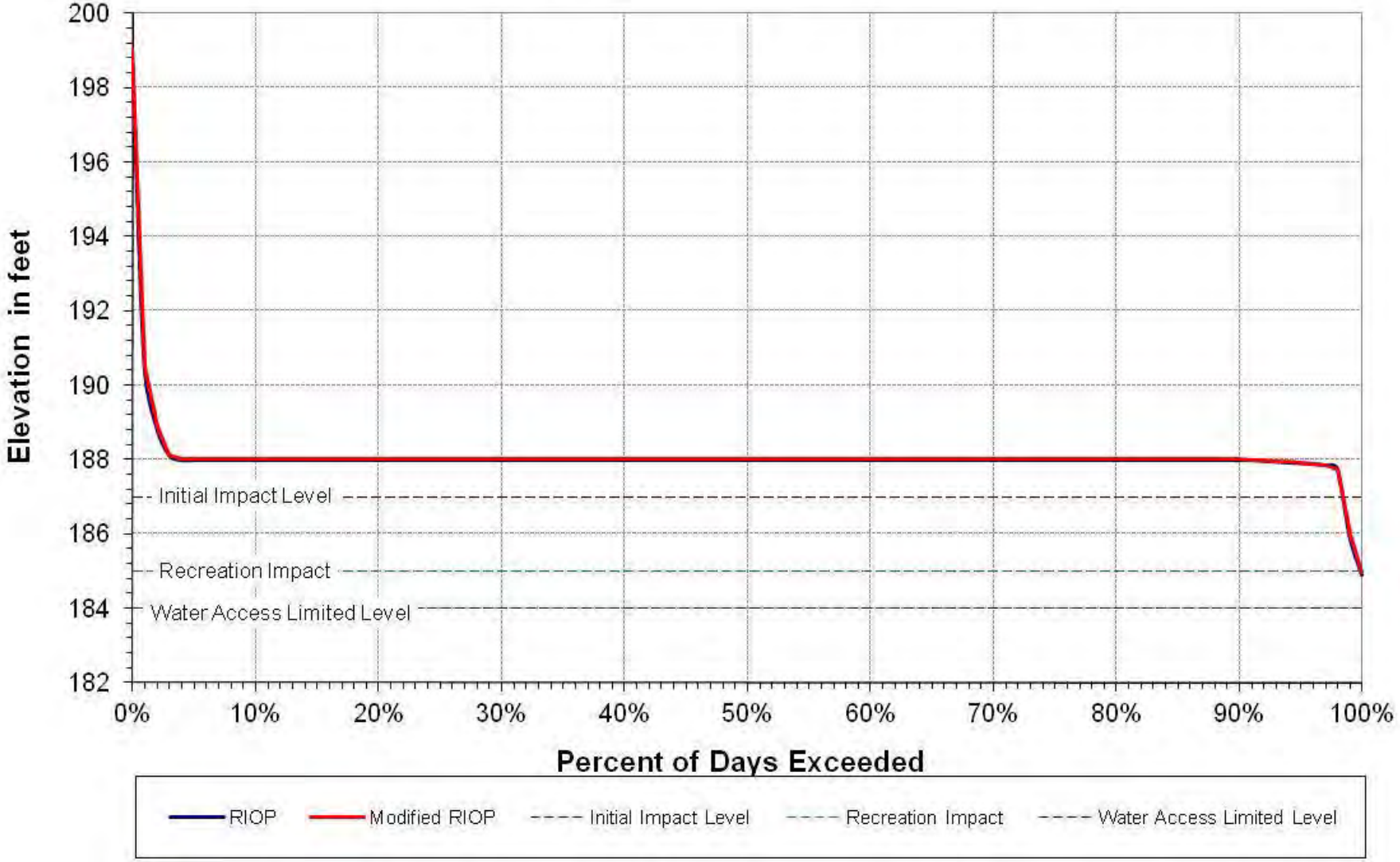
WF George Pool Elevation-Oct



WF George Pool Elevation-Nov

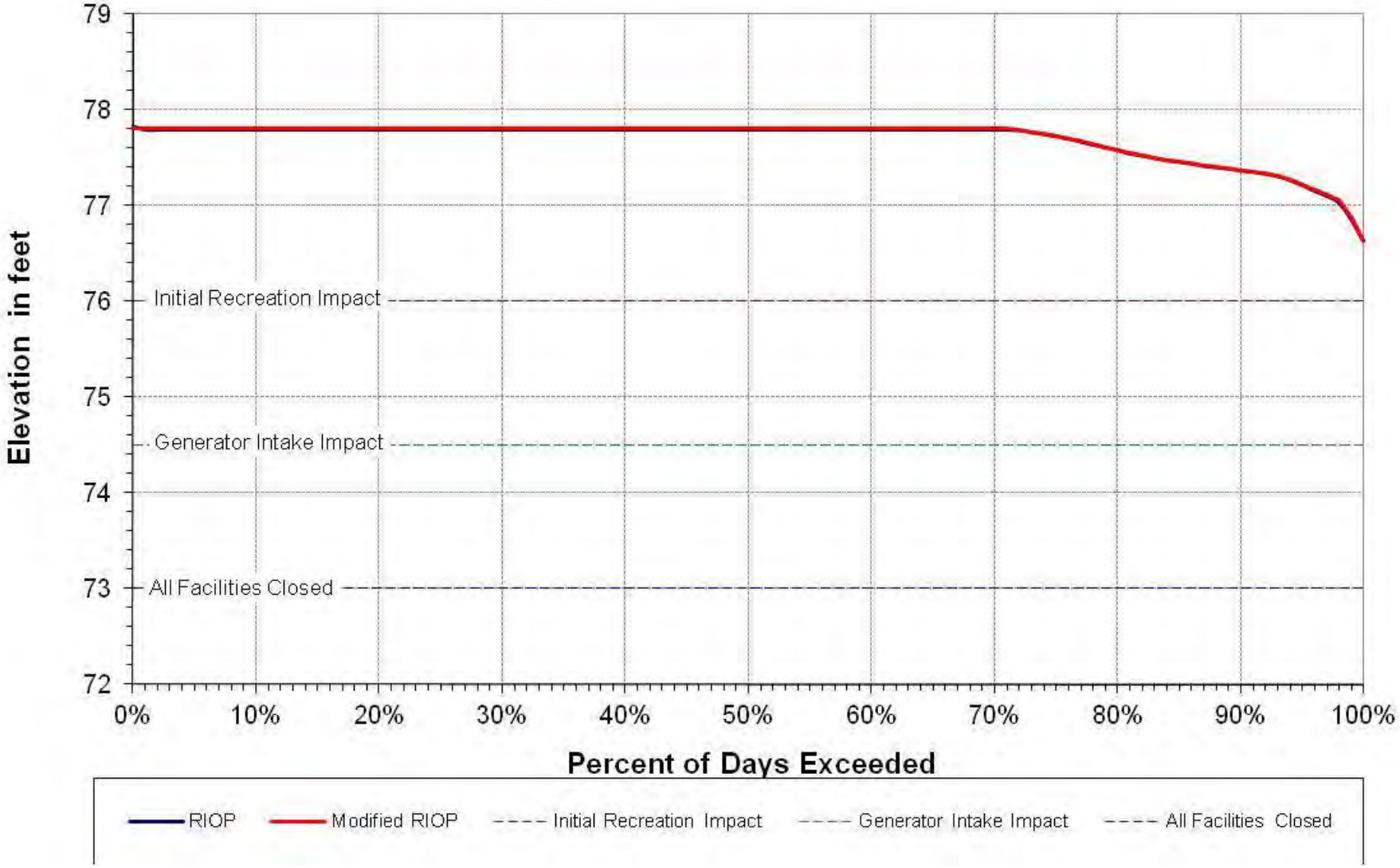


WF George Pool Elevation-Dec

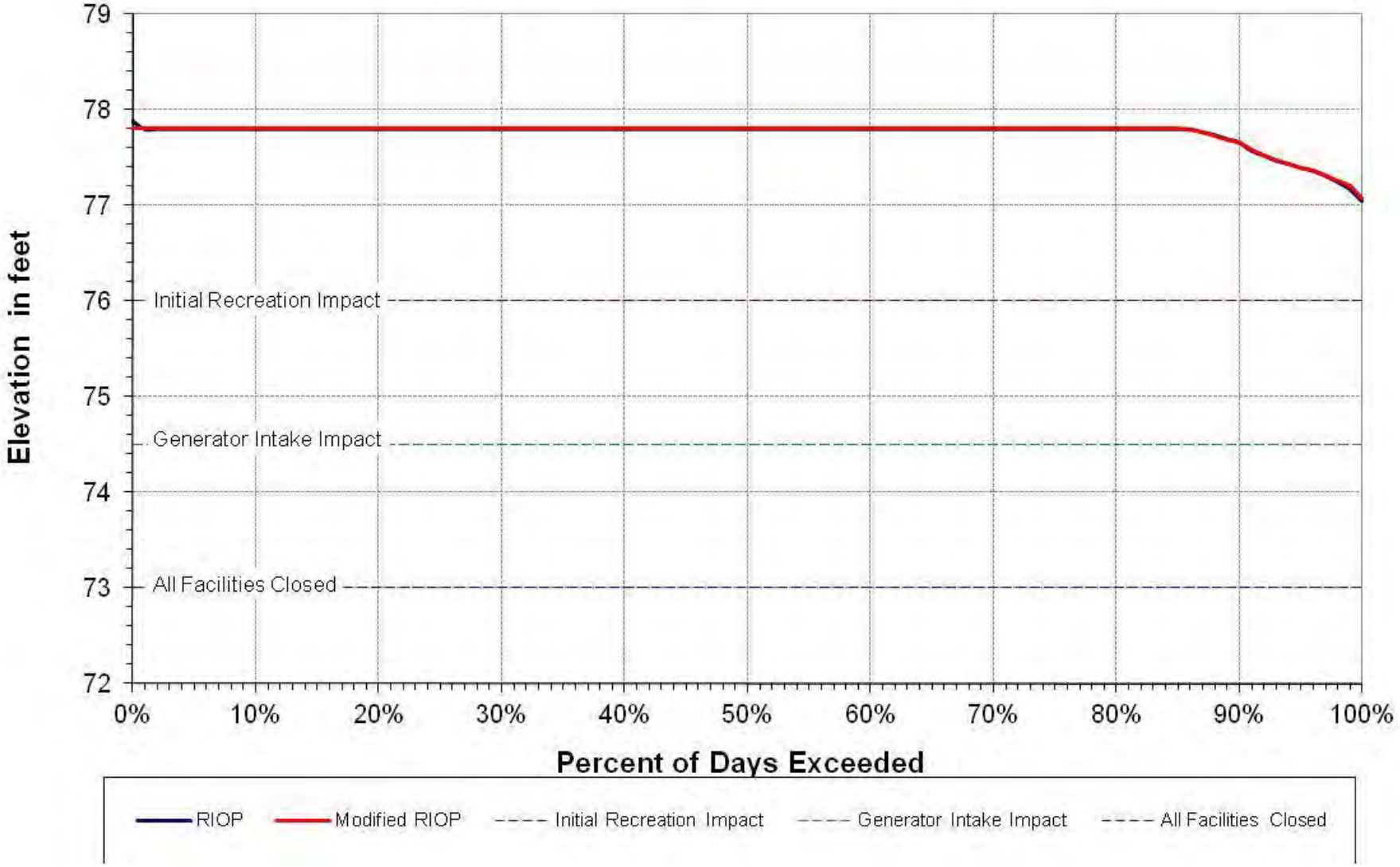


Jim Woodruff Pool Monthly Duration

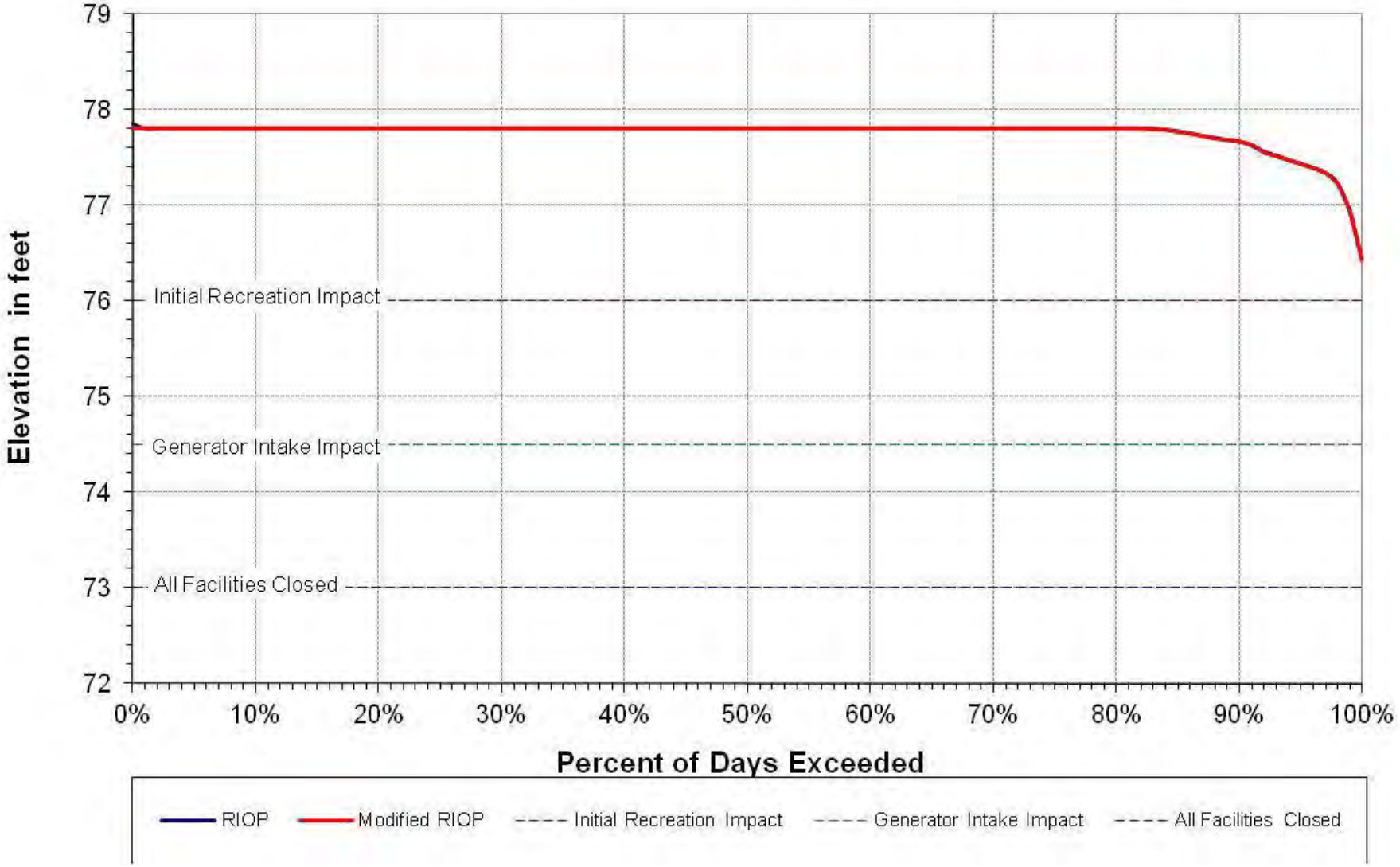
Jim Woodruff Pool Elevation-Jan



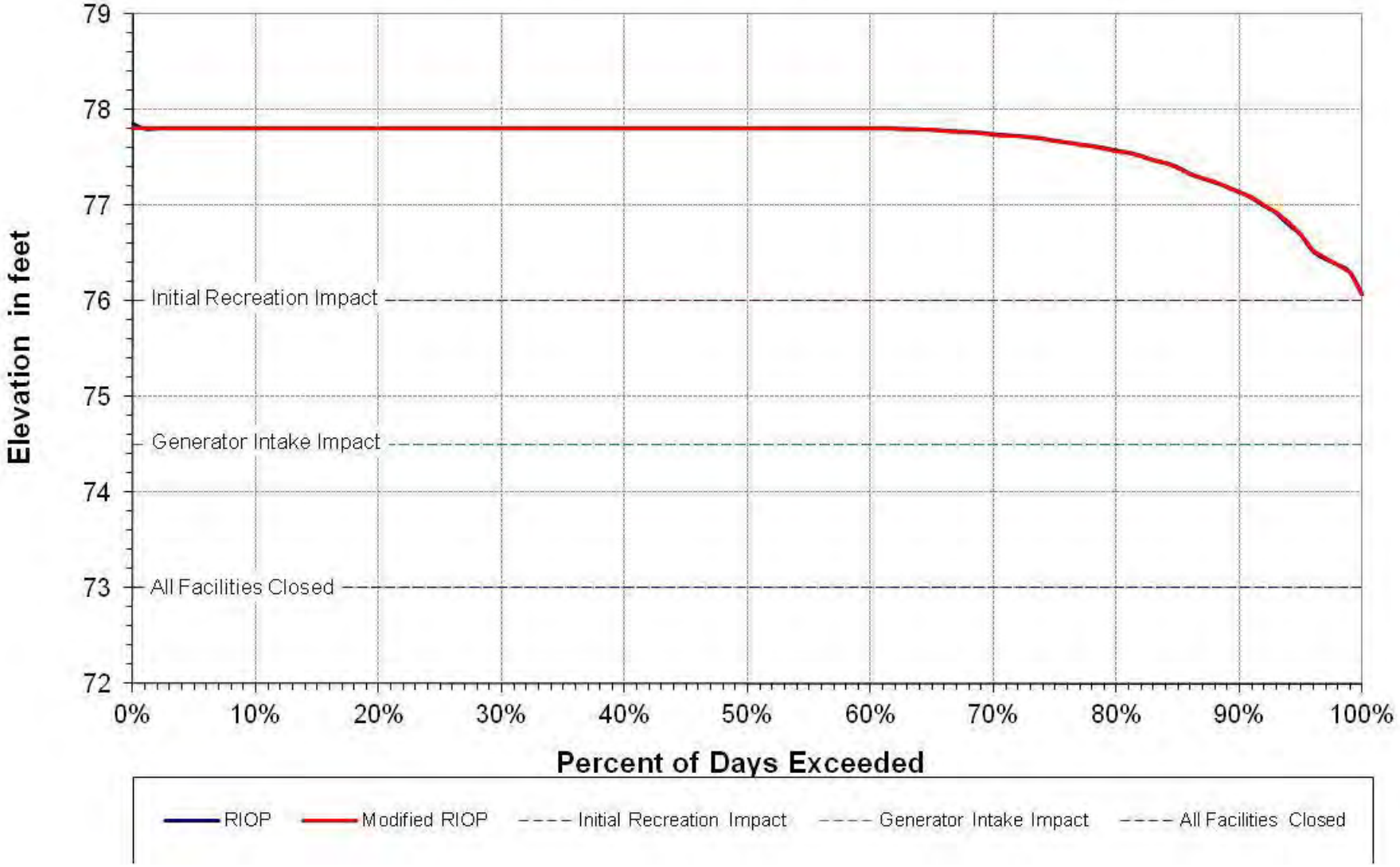
Jim Woodruff Pool Elevation-Feb



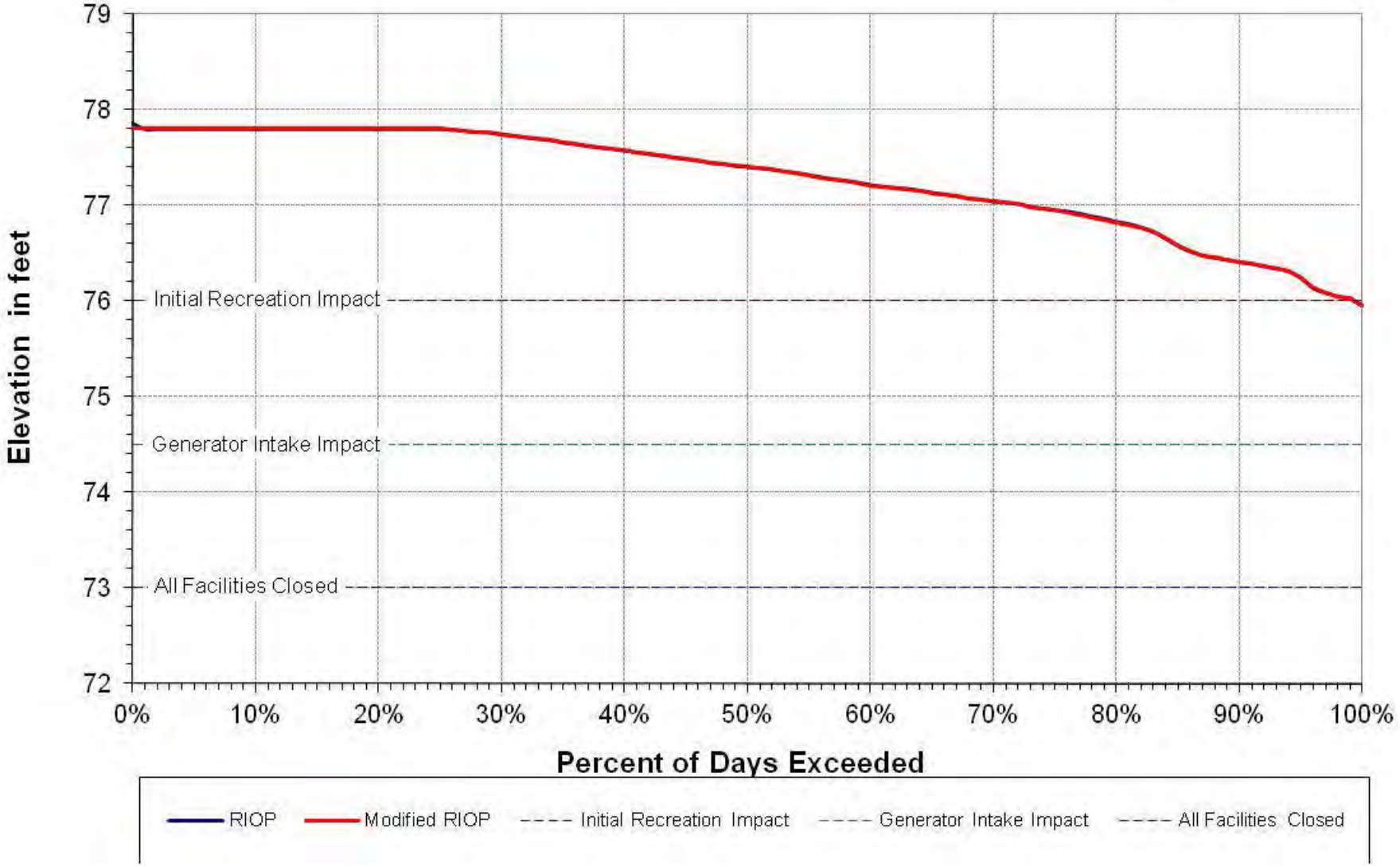
Jim Woodruff Pool Elevation-Mar



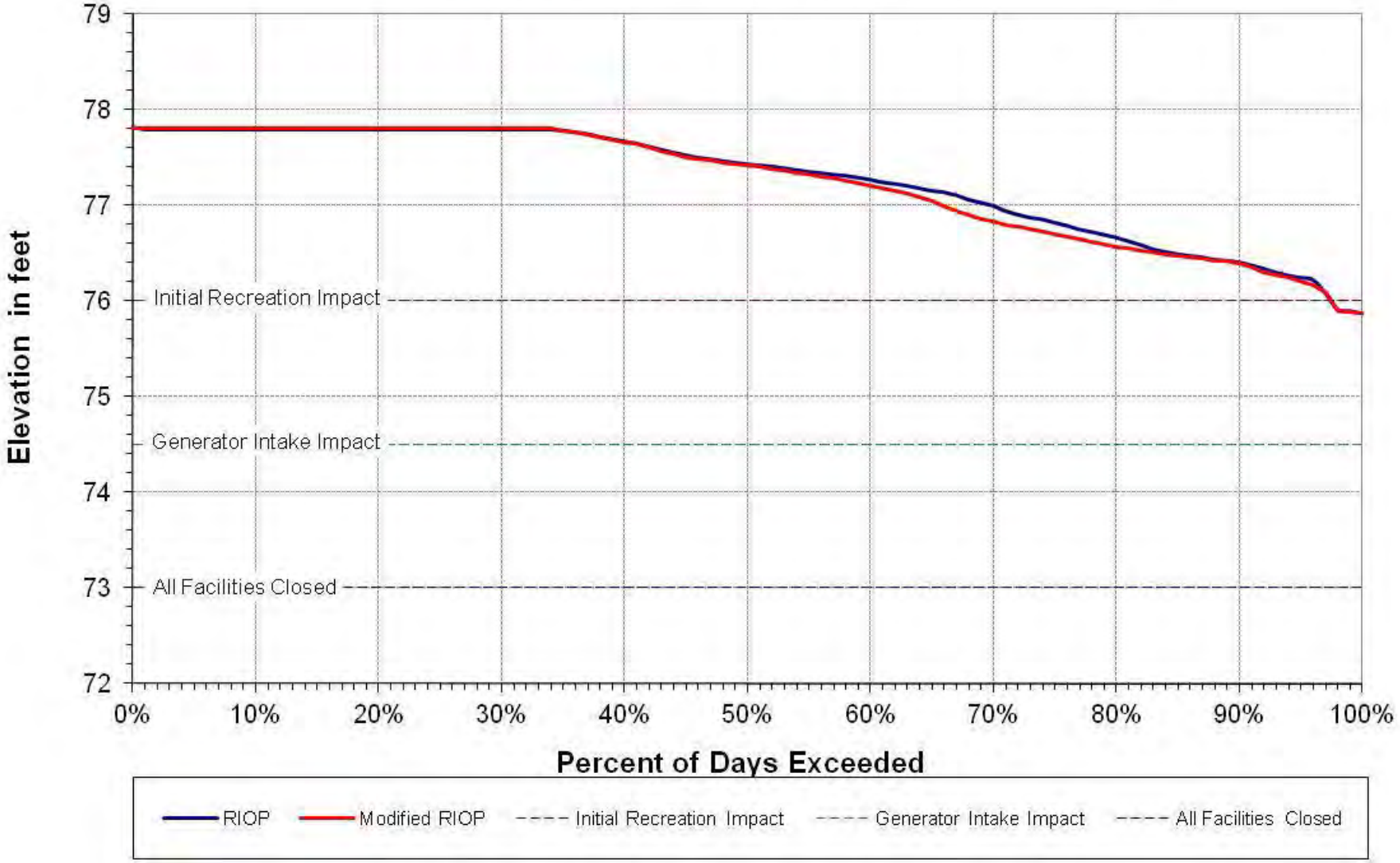
Jim Woodruff Pool Elevation-Apr



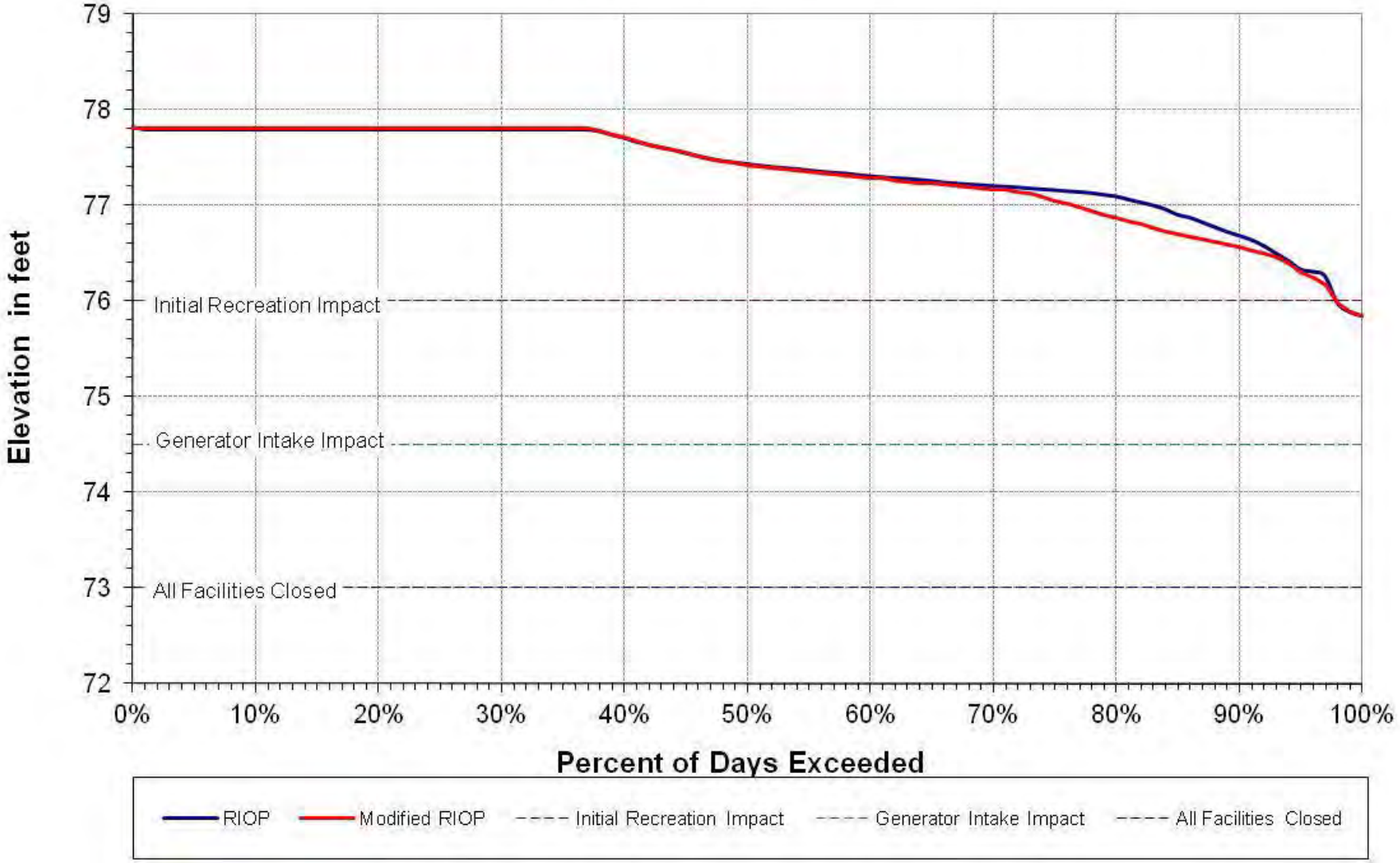
Jim Woodruff Pool Elevation-May



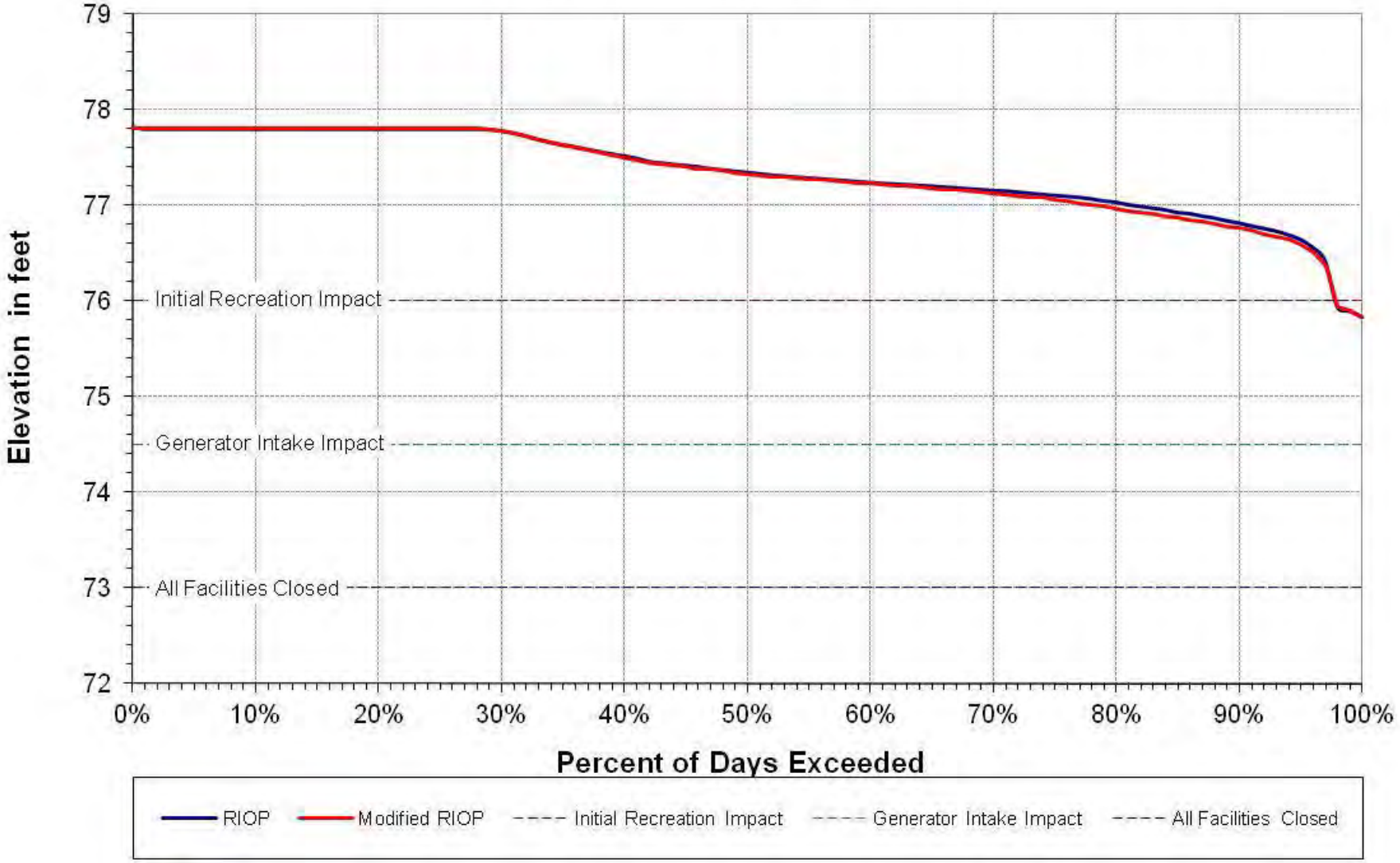
Jim Woodruff Pool Elevation-Jun



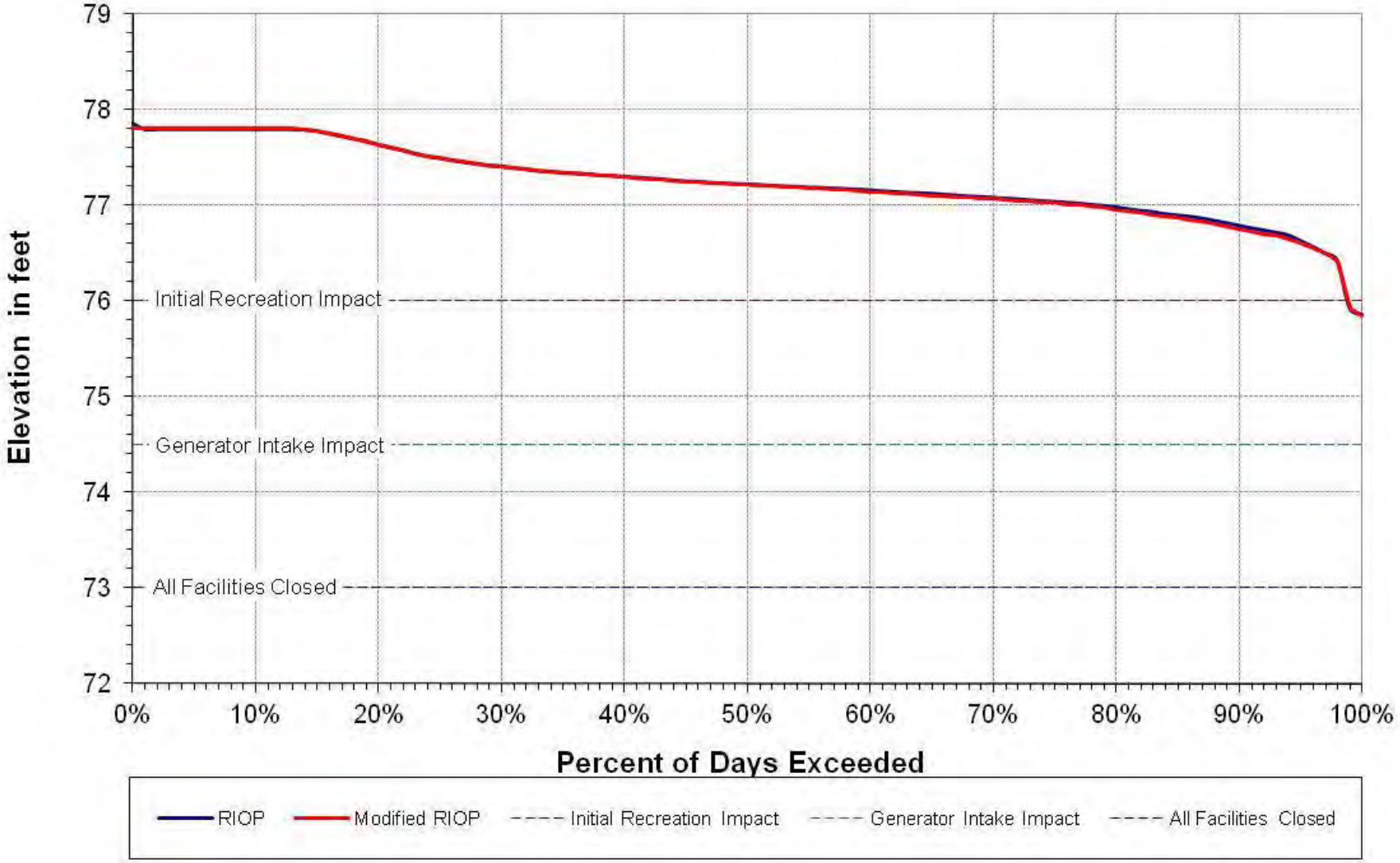
Jim Woodruff Pool Elevation-Jul



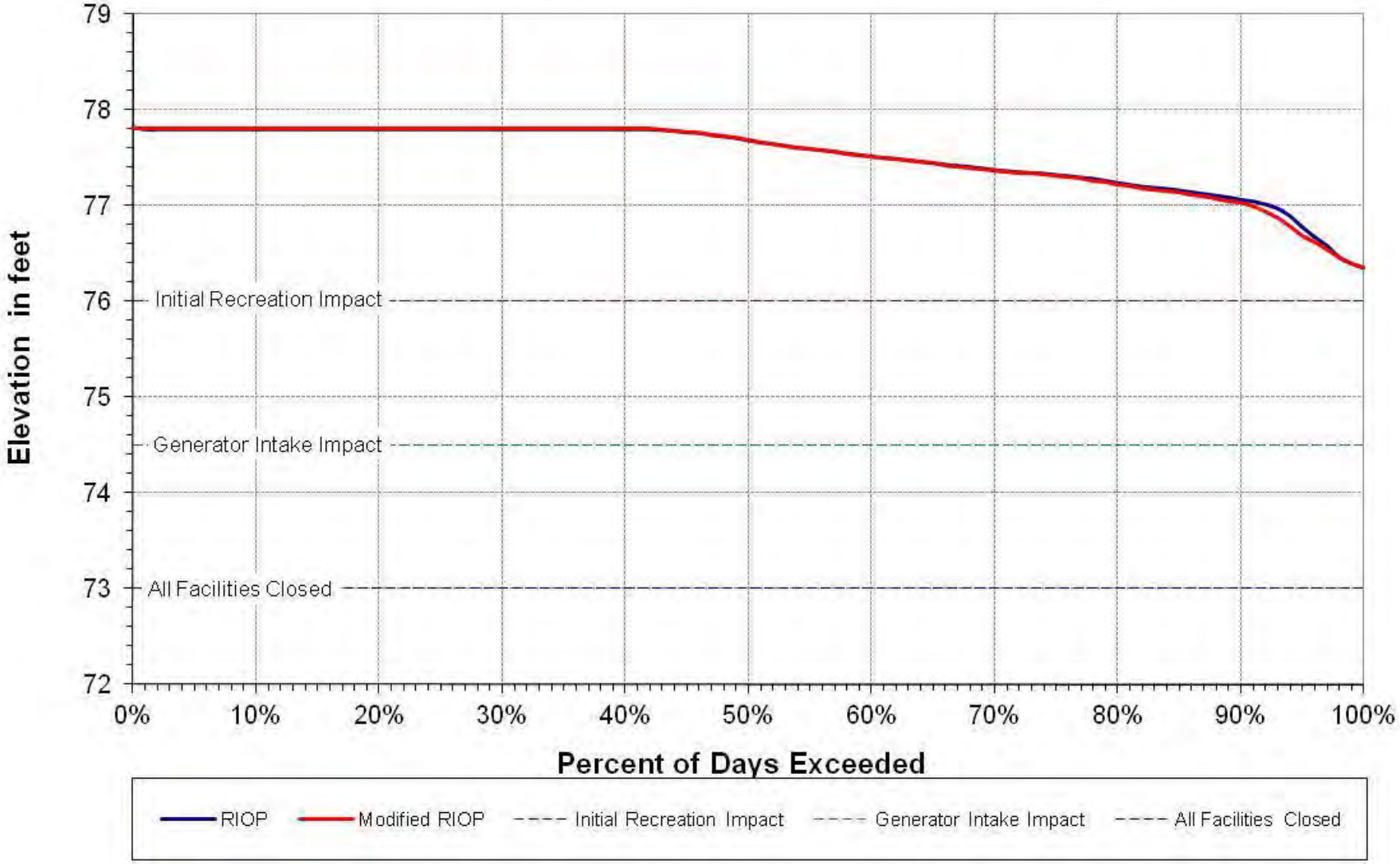
Jim Woodruff Pool Elevation-Aug



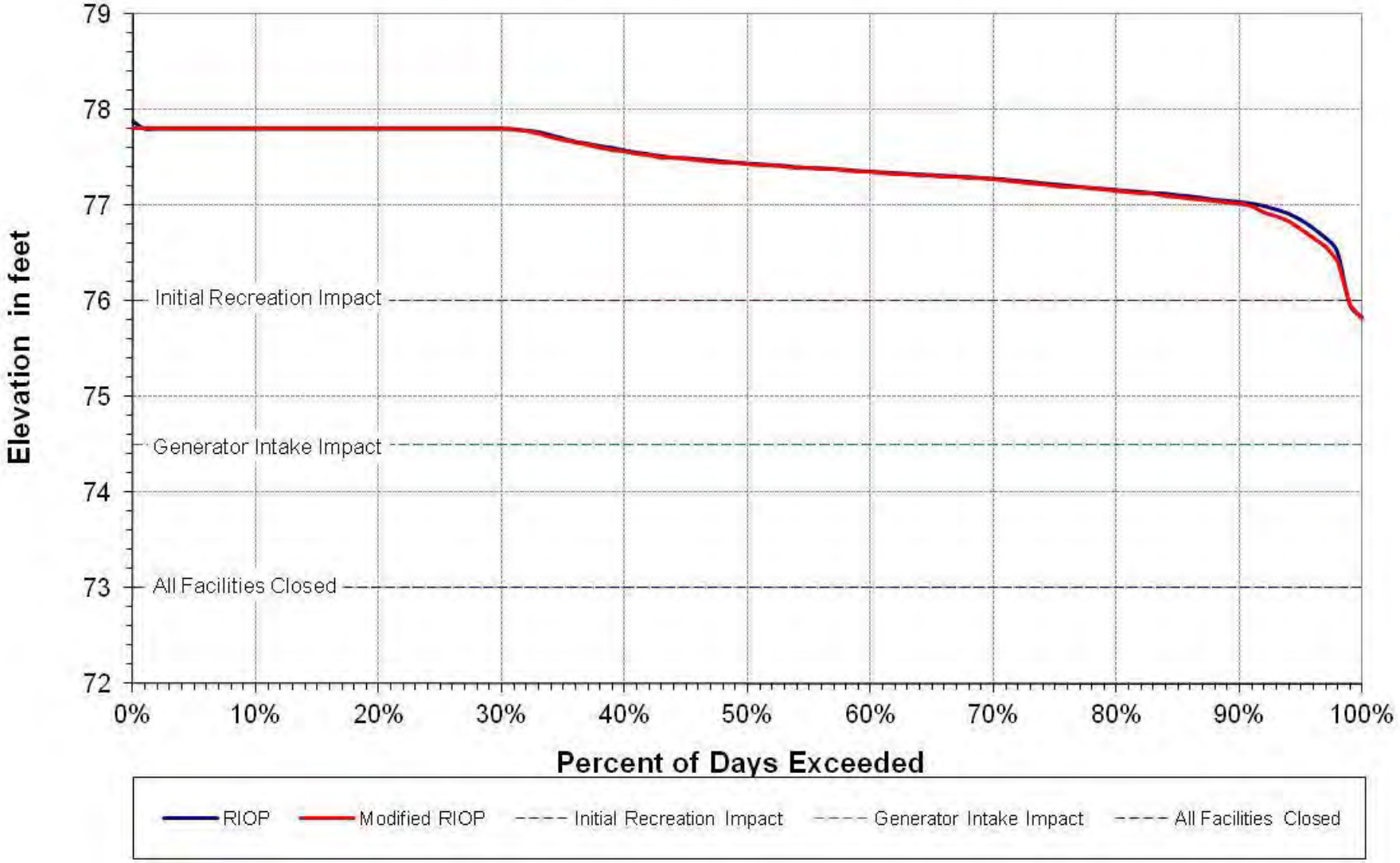
Jim Woodruff Pool Elevation-Sep



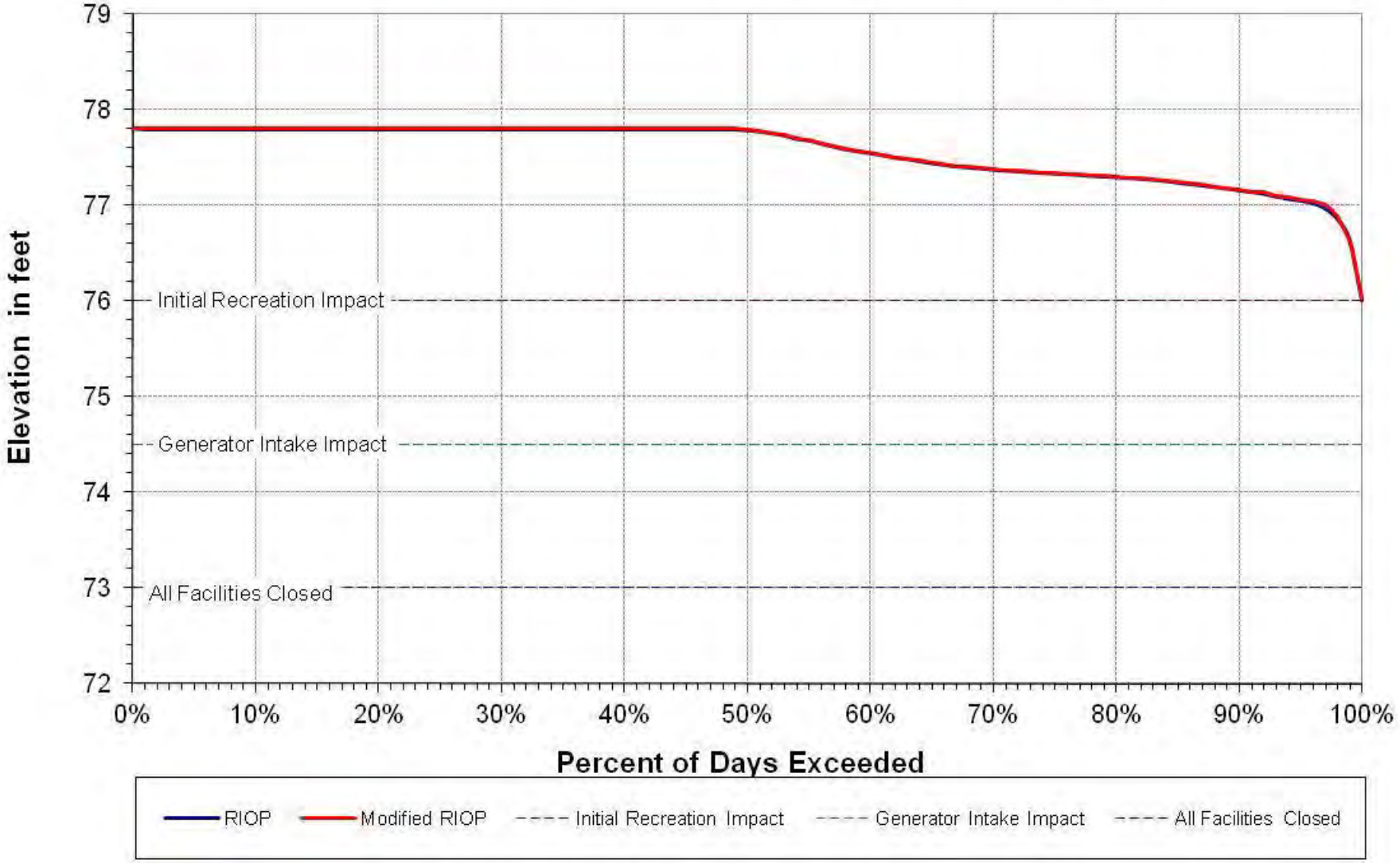
Jim Woodruff Pool Elevation-Oct



Jim Woodruff Pool Elevation-Nov

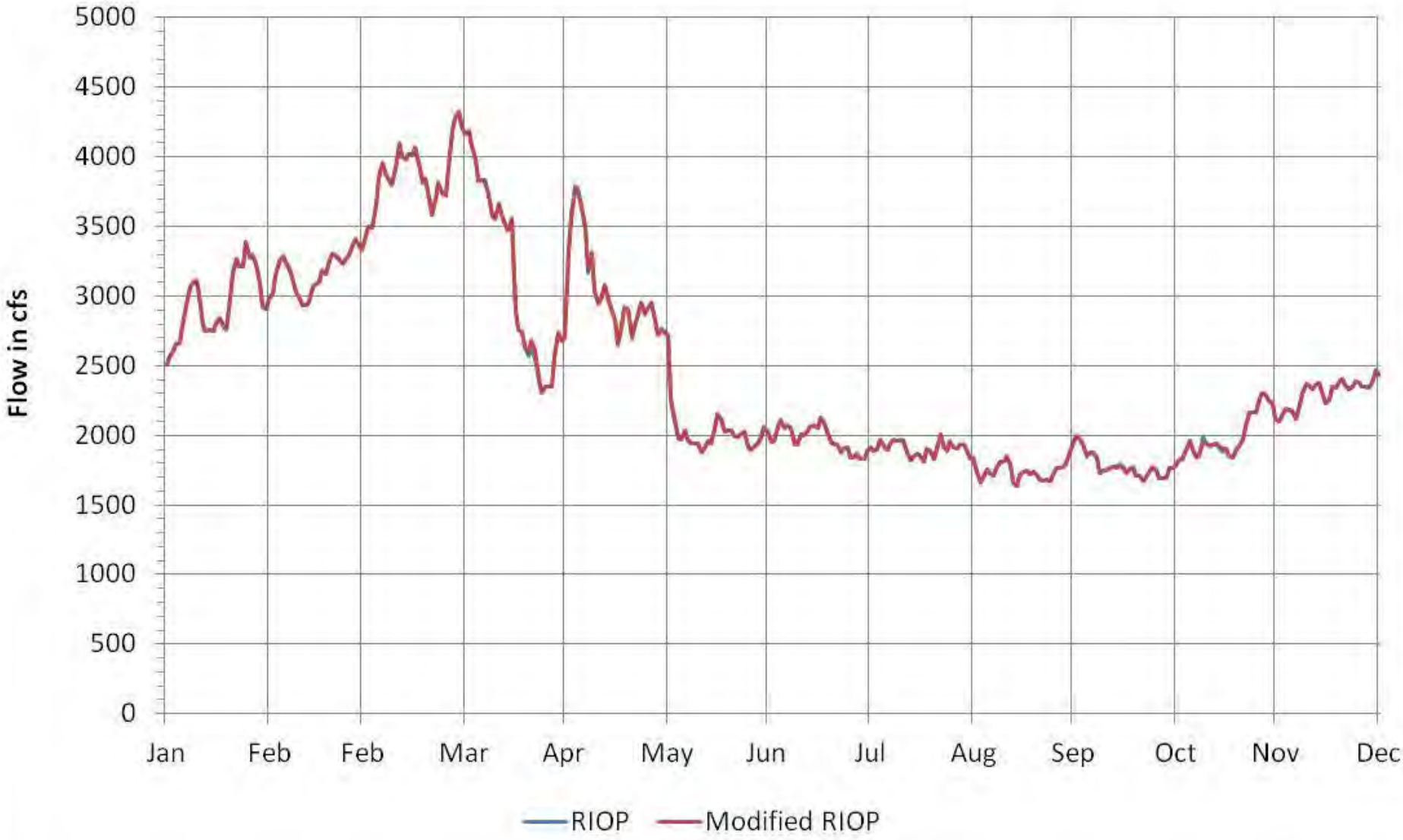


Jim Woodruff Pool Elevation-Dec

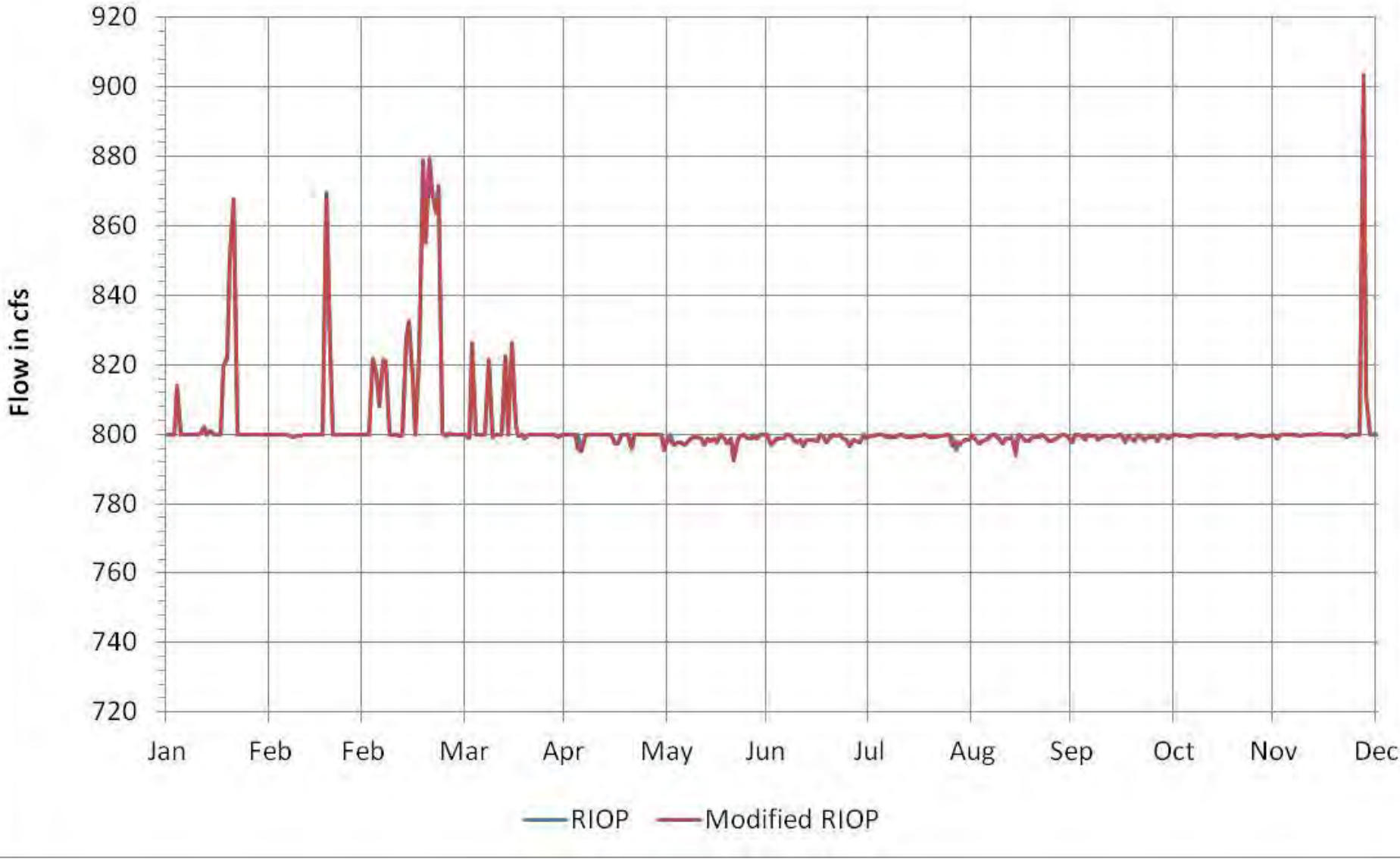


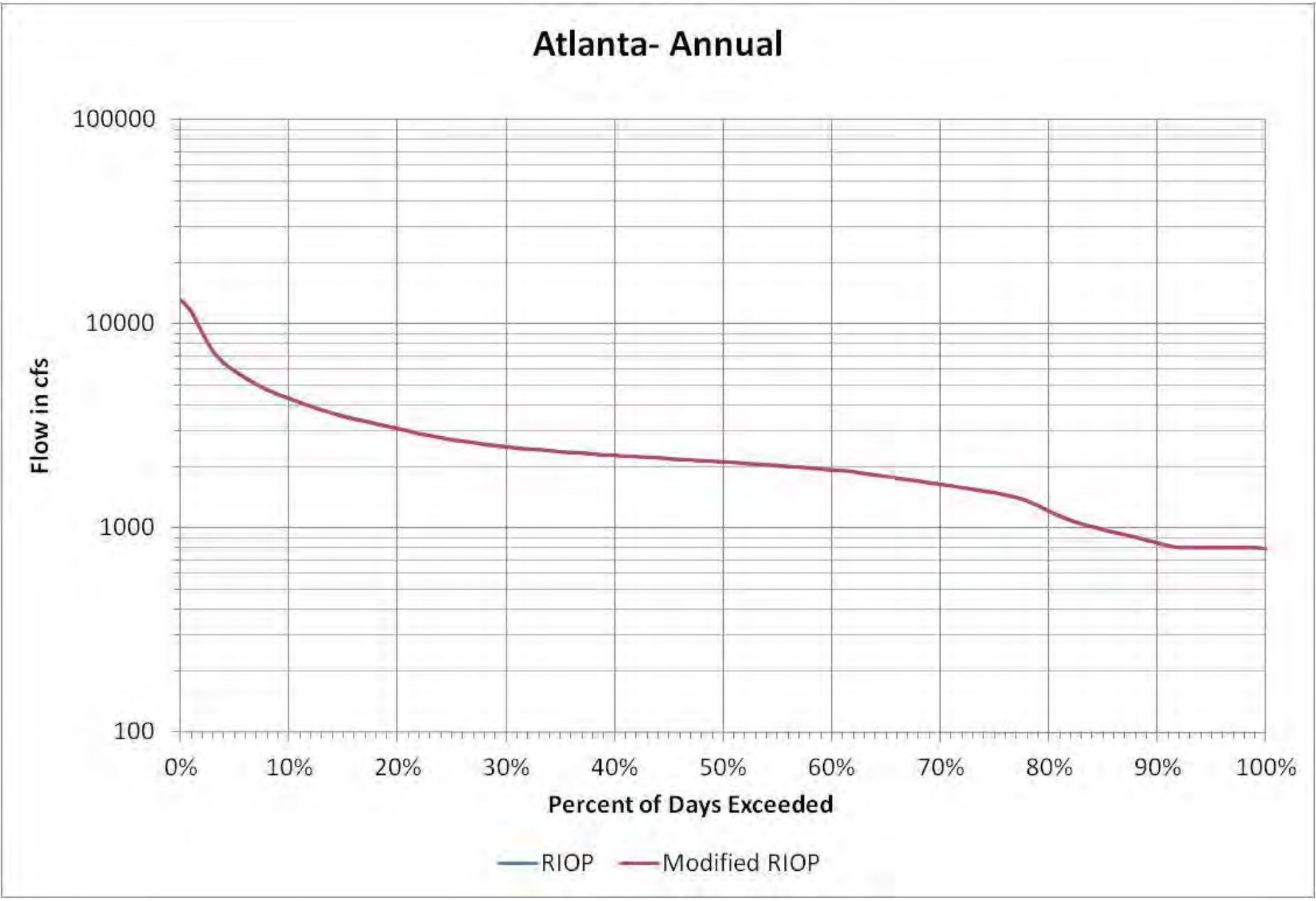
Atlanta Flow

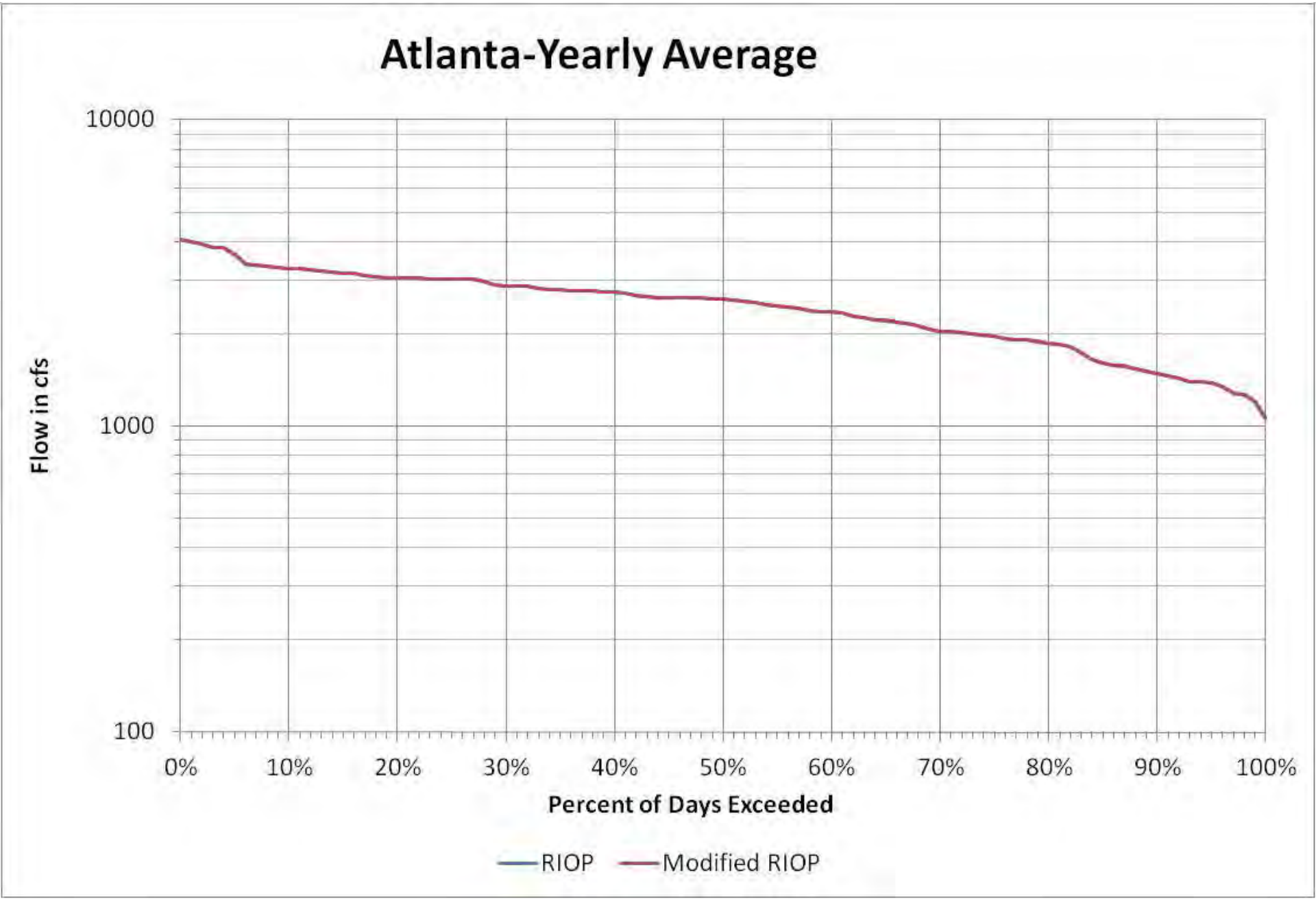
Atlanta-Average Daily



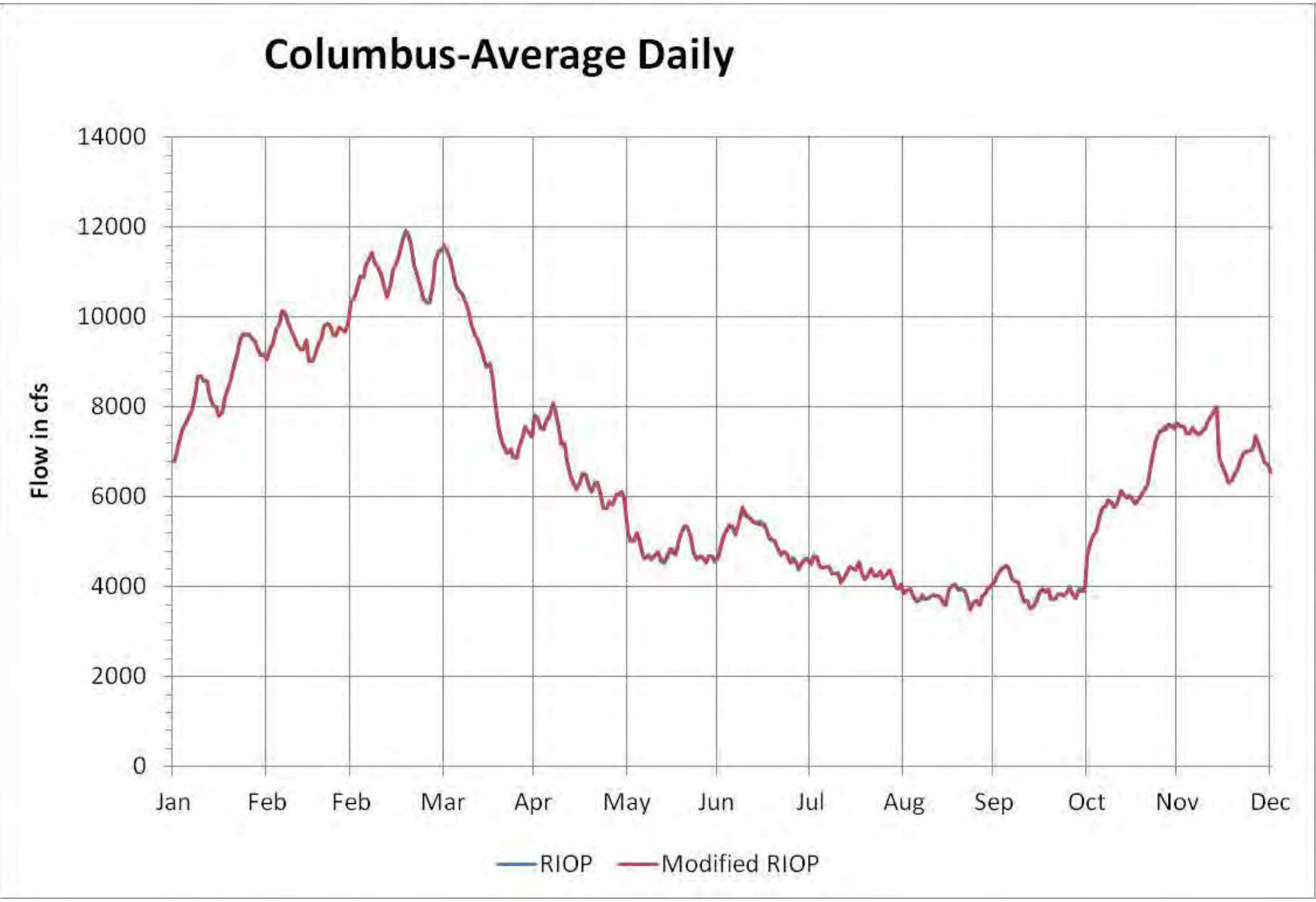
Atlanta-Minimum Daily



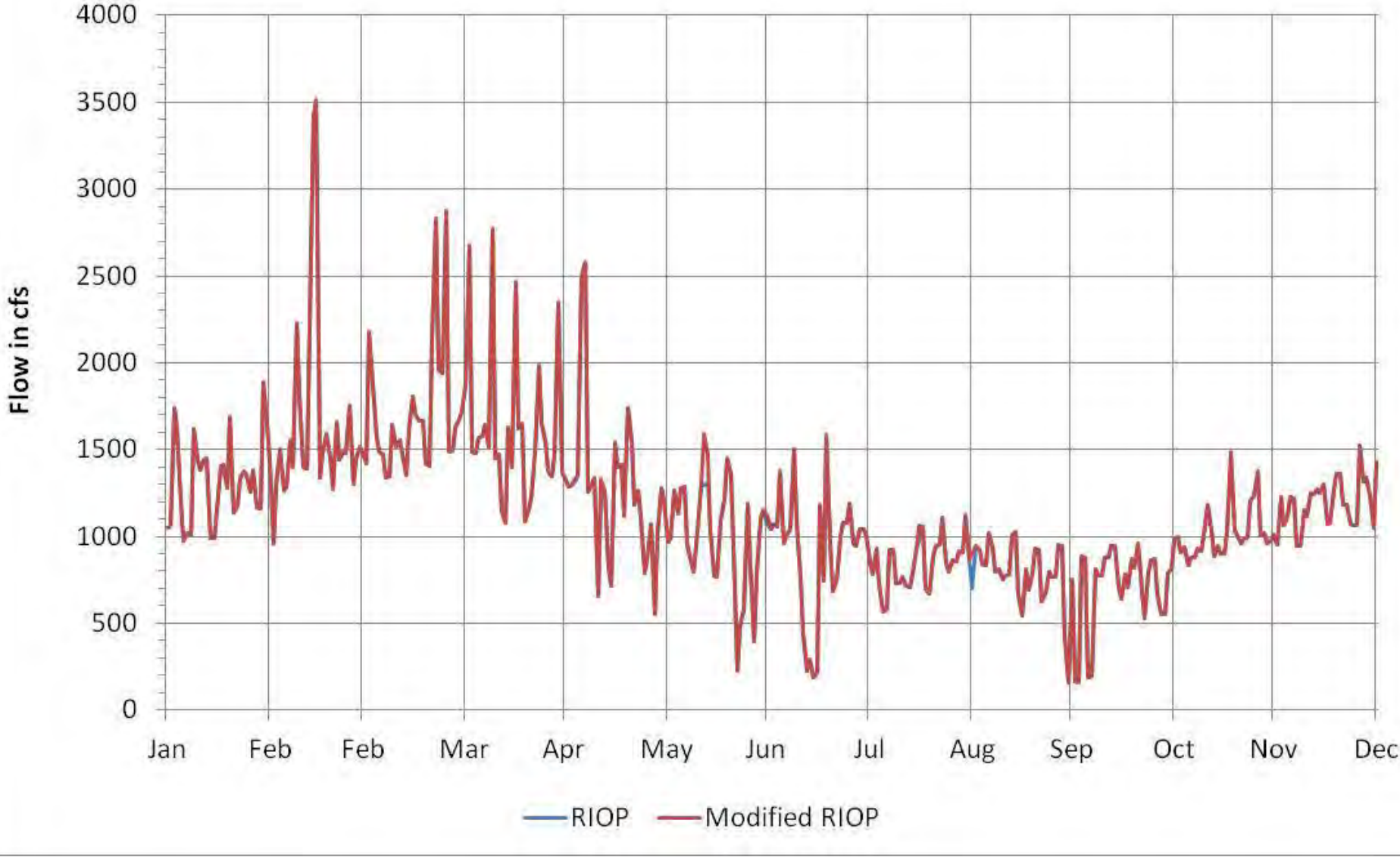

Atlanta- Annual
100000
10000
1000
100
Flow in cfs
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Exceeded
RIOP
Modified RIOP

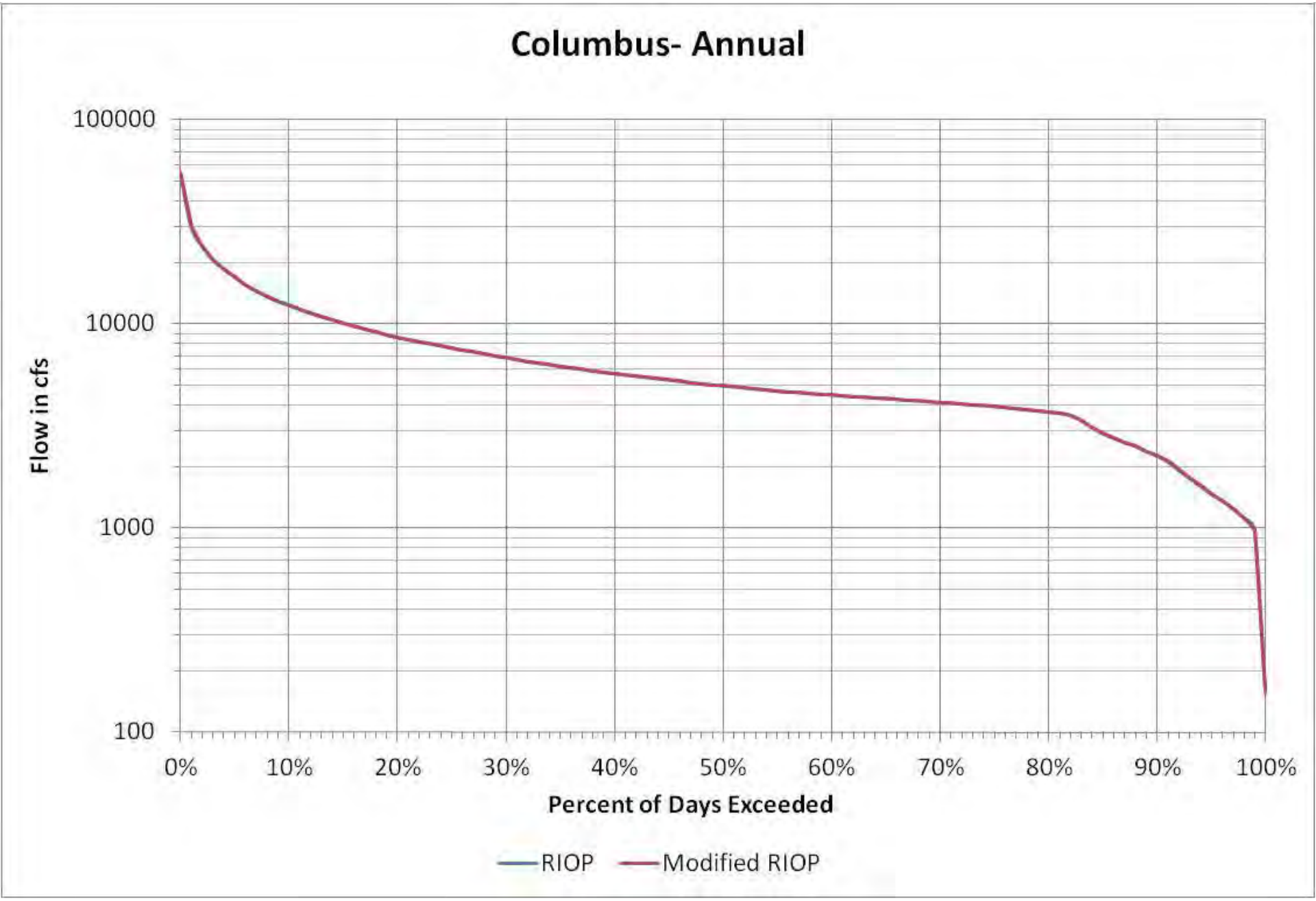

Atlanta-Yearly Average
10000
1000
100
Flow in cfs
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Exceeded
RIOP
Modified RIOP

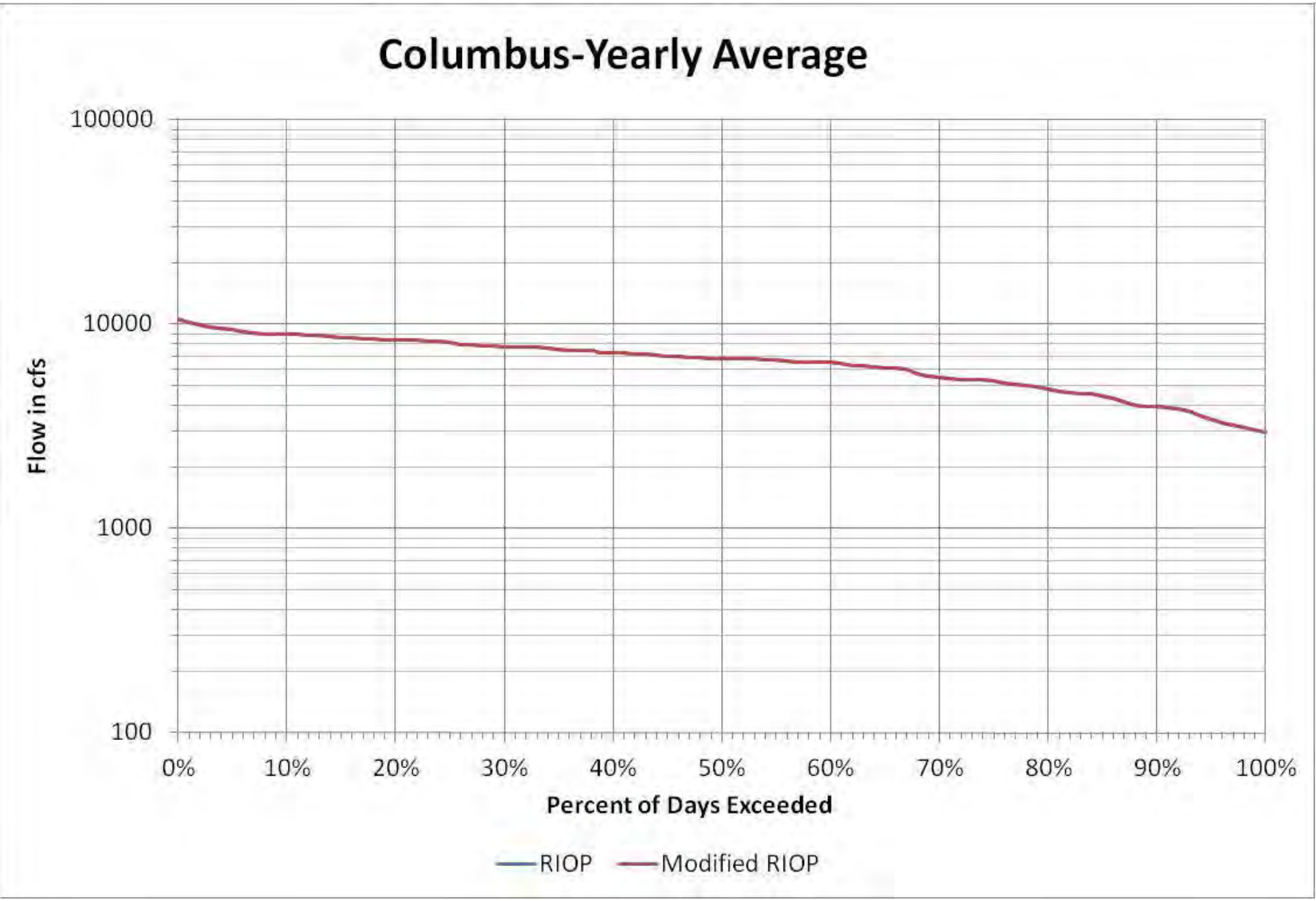
Columbus Flow


Columbus-Average Daily
Flow in cfs
14000
12000
10000
8000
6000
4000
2000
0
Jan
Feb
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
RIOP
Modified RIOP

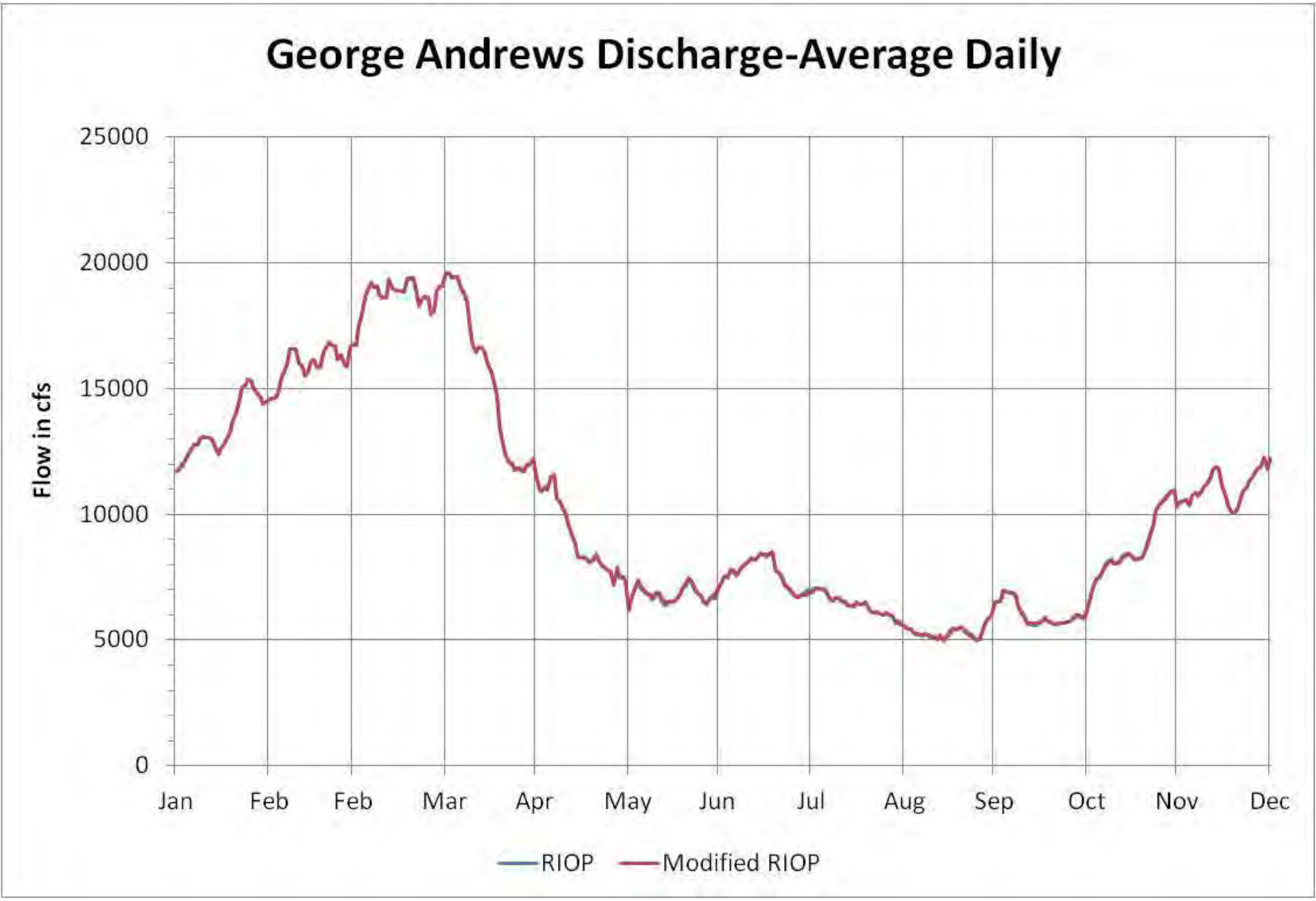
Columbus-Minimum Daily



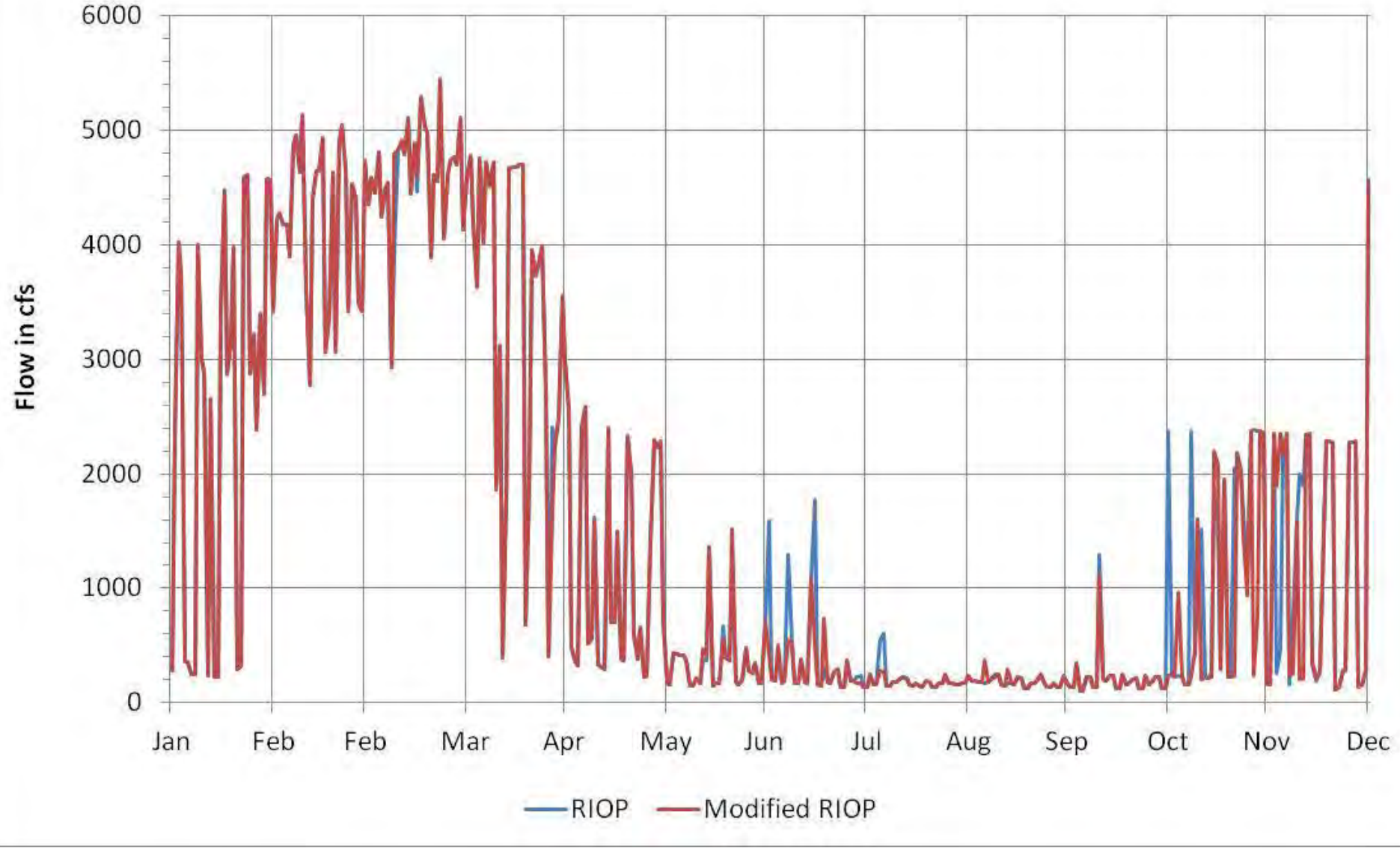

Columbus- Annual
100000
10000
1000
100
Flow in cfs
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Exceeded
RIOP
Modified RIOP

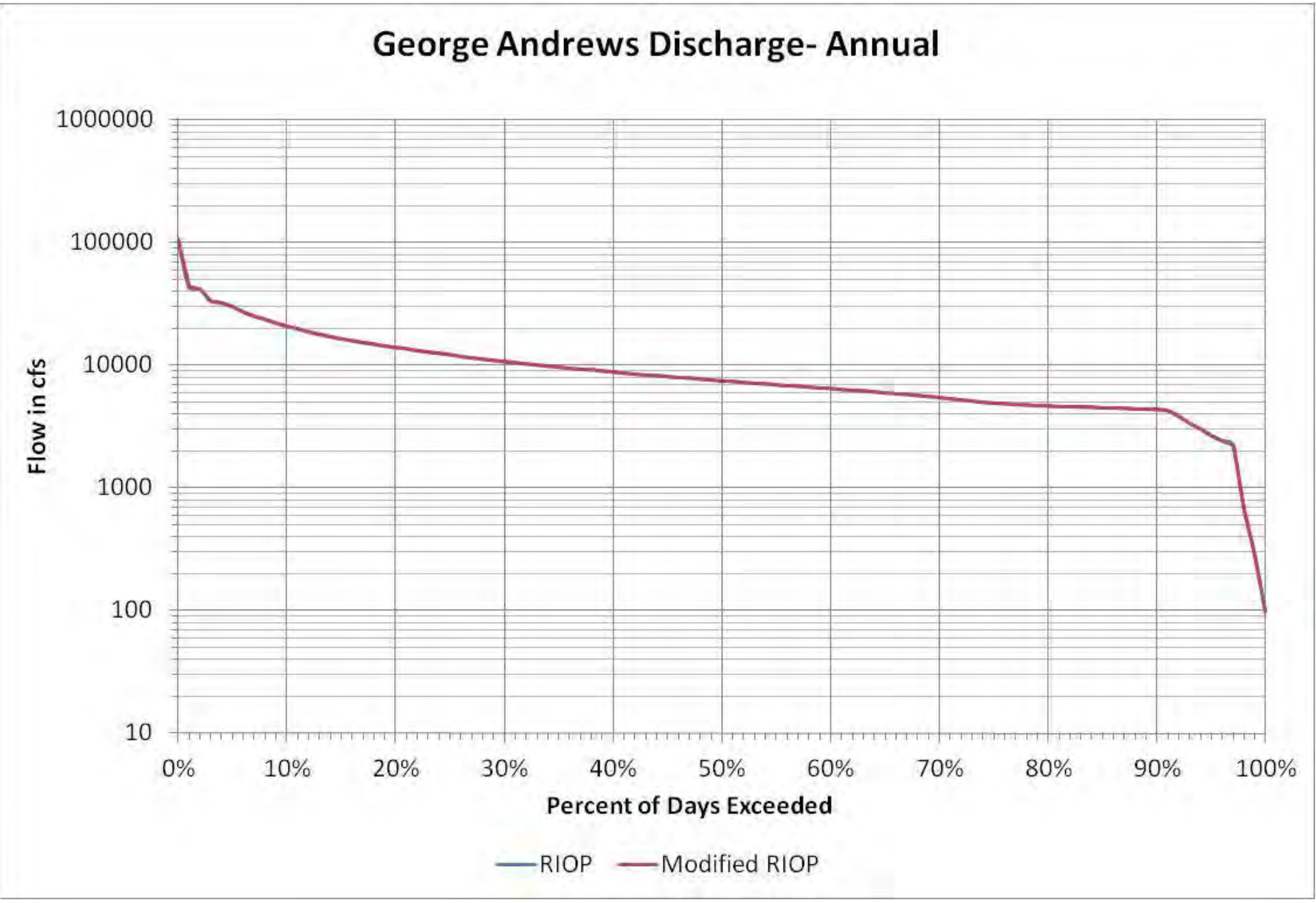

Columbus-Yearly Average
100000
10000
1000
100
Flow in cfs
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Exceeded
RIOP
Modified RIOP

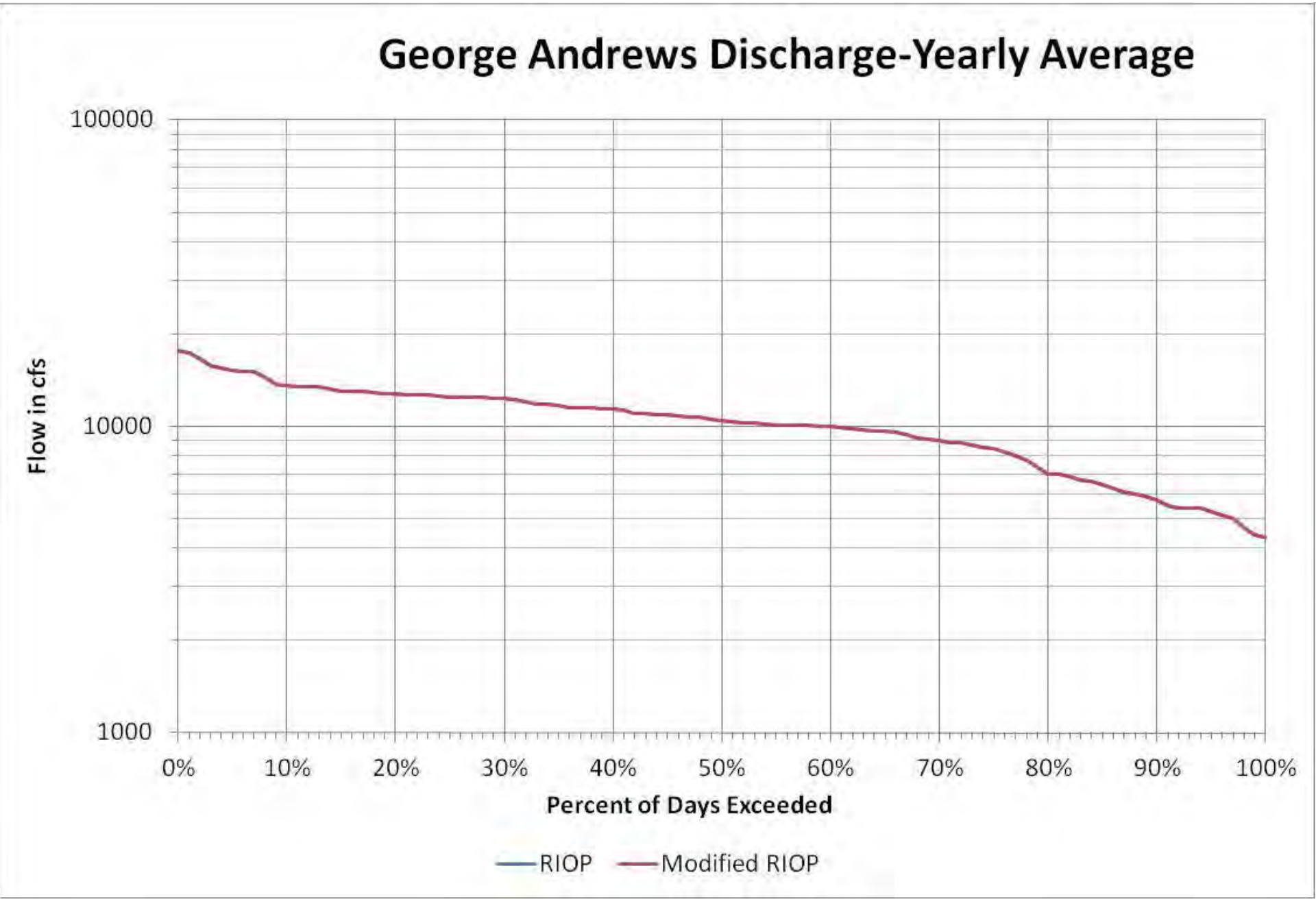
George Andrews Flow


George Andrews Discharge-Average Daily
Flow in cfs
25000
20000
15000
10000
5000
0
Jan
Feb
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
RIOP
Modified RIOP

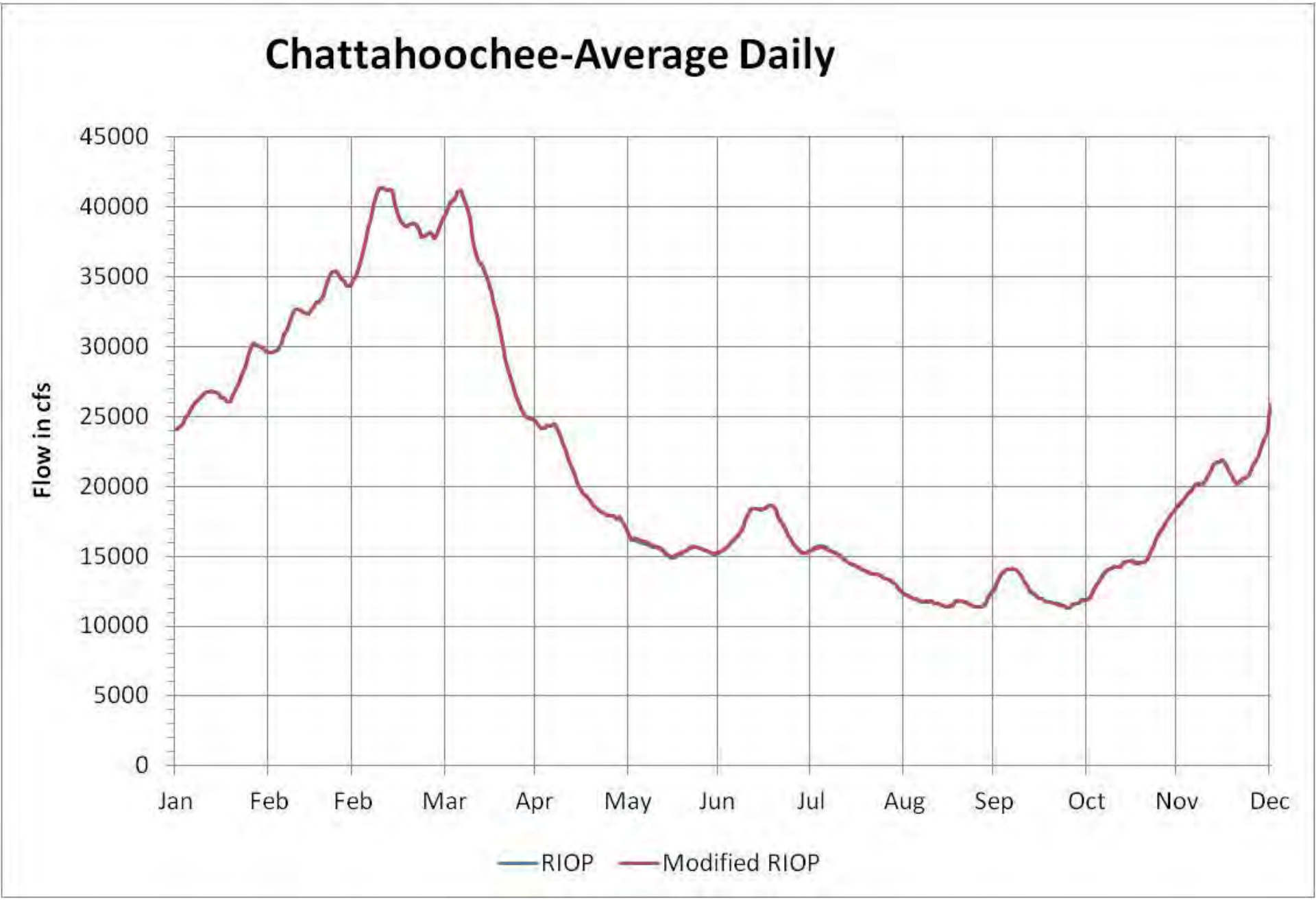
George Andrews Discharge-Minimum Daily

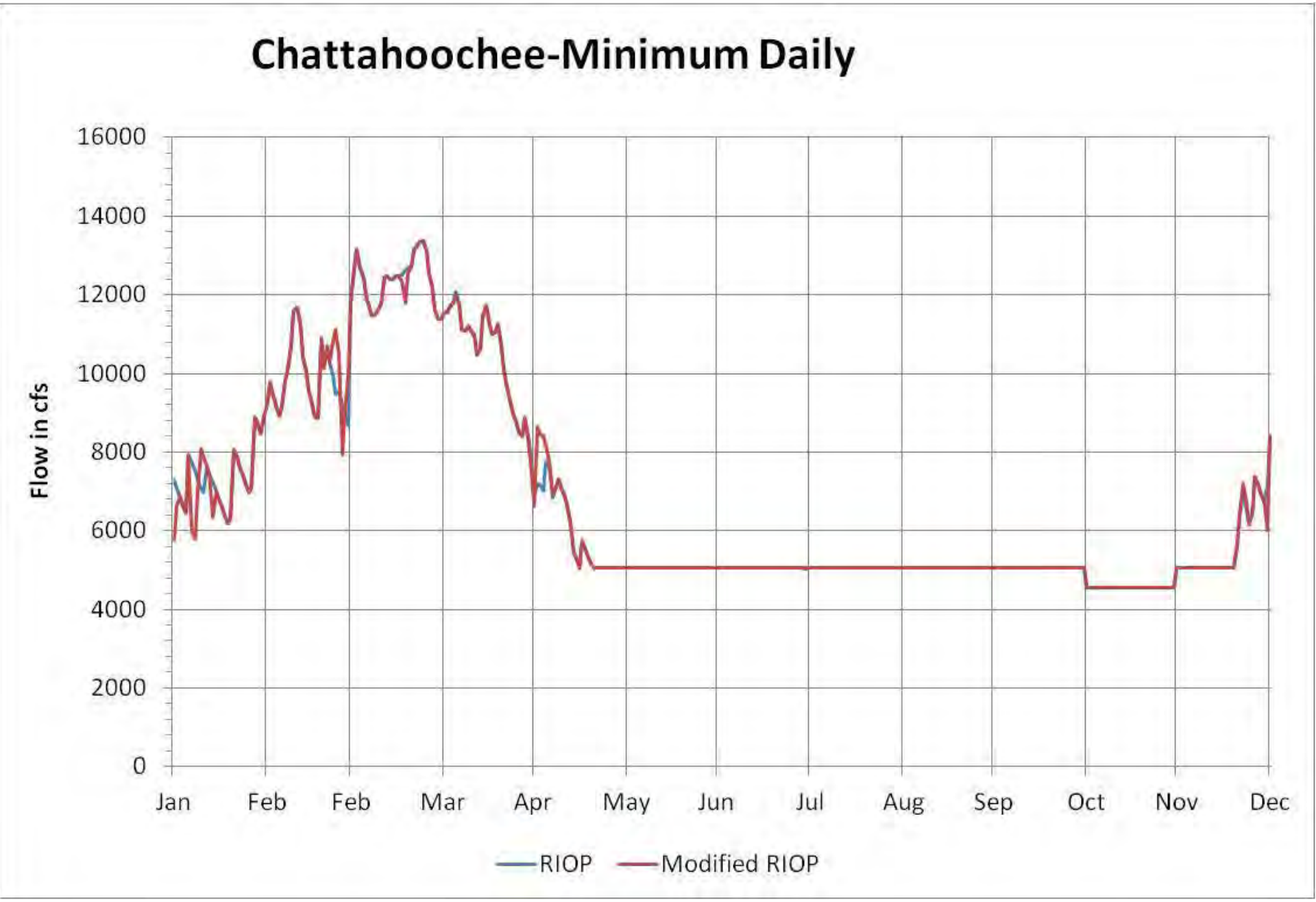


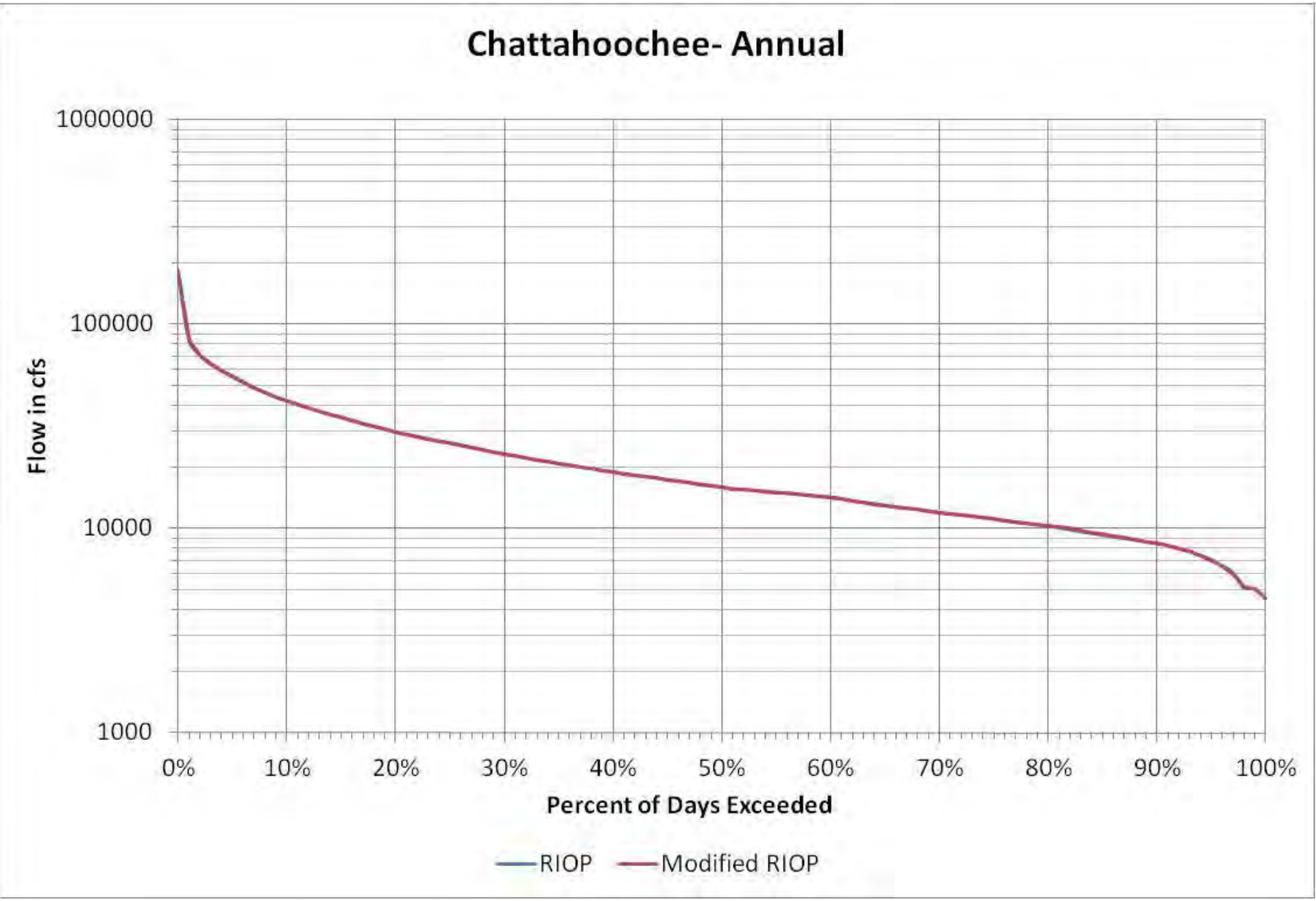

George Andrews Discharge- Annual
1000000
100000
10000
1000
100
10
Flow in cfs
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Exceeded
RIOP
Modified RIOP

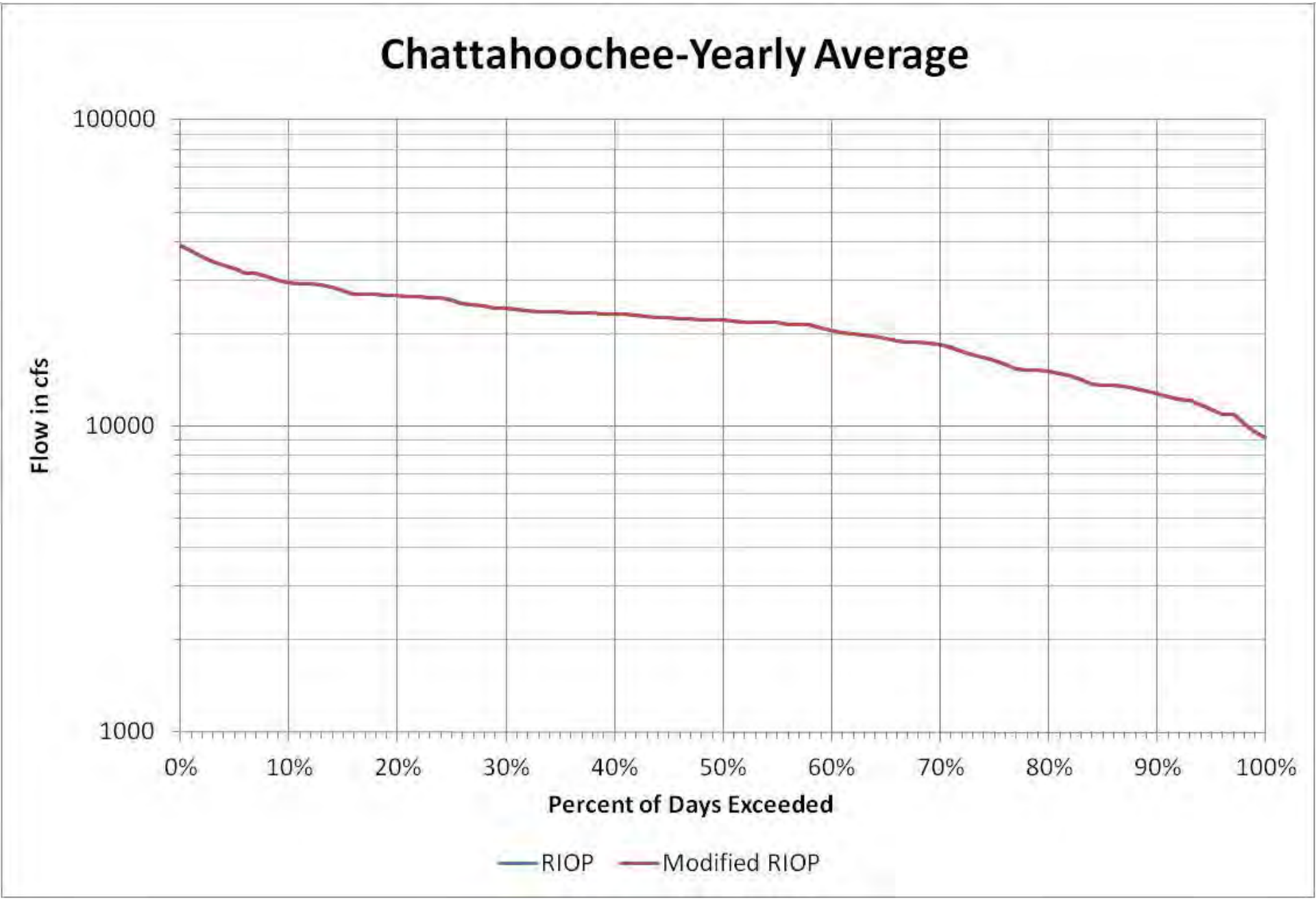

George Andrews Discharge-Yearly Average
100000
10000
1000
Flow in cfs
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Exceeded
RIOP
Modified RIOP

Chattahoochee Gage Flow

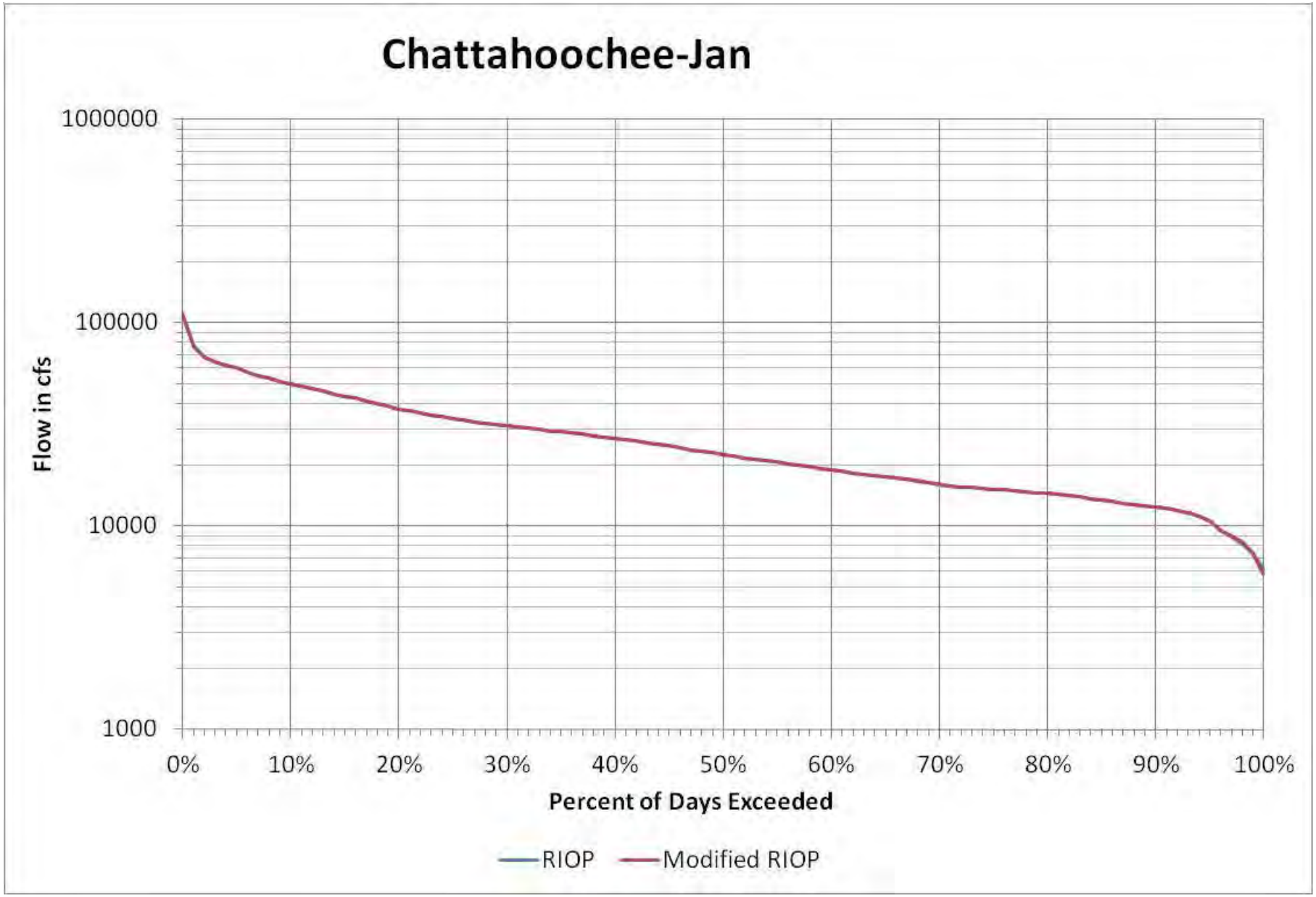

Chattahoochee-Average Daily
Flow in cfs
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
Jan
Feb
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
RIOP
Modified RIOP

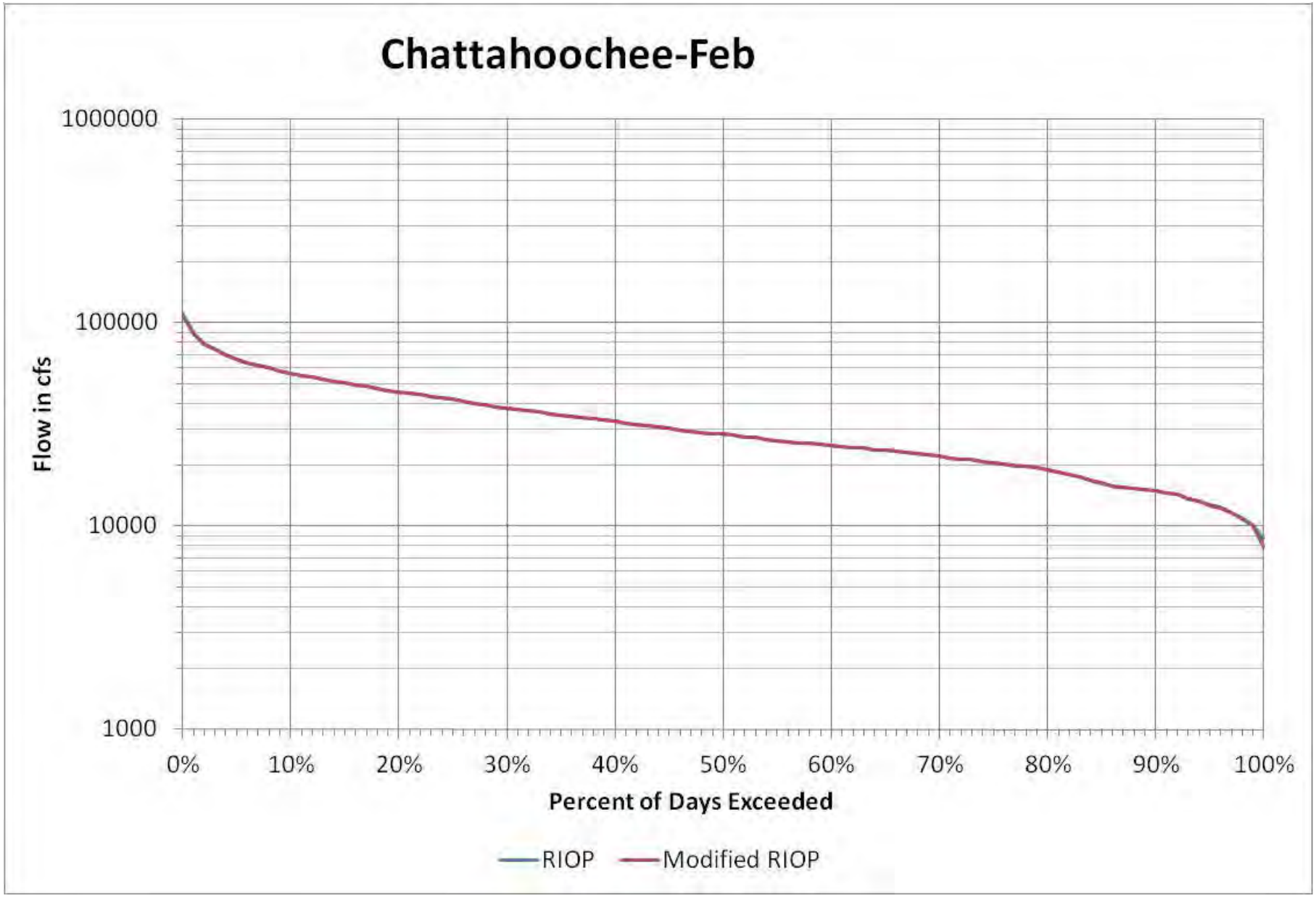

Chattahoochee-Minimum Daily
Flow in cfs
16000
14000
12000
10000
8000
6000
4000
2000
0
Jan
Feb
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
RIOP
Modified RIOP

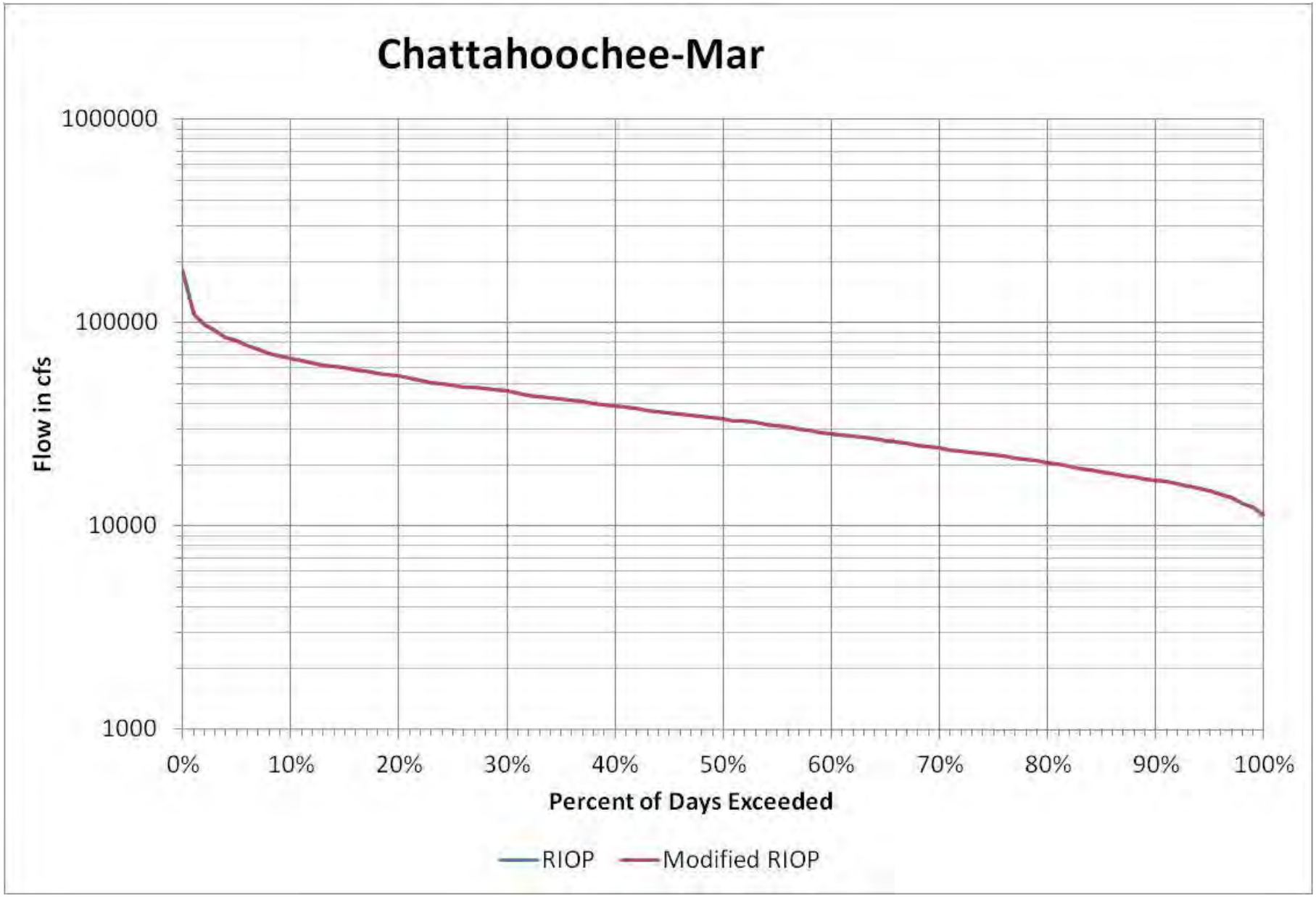

Chattahoochee- Annual
1000000
100000
10000
1000
Flow in cfs
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Exceeded
RIOP
Modified RIOP

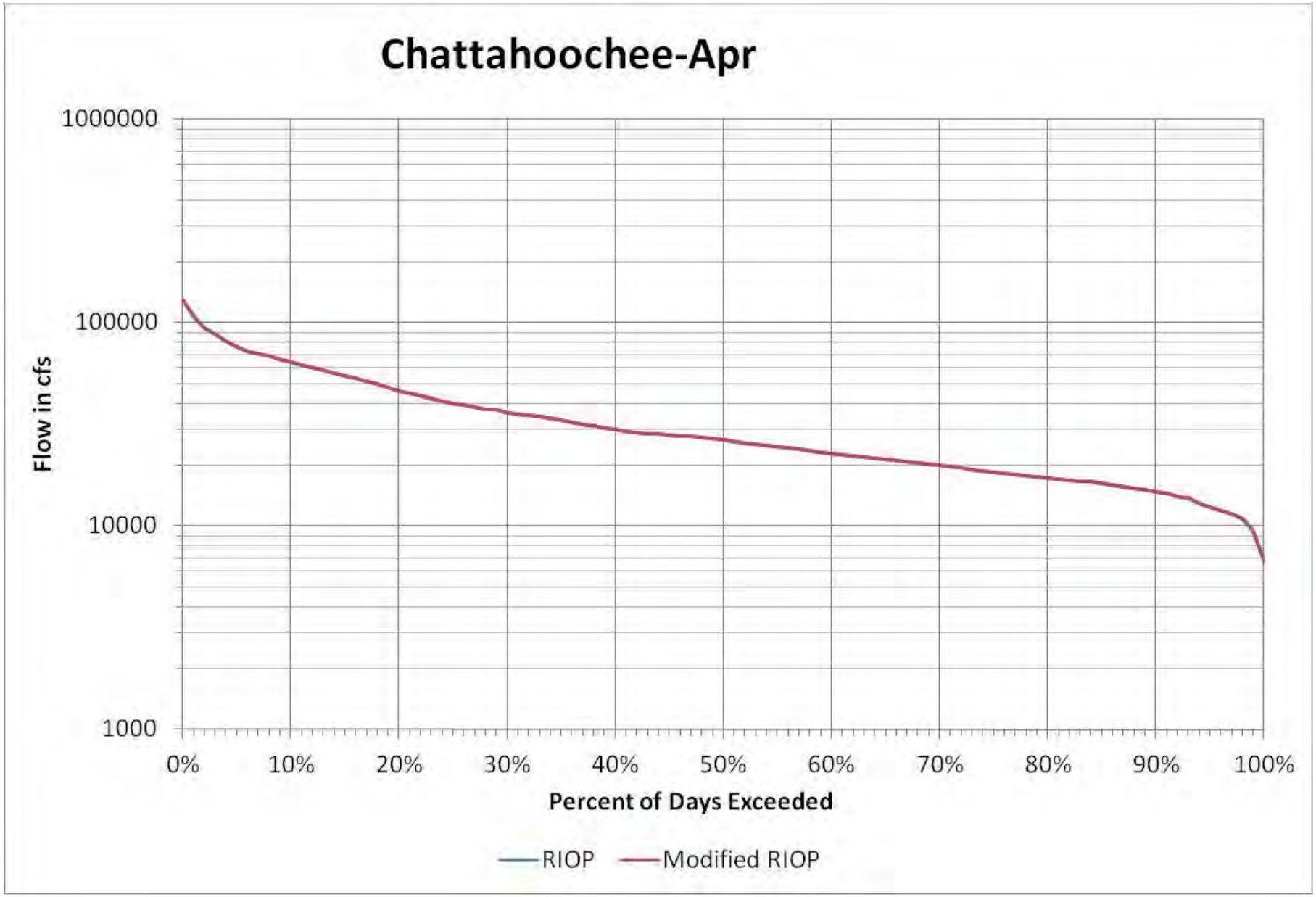

Chattahoochee-Yearly Average
100000
10000
1000
Flow in cfs
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Exceeded
RIOP
Modified RIOP

Chattahoochee Gage Monthly Flow Duration

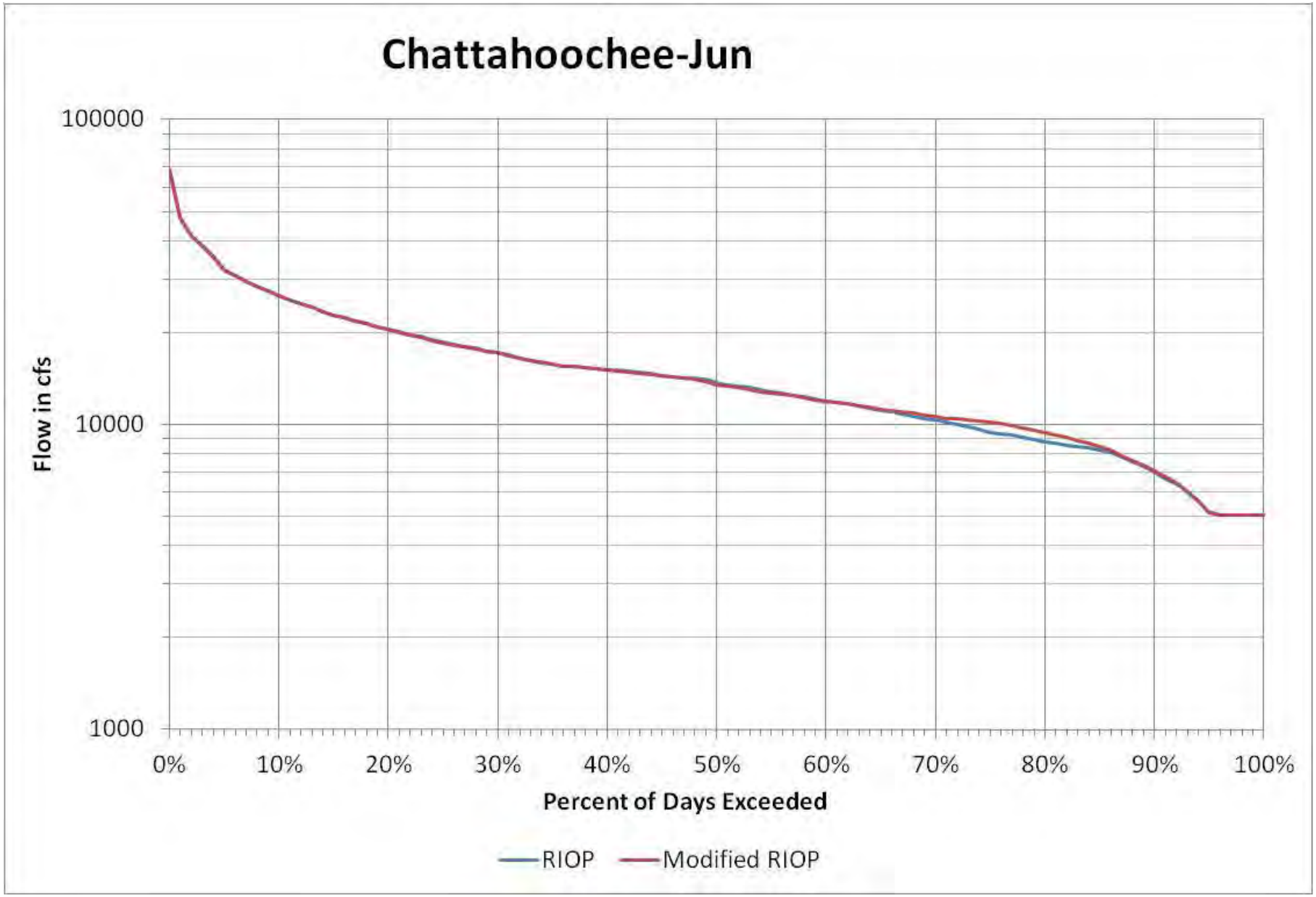

Chattahoochee-Jan
1000000
100000
10000
1000
Flow in cfs
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Exceeded
RIOP
Modified RIOP

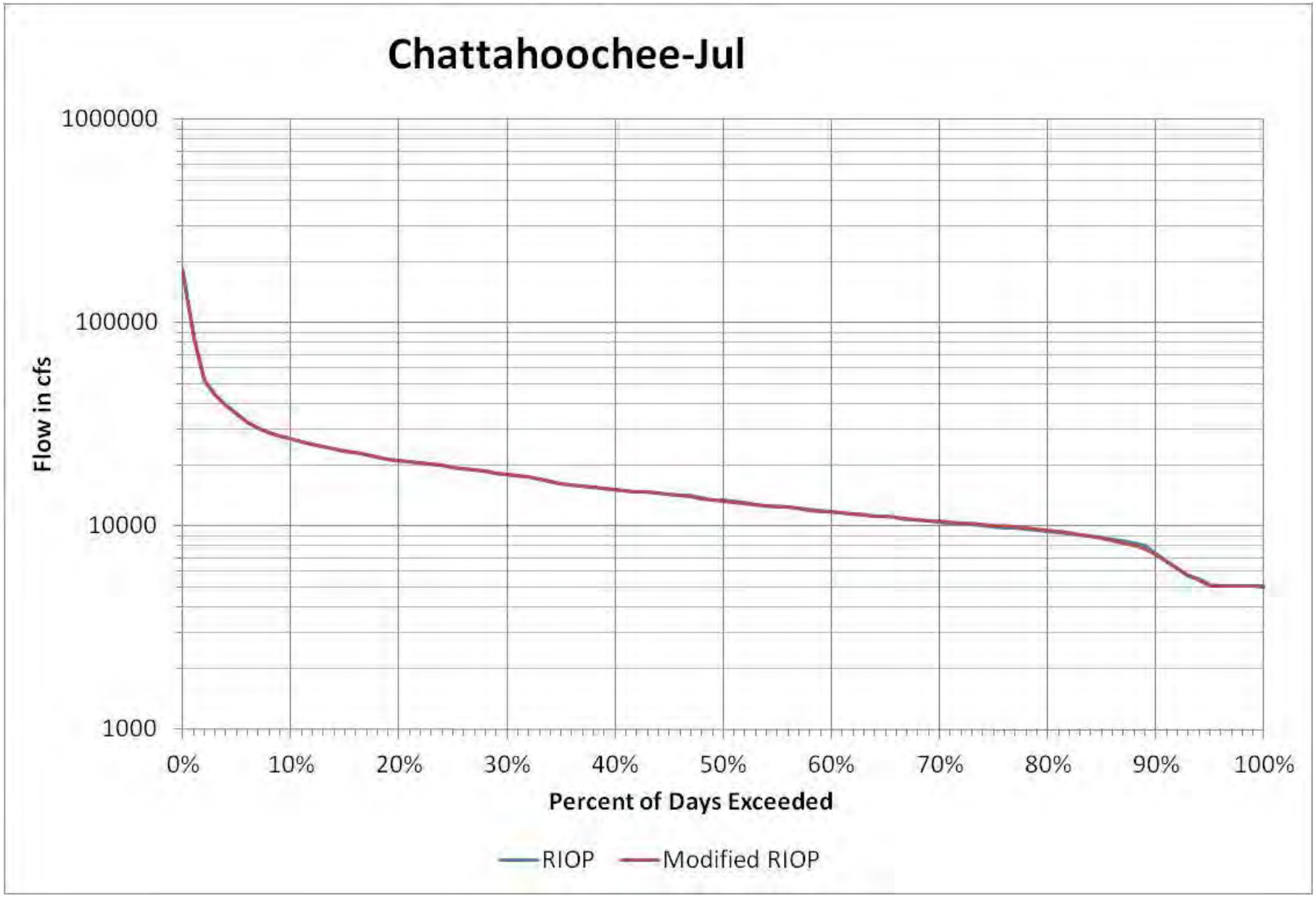

Chattahoochee-Feb
1000000
100000
10000
1000
Flow in cfs
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Exceeded
RIOP
Modified RIOP

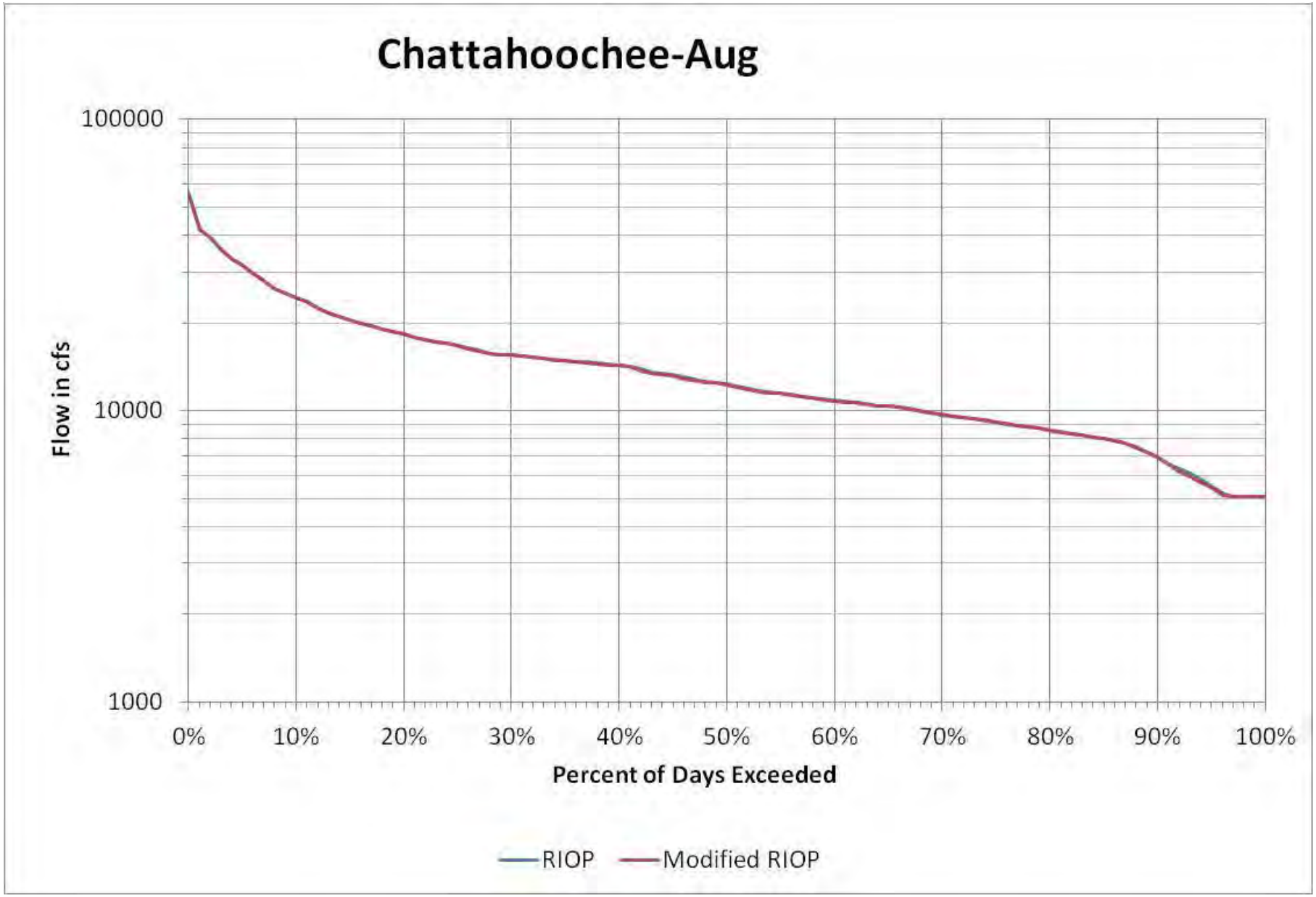

Chattahoochee-Mar
1000000
100000
10000
1000
Flow in cfs
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Exceeded
RIOP
Modified RIOP

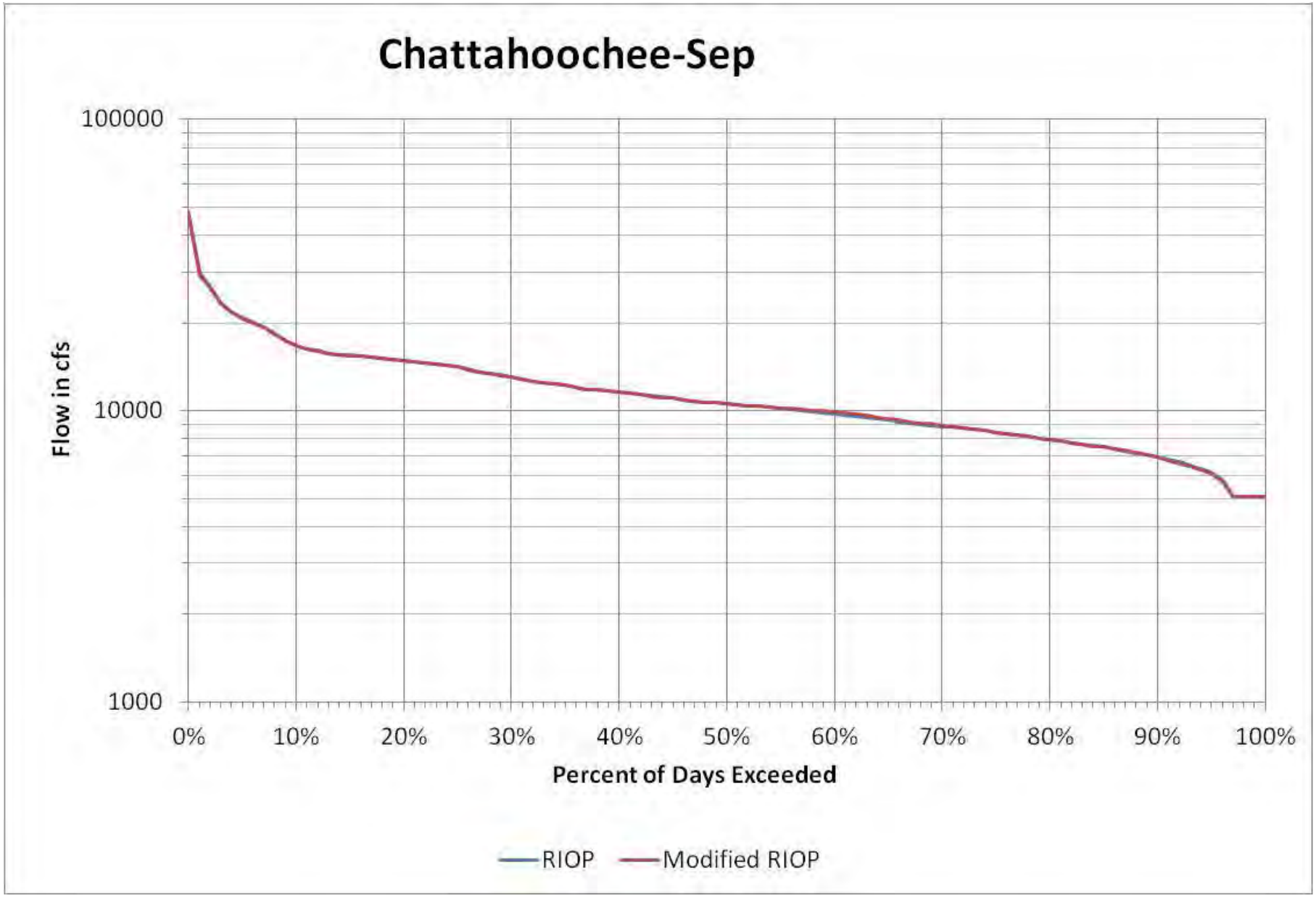

Chattahoochee-Apr
1000000
100000
10000
1000
Flow in cfs
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Exceeded
RIOP
Modified RIOP

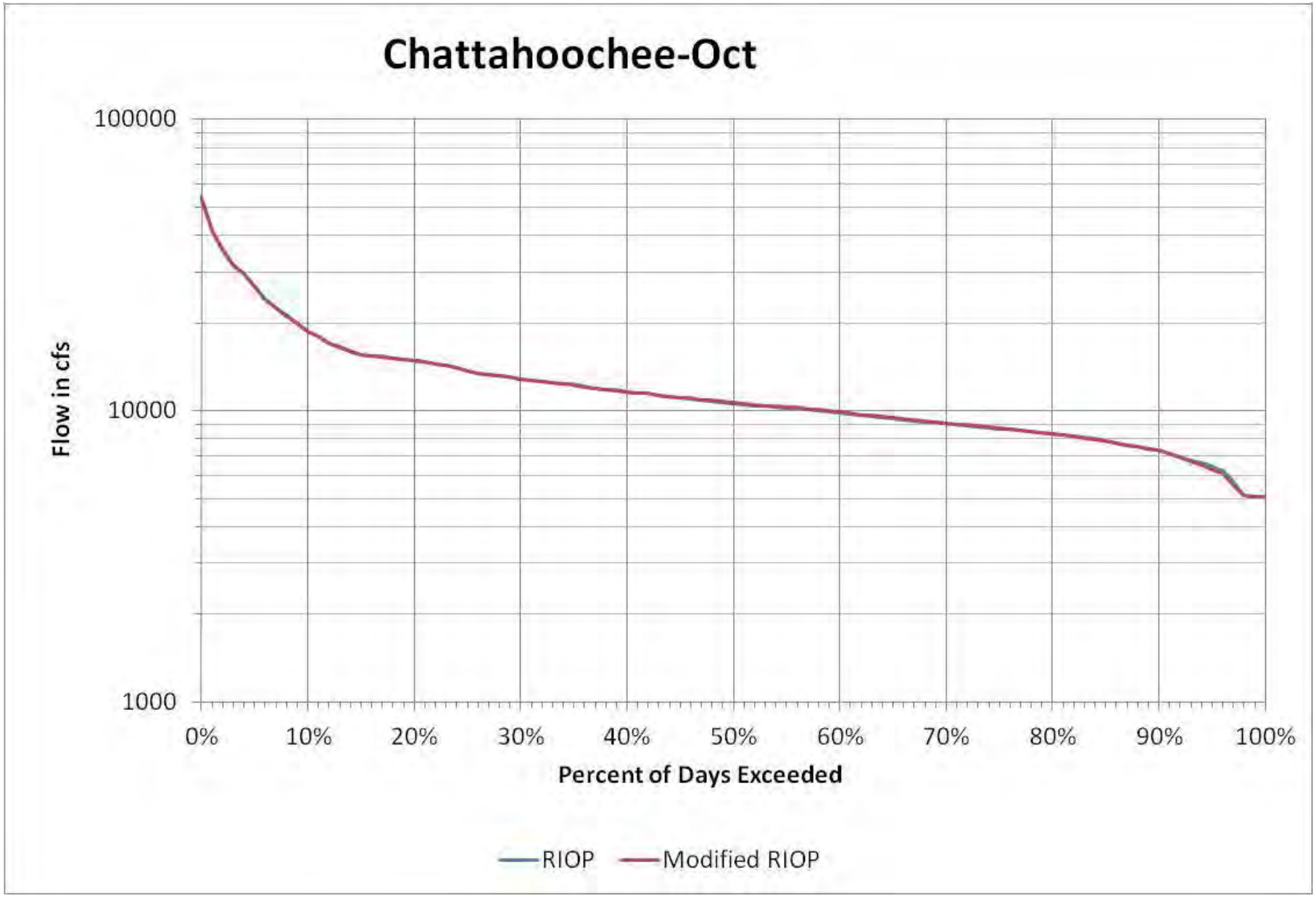

Chattahoochee-May
100000
10000
1000
Flow in cfs
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Exceeded
RIOP
Modified RIOP

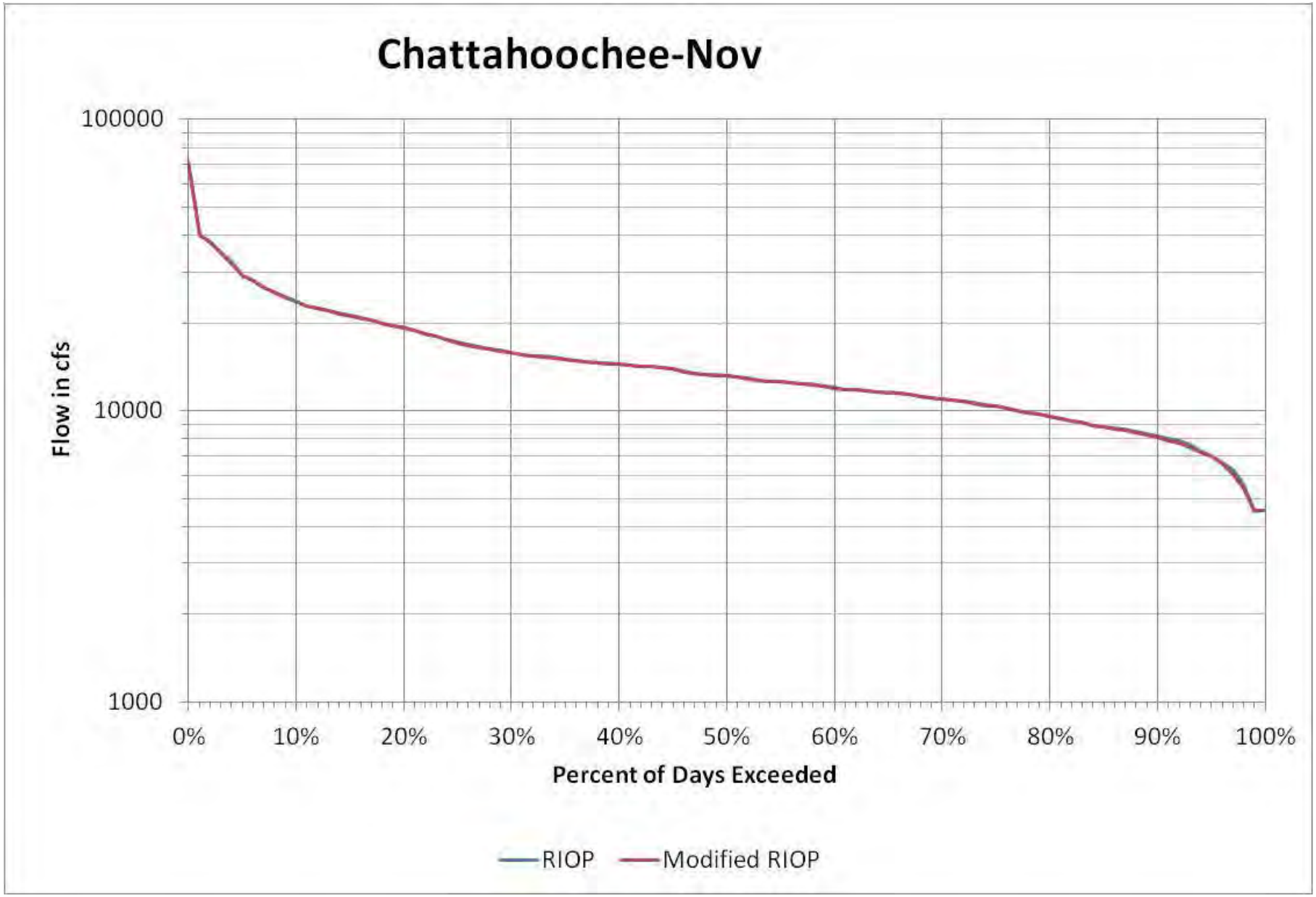

Chattahoochee-Jun
100000
10000
1000
Flow in cfs
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Exceeded
RIOP
Modified RIOP

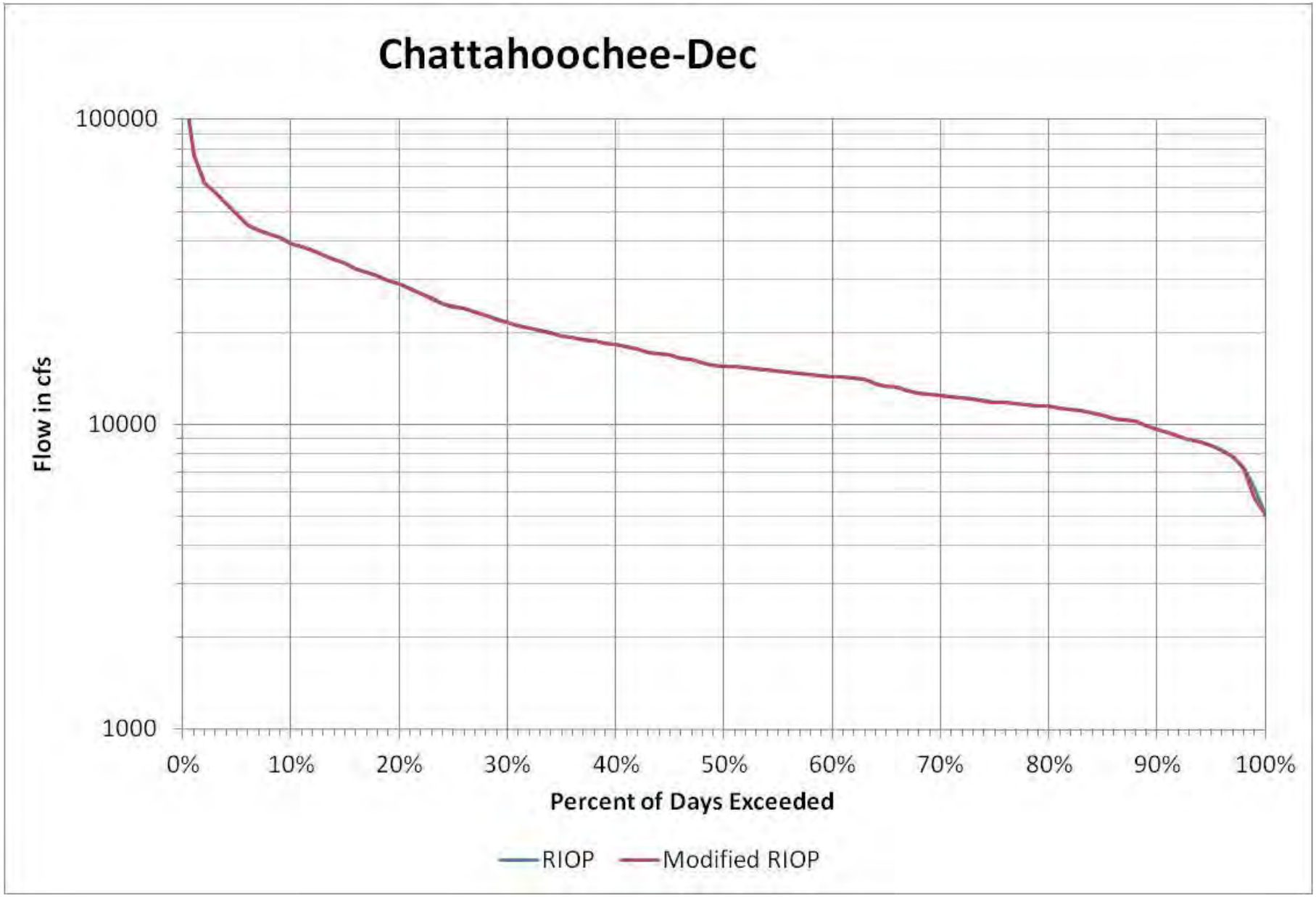

Chattahoochee-Jul
1000000
100000
10000
1000
Flow in cfs
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Exceeded
RIOP
Modified RIOP


Chattahoochee-Aug
100000
10000
1000
Flow in cfs
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Exceeded
RIOP
Modified RIOP

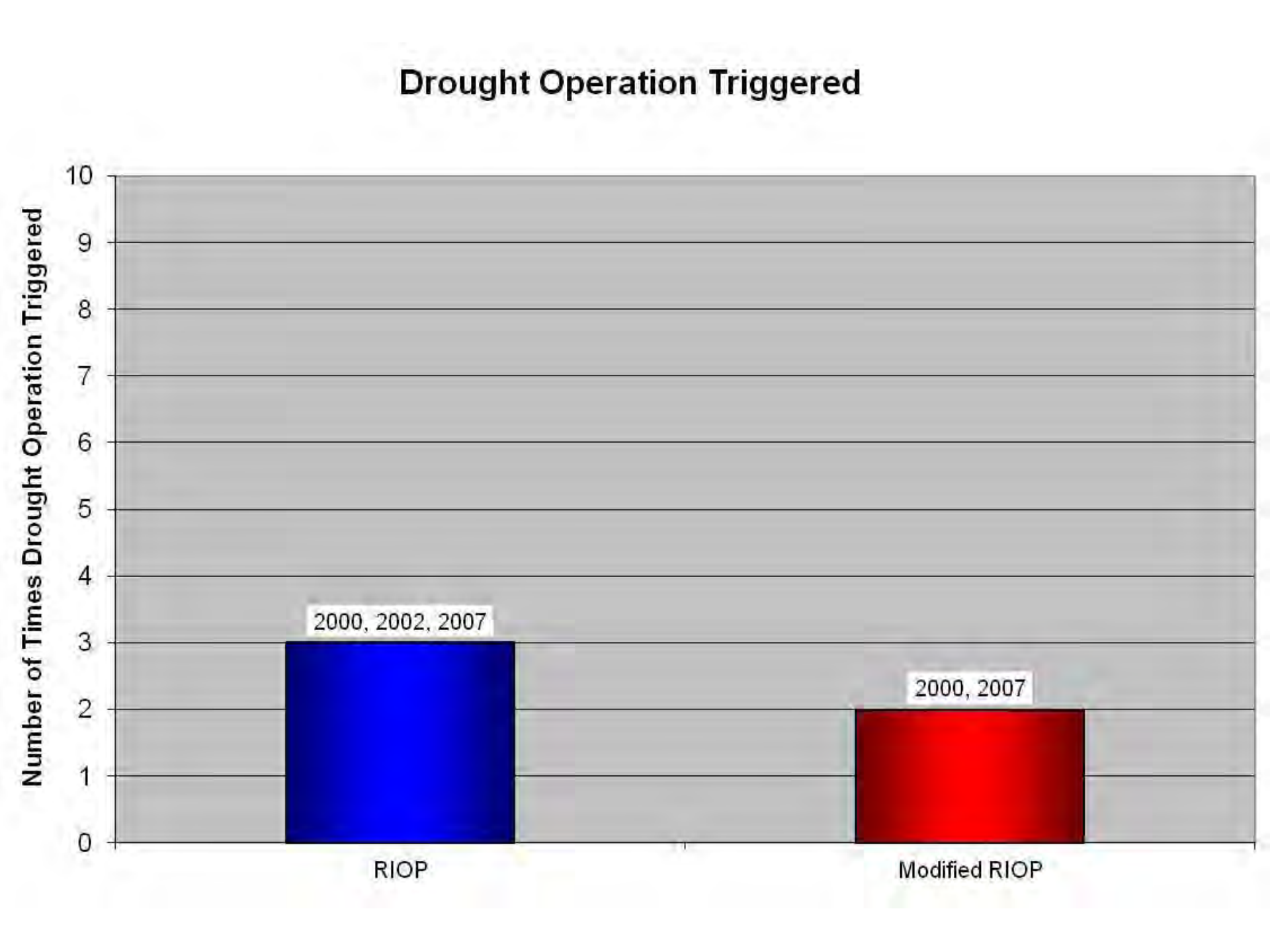

Chattahoochee-Sep
100000
10000
1000
Flow in cfs
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Exceeded
RIOP
Modified RIOP

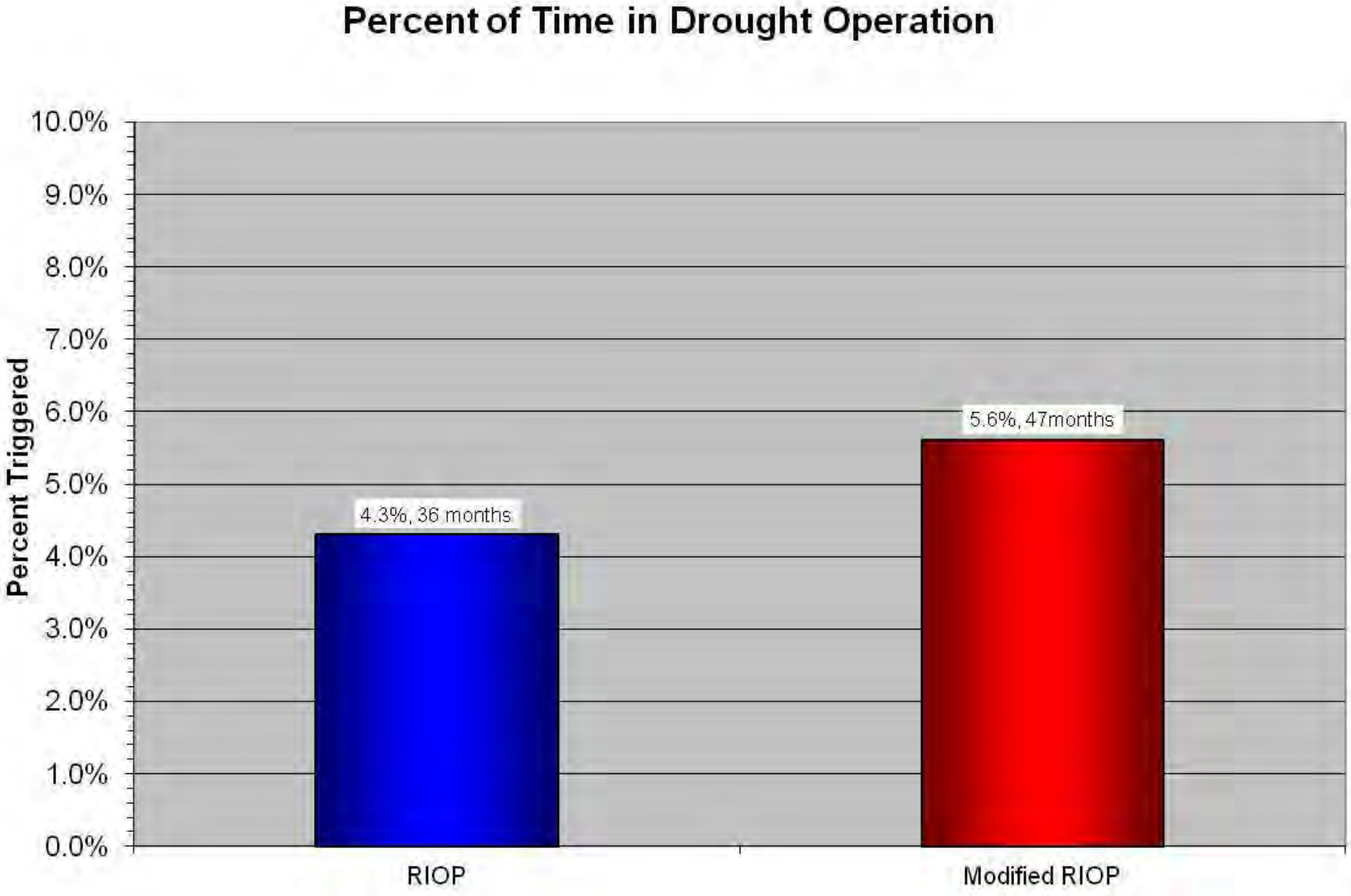

Chattahoochee-Oct
100000
10000
1000
Flow in cfs
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Exceeded
RIOP
Modified RIOP

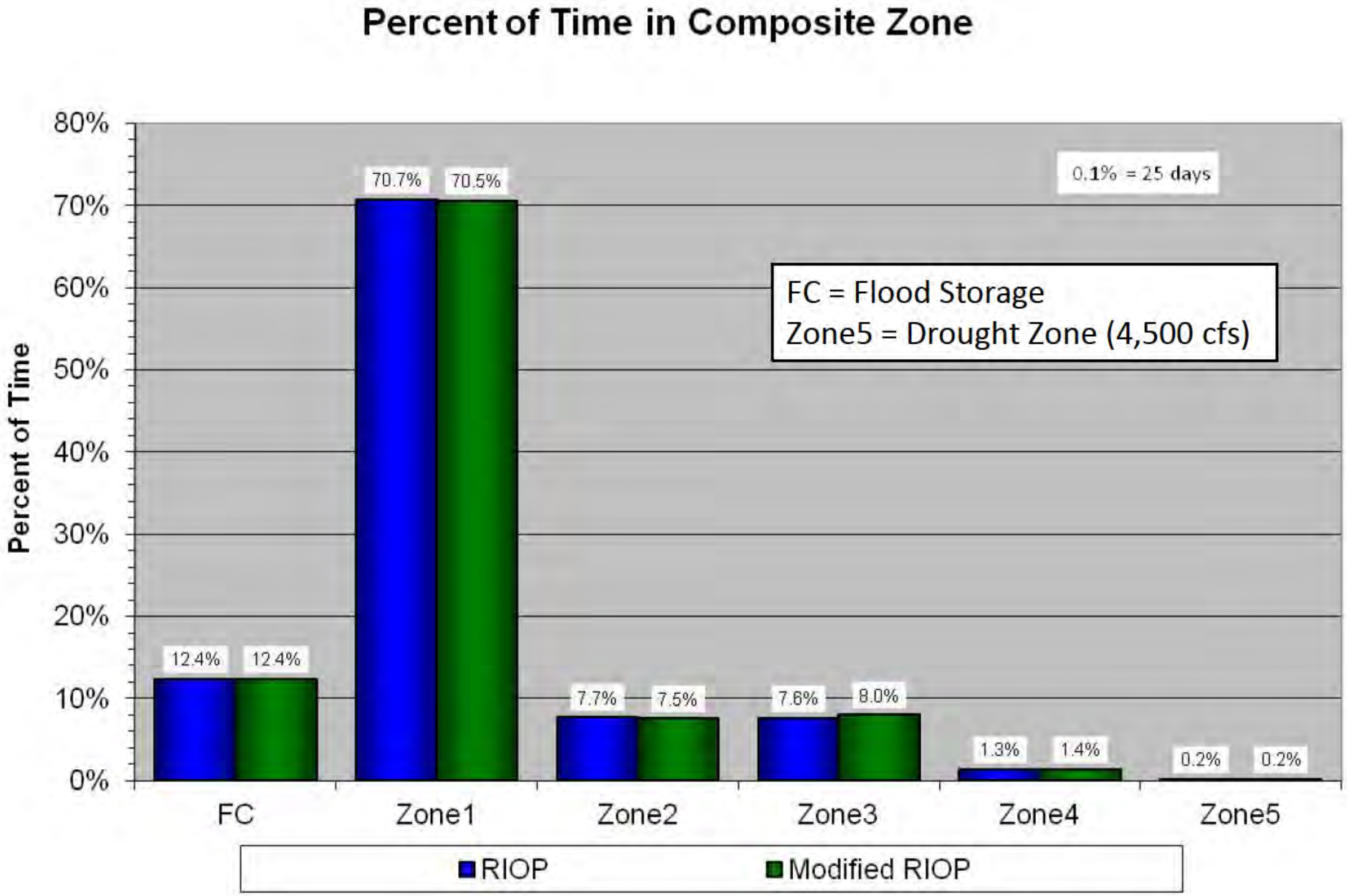

Chattahoochee-Nov
100000
10000
1000
Flow in cfs
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Exceeded
RIOP
Modified RIOP

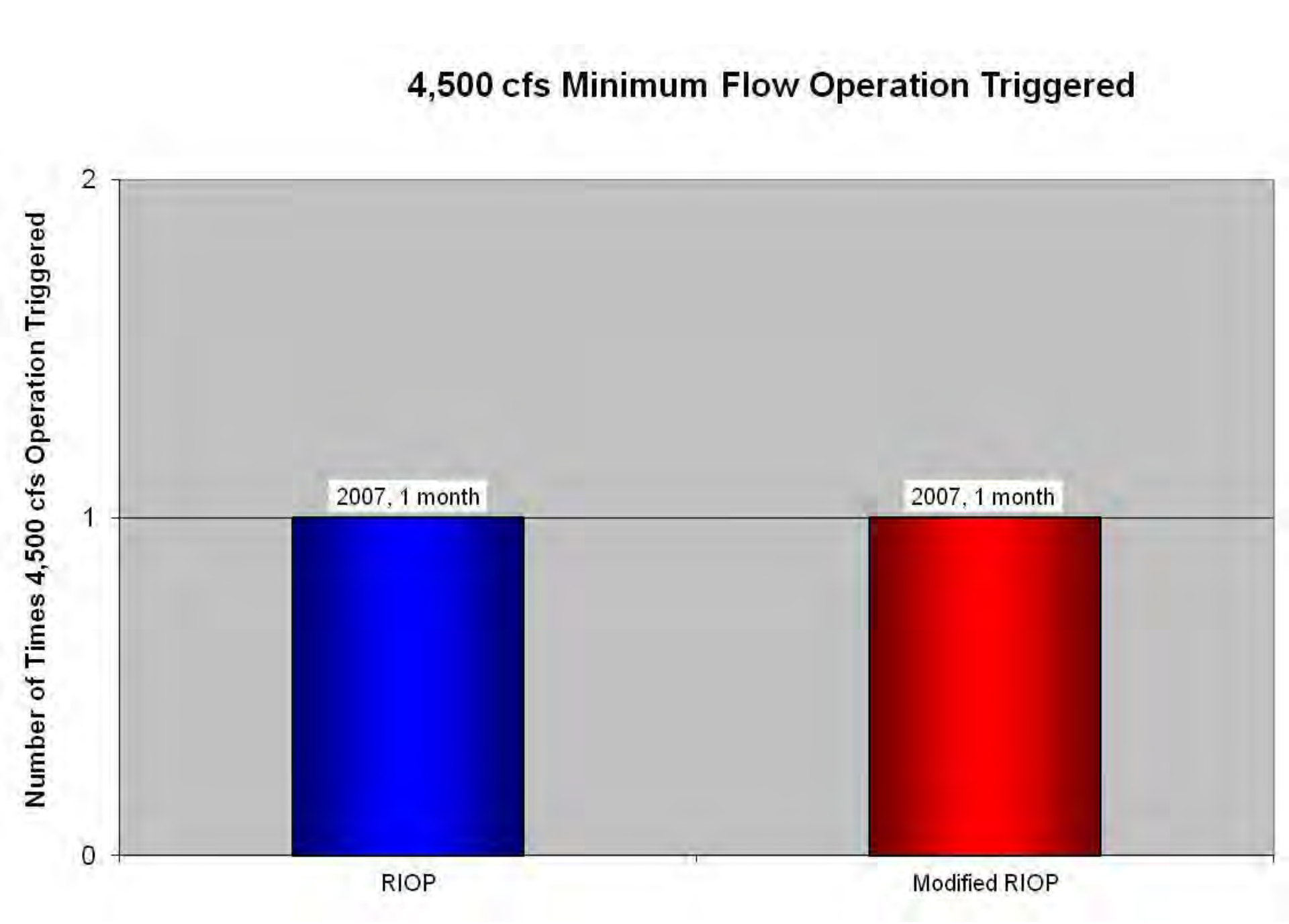

Chattahoochee-Dec
100000
10000
1000
Flow in cfs
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Exceeded
RIOP
Modified RIOP

Drought Operations


Drought Operation Triggered
Number of Times Drought Operation Triggered
10
9
8
7
6
5
4
3
2
1
0
2000, 2002, 2007
2000, 2007
RIOP
Modified RIOP


Percent of Time in Drought Operation
Percent Triggered
10.0%
9.0%
8.0%
7.0%
6.0%
5.0%
4.0%
3.0%
2.0%
1.0%
0.0%
4.3%, 36 months
5.6%, 47months
RIOP
Modified RIOP


Percent of Time in Composite Zone
Percent of Time
80%
70%
60%
50%
40%
30%
20%
10%
0%
70.7%
70.5%
0.1% = 25 days
FC = Flood Storage
Zone5 = Drought Zone (4,500 cfs)
12.4%
12.4%
7.7%
7.5%
7.6%
8.0%
1.3%
1.4%
0.2%
0.2%
FC
Zone1
Zone2
Zone3
Zone4
Zone5
RIOP
Modified RIOP


4,500 cfs Minimum Flow Operation Triggered
Number of Times 4,500 cfs Operation Triggered
2
1
0
2007, 1 month
2007, 1 month
RIOP
Modified RIOP

APPENDIX E

CORRESPONDENCE

United States Department of the Interior

IN REPLY REFER TO:

FISH AND WILDLIFE SERVICE
Field Office
1601 Balboa Avenue
Panama City, FL 32405-3721

Tel: (850) 769-0552
Fax: (850) 763-2177

September 14, 2010

Colonel Steven J. Roemhildt
Commander, Mobile District
U.S. Army Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628-0001

Dear Col. Roemhildt:

The purpose of this letter is to recommend that the Corps' reinitiate consultation with the Fish and Wildlife Service (Service) under the biological opinion (BO) of the Revised Interim Operating Plan (RIOP) for Jim Woodruff Dam, per section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if; (1) the amount or extent of incidental take is exceeded; (2) new information shows that the action may affect listed species in a manner or to an extent not considered in this BO; (3) the action is subsequently modified in a manner that causes an effect to the listed species not considered in this BO; or (4) a new species is listed or critical habitat designated that may be affected by the action.

Under Reasonable and Prudent Measures (RPM) 5c in the BO, the Corps has contracted with Dr. Michael Gangloff to collect additional data on mussel depth distributions. Through conference calls with our staff and Mr. Brian Zettle (Inland Environment), it has come to our attention that endangered fat threeridge mussels have recolonized habitat at stages greater than 5,000 cfs. This constitutes new information to an extent not considered in the BO, as we did not anticipate losses of this nature at the time of the BO. Increased mortality of fat threeridge mussels could affect the conclusions of our 2008 BO and the level of incidental take that is authorized. Further, as flows declined below 6,000 cfs (Chattahoochee gage) last week, our staff visited several sites in the RM40-50 reach of the main channel of the Apalachicola River on September 10, 2010, and found many exposed dead fat threeridge mussels. Preliminary analysis of the data collected indicates that as many as 1,200 fat threeridge may already have been exposed in RM40-50 at Wewahitchka gage stages above 12.75.

Recognizing that you are authorized to reduce flows to 5,000 cfs, we appreciate your continued discretion in preventing additional mussel mortality by augmenting flows at 5,500 cfs while we collect data on mussel exposure and mortality. We look forward to working

with you further on system operations and fish and wildlife conservation in the basin. If you have any questions or comments, please contact myself or Karen Herrington at extension 247 or 250.

Sincerely,

//s//Donald W. Imm

Dr. Donald W. Imm
Project Leader

cc:
DOI Solicitors Office, Atlanta, GA
DOJ, Washington DC
USFWS, Regional Director, Atlanta GA
USFWS, Field Supervisor, Athens, GA and Daphne, AL

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, MOBILE DISTRICT
CORPS OF ENGINEERS
P.O. BOX 2288
MOBILE, ALABAMA 36628-0001

REPLY TO
ATTENTION OF:

SEP 20 2010

Inland Environment Team
Planning and Environmental Division

Mr. Donald Imm
Field Supervisor
U.S. Fish and Wildlife Service
1601 Balboa Avenue
Panama City, Florida 32405-3721

Dear Mr. Imm:

I am writing in response to your September 14, 2010 letter, recommending that the U.S. Army Corps of Engineers (Corps), Mobile District reinitiate consultation of the 2008 biological opinion (BO) of the Revised Interim Operations Plan (RIOP) for Jim Woodruff Dam, per section 7 of the Endangered Species Act (ESA). We agree that the depth distribution data recently collected by Dr. Michael Gangloff, documenting the re-colonization of endangered fat threeridge mussels at river stages greater than 5,000 cubic feet per second (cfs) constitutes new information that was not considered in the BO. Furthermore, the Corps agrees that this information could affect the conclusions of the BO and incidental take statement.

Pursuant to Section 7 of the ESA, the Corps is requesting to reinitiate formal consultation on its RIOP at Jim Woodruff Dam. At this time, we are not recommending any changes to the RIOP and until formal consultation is concluded we intend to operate Jim Woodruff Dam in accordance with the provisions contained in the RIOP. As we notified you on September 14, 2010, in compliance with the RIOP provisions, we resumed the reduction in flows from Jim Woodruff to approximately 5,000 cfs.

The mussel depth distribution data collected by Dr. Gangloff has already been provided to your staff and we stand by ready to assist with additional data collection or analysis. Should you have any questions, comments, or recommendations, please contact Mr. Brian Zettle, (251) 690-2115, Email: brian.a.zettle@sam.usace.army.mil.

Sincerely,

Steven J. Roemhildt

Steven J. Roemhildt, P.E.
Colonel, Corps of Engineers
District Commander

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Field Office
1601 Balboa Avenue
Panama City, FL 32405-3721
Tel: (850) 769-0552
Fax: (850) 763-2177

IN REPLY REFER TO:

October 14, 2010

COL Steven J. Roemhildt
Commander, Mobile District
U.S. Army Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628-0001

Dear Col. Roemhildt:

This letter acknowledges the U.S. Fish and Wildlife Service's (Service) receipt of your September 20, 2010, letter requesting reinitiation of consultation for the Revised Interim Operating Plan (RIOP) for Jim Woodruff Dam, per section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). The U.S. Army Corps of Engineers (Corps) originally requested formal consultation on this action by letter dated April 15, 2008. At that time, the Corps determined that the proposed RIOP may adversely affect the threatened Gulf sturgeon (*Acipenser oxyrinchus desotoi*), endangered fat threeridge mussel (*Amblema neislerii*), threatened purple bankclimber mussel (*Elliptoideus sloatianus*), threatened Chipola slabshell (*Elliptio chipolaensis*), and areas designated as critical habitat for the Gulf sturgeon and the mussels. In the June 1, 2008, biological opinion (BO), the Service determined that the RIOP would not jeopardize the continued existence of these species nor destroy or adversely modify their designated critical habitats. An Incidental Take Statement and Reasonable and Prudent Measures (RPM) were issued to minimize the impacts of incidental take on Gulf sturgeon, fat threeridge, purple bankclimber, and Chipola slabshell in the Apalachicola River.

The Corps has noted that there will be no change in the action. Reinitiation was requested due to depth distribution data recently collected by Dr. Michael Gangloff, documenting the re-colonization of fat threeridge mussels at river stages greater than 5,000 cubic feet per second (cfs). This monitoring was required under RPM 5c, and these results constitute new information about the fat threeridge that was not considered in the BO. The Service understands that the Corps and Dr. Gangloff are planning to conduct depth distribution monitoring for purple bankclimbers on the rock shoal at river mile (RM) 105 in the next few weeks. It is possible that similar new information will be found, thereby requiring reinitiation of consultation for the purple bankclimber. A Service biologist visited this site on September 13, 2010, at a discharge of 5,510 cfs and found one purple bankclimber at a depth of 2.5 inches. This finding indicates that limited re-colonization of purple bankclimbers may have occurred at this location.

We recommend that the Corps reinitiate consultation for the fat threeridge after the RM 105 survey for the purple bankclimber is conducted. If similar re-colonization of purple

bankclimbers has not occurred, no additional consultation for this species would be necessary at this time. Given that there is no change in the action and no new impacts are anticipated for the Gulf sturgeon or Chipola slabshell, the Service does not believe it necessary to reinitiate consultation for these two species. The formal consultation process would not begin until we receive the information on the purple bankclimber and your determination on the need for consultation.

We look forward to working with you further on this consultation. If you have any questions or comments, please contact myself or Karen Herrington at extension 247 or 250.

Sincerely,

Dr. Donald W. Imm
Project Leader

cc:
DOI Solicitors Office, Atlanta, GA
DOJ, Washington DC
USFWS, Regional Director, Atlanta GA
USFWS, Field Supervisor, Athens, GA and Daphne, AL

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, MOBILE DISTRICT
CORPS OF ENGINEERS
P.O. BOX 2288
MOBILE, ALABAMA 36628-0001

REPLY TO
ATTENTION OF:

NOV 17 2010

Inland Environment Team
Planning and Environmental Division

Mr. Donald Imm
Field Supervisor
U.S. Fish and Wildlife Service
1601 Balboa Avenue
Panama City, Florida 32405-3721

Dear Mr. Imm:

This is in response to your October 14, 2010, letter regarding reinitiating formal consultation on fat-three ridge mussels and the Revised Interim Operations Plan (RIOP) operations at Jim Woodruff Dam. The Service recommended reinitiation due to the new scientific data collected by Dr. Michael Gangloff on fat-three ridge mussels. As we discussed in our previous letter dated September 20, 2010, we concur with your assessment that reinitiating consultation on the effects of the U.S. Army Corps of Engineers (Corps) RIOP on the fat-three ridge mussel is warranted. The Corps also agrees that it is not necessary to reinitiate on Gulf sturgeon or Chipola slabshell since there are no proposed changes to the RIOP and no new impacts are anticipated.

In the October 14, 2010, letter the Service recommended reinitation be postponed until depth distribution surveys were conducted for the purple bankclimber mussel near Race Shoals (river mile 105). I want to apprise you of the current status of that work. Due to recent rain events, current basin in-flows and prescribed minimum release flows are too high to facilitate completion of the depth distribution survey. As the wet season is now upon us, it has become difficult to schedule and conduct the survey, and the work could be delayed several more weeks or months. As soon as flow levels allow, we intend to finish the depth distribution survey and will provide the data to the Service. This new scientific information will help the Service and the Corps to determine whether it would be appropriate to also reinitiate consultation with regard to the purple bankclimber mussel.

We do not believe it is prudent to continue to delay reinitiating consultation on the fat- three ridge mussel. Therefore, we request to reinitiate consultation on the fat-three ridge mussel at this time.

We will continue to keep you updated on the purple bankclimber mussel survey and immediately notify you of any new information warranting reinitiation on the purple bankclimber mussel. Should you have any questions, comments, or recommendations please contact Mr. Brian Zettle at (251) 690-2115 or via email at brian.a.zettle@sam.usace.army.mil.

Sincerely,

Steven J. Roemhildt

Steven J. Roemhildt, P.E.
Colonel, Corps of Engineers
District Commander

United States Department of the Interior

IN REPLY REFER TO:

FISH AND WILDLIFE SERVICE
Field Office
1601 Balboa Avenue
Panama City, FL 32405-3721

Tel: (850) 769-0552
Fax: (850) 763-2177

November 23, 2010

Col Steven J. Roemhildt
Commander, Mobile District
U.S. Army Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628-0001

Dear Col. Roemhildt:

Thank you for your letter to the Fish and Wildlife Service (Service) dated November 17, 2010, and received November 19, 2010, letter requesting reinitiation of consultation for the Revised Interim Operating Plan (RIOP) for Jim Woodruff Dam, per section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). The U.S. Army Corps of Engineers (Corps) originally requested formal consultation on this action by letter dated April 15, 2008. At that time, the Corps determined that the proposed RIOP may adversely affect the threatened Gulf sturgeon (*Acipenser oxyrinchus desotoi*), endangered fat threeridge mussel (*Amblema neislerii*), threatened purple bankclimber mussel (*Elliptoideus sloatianus*), threatened Chipola slabshell (*Elliptio chipolaensis*), and areas designated as critical habitat for the Gulf sturgeon and the mussels. In the June 1, 2008, biological opinion (BO), the Service determined that the RIOP would not jeopardize the continued existence of these species nor destroy or adversely modify their designated critical habitats. An Incidental Take Statement and Reasonable and Prudent Measures (RPM) were issued to minimize the impacts of incidental take on Gulf sturgeon, fat threeridge, purple bankclimber, and Chipola slabshell in the Apalachicola River.

As described in your letter, there will be no change in the action, and reinitiation is necessary due to new information on fat threeridge documenting re-colonization at river stages greater than 5,000 cubic feet per second (cfs). It is possible similar re-colonization has occurred for purple bankclimber, but until surveys are conducted, we do not have enough information to reinitiate consultation for purple bankclimber. There is no new information suggesting reinitiation is warranted for Gulf sturgeon or Chipola slabshell. Therefore, the reinitiated consultation only concerns the potential adverse affects on the fat threeridge at this time.

All information required to reinitiate the consultation was either provided in your letter or is otherwise available to the Service. Section 7 allows the Service up to 90 days after receipt of a complete initiation request to conclude formal consultation, and an additional 45 days to prepare our biological opinion (unless we agree to an extension). We expect to deliver a biological opinion no later than April 1, 2010.

During consultation, the Service shall: 1) review all information relevant to the fat threeridge; 2) evaluate the current status of the fat threeridge; 3) evaluate the effects of the RIOP and cumulative effects on the fat threeridge; 4) formulate a biological opinion as to whether the RIOP, taken together with cumulative effects, is likely to jeopardize the continued existence of the fat threeridge; 5) if necessary, work with your agency to identify reasonable and prudent alternatives that would avoid jeopardy; and 6) develop terms and conditions and formulate discretionary conservation measures that will assist your agency in reducing or eliminating impacts to the fat threeridge (50 CFR 402.12(g)).

The Act requires that after initiation of formal consultation, the Federal action agency may not make any irreversible or irretrievable commitment of resources that limits future options. This practice ensures that agency actions do not preclude the formulation or implementation of reasonable and prudent alternatives that would avoid jeopardizing the continued existence of listed species.

We understand that high flows have recently prevented surveys for the purple bankclimber, and we will continue to coordinate with you on any new information warranting reinitiation on the purple bankclimber. We look forward to working with you further on this consultation. If you have any questions or comments, please contact myself or Karen Herrington at extension 247 or 250.

Sincerely,

//s//Donald W. Imm

Dr. Donald W. Imm
Project Leader

cc:
DOI Solicitors Office, Atlanta, GA
DOJ, Washington DC
USFWS, Regional Director, Atlanta GA
USFWS, Field Supervisor, Athens, GA and Daphne, AL

United States Department of the Interior

IN REPLY REFER TO:

FISH AND WILDLIFE SERVICE
Field Office
1601 Balboa Avenue
Panama City, FL 32405-3721
Tel: (850) 769-0552
Fax: (850) 763-2177

February 18, 2011

Col Steven J. Roemhildt
Commander, Mobile District
U.S. Army Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628-0001

Dear Col. Roemhildt:

On November 19, 2010, the U.S. Army Corps of Engineers (Corps) and Fish and Wildlife Service (Service) reinitiated formal consultation for the Revised Interim Operating Plan (RIOP) for Jim Woodruff Dam, per section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). This reinitiated consultation only concerns the effects of the RIOP on the endangered fat threeridge mussel (*Amblema neislerii*) and its designated critical habitat. The 90-day consultation period expires today, and our biological opinion is due on April 1, 2011.

By letter dated January 31, 2011, we received your Annual Report for Fiscal Year 2010 summarizing compliance with the Reasonable and Prudent Measures (RPM) and terms and conditions of the June 1, 2008, Biological Opinion (BO) on the RIOP. Pursuant to RPM 2008-5c, the Annual Report included a Draft Report from Dr. Michael Gangloff on the population size and depth distribution of listed mussels in the Apalachicola and lower Chipola rivers. This morning we received additional new information on fat threeridge in Swift Slough from EnviroScience, Inc., a contractor for the State of Florida. These reports will substantially improve the information base from which we formulate our opinion, but receiving them relatively late in the consultation process presents a challenge to us. Additional time is needed to review this information and prepare the biological opinion.

When an applicant is not involved in a consultation, section 7(b)(1)(A) of the Act and our regulations at 50 CFR 402.14(e) provide that the Service and the action agency may extend the period of consultation by a mutually agreeable period of time. We believe that an additional 60 days would provide us sufficient time to make proper use of the new data and information. Therefore, we request a 60-day extension of the consultation period in accordance with 50 CFR 402.14(e). The BO will be issued before June 1, 2011. We look forward to your response. If

you have any questions or comments, please contact myself or Karen Herrington at extension 247 or 250.

Sincerely,

Dr. Donald W. Imm
Project Leader

cc:
DOI Solicitors Office, Atlanta, GA
DOJ, Washington DC
USFWS, Regional Director, Atlanta GA
USFWS, Field Supervisor, Athens, GA and Daphne, AL

DEPARTMENT OF THE ARMY
MOBILE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO
ATTENTION OF

MAR 04 2011

Inland Environment Team
Planning and Environmental Division

Mr. Donald Imm
Field Supervisor
U.S. Fish and Wildlife Service
1601 Balboa Avenue
Panama City, Florida 32405-3721

Dear Mr. Imm:

This is in response to your letter of February 18, 2011, which requested a 60-day extension of the formal consultation period to allow sufficient time to consider the additional information provided by the U.S. Army Corps of Engineers (Corps) and others during the reinitiated consultation period for fat threeridge mussels and the RIOP operations at Jim Woodruff Dam. The Corps agrees that the new information recently made available should be thoroughly reviewed as part of the reinitiated consultation. Therefore, we agree it is appropriate to extend the formal Section 7 consultation period for an additional 60 days. This will extend the date of completion of consultation from the previously agreed to date of April 1, 2011 to the extended date of June 1, 2011.

If you have any questions regarding our consultation or the information provided to date, please contact Mr. Brian Zettle of the Inland Environment Team, (251) 690-2115, or Email: brian.a.zettle@sam.usace.army.mil. We look forward to continued progress as we work with you and your staff to complete our respective consultation responsibilities.

Sincerely,

Steven J. Roemhildt, P.E.
Colonel, Corps of Engineers
District Commander

DEPARTMENT OF THE ARMY
MOBILE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO
ATTENTION OF

MAY 23 2011

Mr. Donald Imm
Field Supervisor
U.S. Fish and Wildlife Service
1601 Balboa Avenue
Panama City, Florida 32405-3721

Dear Mr. Imm:

On March 4, 2011 the U.S. Army Corps of Engineers (Corps) notified your office of our agreement to the U.S. Fish and Wildlife Service (FWS) request to extend the Revised Interim Operations Plan (RIOP) reinitiated consultation date of completion from April 1, 2011 to June 1, 2011. That extension was based on the need for additional time to thoroughly review new information relevant to the endangered fat threeridge mussel (*Amblema neislerii*) population in the Apalachicola River. Considerable work has occurred since that time in an effort to complete the consultation by June 1, 2011. However, our offices recently agreed that it would be useful for our analysis of these issues for the Corps to develop a ResSim model to simulate Run-of-River (ROR) operations.

Unfortunately, this additional modeling and analysis work cannot be completed in time to complete the consultation by June 1, 2011. In accordance with section 7(b)(1)(A) of the Endangered Species Act and FWS regulations at 50 CFR 402.14(e) we are requesting an extension to the period of consultation. We believe that an additional 60 days would provide sufficient time to develop the model(s) and conduct the effects analysis. This will extend the date of completion of consultation from the previously agreed to date of June 1, 2011 to the extended date of August 1, 2011.

If you have any questions regarding our consultation or the information provided to date, please contact Mr. Brian Zettle of the Inland Environment Team, (251) 690-2115, or Email: brian.a.zettle@sam.usace.army.mil. We look forward to continued progress as we work with you and your staff to complete our respective consultation responsibilities.

Sincerely,

Steven J. Roemhildt, P.E.
Colonel, Corps of Engineers
District Commander

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Field Office
1601 Balboa Avenue
Panama City, FL 32405-3721

Tel: (850) 769-0552
Fax: (850) 763-2177

IN REPLY REFER TO:

June 22, 2011

Col Steven J. Roemhildt
Commander, Mobile District
U.S. Army Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628-0001

Dear Col. Roemhildt:

This is in reference to the Biological Opinion (BO) on the U.S. Army Corps of Engineers, Mobile District, Revised Interim Operating Plan (RIOP) for Jim Woodruff Dam and the Associated Releases to the Apalachicola River, issued by the U.S. Fish and Wildlife Service (Service) on June 1, 2008, per section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). In the BO, the Service determined that the RIOP would not jeopardize the continued existence of the threatened Gulf sturgeon (*Acipenser oxyrinchus desotoi*), endangered fat threeridge mussel (*Amblema neislerii*), threatened purple bankclimber mussel (*Elliptoideus sloatianus*), and threatened Chipola slabshell (*Elliptio chipolaensis*), nor destroy or adversely modify their designated critical habitats. An Incidental Take Statement (ITS) was issued to exempt the Corps from the prohibitions of section 9 of the Act and to minimize the impacts of incidental take on these species. The ITS authorized the taking of a maximum of 200 purple bankclimbers, 100 Chipola slabshells, and 21,000 fat threeridge when the minimum flow of the Apalachicola River is reduced to 4,500 cfs.

On June 20, 2011, the Service was notified by email from Andy Ashley (Chief, Water Management, Mobile District) that the U.S. Geological Survey (USGS) adjusted the rating curve for gage number 02358000 (Chattahoochee gage). As noted in the email, the adjustment was prorated to the last discharge verification on April 28, 2011. The adjustment results in provisional discharge data indicating releases have been less than 5,000 cfs frequently in the past 30 days, with a minimum instantaneous discharge of 3,620 cfs. The Service understands that the Corps did not knowingly violate the minimum releases prescribed by the Corp's RIOP, and releases were immediately adjusted from the projects so that the discharge from Woodruff was consistent with the RIOP. Flows above the 5,000 cfs minimum flow were restored on June 20.

The ITS included Terms and Conditions of Reasonable and Prudent Measures (RPM) to address unforeseen circumstances such as this adjustment in the rating curve. RPM 2008-2c requires that the Corps "establish internal communication procedures to address unanticipated events that could have adverse effects to listed species. These procedures should be written and include 1) alerting the Service and appropriate State agencies, and 2) completing a summary on how the

event was handled and recommendations to further improve procedures that will assist in minimizing harm to listed species". By letter dated August 29, 2008, the Corps completed this RPM by describing the Standard Operating Procedure (SOP) for daily operational decisions. The Corps noted an additional SOP would be drafted and implemented to accelerate recognition and response to mechanical failures, including provisions requiring project operators to regularly evaluate the Chattahoochee gage data and other mechanisms to avoid releases less than the daily average minimum flow. Please advise us of the status of this additional SOP. Due to the importance of this gage, the Service recommends that the Corps work with the USGS to assure that the accuracy of the rating curve is assessed at least monthly. Another option to further improve procedures is to develop and use the relationship between the Corps gage at Woodruff Dam and the USGS Chattahoochee gage to assure consistency of releases.

Although the reduction in the minimum flow was not intended, take of listed mussels has occurred. As required by the ITS, the Corps must report the level of incidental take. RPM 2008-5b requires that the Corps implement the listed mussels take monitoring plan within four days of a reduction in minimum releases from Woodruff Dam to flows less than 5,000 cfs. We do not recommend the current take monitoring plan be implemented. Because flows have been below 5,000 cfs frequently for the last 30 days, it is probable that the incidental take monitoring plan would underestimate the amount of take that occurred. As part of the reinitiated consultation for the RIOP and the fat threeridge, we have been working with Brian Zettle of your staff to assess impacts that result from reductions in flow from 10,000 cfs to 5,000 cfs. We also have recent survey information for purple bankclimbers in the upper river. These data could be shared with your staff and used as part of your take assessment.

We are willing to discuss the best path forward for the Corps to monitor and report the level of take that has occurred for all three listed mussel species in the Apalachicola River. We will also consider any ramifications of the adjusted rating curve to the ongoing reinitiated consultation for fat threeridge. Please advise us of any additional actions you are taking, and please contact myself or Karen Herrington at extension 247 or 250 if you would like to discuss take monitoring or reporting.

Sincerely,

//s//Dr. Donald W. Imm

Dr. Donald W. Imm
Project Leader

cc:
DOI Solicitors Office, Atlanta, GA
DOJ, Washington DC
USFWS, Regional Director, Atlanta GA
USFWS, Field Supervisor, Athens, GA and Daphne, AL

United States Department of the Interior

IN REPLY REFER TO:

FISH AND WILDLIFE SERVICE
Field Office
1601 Balboa Avenue
Panama City, FL 32405-3721

Tel: (850) 769-0552
Fax: (850) 763-2177

July 8, 2011

Curtis Flakes
Chief, Planning and Environmental Division
U.S. Army Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628-0001

Dear Curtis Flakes:

On November 19, 2010, the U.S. Army Corps of Engineers (Corps) and Fish and Wildlife Service (Service) reinitiated formal consultation for the Revised Interim Operating Plan (RIOP) for Jim Woodruff Dam, per section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). This reinitiated consultation only concerns the effects of the RIOP on the endangered fat threeridge mussel (*Amblema neislerii*) and its designated critical habitat. The Corps previously requested that a 60 day extension of this consultation be granted to allow for additional time to develop a ResSim model of Run-of-River (RoR) operations. By letter dated June 1, 2011, we agreed to the extended date of August 1, 2011.

Through recent discussions between our staff, we have learned that the RoR model and other additional RIOP modeling will be available on July 20, 2011. This additional modeling is essential to thoroughly evaluate the effects of the RIOP and consumptive uses in the basin, but receiving this information relatively late in the consultation process presents a challenge to us. Additional time is needed to review this information and prepare the biological opinion.

When an applicant is not involved in a consultation, section 7(b)(1)(A) of the Act and our regulations at 50 CFR 402.14(e) provide that the Service and the action agency may extend the period of consultation by a mutually agreeable period of time. We believe that an additional 45 days would provide us sufficient time to make proper use of the new data and information. Therefore, we request a 45-day extension of the consultation period in accordance with 50 CFR 402.14(e). The BO will be issued before September 15, 2011. We look forward to your response.

If you have any questions or comments, please contact myself or Karen Herrington at extension 247 or 250.

Sincerely,

//s//Dr. Donald W. Imm

Dr. Donald W. Imm
Project Leader

cc:
DOI Solicitors Office, Atlanta, GA
DOJ, Washington DC
USFWS, Regional Director, Atlanta GA
USFWS, Field Supervisor, Athens, GA and Daphne, AL

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, MOBILE DISTRICT
CORPS OF ENGINEERS
P.O. BOX 2288
MOBILE, ALABAMA 36628-0001

REPLY TO
ATTENTION OF:

July 15, 2011

Inland Environment Team
Planning and Environmental Division

Dr. Donald Imm
Field Supervisor
U.S. Fish and Wildlife Service
1601 Balboa Avenue
Panama City, Florida 32405-3721

Dear Dr. Imm:

This is in response to your letter of July 8, 2011, which requested a 45-day extension of the formal consultation period to allow sufficient time to make proper use of new modeling data and information regarding fat threeridge mussels and the Revised Interim Operations Plan (RIOP) operations at Jim Woodruff Dam. The U.S. Army Corps of Engineers agrees that this new information is needed to complete the reinitiated consultation. Therefore, we agree it is appropriate to extend the formal Section 7 consultation period for an additional 45 days. This will extend the date of completion of consultation from the previously agreed to date of August 1, 2011 to the extended date of September 15, 2011.

We look forward to continued progress as we work with you and your staff to complete our respective consultation responsibilities. If you have any questions regarding our consultation or the information provided to date, please contact Mr. Brian Zettle of the Inland Environment Team, (251) 690-2115, or via email at brian.a.zettle@sam.usace.army.mil

Sincerely,

Curtis M. Flakes
Chief, Planning and Environmental
Division

July 20, 2011

Florida Fish and Wildlife Conservation Commission

Commissioners
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Chairman
Jacksonville

Kenneth W. Wright
Vice Chairman
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Mr. Curtis Flakes
Chief, Planning and Environment Division
US Army Corps of Engineers
Post Office Box 2288
Mobile, AL 36628-0001

Mr. Donald W. Imm
Fish and Wildlife Service
Panama City Field Office
1601 Balboa Ave
Panama City, FL 32405-3721

RE: Request for ACF Modeling Data

Messrs. Flakes and Imm:

In a letter to the Army Corp of Engineers dated July 8, 2011, the Fish and Wildlife Service indicated additional modeling undertaken pursuant to the ongoing ESA Section 7 consultation concerning fat three ridge mussels would be available by July 20, 2011. The Service described the modeling as essential to its evaluation of the effects of current reservoir operations on the mussel species. The Florida Fish and Wildlife Conservation Commission requests a copy of that modeling data to assist in our review of the Corps' ongoing operations under the Fish and Wildlife Coordination Act.

Thank you for your anticipated cooperation.

Sincerely

Harold G. Vielhauer
General Counsel

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, MOBILE DISTRICT
CORPS OF ENGINEERS
P.O. BOX 2288
MOBILE, ALABAMA 36628-0001

REPLY TO
ATTENTION OF:

September 7, 2011

Dr. Donald Imm
Field Supervisor
U.S. Fish and Wildlife Service
1601 Balboa Avenue
Panama City, Florida 32405-3721

Dear Dr. Imm:

On July 15, 2011 the U.S. Army Corps of Engineers (Corps) notified your office of our agreement to the U.S. Fish and Wildlife Service (FWS) request to extend the Revised Interim Operations Plan (RIOP) reinitiated consultation date of completion from August 1, 2011 to September 15, 2011. That extension was based on the need for additional time to make proper use of new modeling data and information regarding fat threeridge mussels and the RIOP operations at Jim Woodruff Dam. Since that time our agencies have consulted and identified modifications to the RIOP that further minimize and avoid adverse effects to listed mussel species in the Apalachicola River. Additional modeling was required to evaluate the effects of the modifications. This modeling has been completed and the effects analysis is currently under development.

Unfortunately, this additional effects analysis cannot be completed in time to complete the consultation by September 15, 2011. However, we do anticipate submittal of the effects analysis of the mutually agreed upon modifications to the RIOP by September 15, 2011. In accordance with section 7(b)(1)(A) of the Endangered Species Act and FWS regulations at 50 CFR 402.14(e) we are requesting an extension to the period of consultation. We believe that an additional 60 days after receipt of the Corps' effects analysis would provide sufficient time to complete the consultation.

If you have any questions regarding our consultation or the information provided to date, please contact Mr. Brian Zettle of the Inland Environment Team, (251) 690-2115, or Email: brian.a.zettle@sam.usace.army.mil. We look forward to continued progress as we work with you and your staff to complete our respective consultation responsibilities.

Sincerely,

Curtis M. Flakes
Chief, Planning and Environmental
Division

United States Department of the Interior

IN REPLY REFER TO:

FISH AND WILDLIFE SERVICE
Field Office
1601 Balboa Avenue
Panama City, FL 32405-3721
Tel: (850) 769-0552
Fax: (850) 763-2177

September 13, 2011

Curtis Flakes
Chief, Planning and Environmental Division
U.S. Army Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628-0001

Dear Mr. Flakes:

This is in response to your letter of September 7, 2011, which requested an extension of the formal consultation period for the Revised Interim Operations Plan (RIOP) for Jim Woodruff Dam, per section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). The extension was requested to allow the U.S. Army Corps of Engineers (Corps) to complete an effects analysis for modifications to the RIOP that may minimize adverse effects to federally listed freshwater mussels. We agree that this effects analysis is necessary, and the consultation should be completed within 60 days of receiving the Corps' final biological assessment.

We appreciate the Corps dedication to this consultation to date, and we look forward to reviewing the biological assessment. If you have any questions or comments, please contact myself or Karen Herrington at extension 247 or 250.

Sincerely,

//s//Dr. Donald W. Imm

Dr. Donald W. Imm
Project Leader

cc:
DOI Solicitors Office, Atlanta, GA
DOJ, Washington DC
USFWS, Regional Director, Atlanta GA
USFWS, Field Supervisor, Athens, GA and Daphne, AL

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DEPARTMENT OF THE ARMY
MOBILE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 2288
MOBILE, ALABAMA 36628-0001

REPLY TO
ATTENTION OF:

October 24, 2011

Inland Environment Team
Planning and Environmental Division

Dr. Donald W. Imm
Field Supervisor
U.S. Fish and Wildlife Service
1601 Balboa Avenue
Panama City, Florida 32405-3721

Dear Dr. Imm:

I am writing in response to your September 13, 2011 letter, agreeing to an extension of the formal consultation period for the Revised Interim Operations Plan (RIOP) for Jim Woodruff Dam, per section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*). The extension was necessary for the U.S. Corps of Engineers (Corps) to complete an effects analysis for modifications to the RIOP that may minimize adverse effects to the federally listed freshwater mussels. In the letter, you noted that the consultation should be completed within 60 days of receiving the Corp's final amended biological assessment. The Corps has completed the amended biological assessment in close coordination with your staff and the final version is enclosed.

We look forward to continued progress as we work with you and your staff to complete our respective consultation responsibilities. If you have any questions regarding the consultation or information provided, please contact Mr. Brian Zettle, of the Inland Environment Team, (251) 690-2115 or email: brian.a.zettle@sam.usace.army.mil.

Sincerely,

Curtis M. Flakes
Chief, Planning and Environmental
Division

Enclosures

AMENDED BIOLOGICAL ASSESSMENT
Modifications to the Revised Interim Operations Plan (RIOP) for Jim Woodruff Dam and the Associated Releases to the Apalachicola River

INTRODUCTION

On 1 June 2008, the U.S. Fish and Wildlife Service (FWS) released a Biological Opinion (BO) on the U.S. Army Corps of Engineers, Mobile District (Corps), Revised Interim Operations Plan (RIOP) for Jim Woodruff Dam and the associated releases to the Apalachicola River (USFWS 2008). The BO addressed the effects of Corps operations at Jim Woodruff Dam on Federally listed endangered or threatened species and critical habitat for those species. Species of concern include the threatened Gulf sturgeon (*Acipenser oxyrinchus desotoi*) and critical habitat for the Gulf sturgeon; the endangered fat threeridge mussel (*Amblema neislerii*); the threatened purple bankclimber mussel (*Elliptoideus sloatianus*); the threatened Chipola slabshell mussel (*Eliptio chipolaensis*) and critical habitat for the listed mussels. As described in the BO, the operations regarding releases to the Apalachicola River were described in a revised interim plan, since consultation on the overall project operations for the Apalachicola, Chattahoochee, Flint Rivers (ACF) system would be deferred until future efforts to update the water control plans and basin manual for the system. This Amended Biological Assessment (BA) addresses effects to these same four species for the Corps' proposed modification to the RIOP. The Corps re-initiated consultation on the RIOP in September 2010 based on new information about the distribution and mortality of endangered fat threeridge mussels in the Apalachicola River. This BA is based on numerous conference calls and coordination meetings between the Corps and FWS since the re-initiation began. The proposed modifications to the RIOP are a product of these discussions and extensive hydrologic modeling by the Corps utilizing the HEC-ResSim simulation software.

DESCRIPTION OF PROPOSED ACTION

Like the current RIOP, the proposed action specifies two parameters applicable to the daily releases from Jim Woodruff Dam: a minimum discharge and a maximum fall rate. Also like the current RIOP, the proposed action places limitations on refill, but does not require a net drawdown of composite storage unless basin inflow is less than 5,000 cfs. However, the proposed action includes several modifications to the current RIOP. The intent of the modifications is to further minimize or avoid adverse effects on listed species as a result of Corps' discretionary operations at Jim Woodruff Dam. The modifications include 1) elimination of the use of volumetric balancing as described in the May 16, 2007 letter to USFWS; 2) minimum flow releases will match basin inflow when basin inflow is between 5,000 and 10,000 cubic feet per second (cfs) at all times outside of the spawning season (this provision is suspended during drought contingency operations); 3) drought contingency operations are not suspended and normal operations reinstituted until such a time as the composite conservation storage has recovered above

Zone 2 into Zone 1; and 4) in accordance with RPM 2008-4 of the RIOP BO (USFWS 2008), formal adoption of an additional Gulf sturgeon spawning season (March-May) provision which ensures that river stage declines of 8 feet or more will not occur in less than 14 days when river flows are less than 40,000 cfs (under both normal and drought operations).

The proposed action does not change the current RIOP basin inflow calculation (7-day moving average daily basin inflow), use of Chattahoochee gage (USGS number 02358000) to measure releases/river flow, limited hydropower peaking operations at Jim Woodruff Dam, nor conditions under which maintenance of the minimum release and maximum fall rate schedule are suspended and more conservative drought contingency operations begin. Like the current RIOP, the proposed action is considered an interim operations plan for Jim Woodruff Dam, pending a future update of the ACF Water Control Plan (WCP). The WCP update is currently ongoing. A detailed description of the proposed action and how it modifies the current RIOP is provided below.

Minimum Discharge: Like the current RIOP, the proposed action varies minimum discharges from Jim Woodruff Dam by basin inflow, composite conservation storage level, and by month and the releases are measured as a daily average flow in cfs at the Chattahoochee gage. Table 1 shows minimum releases from Jim Woodruff Dam prescribed by the proposed action and shows when and how much basin inflow is available for increasing reservoir storage. Except when basin inflow is less than 5,000 cfs, the minimum releases are not required to exceed basin inflow. The current RIOP defines basin inflow threshold levels that vary by three seasons: spawning season (March-May); non-spawning season (June-November); and winter (December-February). The current RIOP also incorporates composite conservation storage thresholds that factor into minimum release decisions. Composite conservation storage is calculated by combining the conservation storage of Lake Sidney Lanier, West Point Lake, and Walter F. George Lake. Each of the individual storage reservoirs consists of four Zones. These Zones are determined by the operational guide curve for each project. The composite conservation storage utilizes the four Zone concepts as well; i.e., Zone 1 of the composite conservation storage represents the combined conservation storage available in Zone 1 for each of the three storage reservoirs.

During the spawning season (March-May), two sets of four basin inflow thresholds and corresponding releases exist based on composite conservation storage. In accordance with RPM 2008-4 of the RIOP BO (USFWS 2008), the spawning season also includes a special fall rate provision in order to avoid take of larval Gulf sturgeon. The provision ensures that river stage declines of 8 feet or more do not occur in less than 14 days when river flows are less than 40,000 cfs. When composite conservation storage is in Zones 1 and 2, a less conservative operation is in place. When composite conservation storage is in Zone 3, a more conservative operation is in place while still avoiding or minimizing impacts to listed species and critical habitat in the river. When composite conservation storage falls below the bottom of Zone 3 into Zone 4 the drought contingency operations are “triggered” representing the most conservative operational plan. The spawning season fall rate provision is in place under normal and drought operations. A detailed

description of the drought contingency operations is provided below. During the spawning season, a daily monitoring plan that tracks composite storage will be implemented in order to determine water management operations. Recent climatic and hydrological conditions experienced and meteorological forecasts will be used in addition to the composite conservation storage values when determining the appropriate basin inflow thresholds to utilize in the upcoming days.

Like the current RIOP, during the non-spawning season (June-November), one set of four basin inflow thresholds and corresponding releases exists based on composite conservation storage in Zones 1-3. However, the proposed action modifies the current RIOP basin inflow and minimum release provisions while operating in these composite conservation zones. The proposed action modifies the RIOP by further limiting storage opportunities when basin inflow is between 5,000 and 10,000 cfs. This change also requires slight adjustments to the basin inflow levels and minimum release provisions at basin inflows greater than 10,000 cfs. Table 1 reflects the proposed action with the modifications to the current RIOP. When composite conservation storage falls below the bottom of Zone 3 into Zone 4 the drought contingency operations are "triggered".

Under the current RIOP, during the winter season (December-February), there is only one basin inflow threshold and corresponding minimum release (5,000 cfs) while in composite conservation storage Zones 1-3. The proposed action modifies the current RIOP basin inflow and minimum release provisions while operating in these composite conservation zones. The proposed action modifies the RIOP by further limiting storage opportunities when basin inflow is between 5,000 and 10,000 cfs. When basin inflow calculations are in this range, the minimum flow release provision will match the basin inflow. There are no basin inflow storage restrictions when basin inflow calculations are greater than 10,000 cfs as long as this minimum flow is met. When composite conservation storage falls below the bottom of Zone 3 into Zone 4 the drought contingency operations are "triggered".

Like the current RIOP, the flow rates included in Table 1 prescribe minimum, and not target, releases for Jim Woodruff Dam. During a given month and basin inflow rate, releases greater than the Table 1 minimum releases may occur consistent with the maximum fall rate schedule, described below, or as needed to achieve other project purposes, such as hydropower or flood control.

Maximum Fall Rate: Fall rate, also called down-ramping rate, is the vertical drop in river stage (water surface elevation) that occurs over a given period. The fall rates are expressed in units of feet per day (ft/day), and are measured at the Chattahoochee gage as the difference between the daily average river stage of consecutive calendar days. Rise rates (*e.g.,* today's average river stage is higher than yesterday's) are not addressed. The proposed action does not change the maximum fall rate schedule (Table 2) prescribed by the current RIOP. Unless otherwise noted, fall rates under the drought contingency operation would be managed to match the fall rate of the 1-day basin inflow. Matching

Table 1. Proposed Action Modified RIOP Releases From Jim Woodruff Dam				
Months	**Composite Storage Zone**	**Basin Inflow (BI) (cfs)**	**Releases from JWLD (cfs)**	**Basin Inflow Available for Storage[1]**
March - May	Zones 1 and 2	>= 34,000	>= 25,000	Up to 100% BI > 25,000
		>= 16,000 and < 34,000	>= 16,000 + 50% BI > 16,000	Up to 50% BI > 16,000
		>= 5,000 and < 16,000	>= BI	
		< 5,000	>= 5,000	
	Zone 3	>= 39,000	>= 25,000	Up to 100% BI > 25,000
		>= 11,000 and < 39,000	>= 11,000 + 50% BI > 11,000	Up to 50% BI > 11,000
		>= 5,000 and < 11,000	>= BI	
		< 5,000	>= 5,000	
June - November	Zones 1,2, and 3	>= 22,000	>= 16,000	Up to 100% BI > 16,000
		>= 10,000 and < 22,000	>= 10,000 + 50% BI > 10,000	Up to 50% BI > 10,000
		>= 5,000 and < 10,000	>= BI	
		< 5,000	>= 5,000	
December - February	Zones 1,2, and 3	>= 10,000	>= 10,000	Up to 100% BI > 10,000
		>= 5,000 and < 10,000	>= BI	
		< 5,000	>= 5,000	
At all times	Zone 4	NA	>= 5,000	Up to 100% BI > 5,000
At all times	Drought Zone	NA	>= 4,500[2]	Up to 100% BI > 4,500

[1] Consistent with safety requirements, flood control purposes, and equipment capabilities.

[2] Once composite storage falls below the top of the Drought Zone ramp down to 4,500 cfs will occur at a rate no greater than 0.25 ft/day drop.

Table 2. Proposed Action Modified RIOP Maximum Fall Rate Schedule Composite Storage Zones 1,2, and 3*	
Release Range (cfs)	Maximum Fall Rate (ft/day), measured at Chattahoochee gage
> 30,000**	No ramping restriction***
> 20,000 and <= 30,000*	1.0 to 2.0
Exceeds Powerhouse Capacity (~ 16,000) and <= 20,000*	0.5 to 1.0
Within Powerhouse Capacity and > 8,000*	0.25 to 0.5
Within Powerhouse Capacity and <= 8,000*	0.25 or less

*Maximum fall rate schedule is suspended in Composite Zone 4
**Consistent with safety requirements, flood control purposes, and equipment capabilities.
***For flows greater than 30,000 cfs, it is not reasonable and prudent to attempt to control down ramping rate, and no ramping rate is required.

the 1-day basin inflow fall rate during drought operations facilitates quicker recovery and a faster return to normal operations.

Drought Contingency Operations: Like the current RIOP, the proposed action incorporates a drought contingency operation (referred to as drought plan). The drought plan specifies a minimum release from Jim Woodruff Dam and temporarily suspends the other minimum release and maximum fall rate provisions until composite conservation storage within the basin is replenished to a level that can support them. The minimum discharge is determined in relation to composite conservation storage and not average basin inflow under the drought plan. The drought plan is "triggered" when composite conservation storage falls below the bottom of Zone 3 into Zone 4. At that time all the composite conservation storage Zone 1-3 provisions (seasonal storage limitations, maximum fall rate schedule, and minimum flow thresholds) are suspended and management decisions are based on the provisions of the drought plan. The drought plan includes a temporary waiver from the existing water control plan to allow temporary storage above the winter pool rule curve at the Walter F. George and West Point projects if the opportunity presents itself and/or begin spring refill operations at an earlier date in order to provide additional conservation storage for future needs as well as provide for a minimum releases less than 5,000 cfs from Jim Woodruff Dam.

The drought plan prescribes two minimum releases based on composite conservation storage in Zone 4 and an additional zone referred to as the Drought Zone (Figure 1). The Drought Zone delineates a volume of water roughly equivalent to the inactive storage in lakes Lanier, West Point and Walter F. George plus Zone 4 storage in Lake Lanier. However, the Drought Zone line has been adjusted to include a smaller volume of water at the beginning and end of the calendar year. When the composite conservation storage is within Zone 4 and above the Drought Zone, the minimum release from Jim Woodruff Dam is 5,000 cfs and all basin inflow above 5,000 cfs that is capable of being stored may be stored. Once the composite conservation storage falls below the Drought Zone, the minimum release from Jim Woodruff Dam is 4,500 cfs and all basin inflow above 4,500 cfs that is capable of being stored may be stored. When transitioning from a minimum release of 5,000 to 4,500 cfs, maximum fall rates will be limited to a 0.25 ft/day drop. The 4,500 cfs minimum release is maintained until composite conservation storage returns to a level above the top of the Drought Zone, at which time the 5,000 cfs minimum release is re-instated. Under the current RIOP, the drought plan provisions remain in place until conditions improve such that the composite conservation storage reaches a level above the top of Zone 3 (i.e., within Zone 2). At that time, the temporary drought plan provisions are suspended, and all the other provisions are re-instated. During the drought contingency operations a monthly monitoring plan that tracks composite conservation storage in order to determine water management operations (the first day of each month will represent a decision point) will be implemented to determine which operational triggers are applied. In addition, recent climatic and hydrological conditions experienced and meteorological forecasts will be used when determining the set of operations to utilize in the upcoming month. The proposed action modifies the current RIOP drought plan by increasing the composite conservation storage level "trigger" for re-instating the normal operations. Under the proposed action, the drought

plan provisions remain in place until conditions improve such that the composite conservation storage reaches a level above the top of Zone 2 (i.e., within Zone 1). All other provisions of the current RIOP remain unchanged under the proposed action.

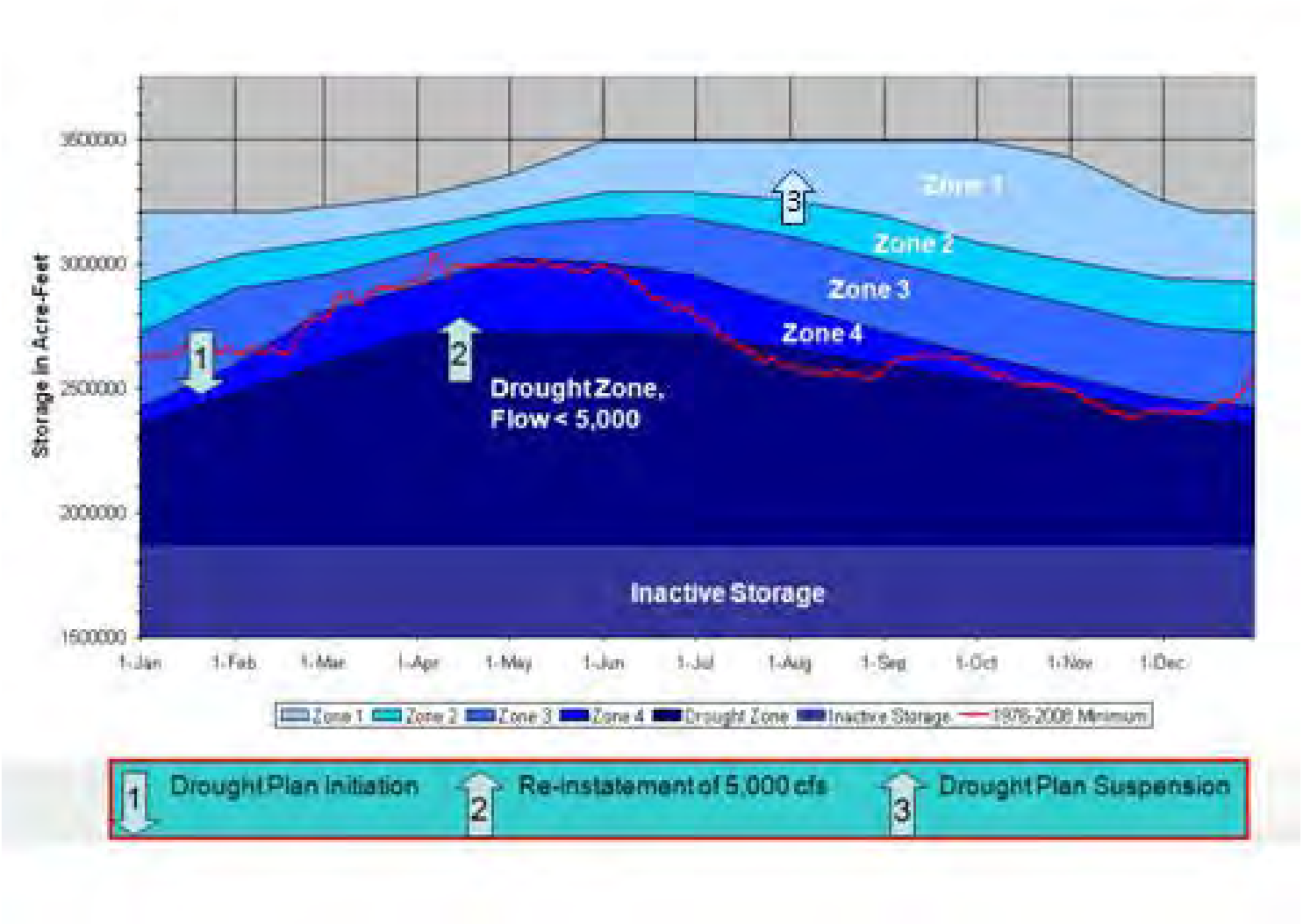


Figure 1. Proposed Action Drought Composite Conservation Storage Triggers.

ALTERNATIVES CONSIDERED

No Action: This alternative consists of continuing to operate under the current RIOP. Although the RIOP provides flows supportive of the listed species, it includes provisions that allow for some storage of basin inflow between 8,000 and 10,000 cfs. Since fat threeridge mussels were observed at stages within this flow range in 2006 and 2010, the FWS requested that we evaluate a modification to the RIOP that eliminated storage opportunities under normal operations when basin inflow is between 8,000 and 10,000 cfs (June-February) in order to minimize the potential for take of fat threeridge mussels. Our evaluation indicated that although there was an impact to conservation storage levels associated with this modification, it was relatively minor. Therefore, the modification was adopted and this alternative was no longer considered.

Modified Maximum Fall Rate Schedule: During the consultation, the FWS also identified a modification to the maximum fall rate schedule that may minimize the potential for take of fat threeridge mussels. The FWS requested that we evaluate modifying the RIOP maximum fall rate schedule for the range of flows where fat threeridge mussels are known to occur (5,000 to 10,000 cfs). The modification consists of reducing the maximum fall rate to 0.15 ft/day between discharges of 5,000 to 8,000 cfs and 0.25 ft/day between discharges of 8,000 cfs to 10,000 cfs. The Corps expressed concern regarding the ability to manage fall rates at 0.15 ft/day given the limitations of the equipment. Despite installation of the new SCADA system at the Woodruff Powerhouse, which improves the operators' ability to make fine adjustments to the turbine releases, there are physical limitations to managing the daily average fall rates for even the current RIOP maximum fall rate of 0.25 ft/day. Because of these limitations, the Corps currently operates very conservatively when managing for a 0.25 ft/day maximum fall rate. This conservative operation generally, but not always, results in maximum fall rates in this lowest range that are equal to or slower than 0.15 ft/day in order to ensure the maximum fall rate schedule is not violated. The Corps evaluated the fall rates that have occurred when flows are less than 10,000 cfs since the RIOP was implemented (5 September 2006 - 25 July 2011). Table 3 and Figure 2 provide the results of this evaluation.

Table 3. Fall Rate Analysis at the Chattahoochee Gage 5 September 2006 - 25 July 2011

Maximum Fall Rate Range (ft/day)	Maximum Fall Rate (ft/day)	Average Fall Rate (ft/day)
<= 0.25	0.25	0.08
> 0.25 - <= 0.5	0.49	0.33
> 0.5 - <= 1.0	0.90	0.68

Since implementation of the RIOP, the maximum fall rate schedule has not been violated and the average fall rates have been considerably lower than the maximum allowed; with the greatest deviation occurring under the most restrictive fall rate range. This is not surprising given the limitations of the equipment and the conservative approach taken to avoid violating the maximum fall rate schedule. Furthermore, fall rates of less than 0.25 ft/day occurred over 80% of the time when flows were less than 10,000 cfs (Figure 3). Based on the results of this analysis and the Corps' understanding of the physical

limitations of the powerhouse equipment, it was determined that maintenance of a maximum fall rate schedule more restrictive than the one that currently exists in the RIOP is neither reasonable nor prudent. Conservative operations for fall rates when flows are less than 10,000 cfs will continue under the proposed action in order to ensure that the maximum fall rate schedule is not violated. Therefore, this alternative was no longer considered.

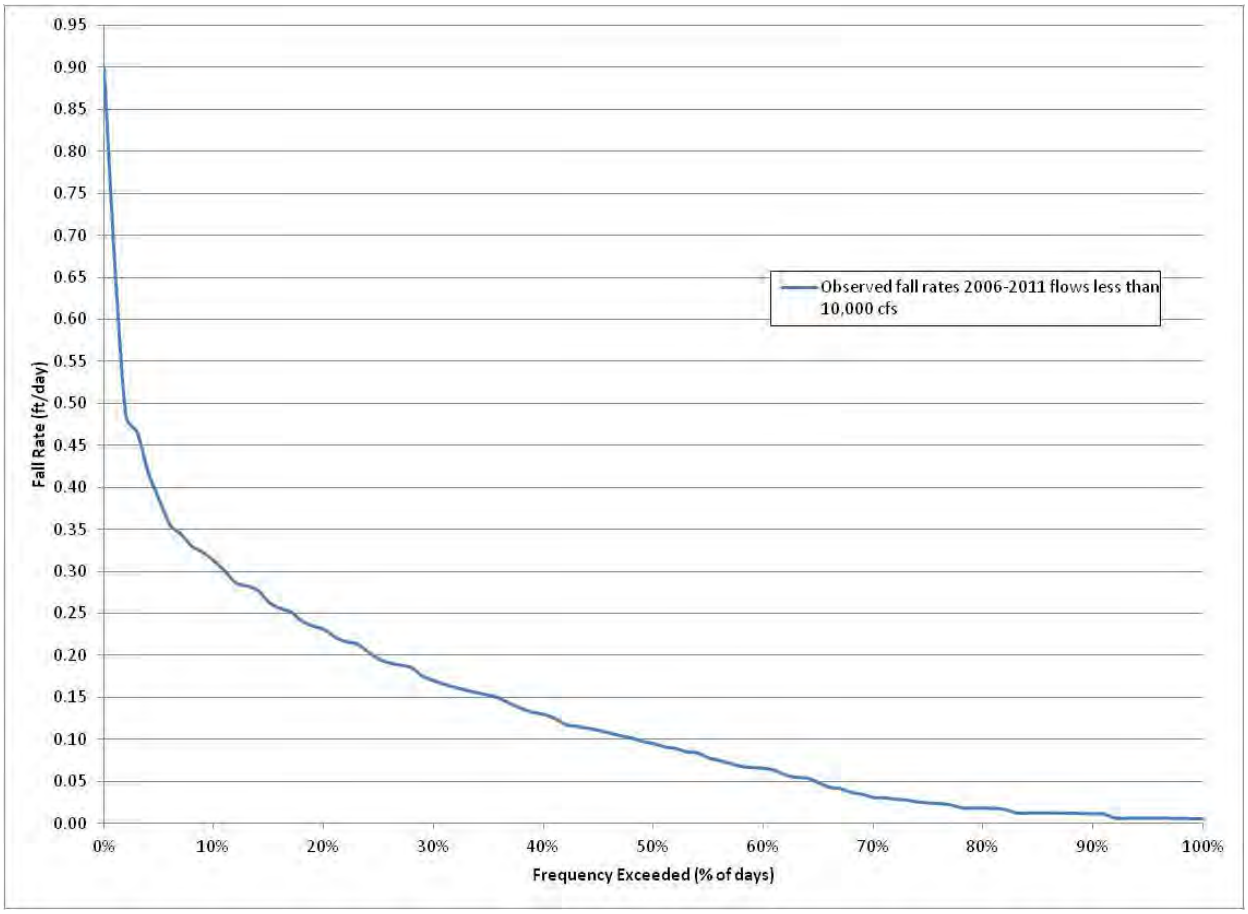


Figure 2. Observed fall rates (% of days) of the Apalachicola River at the Chattahoochee gage since incorporation of a fall rate provision at JWLD (observed flow 2006-2011).

Modified Minimum Flow: At various times during development of the RIOP and since it has been implemented, the FWS has received requests to raise the minimum flow provision of the RIOP to 6,000 cfs. The current RIOP has a minimum flow of 5,000 cfs and includes a provision to reduce flows to as low as 4,500 cfs during the most extreme prolonged drought events. Despite recent conditions that limited the Corps' ability to maintain even the 5,000 cfs minimum (a minimum flow of 4,750 cfs was briefly implemented in 2007), the Corps agreed to evaluate the impact of maintaining a higher minimum flow. The FWS requested that we evaluate how this modification impacted the implementation of drought operations and other authorized purposes. The Corps evaluated the modification by developing three six-month "forecast" models that simulated the current RIOP and the RIOP with a 6,000 cfs minimum flow under the 1999-2000 hydrology, 2007-2008 hydrology, and 20th percentile hydrology. The models

were developed to represent a continuation of the present drought with dry conditions that have occurred in the past and a moderately dry condition generally representative of the current hydrology trend. Reservoir levels for the start of the simulation were set at their present level when the simulation was run. This approach is consistent with the "forecast" modeling conducted for the 2008 BO. The results of this analysis were presented to the FWS during a meeting held at the Panama City Field Office on June 14, 2011 and are summarized here. Under the most moderate drought condition, the 20th percentile scenario, there was little difference in the composite conservation storage levels and river flows. Drought operations were not triggered and composite conservation storage levels remained in Zone 2 for nearly the entire 6-month period with only a brief drop into Zone 3. Under the more severe drought hydrologies, the 1999-2000 and 2007-2008 scenarios, substantial declines in composite conservation storage occur as a result of maintaining the 6,000 cfs minimum flow. Drought operations are not triggered under either of the operational scenarios in the 1999-2000 simulation. However, the 6,000 cfs minimum flow operation resulted in drought operations and a reduction of the minimum flow to 4,500 cfs under the most severe drought hydrology (2007-2008). The current RIOP operation simulation did not result in drought operations or a reduction of the minimum flow to 4,500 cfs under the most severe drought hydrology. The adverse effects to listed species as a result of reducing flows to 4,500 cfs are potentially far greater than any benefits realized through the maintenance of a 6,000 cfs minimum flow. Furthermore, reduction of the composite conservation storage level to below the drought zone (the trigger for a 4,500 cfs minimum flow) negatively impacts all of the Corps' authorized project purposes. Therefore, this alternative was no longer considered.

It should be noted, that the proposed action simulation presented below in the EFFECTS ANALYSIS section does not result in a reduction of the minimum flow to 4,500 cfs and includes the 1999-2000 and 2007-2008 drought conditions.

Eliminate Provision for Releases Less Than 5,000 cfs: As described above in the DESCRIPTION OF PROPOSED ACTION section, the current RIOP and the proposed action include a provision to reduce flows to as low as 4,500 cfs during the most extreme prolonged drought events. Because take of listed mussel species can occur when flows are reduced to 4,500 cfs, the FWS requested that the Corps consider an alternative that eliminates this provision in order to minimize the potential for take. The "trigger" to reduce flows to 4,500 cfs in the current RIOP and proposed action is based on composite conservation storage and requires a drought more severe than the "drought of record" to implement this most conservative operation. The model simulation data presented below in the EFFECTS ANALYSIS section illustrates that even under conditions experienced during the 2007-2008 severe drought, neither the RIOP nor the proposed action resulted in flows less than 5,000 cfs. By design, the drought zone "trigger" for reducing the minimum flow to 4,500 cfs is only triggered during the most severe drought conditions. Although, these conditions have not occurred to date, the Corps maintains that prudent water management requires the flexibility to reduce demands on the system when a more severe drought than has occurred ultimately transpires. Failure to maintain this flexibility could result in a depletion of the system conservation storage and even greater harm to

the listed species than would have otherwise occurred as demonstrated in the discussion above. Furthermore, “take” monitoring in 2007 when flows were reduced to 4,750 cfs and FWS observations during recent inadvertent releases of approximately 4,500 cfs (due to a shift in the Chattahoochee gage reading) suggests that maintenance of the maximum fall rate schedule facilitates the movement of mussels to lower stages when flows are reduced below 5,000 cfs. Thus, resulting in less “take” than currently authorized or previously anticipated. Therefore, this alternative was no longer considered.

STATUS OF THE SPECIES/CRITICAL HABITAT

Please refer to the STATUS OF THE SPECIES/CRITICAL HABITAT section (Section 2) of the June 1, 2008 *Biological Opinion on the U.S. Army Corps of Engineers, Mobile District, Revised Interim Operating Plan for Jim Woodruff Dam and the Associated Releases to the Apalachicola River* (USFWS 2008); and the 2010 Annual Report - January 31, 2011 (USACE 2011). The detailed information provided in Section 2 of the BO and the Annual Report (specifically the draft mussel study report) represent the best scientific information available on the listed species occurring in the action area and provided the basis for determining the flow regime characteristics identified as relevant to the listed species and their habitats during development of the RIOP and considered during development of the modifications to the RIOP. The FWS also has additional information regarding the status of the species that will be updated as part of this re-initiated consultation.

ENVIRONMENTAL BASELINE

As described in the 2008 BO, the environmental baseline is a "snapshot" of a species' health at a specified point in time. It does not include the effects of the proposed action, but rather provides an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem, within the action area. Section 3 of the BO provides a description of the environmental baseline prior to implementation of the RIOP. This detailed information represents the best scientific information available at that time regarding the listed species occurring in the action area. However, the environmental baseline for the proposed action must also consider the effects of operating under the RIOP for the past 36 months. Some of the factors contributing to the environmental baseline, such as the general description of the action area, have not changed significantly since the time the BO was written and we incorporate this information by reference to Section 3 of the BO. The FWS will update the Environmental Baseline section as part of this re-initiated consultation.

EFFECTS ANALYSIS

This section is an analysis of the effects of the proposed action on the species and critical habitat. The previous “Environmental Baseline” section described the effects of the current operations including the RIOP over the past three years. This section addresses the future direct and indirect effects of implementing the proposed action.

FACTORS CONSIDERED

In the "ENVIRONMENTAL BASELINE" section of the 2008 BO, FWS described three principal components of the species' environment in the action area: channel morphology, flow regime, and water quality. Physical habitat conditions for the listed species in the action area are largely determined by flow regime, and channel morphology sets the context for the flow regime. The FWS noted that channel morphology has changed relative to the pre-dam period in the Apalachicola River, but the rate of change has slowed and appears to have entered a somewhat dynamic equilibrium condition (USFWS 2008). We have no ability at this time to predict specific effects on channel morphology due to the influence of the proposed action on the flow regime. The proposed action relates to water management at federal projects in the ACF basin and includes limits on the extent to which the Corps alters basin inflow into the Apalachicola River via operations of the ACF dams and reservoirs; therefore, the primary focus of this analysis is the flow regime of the Apalachicola River with and without the proposed action. Consistent with the BO for the RIOP, our analysis of flow regime alteration relative to the listed species and critical habitats considers the following factors.

Proximity of the action: The proposed action may affect habitat occupied by all life stages of Gulf sturgeon in both the Apalachicola River and Bay, which are designated as critical habitat. The proposed action will also affect habitat known to be occupied by the purple bankclimber, Chipola slabshell, and fat threeridge mussels. These mussel species spend their entire lives within the action area, all of which is proposed as critical habitat for the mussels. The proposed action includes releases from Jim Woodruff Dam and affects some of the species' life history stages and habitat features from as close as immediately below the dam to more than 100 miles downstream.

Distribution: The proposed action could alter flows in the Apalachicola River and its distributaries downstream of the dam, and alter freshwater inflow to Apalachicola Bay. The Gulf sturgeon may occur throughout the river and bay in suitable habitats, and occasionally in the Chipola River downstream of Dead Lake. The Action area includes most of the known range of the fat threeridge, about one third of the range of the purple bankclimber, and a small fraction of the range of the Chipola slabshell. This analysis examines how the proposed action may variously affect different portions of the action area according to the distribution of the species and important habitat features in the action area.

Timing: The proposed action could alter flows in the Apalachicola River and into Apalachicola Bay at all times of the year. It will reduce flows when increasing composite conservation storage in the ACF reservoirs and increase flows when decreasing composite conservation storage. Gulf sturgeon occupy the Apalachicola River year-round as larval and juvenile fish, and then seasonally as subadults and adults, spawning in the Apalachicola River around May. Subadults and adult Gulf sturgeon likewise occupy Apalachicola Bay seasonally, during the coldest months of the year. The three mussel species occupy the action area year-round and during all life phases. The fat threeridge, a species that tends to occupy shallower waters, may be more susceptible to effects of low

flows during the breeding period, in late spring/early summer. Consistent with the 2008 BO, we examine how the proposed action may alter the seasonal timing of biologically relevant flow regime features in our analysis.

Nature of the effect: The proposed action will reduce flows in the Apalachicola River when increasing composite storage in the ACF reservoirs and increase flows when decreasing composite reservoir storage. Two of the Gulf sturgeon primary constituent elements of designated critical habitat may be affected by the actions: flow regime and water quality. Permanently flowing water and water quality are also two of five primary constituent elements of designated critical habitat for the fat threeridge, purple bankclimber, and Chipola slabshell. The proposed action may also affect a third element of designated critical habitat for the mussels: host fish. Consistent with the 2008 BO, we examine how the proposed action may affect the listed species and critical habitat elements through specific analyses focused on relevant habitat features, such as spawning substrate, floodplain inundation, and vulnerability to exposure by low flows.

Duration: This proposed action is a modification to the current interim operations plan (RIOP) at Jim Woodruff Dam and the operations described under the proposed action are applicable until revised or until an updated Water Control Plan is adopted. Although the duration of the proposed action is indefinite, the nature of its effects is such that none are permanent. The Corps can alter its reservoir operations at any time; therefore, flow alterations that may result from the proposed action will not result in permanent impacts to the habitat of any of the listed species. Consistent with the 2008 BO, we examine how implementation of the proposed action may alter the duration of high flows and low flows that are relevant to the listed species and critical habitats.

Disturbance frequency: The proposed action is applicable year round; therefore, changes to the flow regime and water quality parameters may occur at any time and/or continuously until such time as the proposed action is revised or until an updated Water Control Plan is adopted. Consistent with the 2008 BO, we examine how implementation of the proposed action may alter the frequency of high flows and low flows that are relevant to the listed species and critical habitats.

Disturbance intensity and severity: The proposed action may variously affect the flow regime depending on time of year, basin inflow, and composite conservation storage levels as defined in DESCRIPTION OF PROPOSED ACTION section above. Like the current RIOP, the proposed action maintains a minimum flow of 5,000 cfs except during extreme drought events more severe than have previously occurred and maintains a minimum flow of 4,500 cfs at all times. Consistent with the 2008 BO, we examine how the proposed action affects the magnitude of flow events relative to the baseline and to no action (RIOP).

ANALYSIS FOR EFFECTS OF THE ACTION

The Effects Analysis for the proposed action is generally consistent with that of the 2008 BO, with the exception of using the HEC-ResSim Model to simulate flow operations in

the ACF Basin rather than the HEC-5 model used in 2008 and changes to the assumptions regarding consumptive demands. Details about the ResSim model are provided below in the MODEL DESCRIPTION section. A description of the changes to the assumptions regarding consumptive demands follows.

Consistent with the 2008 BO, we determine the future effect of project operations, as prescribed by the proposed action, by comparing the environmental conditions expected to occur under the proposed action to the environmental baseline. In the BO for the RIOP, the flow regime of the environmental baseline was described using post-1975 flow records, because this period represented the complete hydrology of the current configuration of the ACF federal reservoir projects.

In the 2008 BO the USFWS compared the flow regime expected under the RIOP to this historic flow record to identify changes in flows that were relevant to the listed species and their habitats. The 2008 RIOP simulations, evaluated in the BO, were simulated with present-level consumptive demands (year 2000) occurring in all years. To isolate the effects of the present level of consumptive water use on the flow regime from the effects of implementing the RIOP, the USFWS also examined environmental conditions that would result if project operations were not continued, *i.e.*, discontinuing Corps' reservoir operations that alter the flow regime of the river. This flow regime was termed the run-of-river (RoR) regime. RoR is the expected flow regime if the Corps maintained a constant water surface elevation on all of the ACF federal reservoirs, never diminishing basin inflow by raising reservoir levels and never augmenting basin inflow by lowering reservoir levels. RoR is the constant release of basin inflow from Woodruff Dam. By comparing all three flow regimes, Baseline (1975-2007 observed flow), RIOP, and RoR, the USFWS identified effects relative to the baseline attributable to the RIOP apart from effects attributable to an increase in depletions due to consumptive losses in the basin since 1975 (USFWS 2008). In this effects analysis the definition for RoR remains the same, but the method for computing the RoR has changed along with its ability to differentiate effects attributable to the proposed action from those to an increase in depletions due to consumptive losses in the basin since 1975.

In the 2008 BO, we used the same basin inflow time series (1-day basin inflow) upon which the model based its simulation of the RIOP to represent the RoR. As described in the 2008 BO, 1-day basin inflow is the sum of local inflow for each of the Corps' ACF reservoirs on a given day and does not reflect travel time through the basin; therefore, if is a rough approximation of an actual RoR operation. During this re-initiated consultation, the FWS and the Corps agreed that an HEC-ResSim simulation of a RoR operation (instead of 1-day basin inflow) that includes the same historic consumptive demands as used for synthesizing the unimpaired flows and simulating the RIOP and proposed action would allow us to better analyze operational differences between historic and simulated operations. For this analysis, the consumptive water demands used in the models are the actual reported municipal and industrial (M&I) depletions for the period of 1980-2008 and the estimated agricultural water use. Consumptive water-use values prior to 1980 were hindcasted based on census population data. The method for estimating agricultural water use which varied by month and by year (wet, normal, dry) is

consistent with the method utilized during the development of the RIOP and the effects analysis in the 2008 BO. However, the use of actual reported M&I depletions is an update to the previous method which applied an estimate of the highest demand year (2000) to the period of record simulation.

It was mutually agreed that this updated method for simulating the no action, proposed action, and RoR provides a more useful comparison to the baseline (observed) condition as these simulations more accurately reflect the influences of reservoir evaporative losses, inter-basin water transfers, and consumptive water uses, such as municipal/industrial water supply and agricultural irrigation that also influenced the observed Apalachicola River flows during the period of record. Therefore, the difference between the various flow regimes is the net effect of continued operation under each scenario including the effect of influences that are unrelated to project operations (hydrology, evaporation, land use and climate change). By taking this approach, the RoR flow regime no longer differentiates whether an effect (either beneficial or adverse) is attributable to the Corps discretionary operations as it includes the same assumptions regarding reservoir evaporative losses, inter-basin water transfers, and consumptive water uses. It does still provide a useful frame of reference since the RoR simulation represents a flow regime with no Corps discretionary operations (i.e., Corps reservoirs maintain a constant water surface elevation during the period, such that the reservoirs only release the net inflow into the dam). The RoR is not the natural flow of the basin at the site of Jim Woodruff Dam, because it reflects the influences of reservoir evaporative losses, inter-basin water transfers, and consumptive water uses.

As described above, the principal factor examined in determining effects for the proposed action is the flow regime of the Apalachicola River and how the flow regime affects habitat conditions for the listed species. Any differences between the Baseline, RIOP, and proposed action simulated flow regimes are attributable to the Corps discretionary operations. Consistent with the 2008 BO, if the proposed action does not alter the Baseline, its effect on the species/habitat is a continuation of the Baseline effect, if any. If the proposed action condition represents a beneficial or adverse alteration of the Baseline condition, the effect is accordingly beneficial or adverse.

MODEL DESCRIPTION

The HEC-ResSim model was used to simulate flow operations in the ACF Basin. HEC-ResSim is a state-of-the-art tool for simulating flow operations in managed systems. It was developed by the Corps' Hydrologic Engineering Center (HEC) to aid engineers and planners performing water resources studies in predicting the behavior of reservoirs and to help reservoir operators plan releases in real time during day-to-day and emergency operations. This effects analysis used HEC-ResSim Version 3.1 "Release Candidate 3, Build 42" (USACE, 2010a). The label "Release Candidate" means that the software is undergoing final testing before distribution as an official version.

HEC-ResSim has a graphical user interface designed to follow Windows® software development standards. The model's interface can be learned without extensive tutorials.

Familiar data entry features make model development easy, and localized mini plots graph the data entered in most tables so that errors can be seen and corrected quickly. A variety of default plots and reports, along with tools to create customized plots and reports, facilitate output analysis.

HEC-ResSim provides a realistic view of the physical river/reservoir system using a map-based schematic. The program's user interface allows the user to draw the network schematic as a stick figure or as an overlay on one or more geo-referenced maps of the watershed. HEC-ResSim represents a system of reservoirs as a network composed of four types of physical elements: junctions, routing reaches, diversions, and reservoirs. By combining those elements, the HEC-ResSim modeler is able to build a network capable of representing anything from a single reservoir on a single stream to a highly developed and interconnected system like that of the ACF Basin. A reservoir is the most complex element of the reservoir network and is composed of a pool and a dam. HEC-ResSim assumes that the pool is level (i.e., it has no routing behavior), and its hydraulic behavior is completely defined by an elevation-storage-area table. The real complexity of HEC-ResSim's reservoir network begins with the dam.

Most reservoirs are constructed for one or more of the following purposes: flood risk management, power generation, navigation, water supply, recreation, and environmental quality. Those purposes typically define the goals and constraints that describe the reservoir's release objectives. Other factors that might influence the objectives include time of year, hydrologic conditions, water temperature, current pool elevation (or zone), and simultaneous operations by other reservoirs in a system. HEC-ResSim uses an original rule-based description of the operational goals and constraints that reservoir operators must consider when making release decisions.

To provide a potential range of flows that might be experienced while the proposed action scenarios are in effect, the ResSim model simulates river flow and reservoir levels using a daily time series of unimpaired flow data as input for a certain period of record. Whereas basin inflow is computed to remove the effects of reservoir operations from observed flow, unimpaired flow is developed to remove the effects of both reservoir operations and consumptive demands from observed flow. The ResSim model imposes reservoir operations and consumptive demands onto the unimpaired flow time series to simulate flows and levels under those operations and demands. The unimpaired flow data set is the product of the Tri-State Comprehensive Study, in which the States of Alabama, Florida, and Georgia, participated.

The current unimpaired flow data set represents the years 1939 to 2008. The Corps has not yet computed unimpaired flow for 2009-current day. Unimpaired flow computations require actual water use data from the three States and 2008 is the most recent year of this data provided to the Corps. For purposes of evaluating the proposed action, a 70-year unimpaired flow hydrologic period of record (1939 through 2008) was used to run the simulations. However, for the purposes of this effects analysis, we focus on the data from 1975-2008, because this period represents the complete hydrology of the current

physical configuration of the ACF federal and private reservoir projects with an unimpaired flow computation.

MODEL SIMULATIONS

The Corps has simulated the 1975 – 2008 ACF project operations under the RIOP, proposed action, and RoR using the HEC-ResSim hydrologic simulation software. As described above, the RoR simulation represents flow conditions without the influence of Corps project operations.

To ensure comparisons that are most likely to reveal anthropogenic differences between the sets of environmental conditions (RIOP, Proposed Action, RoR, and Baseline) and not hydrologic differences between years, we use the output from the ResSim models for the period that is also represented in the baseline, which is 1975 to 2008 (34 years). Using only the latter 34 years of the ResSim results removes 36 years of model results from our analysis, including a drought during the 1950's. However, the later 34 years of the simulated period appear to represent the most "critical" period for the model, as this is when reservoir levels and flows reach their lowest levels in the simulation. Further, the basin experienced below normal precipitation and basin inflow levels from 2006 through much of 2008 and record low composite conservation storage levels were recorded per calendar date in 2007 and 2008.

GENERAL EFFECTS ON THE FLOW REGIME

Consistent with the analysis conducted in the 2008 BO, the effects of the proposed action on the flow regime is evaluated by comparing the Apalachicola River flow frequencies for the various conditions (Proposed Action, RIOP, RoR, and Baseline).

Figure 3 displays the frequency analysis for flows that are exceeded at least 80% of the time (i.e., the lowest flows), to illustrate the low-flow differences between the various flow regimes. These low flow events represent the most severe flow conditions for the aquatic biota in the river. The RoR simulation consistently results in a higher frequency of lower flows during the driest conditions. The proposed action, RIOP, and Baseline flow regimes are all comparable with very little difference between the proposed action and RIOP. The proposed action curve crosses the Baseline curve at multiple locations, thus providing a mix of beneficial and adverse effects. However, the proposed action includes the added benefit of never resulting in flows less than 5,000 cfs, which occurred in approximately 1% of the days under the Baseline.

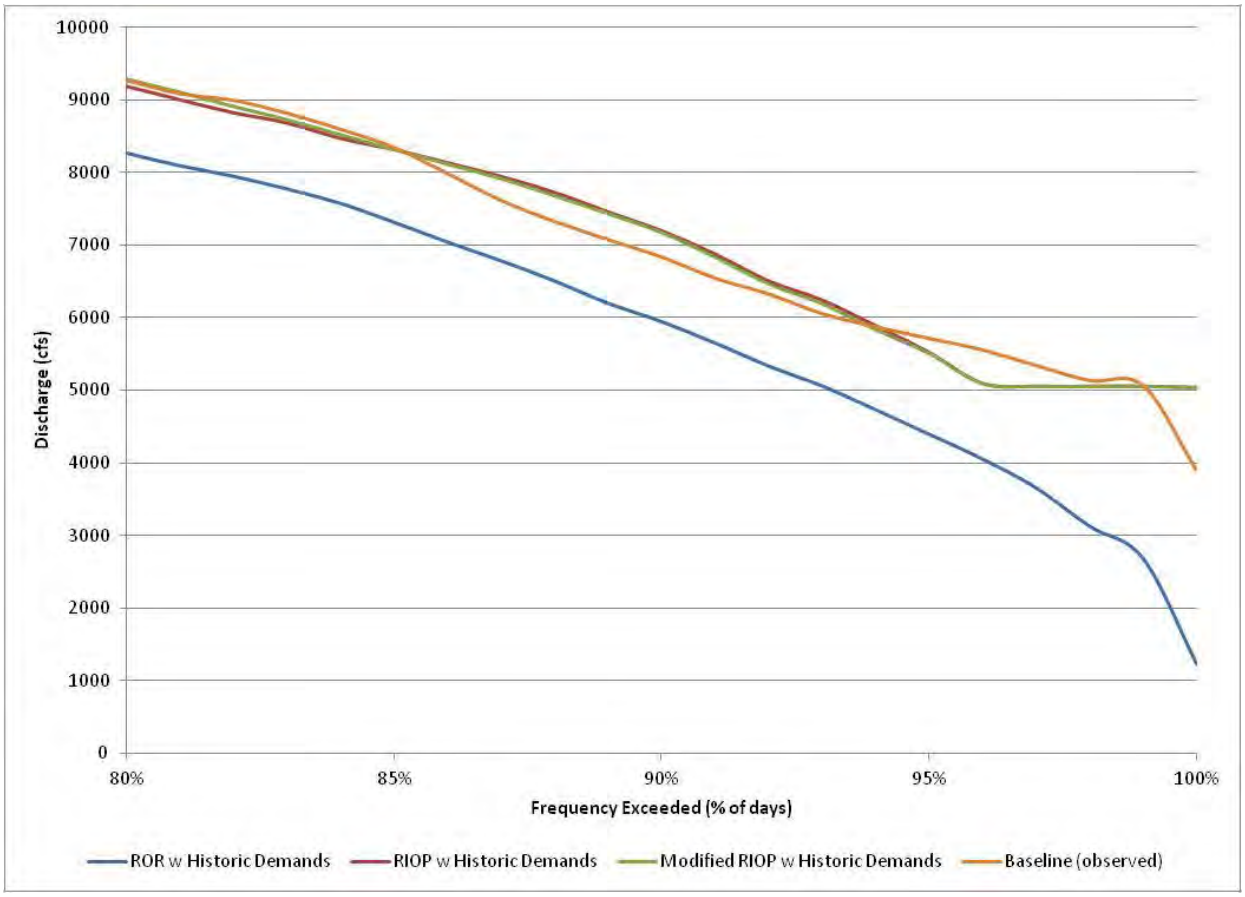


Figure 3. Observed and simulated flow frequency (% of days flow exceeded) of the Apalachicola River at the Chattahoochee gage under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

GULF STURGEON EFFECTS ANALYSIS

This section provides the effects analysis of the proposed action on flow dependent habitat characteristics relevant to Gulf sturgeon consistent with that utilized in the 2008 BO.

Submerged Hard Bottom

As described in the 2008 BO, the principal analysis for effects of the proposed action on Gulf sturgeon consists of comparing the amount of potential spawning habitat available under the various conditions. The method for calculating the amount of habitat and the frequency analysis in Figure 4 below is the same as the 2008 BO method. The four curves cross each other multiple times over the full range of 0 to a little over 20 acres of habitat, but generally provide for the same amount of habitat availability (average daily habitat availability of approximately 18 acres). Habitat availability under the proposed action scenario flow regime is identical to that provided by the RIOP flow regime. The RoR flow regime generally results in slightly less habitat availability than the other three

flow regimes. Given the similarities of all the flow regimes with regards to this flow-dependent habitat parameter, it appears effects (if any at all) are a continuation of the baseline condition.

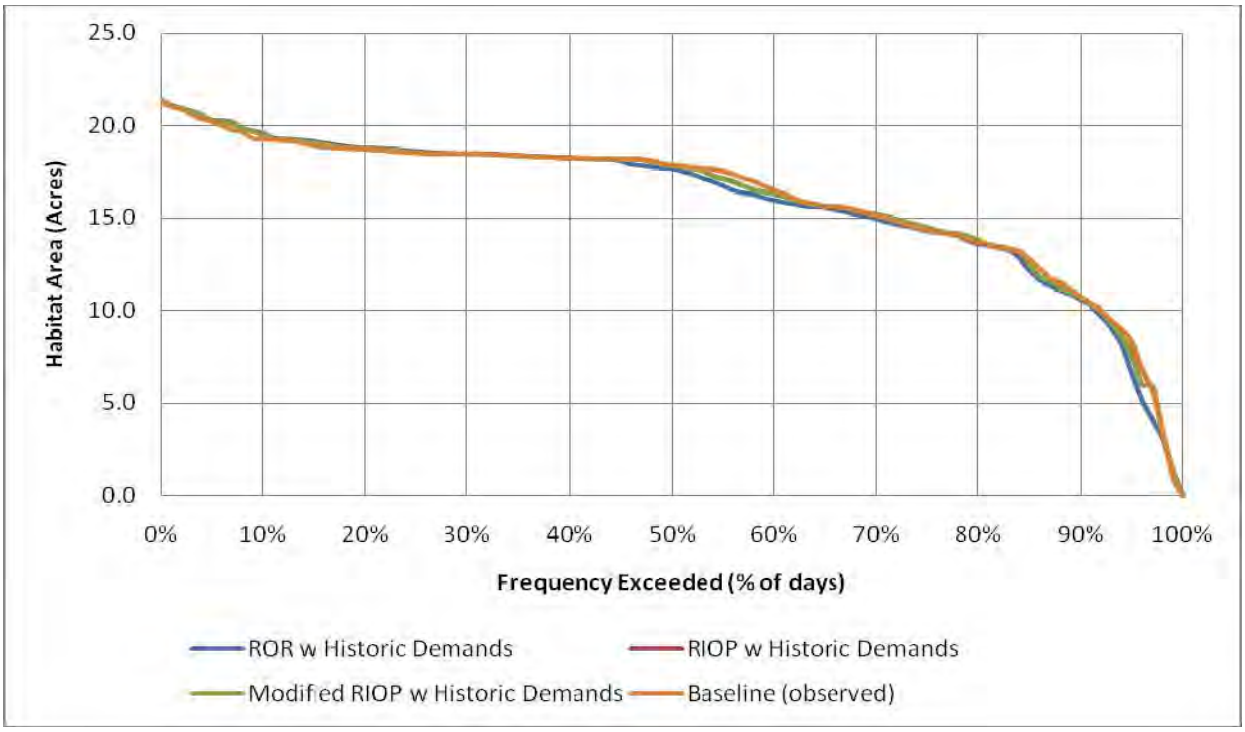


Figure 4. Frequency (% of days) of Gulf sturgeon spawning habitat availability (acres of potentially suitable spawning substrate inundated to depths of 8.5 to 17.8 feet), on each day March 1 through May 31, at the three sites known to support spawning, under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

The analysis shown in Figure 4 above, combines data from all years of each time series into a single dataset for frequency computations and does not examine differences between years or the changes in habitat availability within a year. However, as described in the 2008 BO, it is also important to determine whether the similarities in the average conditions between the proposed action and the baseline are the result of exceptionally low and high habitat availability between years or within a year. Again we use the 2008 BO method to analyze the effect of the proposed action on Gulf sturgeon spawning success by comparing the frequency (percent of years) of continuously available spawning habitat availability (maximum amount of habitat inundated to the 8.5 to 17.8 ft depth range for at least 30 consecutive days each year), March through May, under the four flow time series (Figure 5).

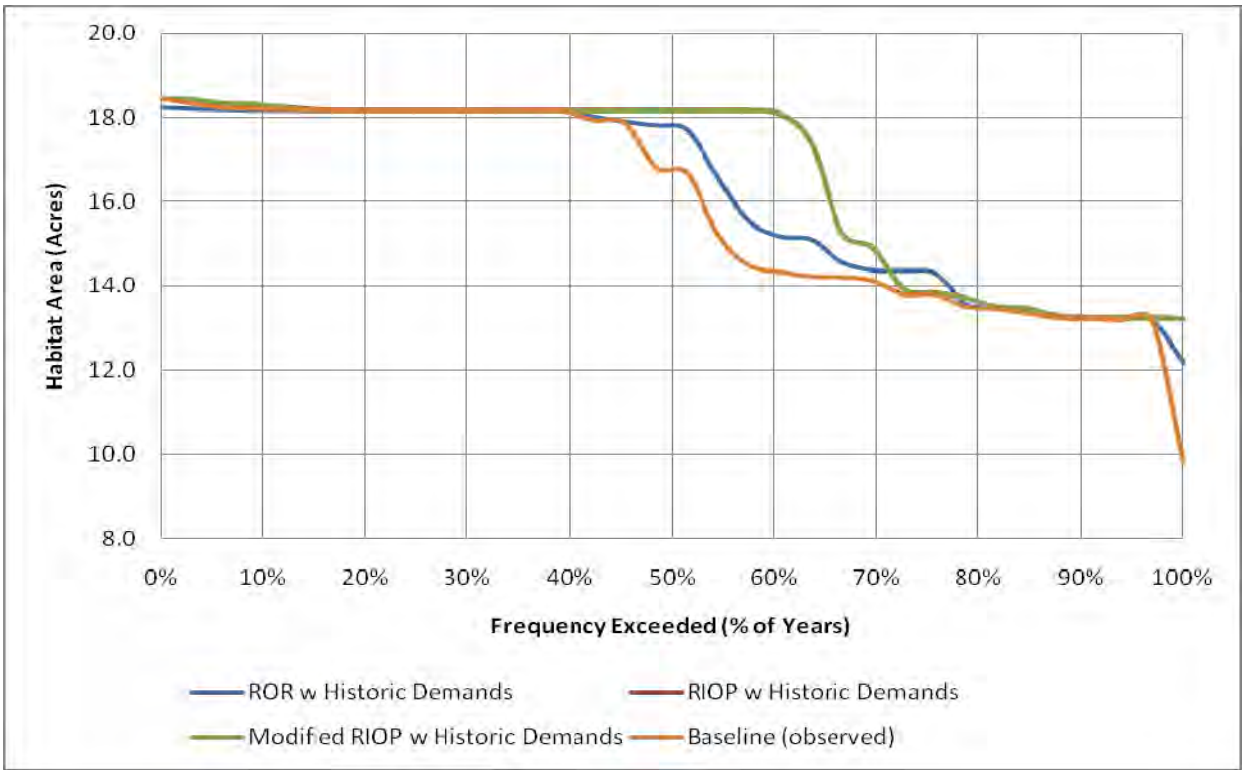


Figure 5. Frequency (% of years) of Gulf sturgeon spawning habitat availability (maximum acres of potentially suitable spawning substrate inundated to depths of 8.5 to 17.8 feet for at least 30 consecutive days each year), March 1 through May 31, at the three sites known to support spawning, under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

Again, the habitat availability under the proposed action scenario flow regime is identical to that provided by the RIOP flow regime. The RIOP and Modified RIOP flow regimes generally provide for more 30-day continuous habitat availability than the Baseline and RoR, with median values of approximately 18.2 acres versus approximately 16.7 acres and approximately 17.7 acres respectively. All the time series provide for a minimum of about 10 acres of 30-day continuous habitat in the appropriate depth range, but the proposed action never provides less than approximately 13 acres. The RoR never provides less than approximately 12 acres. Regarding this flow-dependent habitat parameter, the proposed action continues to provide a beneficial effect to Gulf sturgeon realized by the RIOP by providing more 30-day continuous habitat in the appropriate depth range than the Baseline. This benefit may be the most biologically significant during the most extreme spring low flow events where the proposed action provides for approximately 3.5 acres more than the baseline condition.

In the 2008 BO the FWS determined that rapid declines in river stage (greater than 8 ft in a 14 day period) when flows are less 40,000 cfs may potentially result in take of Gulf sturgeon eggs and/or larvae. In accordance with RPM 2008-4 of the 2008 BO the Corps evaluated the circumstances leading to the two potential take events (one during the 2007 spawning season and the other during the 2008 spawning season) and determined that they can be avoided through minor proactive adjustments to releases from upstream

reservoirs and Jim Woodruff Dam. Like the RIOP, the proposed action includes provisions for these minor proactive adjustments and the simulated flow regimes do not include any of these potential take events.

Changes in Salinity and Invertebrate Populations in Apalachicola Bay

Very little is known about Gulf sturgeon feeding behavior and habitat selection in Apalachicola Bay. However, Gulf sturgeon studies in other systems, known life history patterns, and other studies of the role of freshwater inflow in estuarine ecology can be used to evaluate the possibility of effects of the proposed action on Gulf sturgeon in Apalachicola Bay (see discussion in the Water Quality section of the 2008 BO Environmental Baseline section).

Studies indicate that most adult and sub-adult sturgeon limit feeding almost exclusively to estuarine and marine environments upon departing the river and do not feed much, if at all, during the months of riverine residency. Juvenile Gulf sturgeon studies have also established that direct transition from fresh water into salinities greater than 30 ppt is lethal, and gradual acclimation to seawater with higher salinities (34 ppt) is required. Juvenile growth rates are highest at 9 ppt salinity (USFWS 2008).

Since Apalachicola Bay is the first estuarine habitat that both juvenile fish and older fish encounter upon departing the river, substantial alteration of flow regime features may directly relate to sturgeon and sturgeon critical habitat elements in the bay and should be minimized or avoided. Based on the analysis in the 2008 BO, adverse impacts to ecological processes in the bay critical to sturgeon can be evaluated by comparing the number of consecutive days per year that flows less than 16,000 cfs occurred for the various flow time series. Figure 6 illustrates this comparison and indicates that the proposed action is comparable to the Baseline flow regime; providing slightly lower maximum numbers of consecutive days per year less than 16,000 cfs on average. Given the similarities of the two flow regimes with regards to this flow-dependent habitat parameter, it appears effects (if any at all) are a continuation of the baseline condition.

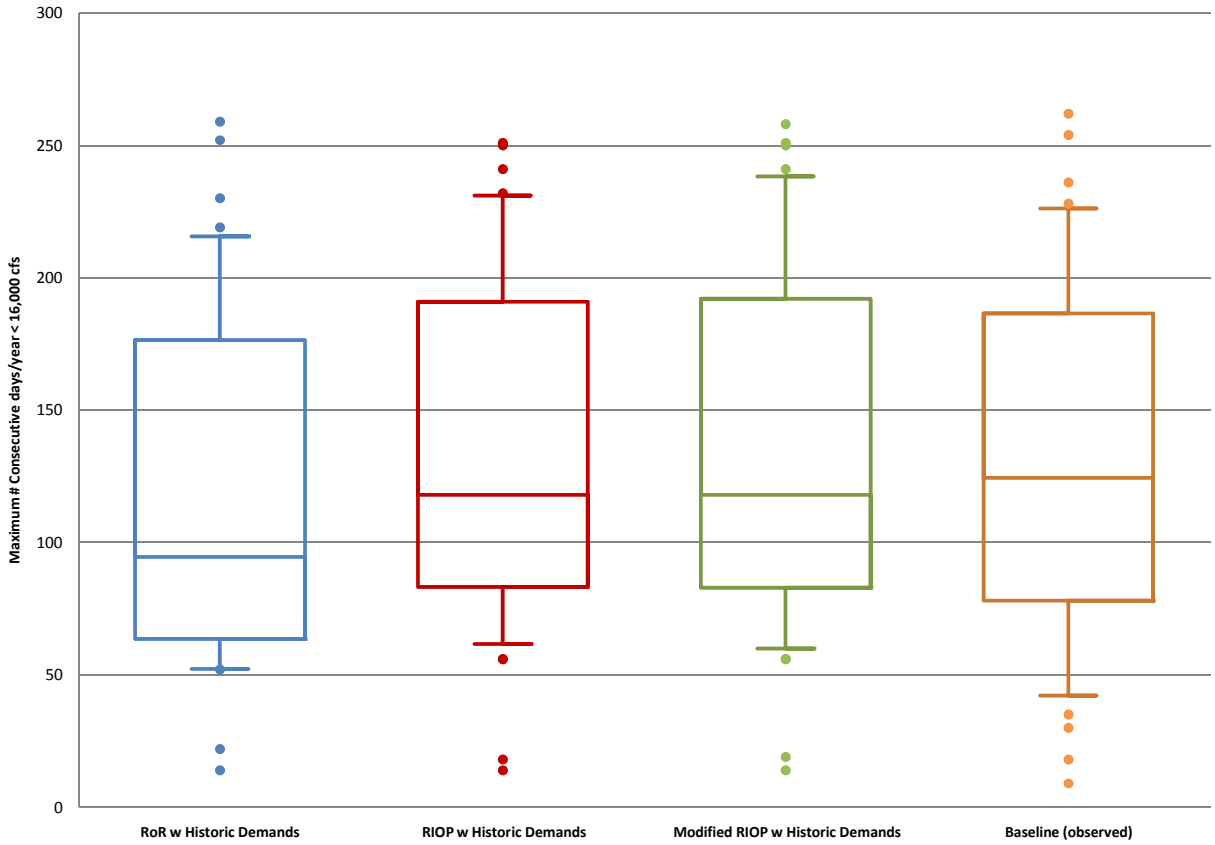


Figure 6. Maximum number of consecutive days/year of flow less than 16,000 cfs under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

Since Gulf sturgeon do not utilize the bay year-round, but rather occupy it seasonally (October through March), we also conducted this same evaluation but used only observed and simulated data from the months sturgeon are known to actively forage in the Apalachicola Bay. This analysis was not conducted in the 2008 BO. Figure 7 presents the results of this analysis. Again, the RIOP and proposed action scenarios yield results consistent with those observed. However, when focusing on the months when sturgeon are known to utilize the bay, it appears that the proposed action reduces the maximum number of consecutive days with flows less than 16,000 cfs as compared to the baseline flow regime. This would be beneficial to Gulf sturgeon and their prey resources in the bay.

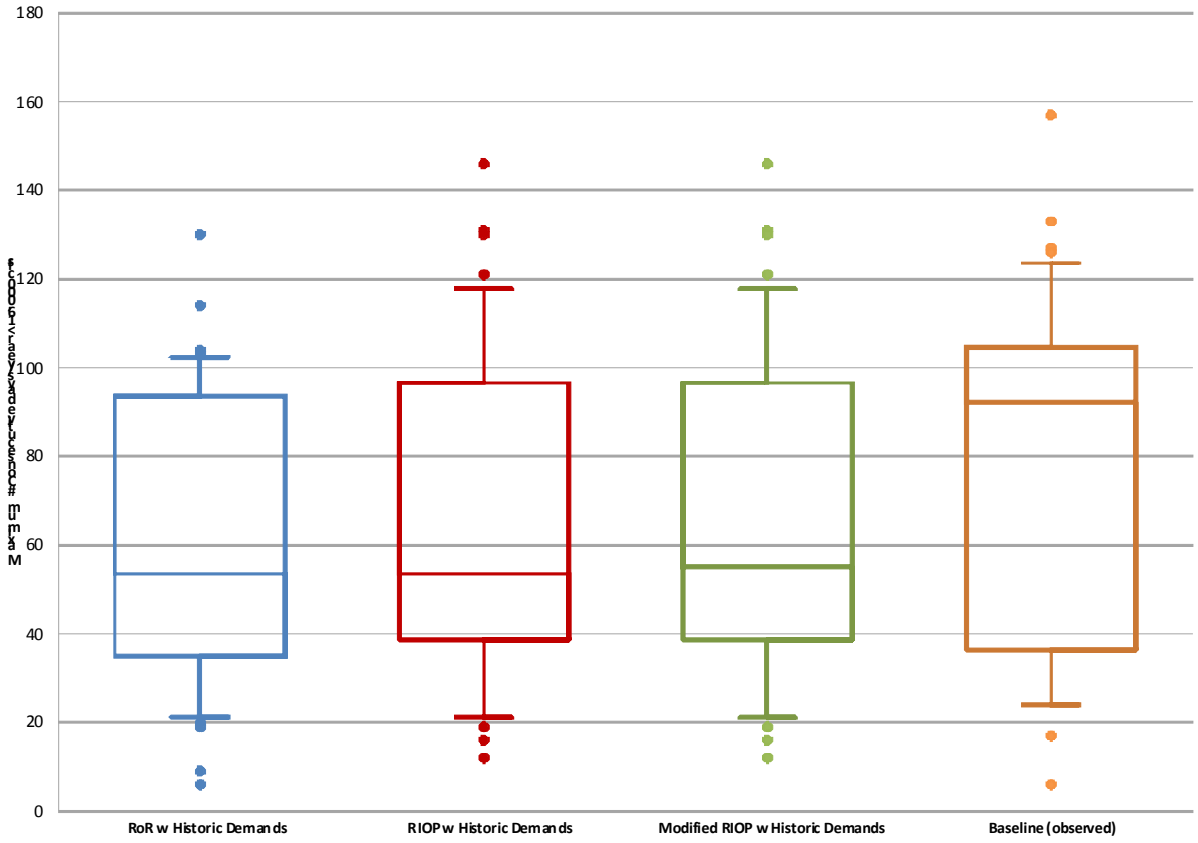


Figure 7. Maximum number of consecutive days/year of flow less than 16,000 cfs (October-March) under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

LISTED MUSSEL SPECIES EFFECTS ANALYSIS

This section focuses on direct effects to listed mussels by potential exposure during low-flow conditions. During the summer of 2006 and fall of 2010, listed mussels were found exposed and stranded at elevations up to approximately 10,000 cfs. Therefore, consistent with the 2008 BO, impacts to listed mussel species will be evaluated by analyzing the differences between the four flow regimes in the range of flow less than 10,000 cfs.

Table 4 lists the lowest daily flow each year for the RoR, RIOP, proposed action, and Baseline flow regimes. The RIOP and proposed action simulations result in virtually identical annual 1-day minimum flows and never result in flows less than 5,000 cfs which occurs in approximately half (44%) of the years under the RoR simulation and approximately a quarter (21%) of the Baseline. However, the proposed action does result in a lower 1-day minimum flow than the Baseline in half of the years. With regards to this flow-dependent habitat parameter, the proposed action provides a mix of beneficial and adverse effects.

Year	Min of ROR w Historic Demands	Min of RIOP w Historic Demands	Min of Modified RIOP w Historic Demands	Min of Baseline (observed)
1975	14816	15077	15077	12400
1976	7999	9163	9163	11600
1977	6646	7393	7160	9220
1978	4485	7018	7018	8190
1979	7161	7739	7740	9590
1980	5088	6729	6573	8790
1981	3689	5049	5049	4980
1982	7107	8824	9208	11500
1983	7699	8297	8297	10800
1984	7739	7890	7890	10300
1985	5283	6922	6922	8550
1986	3099	5049	5049	4430
1987	4026	6253	6253	3900
1988	3414	5486	5300	4430
1989	7297	7960	7960	9140
1990	5211	5964	5937	5540
1991	7572	8931	8931	6580
1992	7625	8506	8657	7650
1993	4631	6254	6254	5150
1994	10275	8762	9028	7590
1995	5572	5797	6059	7130
1996	6383	7403	7171	6350
1997	4366	5961	5961	6250
1998	7094	8056	8113	8130
1999	2572	5034	5034	5280
2000	1227	5050	5050	4530
2001	2827	5050	5050	5360
2002	2362	5050	5050	5250
2003	7250	8506	8692	8050
2004	4921	6416	6244	7360
2005	5635	9113	9113	8670
2006	2988	5042	5042	5030
2007	2124	5050	5050	4760
2008	3376	5050	5050	4940

Table 4. Annual 1-day Minimum Flow (cfs) of the Apalachicola River at the Chattahoochee Gage for the RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

Submerged Habitat Below 10,000 cfs

Figure 8 shows the inter-annual frequency (percent of years) of flow rates less than 5,000 to 10,000 cfs in the four flow regimes. The proposed action results in a lower occurrence of flows less than about 6,200 cfs and eliminates flows less than 5,000 cfs which occurred in approximately 20% of the years under the Baseline flow regime. The inter-annual frequency of flow events less than 10,000 cfs is higher in the proposed action flow regime than in the Baseline regime for the remainder of the years. However, the proposed action does lower the occurrence of flows less than 8,000 – 10,000 cfs resulting from the RIOP flow regime. In this regard, the proposed action achieves the desired goal of minimizing adverse effects to listed mussel species by more closely matching the occurrence of these flows under the Baseline regime. The RIOP, proposed action, and Baseline flow regimes all generally provide for a lower inter-annual frequency of flow events less than 10,000 cfs than the RoR flow regime. With regards to this flow-dependent habitat parameter, the proposed action again provides a mix of beneficial and adverse effects as compared to the Baseline.

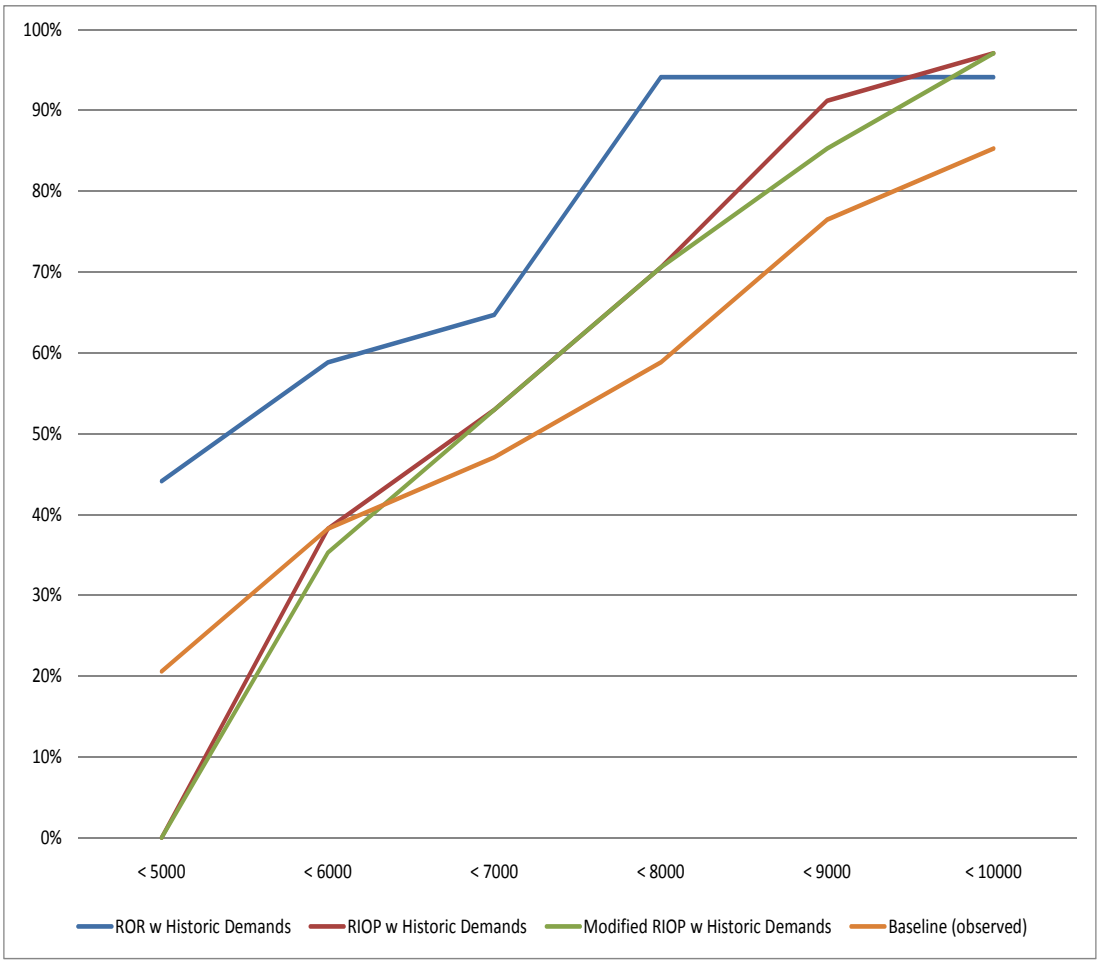


Figure 8. Inter-annual frequency (% of years) of discharge events less than 5,000 to 10,000 cfs under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

Consistent with the 2008 BO, we use the maximum number of days per year with flows less than 5,000 to 10,000 cfs as a measure of the most severe year for aquatic biota under each flow scenario (Figure 9). The RIOP and proposed action have identical results with regard to this flow-dependent habitat parameter. A mix of beneficial and adverse effects is realized. All of the flow regimes include more than 200 days during the driest year at all flow levels except the <5,000 cfs level. The maximum annual duration of flow less than 5,000 cfs is approximately 190 days and occurs in the RoR flow regime. The proposed action flow regime includes no years with flows less than 5,000 cfs, which is a benefit to mussels. However, the proposed action flow regime includes the highest maximum annual durations of flows less than 6,000 and 7,000 cfs of the four flow regimes; with an additional 18 days at flows less than 6,000 cfs and an additional 3 days at flows less than 7,000 cfs over the Baseline flow regime. This represents an adverse effect to mussels with respect to this flow-dependent habitat parameter. At flows less than 8,000-10,000 cfs the proposed action flow regime provides for slightly lower maximum annual durations than the Baseline flow regime, which is a benefit to mussels. At flows in this range, the Baseline flow regime includes the highest maximum number of days. The RoR flow regime provides comparable values to the proposed action in this range.

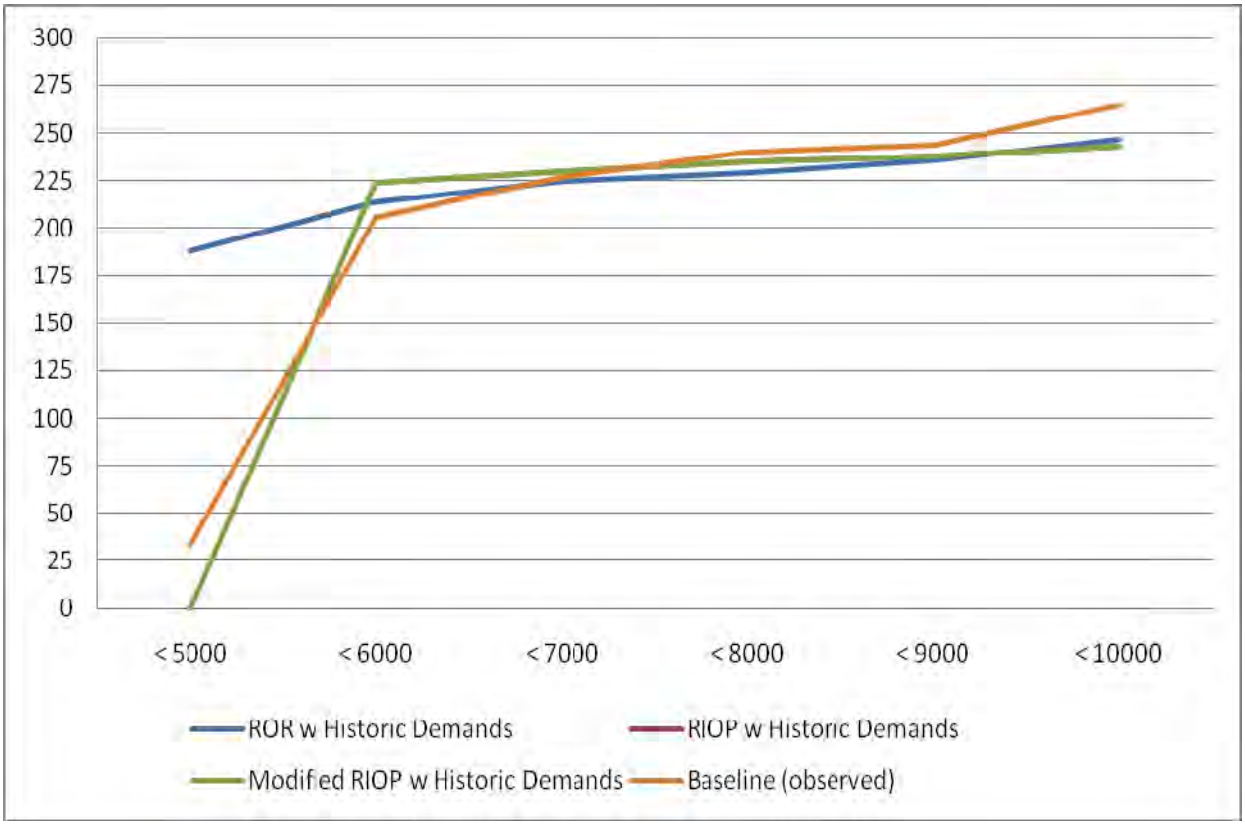


Figure 9. Maximum number of days per year of discharge less than 5,000 to 10,000 cfs under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

On multiple occasions in recent years, FWS has observed mussels surviving brief periods of exposure by closing their shells tightly or burrowing into the substrate (USFWS 2008;

K. Herrington Pers. Comm. 2011). Typically, unless water temperature is extreme, the stress of exposure is most likely a function of exposure duration. Figure 10 illustrates a most-severe event analysis, consistent with the 2008 BO, by computing the maximum number of consecutive days of flow less than the 5,000 to 10,000 cfs. Again, the RIOP and proposed action have identical results with regard to this flow-dependent habitat parameter. The proposed action shows a beneficial effect at the 5,000 cfs level because it does not include any days with flows less than 5,000 cfs. Both the Baseline and the RoR include consecutive periods with flows less than 5,000 cfs (26 days and 127 days respectively). The RoR shows the lowest maximum number of consecutive days per year for flows ranging from 7,000 to 10,000 cfs. The proposed action flow regime has an adverse effect at the 6,000 cfs level, because it substantially increases the maximum number of consecutive days per year for flows at 6,000 cfs over the Baseline. However, all of the flow regimes have an extreme effect on mussels at the 6,000 cfs level and greater, because it is unlikely that mussels would survive an exposure under even the best of the flow regimes, the Baseline, with 104 consecutive days. At the 7,000 cfs level and greater, all the flow regimes are comparable and include exposure events greater than 200 consecutive days.

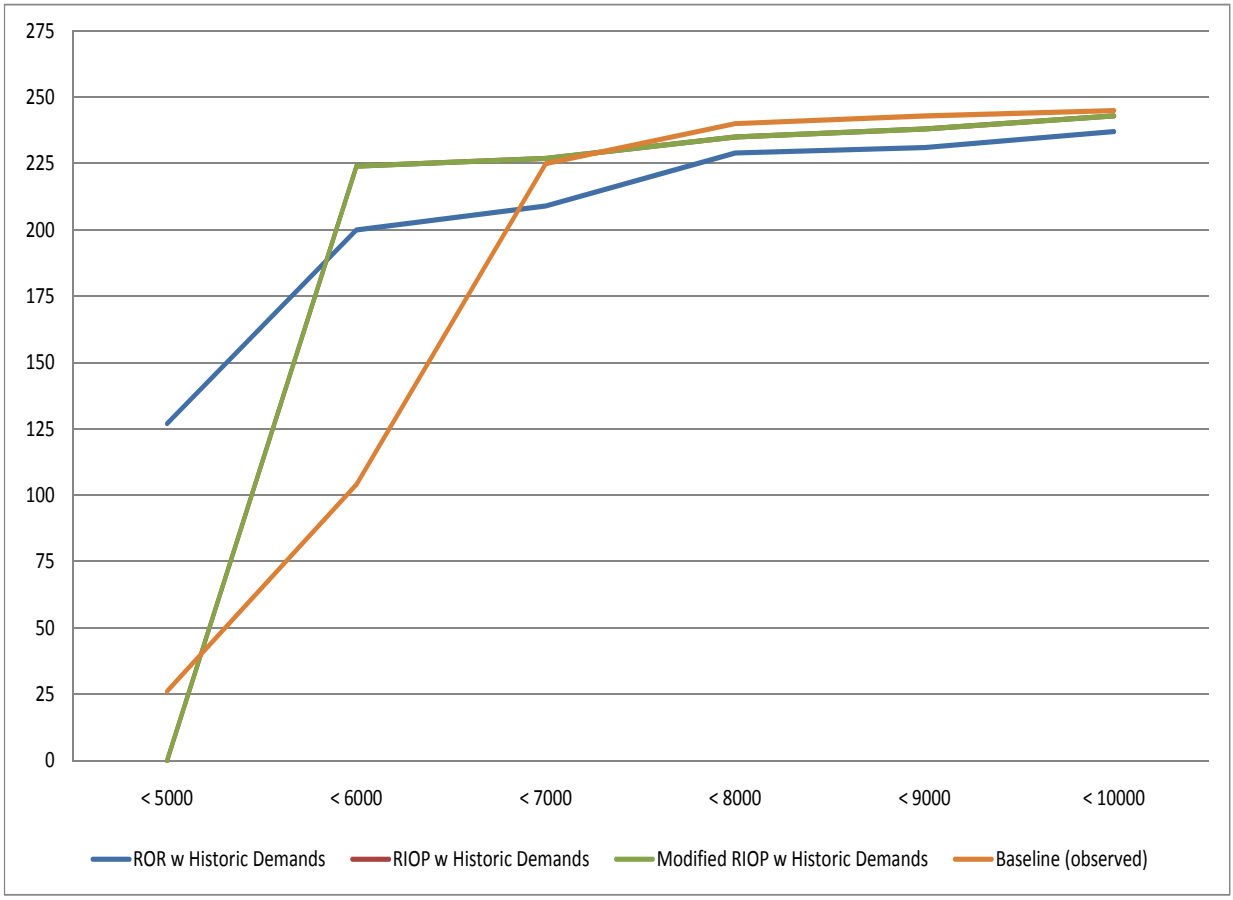


Figure 10. Maximum number of consecutive days per year of discharge less than 5,000 to 10,000 cfs under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

Since the maximum number of consecutive days per year of discharge less than 5,000 to 10,000 cfs analysis only focused on the most-severe event and included extensive durations of low flows for all the flow regimes at the 7,000 cfs level and greater, we decided it would be advantageous to analyze the less severe, but more frequent exposure events, to determine if the proposed action was comparable or improved upon the Baseline condition. This analysis was not conducted in the 2008 BO and consisted of computing the median number of consecutive days of flow less than the 5,000 to 10,000 cfs. Figure 11 displays the results of this analysis. Unlike the maximum number of consecutive days analysis above, the RoR simulation resulted in the most severe potential exposure events. However, all of the flow regimes resulted in event durations short enough to potentially allow mussels to survive exposure by closing their shells tightly or burrowing into the substrate (less than approximately 40 days). The RIOP, proposed action, and Baseline flow regimes provide for the greatest likelihood of this occurring by significantly lowering the median number of consecutive days of flows at all levels compared to the RoR. The RIOP, proposed action, and Baseline flow regimes are generally comparable at all flow levels, but begin to differentiate at flows greater than 7,000 cfs.

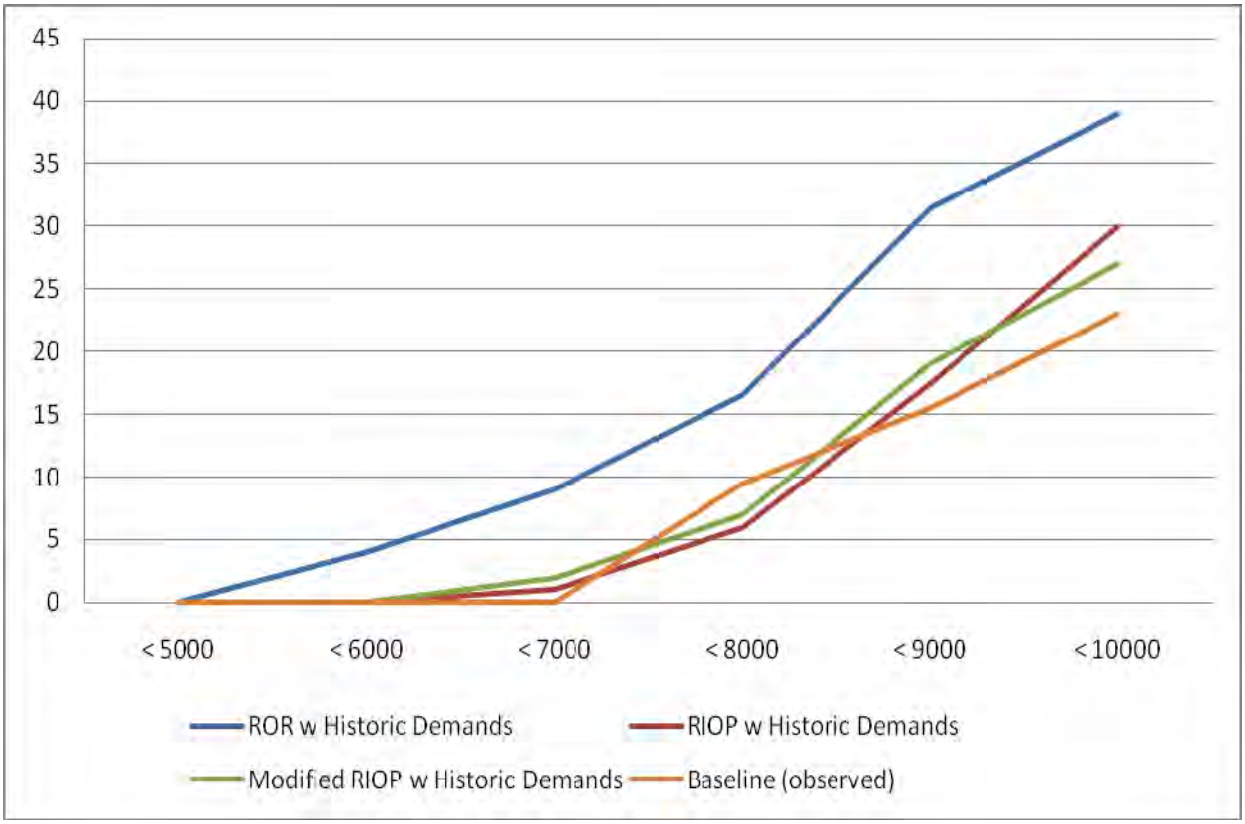


Figure 11. Median number of consecutive days per year of discharge less than 5,000 to 10,000 cfs under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

The proposed action results in a higher median number of consecutive days per year than the Baseline at all flow levels except 5,000 cfs and 8,000 cfs. Like the current RIOP, the proposed action has a lower value at the 8,000 cfs level, but the proposed action results in

a higher median number of consecutive days per year than the RIOP when flows are approximately 7,000 cfs - 9,000 cfs. Although both the RIOP and proposed action flow regimes result in a mix of adverse and beneficial effects to listed mussels, this shift represents a more adverse effect than occurs under the current operations and is an unexpected consequence of implementing the proposed modifications to the RIOP. At flow levels greater than approximately 9,000 cfs the proposed action results in a lower median number of days per year than the RIOP flow regime, which was the intent of the proposed modifications to the RIOP. In order to evaluate whether the adverse effects realized under the proposed action are a reflection of how the median values are calculated or are truly a more adverse effect than the RIOP, we also analyzed the average number of consecutive days per year of discharge less than 5,000 to 10,000 cfs under the various flow regimes. Figure 12 displays the results of this analysis. As suspected, the average number of consecutive days per year of discharge less than 5,000 to 10,000 cfs for the proposed action and RIOP are essentially the same at flow levels less than 9,000 cfs and the proposed action provides slightly lower values at flow levels above 9,000 cfs. This is expected since the proposed action eliminates the storage opportunities present in the RIOP between 8,000 and 10,000 cfs. This analysis also shows that the proposed action generally provides a comparable or lower average number of consecutive days per year across all flow levels between 8,000 and 10,000 cfs as compared to the Baseline. Therefore, with regards to this flow-dependent variable, the proposed action likely provides a beneficial effect to the listed mussel species.

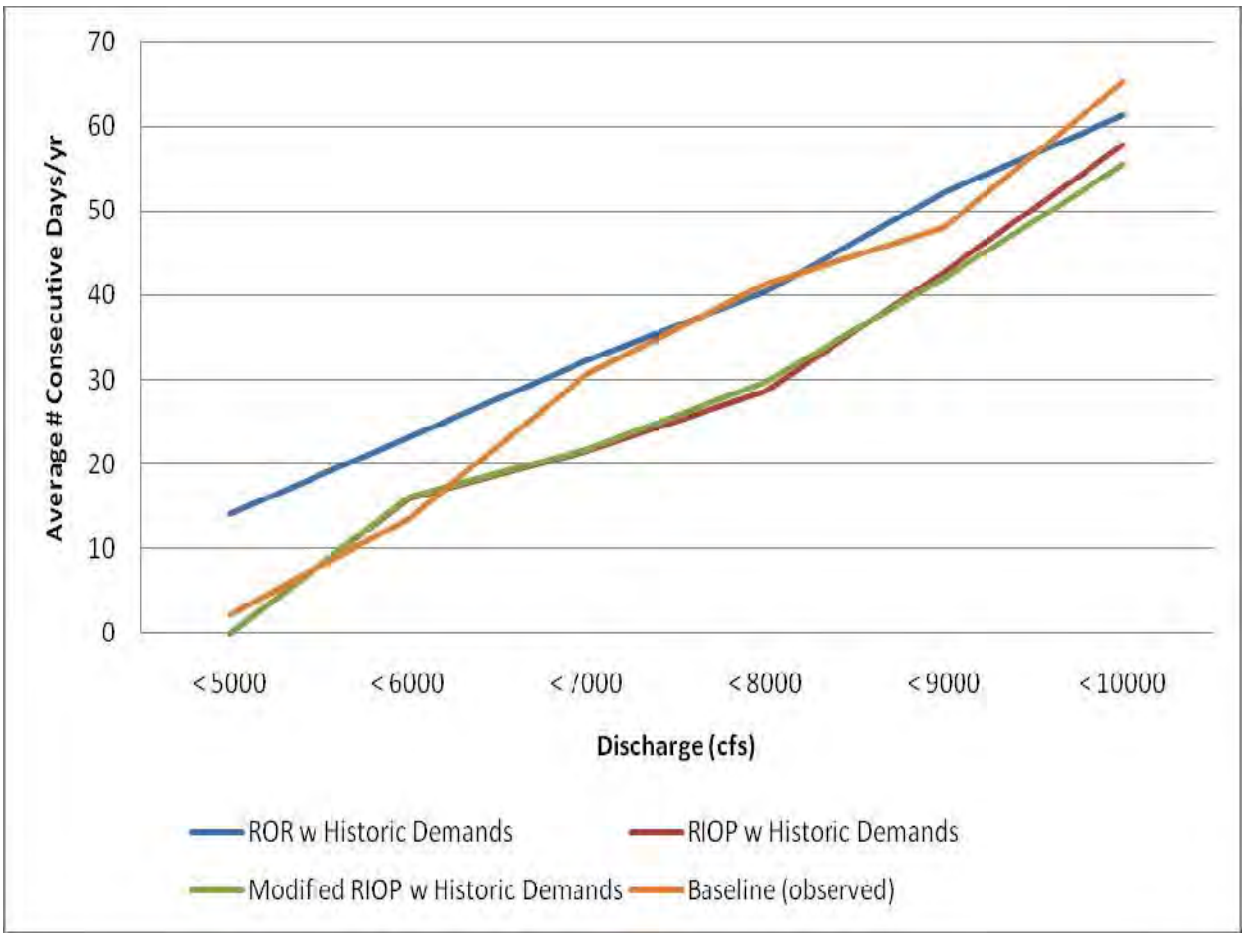


Figure 12. Average number of consecutive days per year of discharge less than 5,000 to 10,000 cfs under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

In the 2008 BO, the FWS determined that "Because moderately low flows, not just the most extreme events, constrict aquatic habitat availability and are generally stressful to mussels and other aquatic biota, it is appropriate to also consider the more common low-flow condition, *i.e.*, the magnitude and duration of low flows that occur in half the years of the flow regime. If the common low-flow conditions become even more common or more severe, it would reduce the amount of habitat available to mussels and would increase their vulnerability to exposure-related mortality, including increased predation by terrestrial predators" (USFWS 2008). Consistent with the 2008 BO, Figure 13 displays the median number of days per year less than the thresholds of 5,000 to 10,000 cfs. The RoR flow regime results in a more common low flow condition at all flows below 10,000 cfs than either the proposed action or the Baseline. The proposed action results in a higher median number of days per year for flows between 6,000 cfs and about 9,500 cfs than the Baseline. At flow levels greater than approximately 9,500 cfs the proposed action results in a lower median number of days per year than the Baseline and RIOP flow regimes, which was the intent of the proposed modifications to the RIOP. However, the proposed action also results in a higher median number of days per year for flows between 6,000 cfs and about 8,500 cfs than the RIOP flow regime. Although both

the RIOP and proposed action flow regimes result in an adverse effect to listed mussels at these flow levels, this represents a more adverse effect than occurs under the current operations and is an unexpected consequence of implementing the proposed modifications to the RIOP.

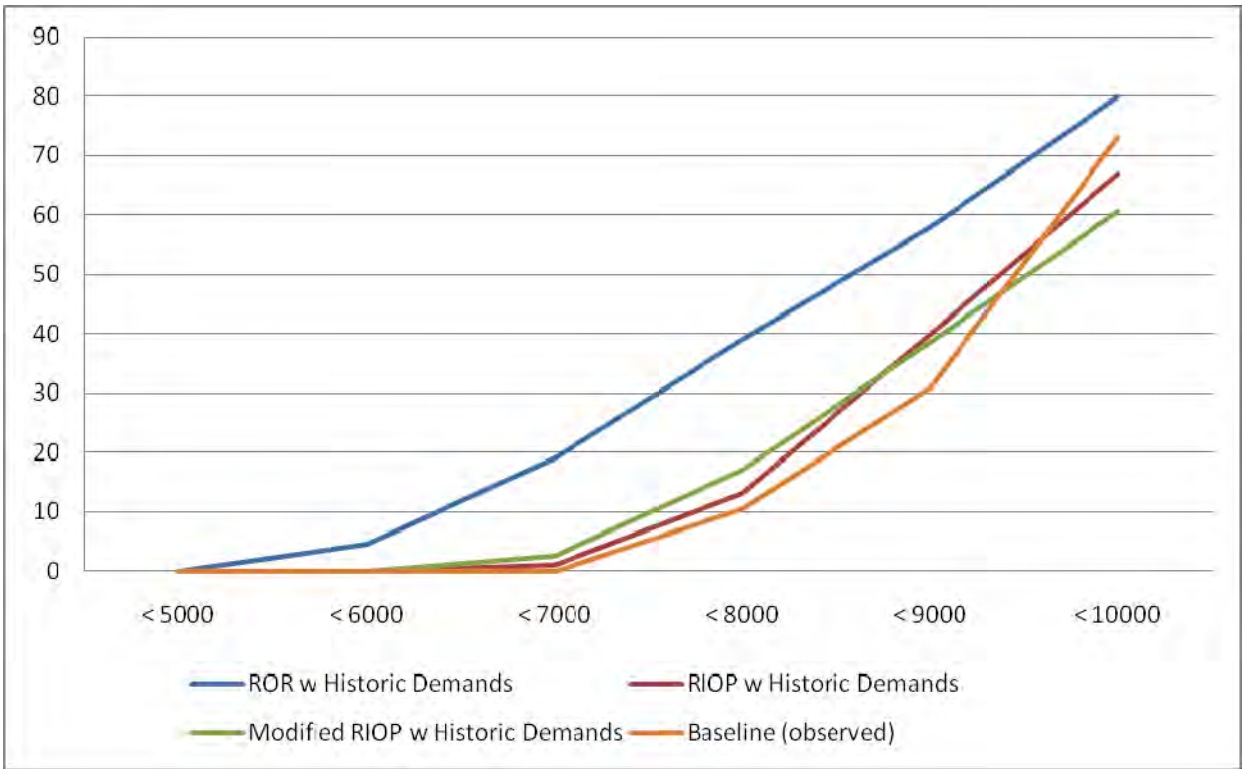


Figure 13. Median number of days per year of discharge less than 5,000 to 10,000 cfs under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

This is similar to what we observed when analyzing the median number of consecutive days per year of flow at the various levels. Therefore, we once again analyzed the average values in addition to the median values in order to determine whether this phenomenon was a reflection of how the median values are calculated or truly a more adverse effect with regards to the number of days per year of discharge less than 5,000 to 10,000 cfs under the various flow regimes. Figure 14 displays the results of this analysis. As suspected, the average number of days per year of discharge less than 5,000 to 10,000 cfs for the proposed action and RIOP are essentially the same. The proposed action generally provides a lower average number of days per year of discharge less than 5,000 cfs to approximately 8,500 cfs than the Baseline and nearly mirrors the Baseline values for discharge levels greater than 8,500 cfs. With regards to this flow-dependent variable, the proposed action likely provides a beneficial effect to the listed mussel species.

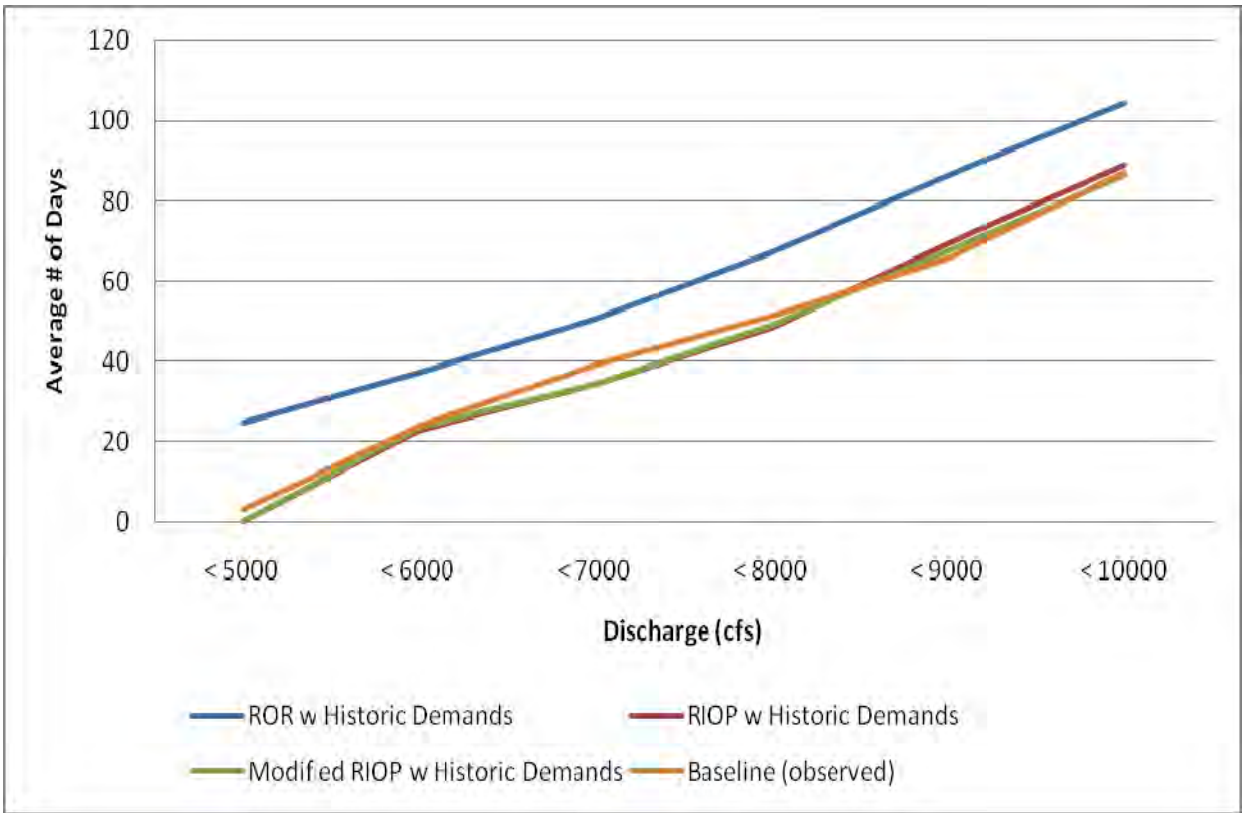


Figure 14. Average number of days per year of discharge less than 5,000 to 10,000 cfs under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

As described in the DESCRIPTION OF PROPOSED ACTION section above, the proposed action continues to utilize the RIOP maximum fall rate schedule. The schedule limits operations to more gradual fall rates as flow declines to the river stages where listed mussels may occur in order to facilitate, as much as possible, the movement of mussels and other aquatic biota from higher to lower elevation habitats. The general intent of the schedule is to avoid extreme daily declines in river stage and thereby lessen the potential for exposing or stranding listed mussels, their host fish, and other aquatic biota.

Consistent with the 2008 BO, the effects of altered fall rates were analyzed by comparing the daily average fall rates observed at the Chattahoochee gage (Baseline) to those computed for the simulated daily flows. The methodology for computing the daily average fall rates is the same.

Figure 15 is a frequency histogram of the rate of change results, which lumps all stable or rising days into one category and uses the ranges that correspond to the current maximum fall rate schedule as categories for the falling days (<=0.25 ft/day, > 0.25 to <= 0.50 ft/day, > 0.50 to <= 1.00 ft/day, > 1.00 to <= 2.00 ft/day, and > 2.00 ft day). The proposed action includes the current maximum fall rate schedule. Since the listed mussels are known to occur at flows between 5,000 and 10,000 cfs, preservation of the more conservative maximum fall rates should facilitate the movement of mussels as river stages decline. The most critical fall rate category is likely the 0.25 or less ft/day

category which corresponds to the maximum fall rate provision for flows ≤ 8,000 cfs. Among the falling days, rates less than 0.25 ft day are the most common occurrence in all of the flow regimes. The proposed action and the RIOP have a higher frequency of days when fall rates are in the > 0.25 to <= 0.50 ft/day range than the Baseline, but the proposed action results in a lower occurrence than the RIOP. As discussed in the Alternatives Section above, actual operations under the proposed action would yield

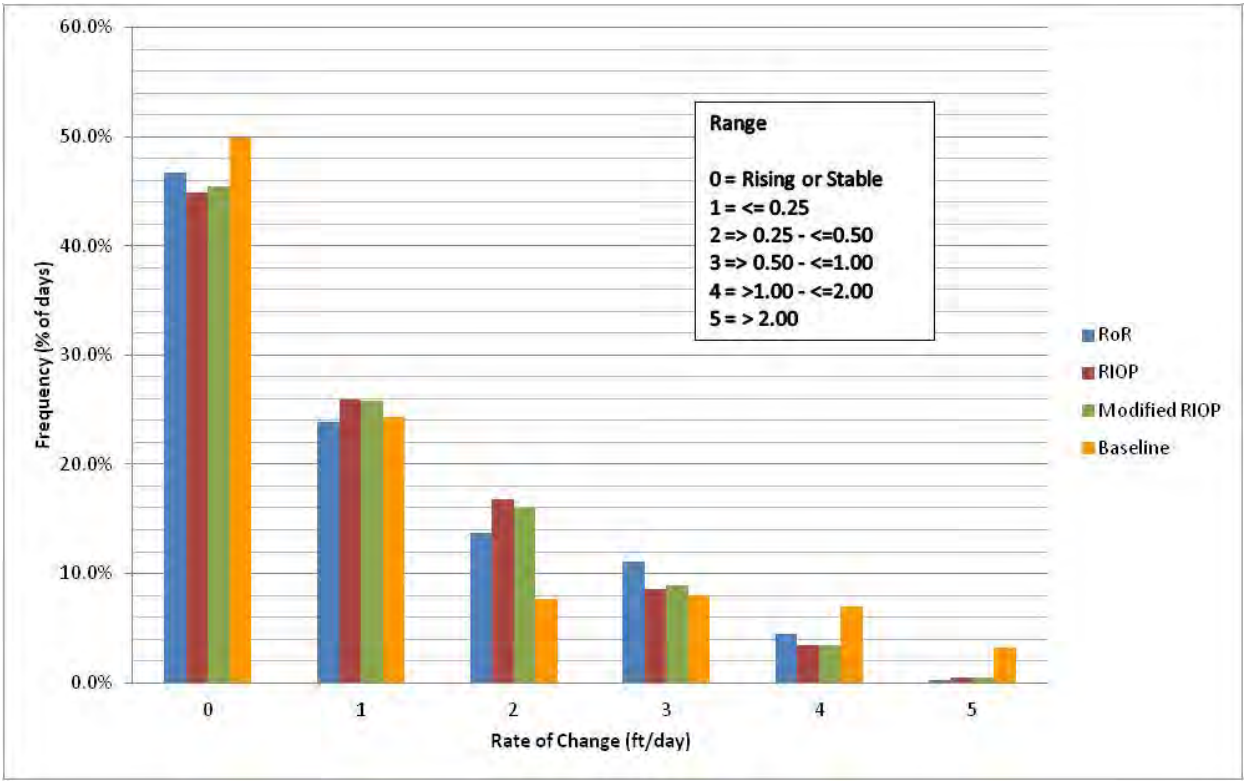


Figure 15. Frequency (percent of days) of daily stage changes (ft/day) under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

slower fall rates than those simulated when discharges are within the powerhouse capacity (approximately 16,000 cfs and less) due to physical limits on the Corps' ability to exact releases in strict conformance with the daily average fall rate schedule and thus a need to operate much more conservatively in order to not violate the maximum fall rate schedule. The ResSim model assumes the releases can be made in strict adherence to the daily fall rate schedule and thus represents a "worse case" of fall rate management under the proposed action. We expect the actual fall rates in these lower ranges would approximate or improve upon those in the Baseline flow regime and this is supported by evaluation of the observed fall rates since the RIOP maximum fall rate schedule has been in place (discussed above in the ALTERNATIVES CONSIDERED section). In the most extreme fall rate categories, the proposed action and RIOP result in lower frequencies than the Baseline, which may reduce the risk of stranding to host fish species for the listed mussels that utilize floodplain habitat. This is a beneficial effect.

As noted in the 2008 BO, the USFWS has observed mussels exposed at stages as high as about 10,000 cfs (USFWS 2008). Therefore, listed mussels could potentially be directly impacted by increases in the number of days that fall rates greater than 0.25 ft/day occur and flows are less than 10,000 cfs. Figure 16 shows a count of days in the various rate-of-change categories when flow was less than 10,000 cfs. The methodology for conducting the analysis is the same as that used in the 2008 BO.

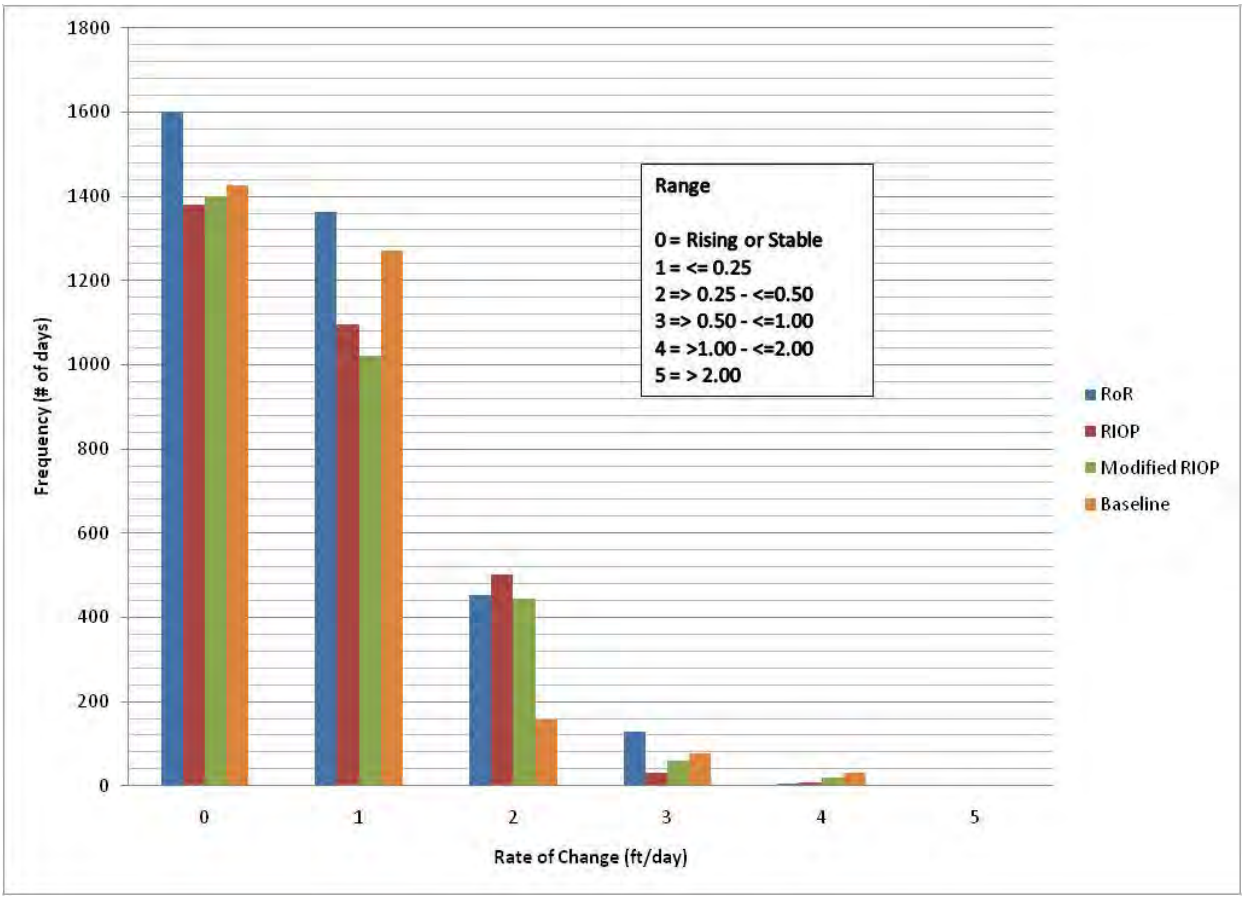


Figure 16. Frequency (number of days) of daily stage changes (ft/day) when releases from Woodruff Dam are less than 10,000 cfs under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

Similar to the previous analysis, the Baseline flow regime provides the least relative risk to listed mussel species by preserving the slowest fall rate (<=0.25 ft/day). The number of days in the greater than 0.25 ft/day categories for the proposed action is 523, nearly double the number in the Baseline. Approximately 85% of these days occur in the > 0.25 to <= 0.50 ft/day range and the proposed action has fewer days in each of the more extreme categories than the Baseline. Regardless, this increase relative to historic operations may represent an increased risk of stranding when mussels are located at stages greater than 5,000 cfs. Table 5 presents a comparison of the maximum and average daily fall rates for each fall rate category under the proposed action simulation and the Baseline flow regimes. The maximum and average daily fall rates under both scenarios are comparable.

	Modified RIOP		Baseline (observed)	
Fall Rate Range (ft/day)	Maximum Fall Rate (ft/day)	Average Fall Rate (ft/day)	Maximum Fall Rate (ft/day)	Average Fall Rate (ft/day)
<=0.25	0.25	0.15	0.25	0.07
>0.25 - <=0.5	0.50	0.30	0.50	0.34
>0.5 - <=1.0	0.92	0.69	1.00	0.70
>1.0 - <=2.00	1.84	1.23	1.98	1.37
>2.00	2.97	2.97	2.37	2.21

Table 5. Maximum and average daily fall rates (ft/day) for each fall rate category when releases from Woodruff Dam are less than 10,000 cfs under Modified RIOP (ResSim simulated flow 1975-2008) and Baseline (observed flow 1975-2008).

As discussed above, the ResSim model assumes the releases can be made in strict adherence to the daily fall rate schedule and thus represents a "worse case" of fall rate management under the proposed action. We expect the actual fall rates in the lower fall rate categories would approximate or improve upon those in the Baseline flow regime.

FLOODPLAIN CONNECTIVITY AND SYSTEM PRODUCTIVITY

The Apalachicola River floodplain is a highly productive area that likely provides spawning and rearing habitats for one or more of the host fishes of the purple bankclimber and fat threeridge. Floodplain inundation is also critical to the movement of organic matter and nutrients into the riverine feeding habitats of both the mussels and juvenile sturgeon, and into the estuarine feeding habitats of juvenile and adult sturgeon (USFWS 2008). Therefore, listed mussels and sturgeon can be indirectly affected by changes to the frequency, timing, and duration of floodplain habitat connectivity and inundation.

To assess these effects we compare the four flow regimes on the timing and duration of floodplain habitat connectivity and inundation. Consistent with the 2008 BO, this is accomplished by utilizing the relationship documented by Light *et al.* (1998) between total area of non-tidal floodplain area inundated and discharge at the Chattahoochee gage (USFWS 2008). Figure 17 displays a frequency analysis of the results of transforming the four daily discharge time series during the growing season months (April – October) to connected floodplain area. All four flow regimes provide for essentially the same frequency of floodplain habitat inundation, with the RIOP and proposed action resulting in nearly identical frequencies. The median amount of connected habitat under the proposed action (acres inundated for half of the growing season days 1975-2008) is 1,858 acres, compared to 2,286 and 1,780 acres for the Baseline and RoR flow regimes. However, the curves for the proposed action and the Baseline flow regimes cross each other several times. Therefore, with regards to this flow dependent habitat parameter, it appears that effects (if any at all) are likely a continuation of the Baseline effect.

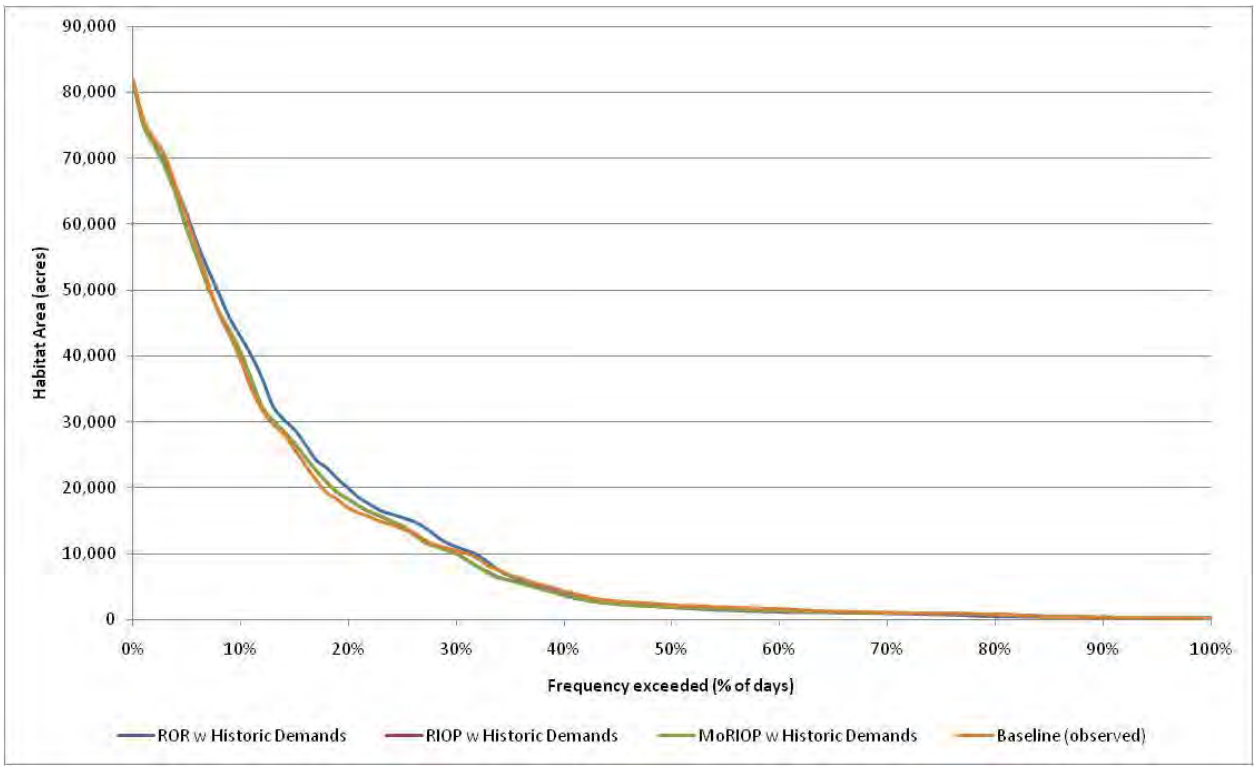


Figure 17. Frequency (percent of days) of growing-season (April-October) floodplain connectivity (acres) to the main channel under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

In order to interpret biological effects related to the temporal pattern of floodplain inundation we evaluate the annual 30-day continuous floodplain habitat inundation consistent with the methodology described in the 2008 BO. Figure 18 displays the results of this analysis. The proposed action and RIOP provide for identical annual 30-day continuous connectivity. Annual 30-day continuous connectivity is roughly comparable between the proposed action and RoR, which suggests that refilling reservoirs to summer pool levels following the winter drawdown has little effect with regards to this flow dependent habitat parameter. The proposed action almost always results in more annual 30-day continuous connectivity than the Baseline flow regime. The median amount of 30-day continuous connected habitat under the proposed action (acres inundated for at least 30 days in half of the years 1975-2008) is 27,601 acres, compared to 22,169 and 30,295 acres for the Baseline and RoR flow regimes, respectively. Therefore, with regards to this flow dependent habitat parameter, the proposed action provides a beneficial effect.

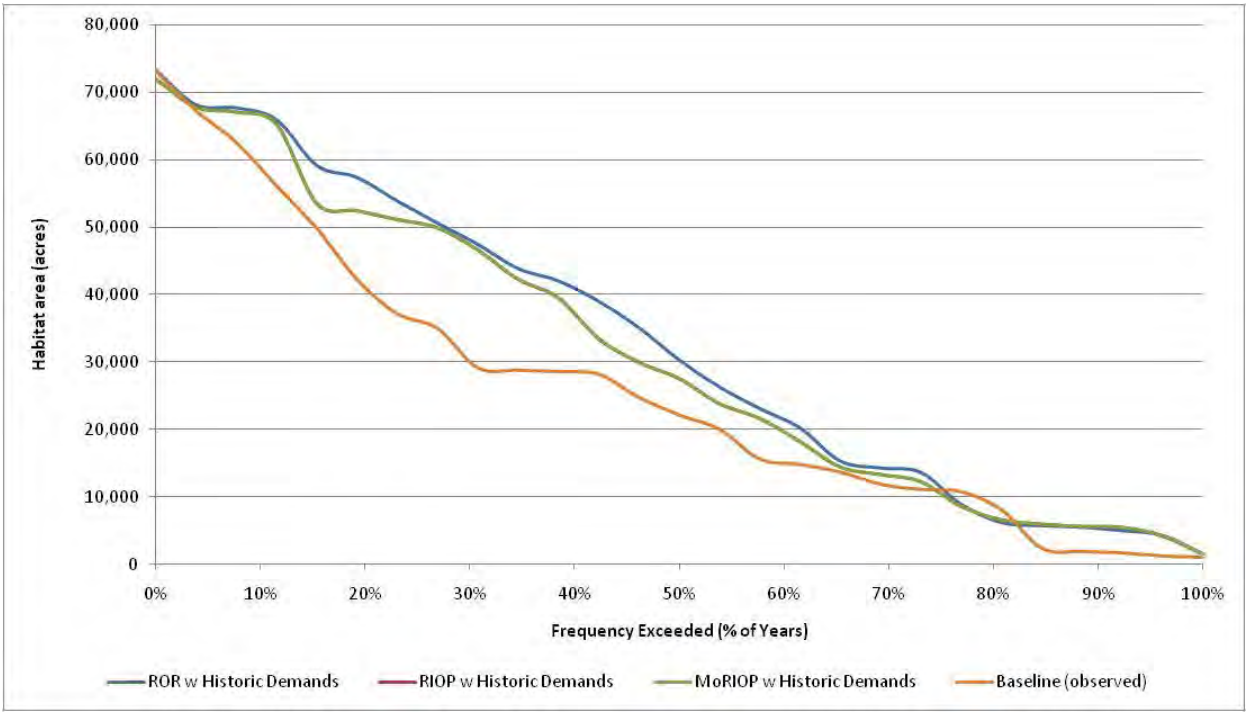


Figure 18. Inter-annual frequency (percent of years) of growing season (April-October) floodplain connectivity (maximum acres inundated for at least 30 consecutive days each year) to the main channel under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

CUMULATIVE EFFECTS

Consistent with the 2008 BO, we also considered the cumulative effects of implementing the proposed action by focusing on the effects of increased water depletions due to an increase in M&I use. Like the analysis in the 2008 BO, the 2017 projection is based on an increase in M&I use only and it could occur sooner or later than 2017, depending on population growth and other factors. It could also result from a combination of increased M&I and agricultural demands. The Corps used the same approach to simulate the proposed action using the 2017 depletions (+27% for M&I). In order to fully evaluate the effects to the listed species, all of the figures created above in the EFFECTS ANALYSIS section were recreated using the 2017 simulations for the RoR and proposed action. For comparison, the Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008) flow regimes were included as well. These figures are included in Appendix A.

The various Gulf sturgeon cumulative effects analyses (Figures 2,3,4,14, and 15) indicate that increased water depletions would not appreciably affect Gulf sturgeon beyond any effects that occur under the proposed action simulation (with historic demands) and the Baseline. The remaining figures in Appendix A address cumulative effects on the listed mussel species. All of the listed mussels' cumulative effects analyses indicate that increased water depletions results in reduced low flows during drought periods. In general, this results in a continuation of the adverse effects realized under the proposed action simulations that utilized historic demands, but at greater intensity. The proposed

action with 2017 demands simulation resulted in flows less than 5,000 cfs due to implementation of the drought plan minimum flow provision of 4,500 cfs during severe drought conditions such as those experienced in 2007. However, the proposed action continues to offset the impact of an increase in depletions by maintaining minimum releases of 5,000 cfs in all the simulated years except 2007 (when releases dropped to 4,500 cfs). The 2007 drought was a 1-in-200 year event and is unlikely to occur again during the implementation period of the proposed action (until an updated WCP is approved). Furthermore, water conservation programs implemented by the State of Georgia, should reduce the risk of water depletions reaching the estimated 2017 demand levels during the implementation period of the proposed action.

CONCLUSIONS

Gulf Sturgeon

Based on the effects analyses described above, the Corps has determined that the proposed action may affect but is not likely to adversely affect Gulf sturgeon and that it may affect but is not likely to adversely modify Gulf sturgeon critical habitat. Therefore, we request concurrence with this determination per section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*).

Fat Threeridge

The Corps re-initiated consultation on the RIOP in September 2010 based on new information about the distribution and mortality of endangered fat threeridge mussels in the Apalachicola River. Through the consultation process, it was determined that modifications to the RIOP should be evaluated to further minimize the potential for "take" of fat threeridge mussels when releases are between 5,000 and 10,000 cfs. In the 2008 BO, "take" of listed mussel species only occurred when releases were less than 5,000 cfs. The proposed action still includes a provision for releases as low as 4,500 cfs and implements minimization measures, but does not eliminate adverse effects to the species when releases are between 5,000 and 10,000 cfs and mussels have re-colonized at stages in this flow range. The period of record simulation (1975-2008) of the proposed action does not include releases less than 5,000 cfs which occur under the RoR and Baseline flow regimes. Like the RIOP, this is a beneficial effect. "Take" of fat threeridge when releases are between 5,000 and 10,000 cfs is dependent upon re-colonization of the species at stages in this flow range and discretionary operations by the Corps that influence these flows. As FWS will describe in the STATUS OF THE SPECIES section of the BO, the 2006 and 2010 mussel mortality events suggest that re-colonization is dependent on several hydrology driven variables that do not necessarily occur every year. They include 1) at least 24 days of bankfull flow (defined as 72,100 cfs) and 2) a prolonged period of monthly average flows greater than 8,000 cfs (22 consecutive months or at least two full spawning periods). The effects analyses above do not presume that mussels are always present at river stages equivalent to flows between 5,000 and 10,000 cfs, but rather evaluate to what extent Corps operations are influencing flows as compared to the Baseline. The effects analyses above, illustrate that the

proposed action results in a mix of beneficial and adverse effects to fat threeridge mussels when releases are between 5,000 and 10,000 cfs. Therefore, we have determined that the proposed action may adversely affect fat threeridge. However, it is not evident that the proposed action would appreciably change the quantity or quality of the designated Critical Habitat primary constituent elements (PCE) compared to the Baseline. Droughts substantially change the nature of all of these PCEs compared to normal flows. Therefore, we have determined that the proposed action may affect but is not likely to adversely modify fat threeridge mussel designated Critical Habitat.

PURPLE BANKCLIMBER

The flow regime changes discussed in the effects analyses for listed mussel species apply to the purple bankclimber as well, but probably to a lesser extent, because the data suggests that this species appears to occur more often in deeper portions of the stream channel than the fat threeridge. Purple bankclimber exposure was not observed during 2006 or 2010 when exposed fat threeridge were observed at stages greater than 5,000 cfs. Although the proposed action simulation did not result in a reduction of flows below 5,000 cfs, it does include a provision allowing this; if more severe droughts than have previously occurred transpire. A small number of purple bankclimber could be exposed under this condition and this is an adverse effect that is also applicable to the current RIOP. Therefore, we have determined that the proposed action may adversely affect purple bankclimber. The PCE discussion above also applies to purple bankclimber and therefore, we have determined that the proposed action may affect but is not likely to adversely modify purple bankclimber mussel designated Critical Habitat.

CHIPOLA SLABSHELL

Like the purple bankclimber, Chipola slabshell exposure was not observed during 2006 or 2010 when exposed fat threeridge were observed at stages greater than 5,000 cfs. The Chipola slabshell known range within the action area is limited to the Chipola River downstream of the Chipola Cutoff. As discussed in the 2008 BO, channel morphology appears less altered in the Chipola River than the Apalachicola River and the Corps' influence on flow regime in the Chipola River is likely reduced due to the narrower channel and contributions from the Chipola River upstream of the cutoff (approximately 132 miles). Flowing water from the Apalachicola River influences flow in the Chipola River and Chipola Cutoff under the full range of flows simulated in the proposed action flow regime. Therefore, the effects analyses above for the fat threeridge apply also to the Chipola slabshell, but probably to a lesser extent. Although the proposed action simulation did not result in a reduction of flows below 5,000 cfs, it does include a provision allowing this; if more severe droughts than have previously occurred transpire. A small number of Chipola slabshell could be exposed under this condition and this is an adverse effect that is also applicable to the current RIOP. Therefore, we have determined that the proposed action may adversely affect Chipola slabshell. The PCE discussion above also applies to Chipola slabshell and therefore, we have determined that the proposed action may affect but is not likely to adversely modify Chipola slabshell mussel designated Critical Habitat.

CITATIONS

Light, H.M, M.R. Darst, and J.W. Grubbs. 1998. Aquatic habitats in relation to river flow in the Apalachicola River floodplain, Florida. U.S. Geological Survey Professional Paper 1594.

United States Fish and Wildlife Service (USFWS). 2008. Biological Opinion on the U.S. Army Corps of Engineers, Mobile District, Revised Interim Operating Plan for Jim Woodruff Dam and the Associated Releases to the Apalachicola River.

APPENDIX A

CUMULATIVE EFFECTS ANALYSES

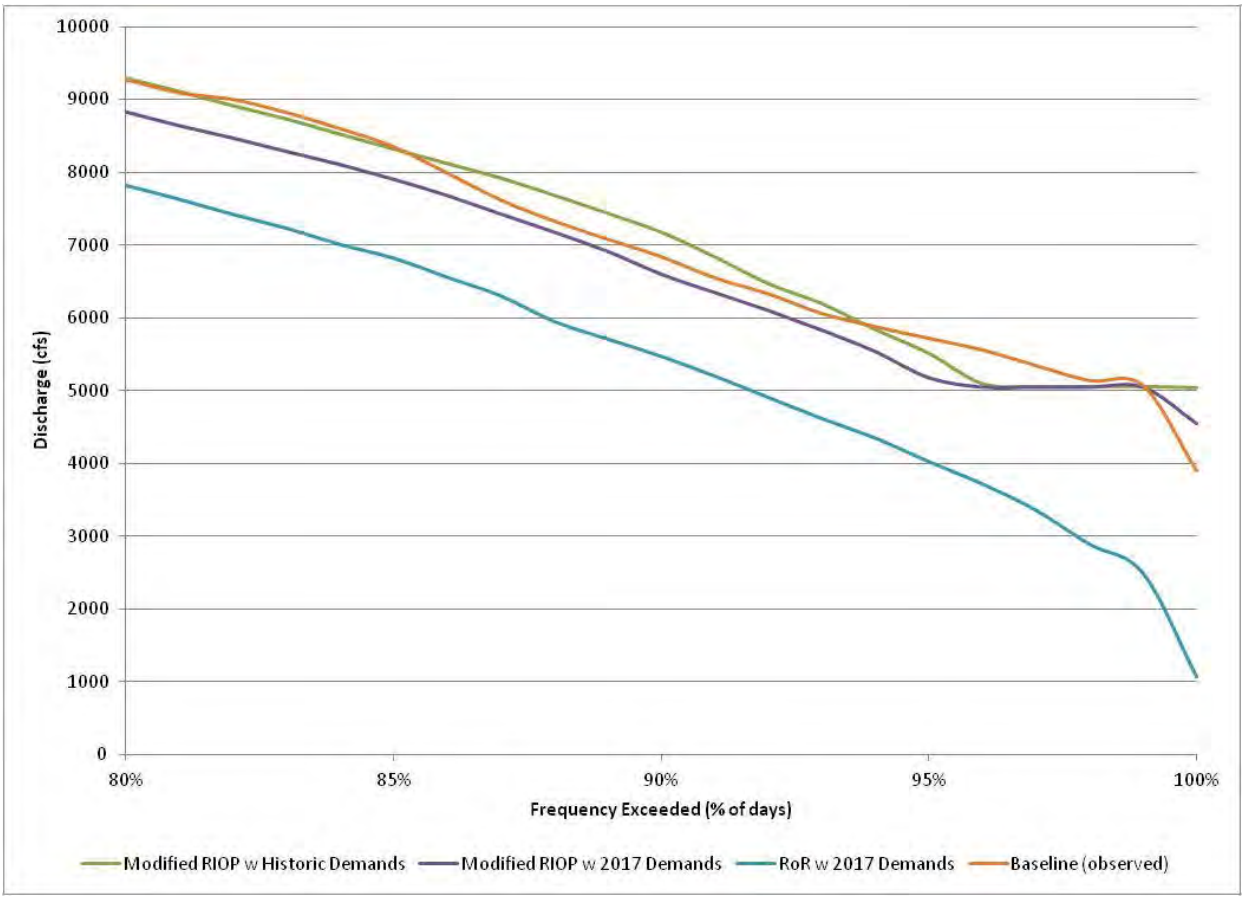


Figure 1. Observed and simulated flow frequency (% of days flow exceeded) of the Apalachicola River at the Chattahoochee gage under Modified RIOP (ResSim simulated flow 1975-2008); Modified RIOP w 2017 demands (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

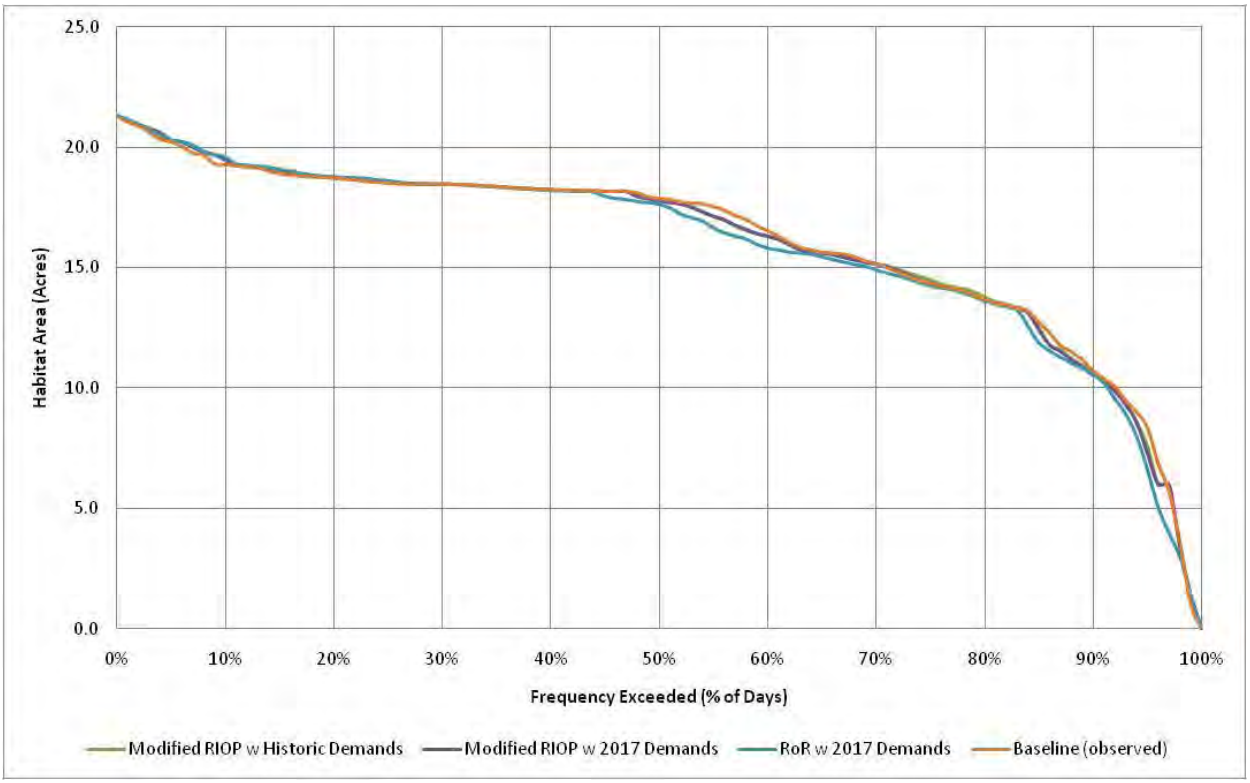


Figure 2. Frequency (% of days) of Gulf sturgeon spawning habitat availability (acres of potentially suitable spawning substrate inundated to depths of 8.5 to 17.8 feet), on each day March 1 through May 31, at the three sites known to support spawning, under Modified RIOP (ResSim simulated flow 1975-2008); Modified RIOP w 2017 demands (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

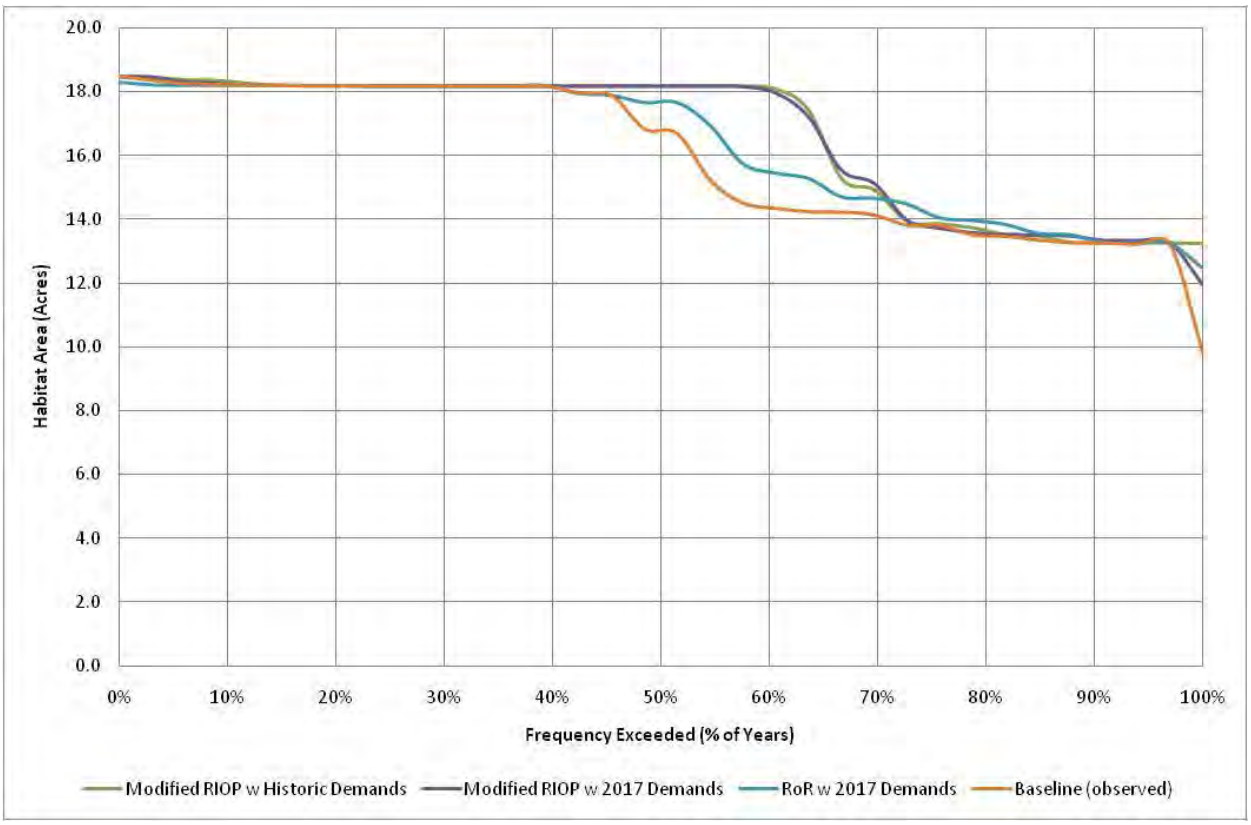


Figure 3. Frequency (% of years) of Gulf sturgeon spawning habitat availability (maximum acres of potentially suitable spawning substrate inundated to depths of 8.5 to 17.8 feet for at least 30 consecutive days each year), March 1 through May 31, at the three sites known to support spawning, under Modified RIOP (ResSim simulated flow 1975-2008); Modified RIOP w 2017 demands (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

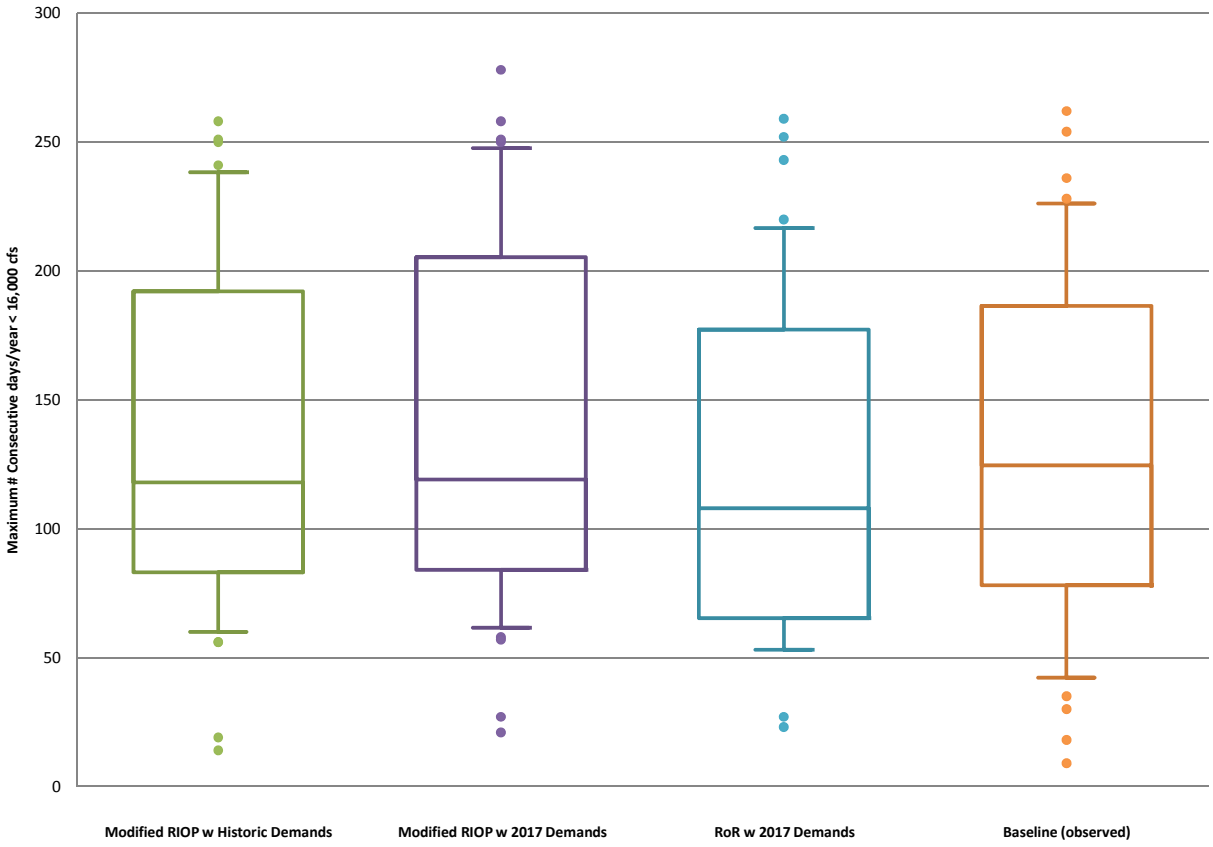


Figure 4. Maximum number of consecutive days/year of flow less than 16,000 cfs under Modified RIOP (ResSim simulated flow 1975-2008); Modified RIOP w 2017 demands (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

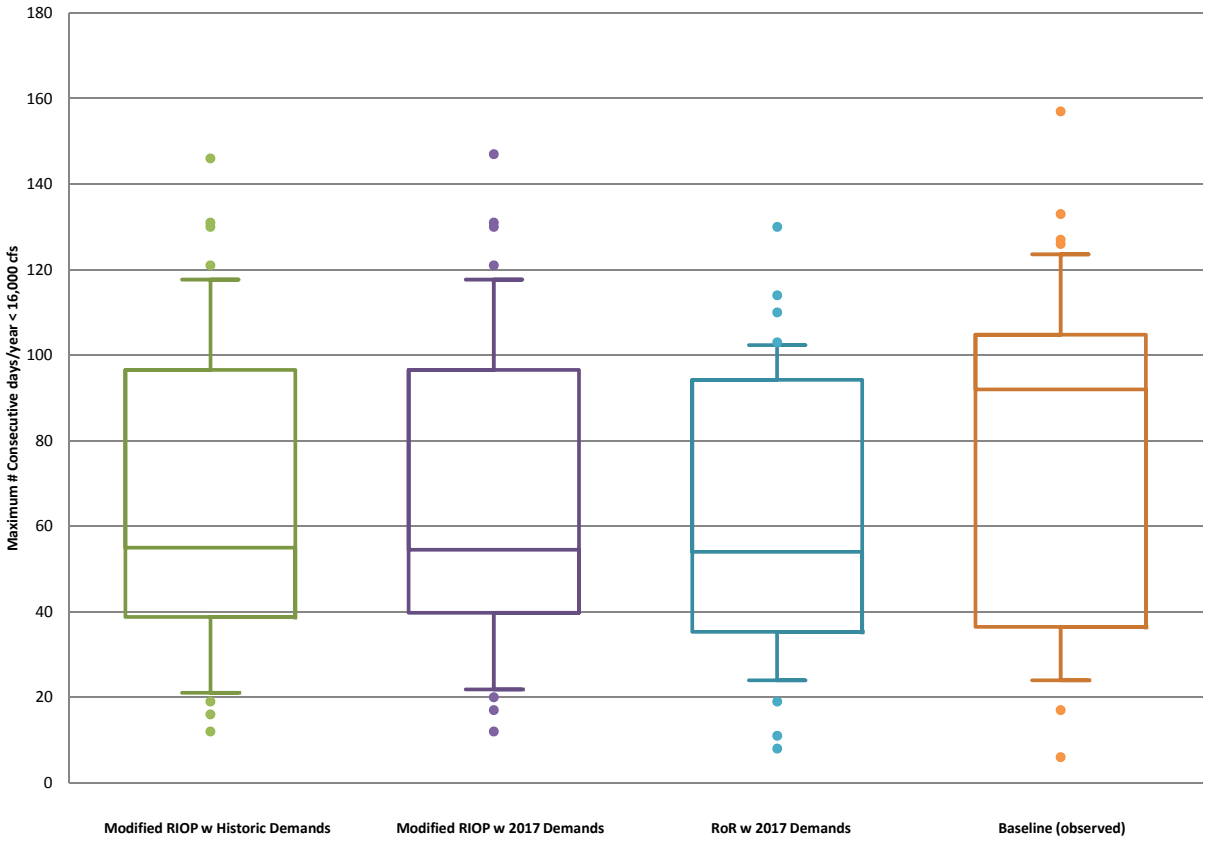


Figure 5. Maximum number of consecutive days/year of flow less than 16,000 cfs (October-March) under Modified RIOP (ResSim simulated flow 1975-2008); Modified RIOP w 2017 demands (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

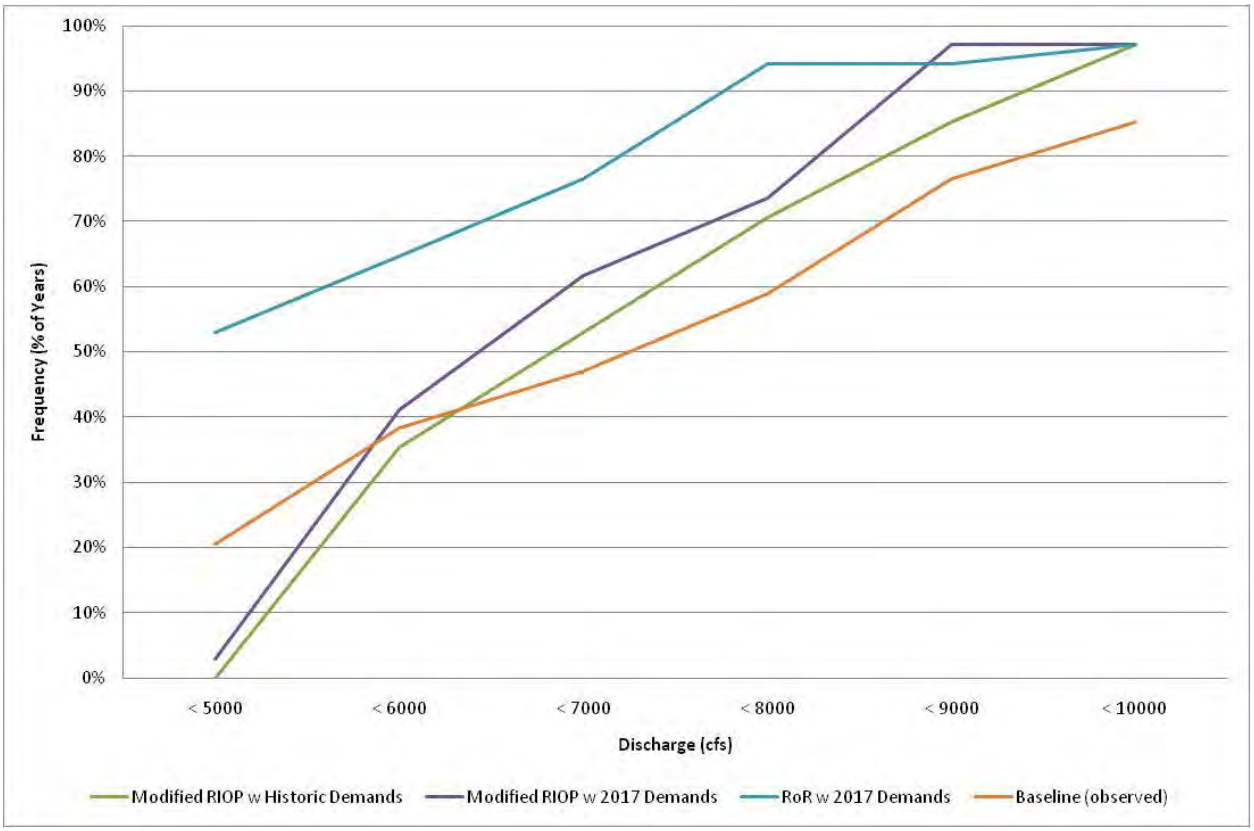


Figure 6. Inter-annual frequency (% of years) of discharge events less than 5,000 to 10,000 cfs under Modified RIOP (ResSim simulated flow 1975-2008); Modified RIOP w 2017 demands (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

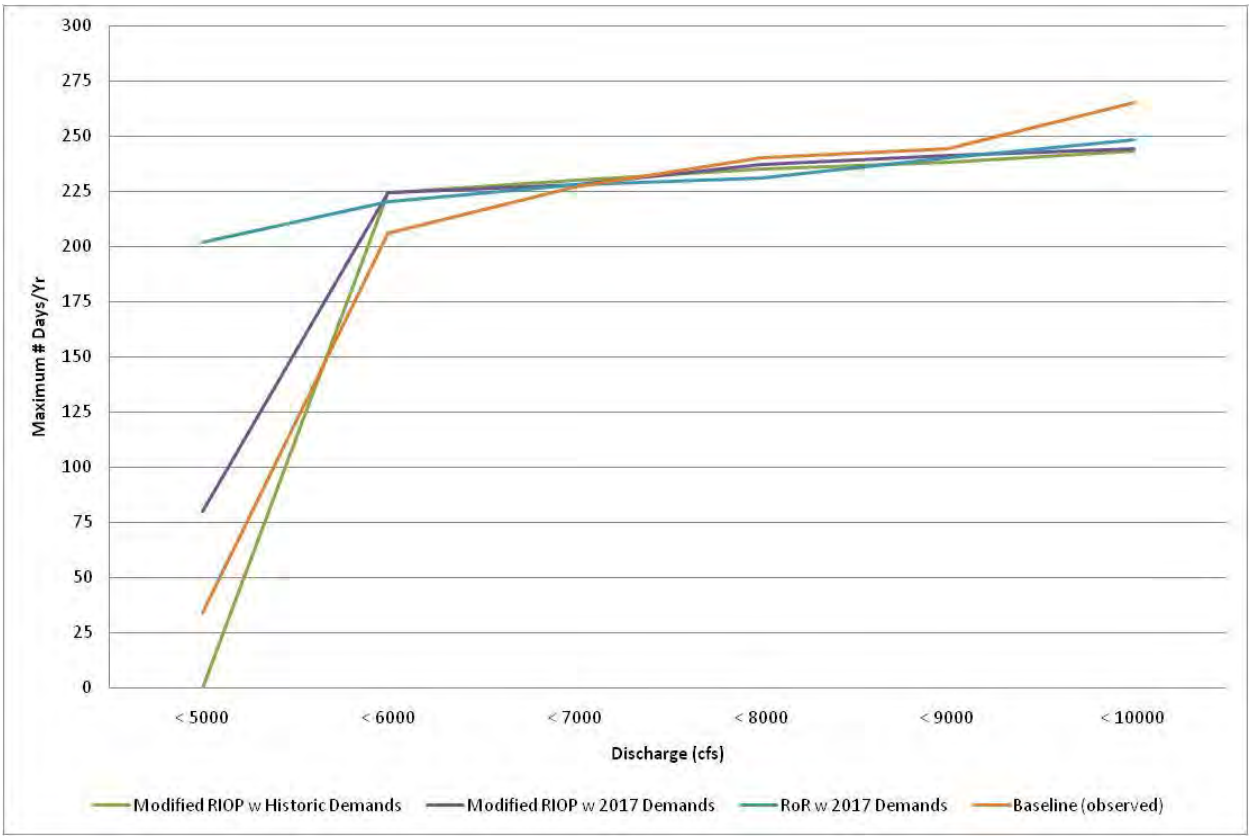


Figure 7. Maximum number of days per year of discharge less than 5,000 to 10,000 cfs under Modified RIOP (ResSim simulated flow 1975-2008); Modified RIOP w 2017 demands (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

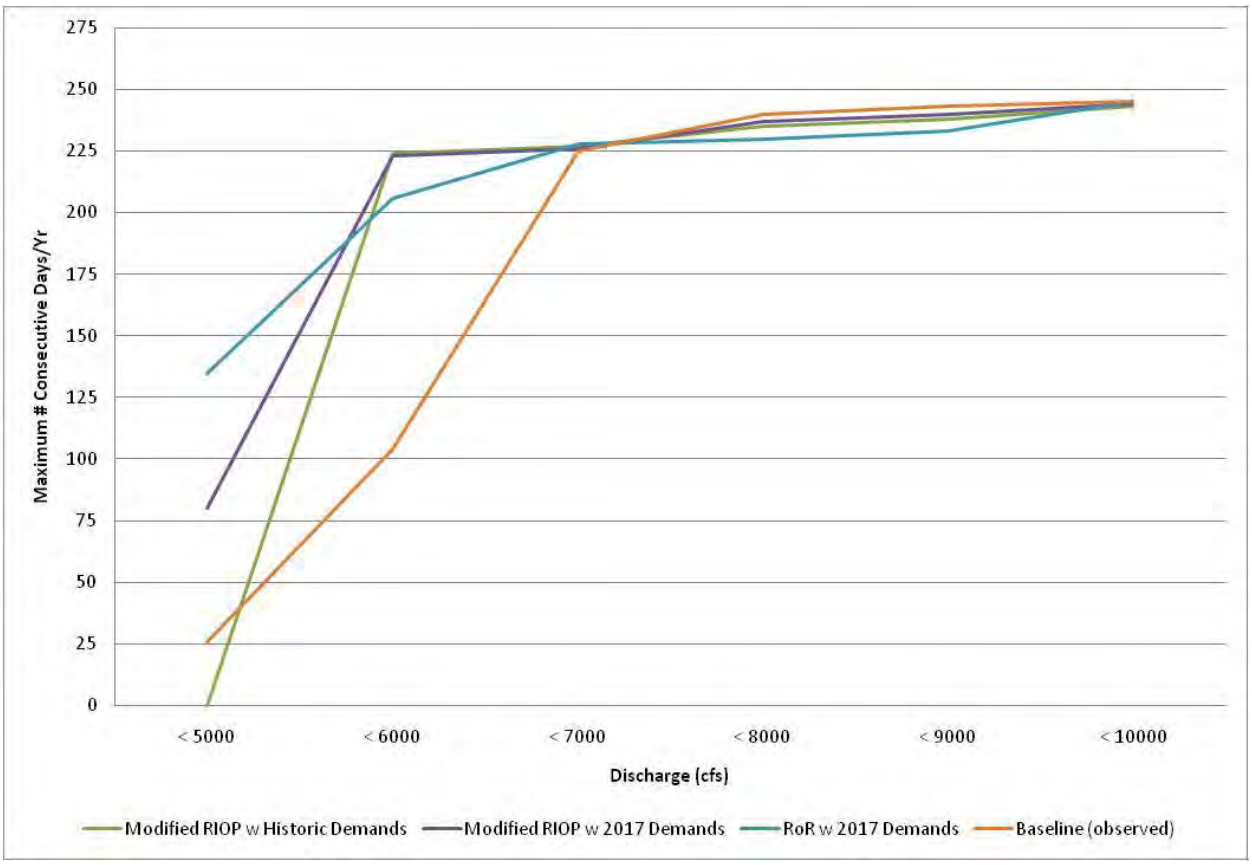


Figure 8. Maximum number of consecutive days per year of discharge less than 5,000 to 10,000 cfs under Modified RIOP (ResSim simulated flow 1975-2008); Modified RIOP w 2017 demands (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

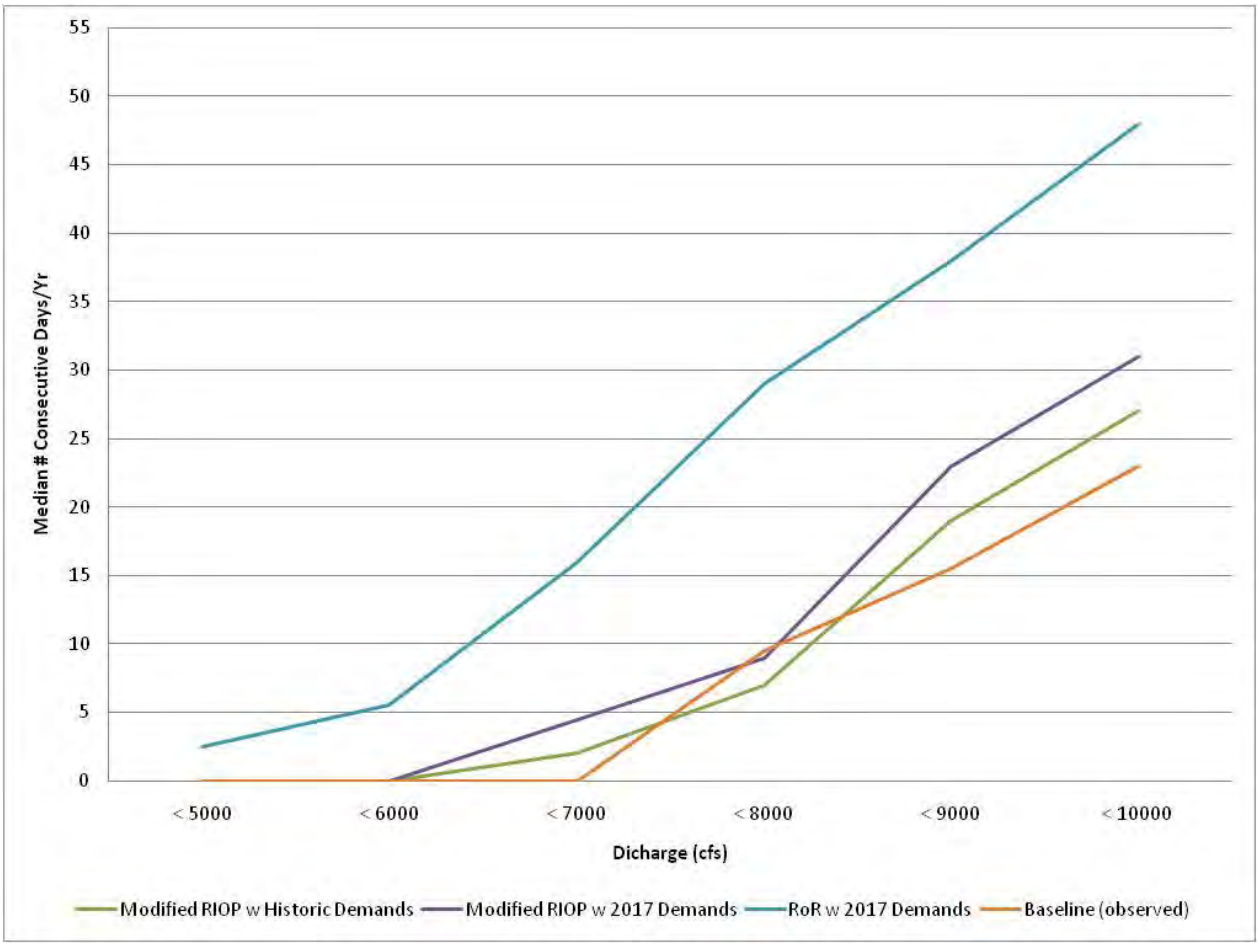


Figure 9. Median number of consecutive days per year of discharge less than 5,000 to 10,000 cfs under Modified RIOP (ResSim simulated flow 1975-2008); Modified RIOP w 2017 demands (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

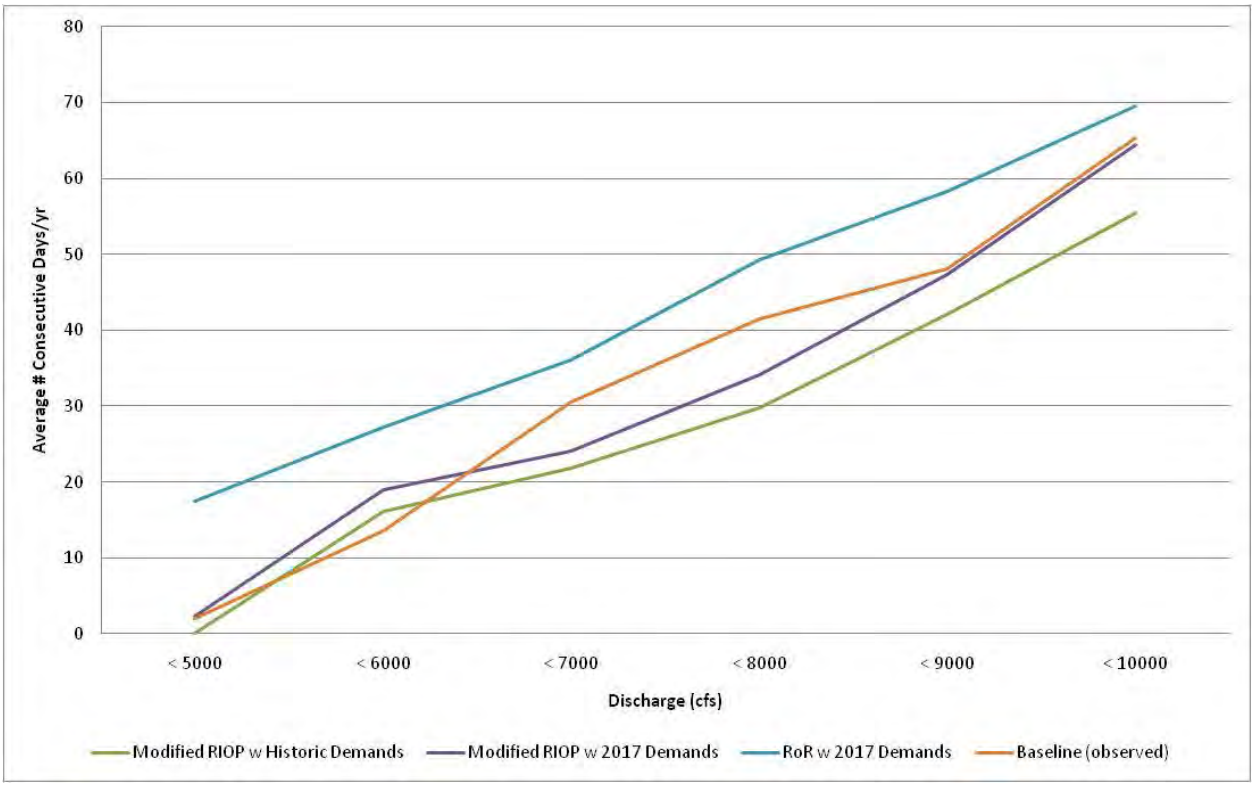


Figure 10. Average number of consecutive days per year of discharge less than 5,000 to 10,000 cfs under Modified RIOP (ResSim simulated flow 1975-2008); Modified RIOP w 2017 demands (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

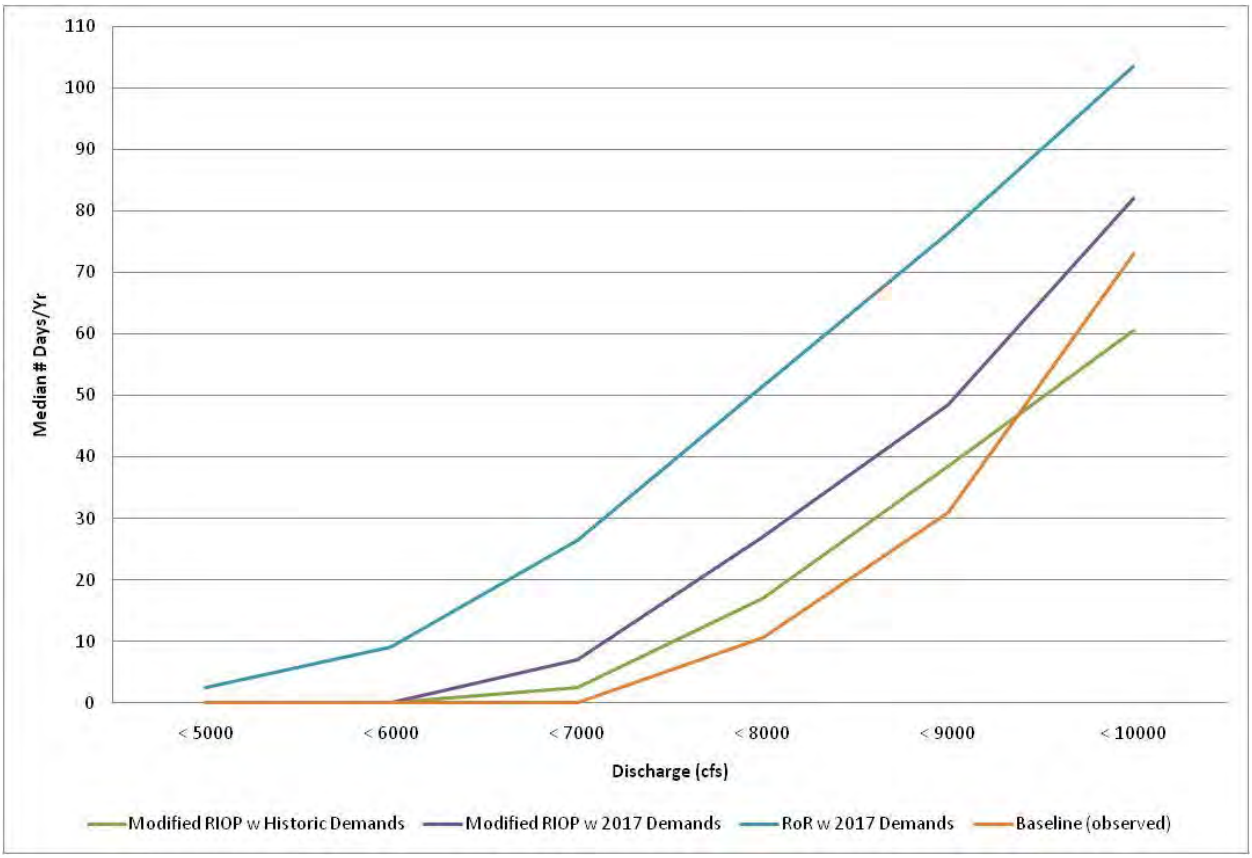


Figure 11. Median number of days per year of discharge less than 5,000 to 10,000 cfs under Modified RIOP (ResSim simulated flow 1975-2008); Modified RIOP w 2017 demands (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

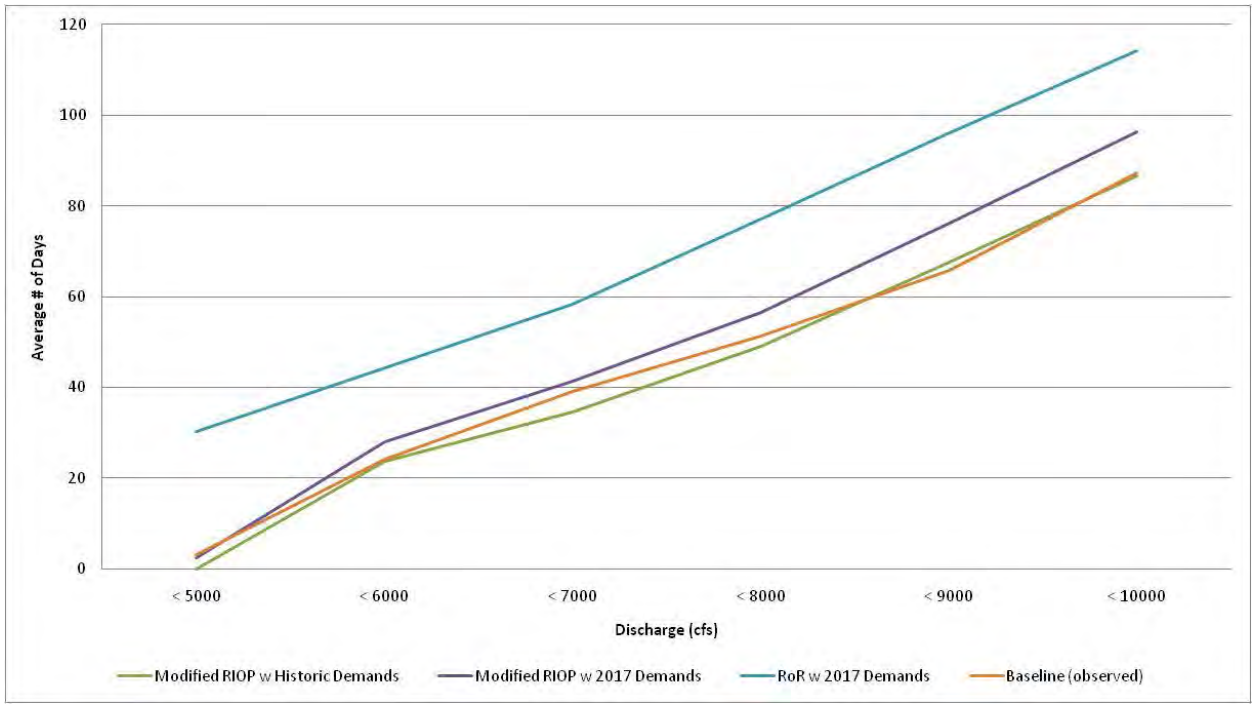


Figure 12. Average number of days per year of discharge less than 5,000 to 10,000 cfs under Modified RIOP (ResSim simulated flow 1975-2008); Modified RIOP w 2017 demands (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

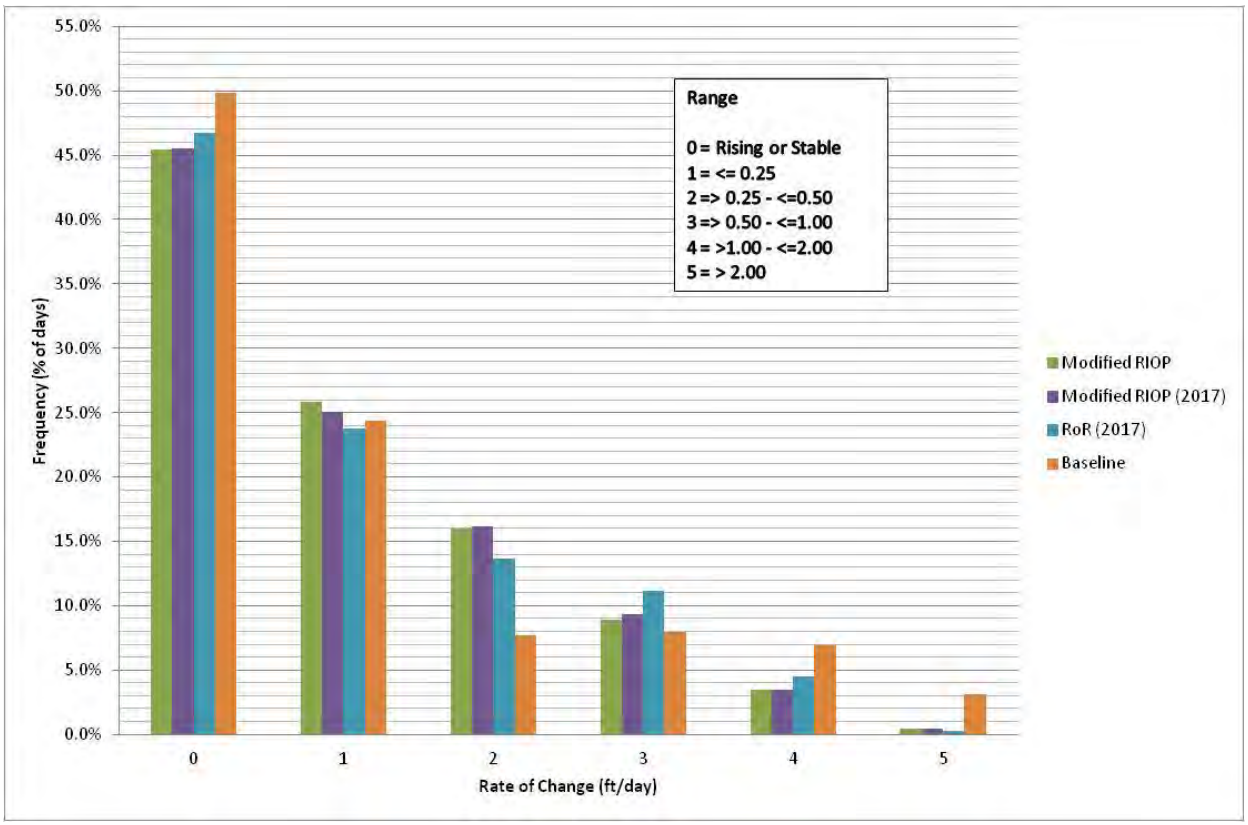


Figure 13. Frequency (percent of days) of daily stage changes (ft/day) under Modified RIOP (ResSim simulated flow 1975-2008); Modified RIOP w 2017 demands (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

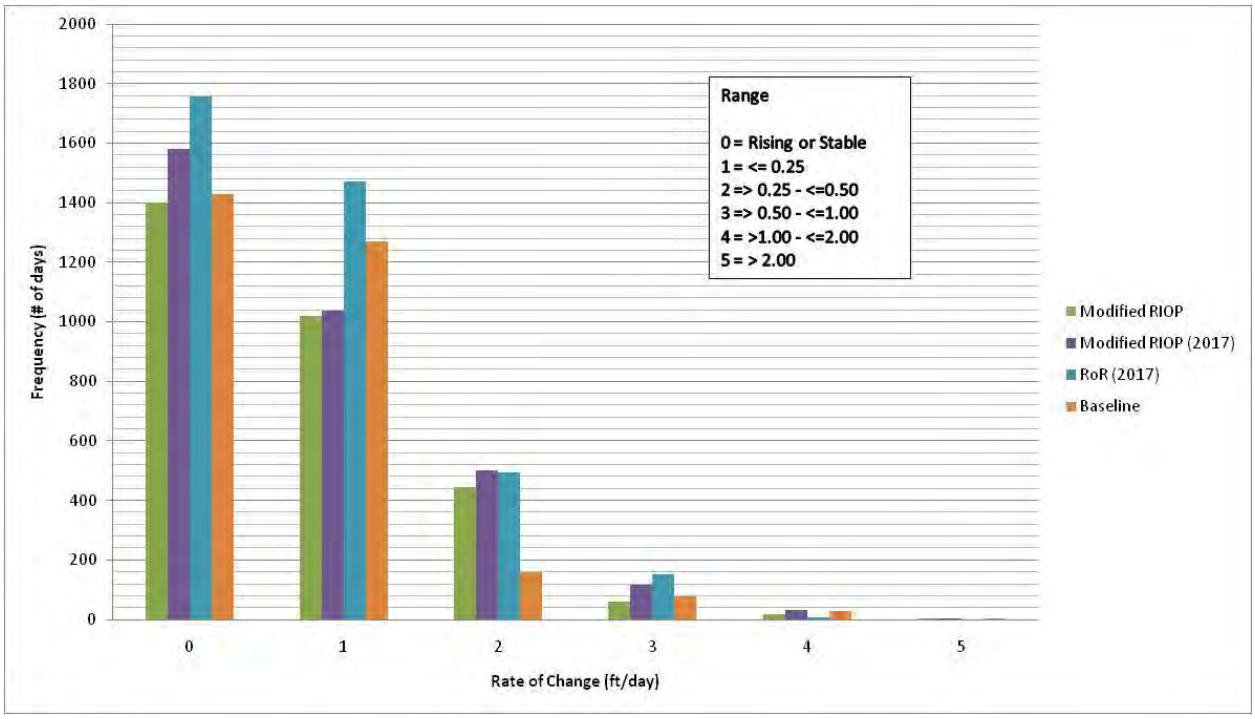


Figure 14. Frequency (number of days) of daily stage changes (ft/day) when releases from Woodruff Dam are less than 10,000 cfs under Modified RIOP (ResSim simulated flow 1975-2008); Modified RIOP w 2017 demands (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

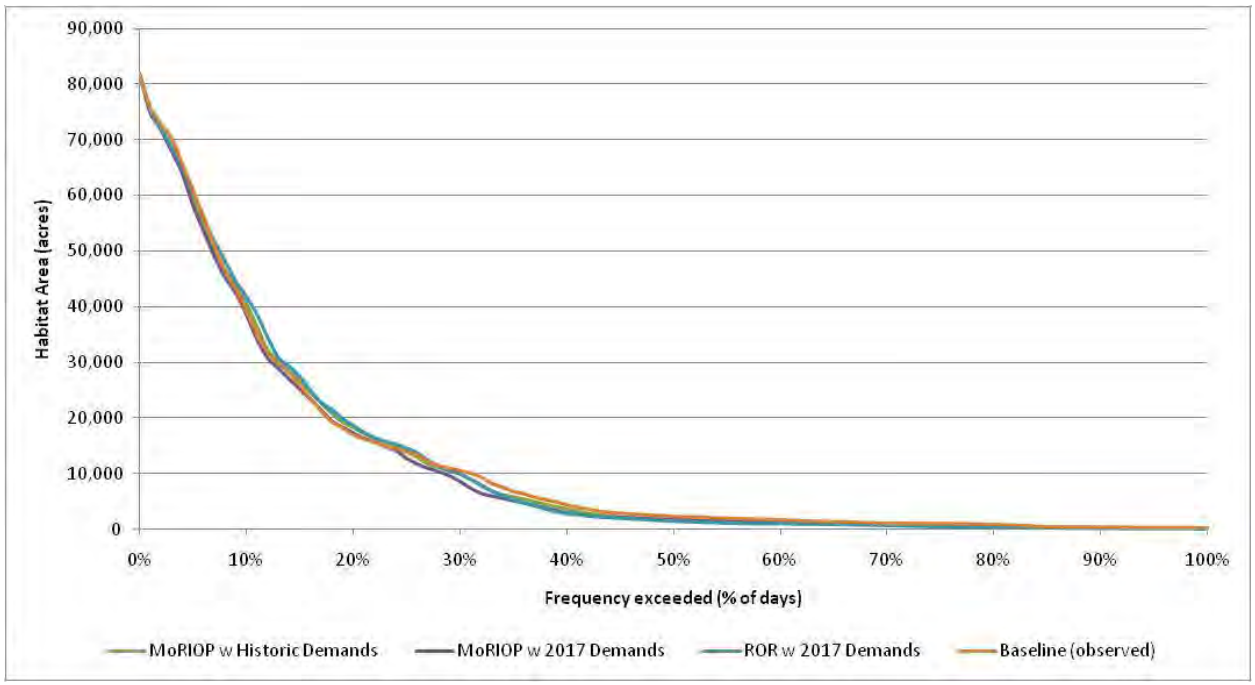


Figure 15. Frequency (percent of days) of growing-season (April-October) floodplain connectivity (acres) to the main channel under Modified RIOP (ResSim simulated flow 1975-2008); Modified RIOP w 2017 demands (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

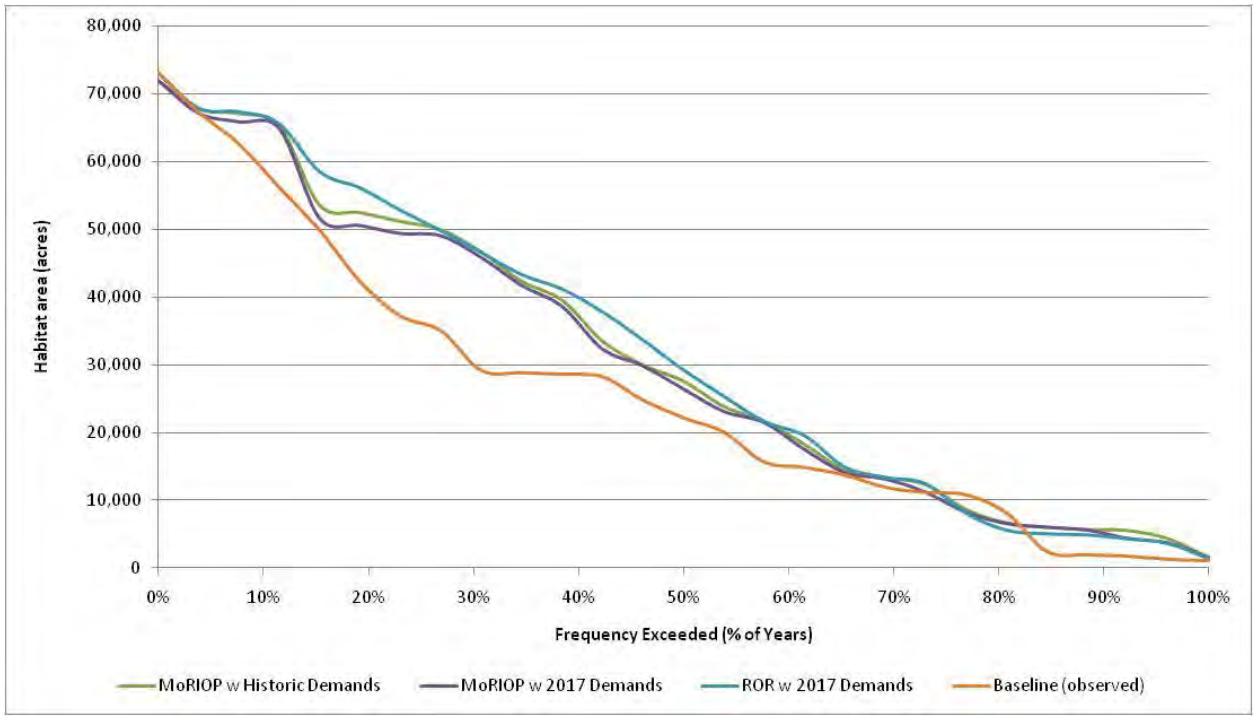


Figure 16. Inter-annual frequency (percent of years) of growing season (April-October) floodplain connectivity (maximum acres inundated for at least 30 consecutive days each year) to the main channel under Modified RIOP (ResSim simulated flow 1975-2008); Modified RIOP w 2017 demands (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

DEPARTMENT OF THE ARMY
MOBILE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 2288
MOBILE, ALABAMA 36628-0001

REPLY TO
ATTENTION OF:

December 14, 2011

Inland Environment Team
Planning and Environmental Division

Dr. Donald Imm
Field Supervisor
U.S. Fish and Wildlife Service
1601 Balboa Avenue
Panama City, Florida 32405-3721

Dear Dr. Imm:

We received the draft Biological Opinion (BO) for the reinitiated consultation for the revised interim operations plan (RIOP) at Jim Woodruff Lock and Dam on December 7, 2011. Unfortunately our subject matter experts are unavailable to thoroughly analyze the draft BO by the current December 16, 2011 deadline due to use or lose leave requirements and other conflicts. Therefore, in accordance with section 7(b)(1)(A) of the Endangered Species Act and FWS regulations at 50 CFR 402.14(e), we request an extension to the period of consultation. We believe that an additional 60 days would provide sufficient time for our subject matter experts to thoroughly review the draft Biological Opinion, provide comments, and complete the consultation.

We look forward to continued progress as we work with you and your staff to complete our respective consultation responsibilities. If you have any questions regarding our consultation or the information provided to date, please contact Mr. Brian Zettle of the Inland Environment Team, (251) 690-2115, or email: brian.a.zettle@sam.usace.army.mil.

Sincerely,

Curtis M. Flakes
Chief, Planning and Environmental
Division

FILE

United States Department of the Interior

IN REPLY REFER TO:

FISH AND WILDLIFE SERVICE
Field Office
1601 Balboa Avenue
Panama City, FL 32405-3721
Tel: (850) 769-0552
Fax: (850) 763-2177

December 15, 2011

Curtis Flakes
Chief, Planning and Environmental Division
U.S. Army Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628-0001

Dear Mr. Flakes:

This is in response to your letter of December 14, 2011, which requested an extension of the formal consultation period for the Revised Interim Operations Plan (RIOP) for Jim Woodruff Dam, per section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). The extension was requested to allow the U.S. Army Corps of Engineers (Corps) sufficient time to review the draft biological opinion. We agree it is appropriate to extend the formal consultation period for an additional 60 days from the previously agreed to date of December 24, 2011 to February 22, 2012.

We appreciate the Corps dedication to this consultation to date, and we look forward to its completion. If you have any questions or comments, please contact myself or Karen Herrington at extension 247 or 250.

Sincerely,

Dr. Donald W. Imm
Project Leader

cc:
DOI Solicitors Office, Atlanta, GA
DOJ, Washington DC
USFWS, Regional Director, Atlanta GA
USFWS, Field Supervisor, Athens, GA and Daphne, AL

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, MOBILE DISTRICT
CORPS OF ENGINEERS
P.O. BOX 2288
MOBILE, ALABAMA 36628-0001

REPLY TO
ATTENTION OF:

February 13, 2012

Dr. Donald W. Imm
Field Supervisor
U.S. Fish and Wildlife Service
1601 Balboa Avenue
Panama City, Florida 32405-3721

Dear Dr. Imm:

I am writing in response to your December 15, 2011 letter, agreeing to an extension of the formal consultation period for the Revised Interim Operations Plan (RIOP) for Jim Woodruff Dam, per Section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) from December 24, 2011 to February 22, 2012. The extension was necessary to allow the U.S. Army Corps of Engineers (Corps) sufficient time to review the draft Biological Opinion (BO) for modifications to the RIOP. As you know, the Corps' review of the draft BO resulted in additional coordination with your staff and ultimately a modification to the previously submitted proposed action and effects analysis. The effects analysis and revised action were developed in close coordination with your staff and the final version of the revised amended biological assessment is enclosed. In order to allow your staff sufficient time to review the revised amended biological assessment and incorporate the information into the BO, the Corps is requesting a 90-day extension to the formal consultation period.

If you have any questions regarding the consultation or information provided, please contact Mr. Brian Zettle, of the Inland Environment Team, (251) 690-2115 or email: brian.a.zettle@sam.usace.army.mil. We look forward to continued progress as we work with you and your staff to complete our respective consultation responsibilities.

Sincerely,

Curtis M. Flakes
Chief, Planning and Environmental
Division

REVISED AMENDED BIOLOGICAL ASSESSMENT
Modifications to the Revised Interim Operations Plan (RIOP) for Jim Woodruff Dam and the Associated Releases to the Apalachicola River

INTRODUCTION

On 1 June 2008, the U.S. Fish and Wildlife Service (FWS) released a Biological Opinion (BO) on the U.S. Army Corps of Engineers, Mobile District (Corps), Revised Interim Operations Plan (RIOP) for Jim Woodruff Dam and the associated releases to the Apalachicola River (USFWS 2008). The BO addressed the effects of Corps operations at Jim Woodruff Dam on Federally listed endangered or threatened species and critical habitat for those species. Species of concern include the threatened Gulf sturgeon (*Acipenser oxyrinchus desotoi*) and critical habitat for the Gulf sturgeon; the endangered fat threeridge mussel (*Amblema neislerii*); the threatened purple bankclimber mussel (*Elliptoideus sloatianus*); the threatened Chipola slabshell mussel (*Eliptio chipolaensis*) and critical habitat for the listed mussels. As described in the BO, the operations regarding releases to the Apalachicola River were described in a revised interim plan, since consultation on the overall project operations for the Apalachicola, Chattahoochee, Flint Rivers (ACF) system would be deferred until future efforts to update the water control plans and basin manual for the system. This Revised Amended Biological Assessment (BA) addresses effects to these same four species under a revision to the previously submitted Corps' proposed modifications to the RIOP. The effects analysis described in the Revised BA also utilizes updated HEC-ResSim modeling that reflects the changes to the proposed action, as well as, an alternative approach (more representative of actual operations) to simulating down-ramping during low flow conditions. The Corps re-initiated consultation on the RIOP in September 2010 based on new information about the distribution and mortality of endangered fat threeridge mussels in the Apalachicola River. This Revised BA is based on numerous conference calls and coordination meetings between the Corps and FWS since the re-initiation began. The revisions to the proposed action and model simulation reflected herein are specifically the product of a meeting between the U.S. Fish and Wildlife Service (USFWS) and the Corps on 13 January 2012.

DESCRIPTION OF PROPOSED ACTION

Like the current RIOP, the proposed action specifies two parameters applicable to the daily releases from Jim Woodruff Dam: a minimum discharge and a maximum fall rate. Also like the current RIOP, the proposed action places limitations on refill, but does not require a net drawdown of composite storage unless basin inflow is less than 5,000 cfs. However, the proposed action includes several modifications to the current RIOP. These modifications are generally consistent with those submitted in the previous Amended BA in December 2011. The intent of the modifications is to further minimize or avoid adverse effects on listed species as a result of Corps' discretionary operations at Jim

Woodruff Dam, while still maintaining storage opportunities and/or reductions in the demand of storage in order to provide continued support to project purposes, minimize impacts to other water users, and provide greater assurance of future sustained flows for species and other users during a severe multi-year drought. The modifications include 1) elimination of the use of volumetric balancing as described in the May 16, 2007 letter to USFWS; 2) minimum flow releases will match basin inflow when basin inflow is between 5,000 and 10,000 cubic feet per second (cfs) during the months of June through November (this provision is suspended during drought contingency operations); 3) drought contingency operations are not suspended and normal operations reinstituted until such a time as the composite conservation storage has recovered above Zone 2 into Zone 1; 4) when releases are within powerhouse capacity and less than 10,000 cfs the maximum fall rate is limited to 0.25 feet per day (ft/day) or less; and 5) in accordance with RPM 2008-4 of the RIOP BO (USFWS 2008), formal adoption of an additional Gulf sturgeon spawning season (March-May) provision which ensures that river stage declines of 8 feet or more will not occur in less than 14 days when river flows are less than 40,000 cfs (under both normal and drought operations).

The proposed action does not change the current RIOP basin inflow calculation (7-day moving average daily basin inflow), use of Chattahoochee gage (USGS number 02358000) to measure releases/river flow, limited hydropower peaking operations at Jim Woodruff Dam, nor conditions under which maintenance of the minimum release and maximum fall rate schedule are suspended and more conservative drought contingency operations begin. Like the current RIOP, the proposed action is considered an interim operations plan for Jim Woodruff Dam, pending a future update of the ACF Water Control Plan (WCP). The WCP update is currently ongoing. A detailed description of the proposed action and how it modifies the current RIOP is provided below.

Minimum Discharge: Like the current RIOP, the proposed action varies minimum discharges from Jim Woodruff Dam by basin inflow, composite conservation storage level, and by month and the releases are measured as a daily average flow in cfs at the Chattahoochee gage. Table 1 shows minimum releases from Jim Woodruff Dam prescribed by the proposed action and shows when and how much basin inflow is available for increasing reservoir storage. Except when basin inflow is less than 5,000 cfs and during some down-ramping periods, the minimum releases are not required to exceed basin inflow. The current RIOP defines basin inflow threshold levels that vary by three seasons: spawning season (March-May); non-spawning season (June-November); and winter (December-February). The current RIOP also incorporates composite conservation storage thresholds that factor into minimum release decisions. Composite conservation storage is calculated by combining the conservation storage of Lake Sidney Lanier, West Point Lake, and Walter F. George Lake. Each of the individual storage reservoirs consists of four Zones. These Zones are determined by the operational guide curve for each project. The composite conservation storage utilizes the four Zone concepts as well; i.e., Zone 1 of the composite conservation storage represents the combined conservation storage available in Zone 1 for each of the three storage reservoirs.

During the spawning season (March-May), two sets of four basin inflow thresholds and corresponding releases exist based on composite conservation storage. In accordance with RPM 2008-4 of the RIOP BO (USFWS 2008), the spawning season also includes a special fall rate provision in order to avoid take of larval Gulf sturgeon. The provision ensures that river stage declines of 8 feet or more do not occur in less than 14 days when river flows are less than 40,000 cfs. When composite conservation storage is in Zones 1 and 2, a less conservative operation is in place. When composite conservation storage is in Zone 3, a more conservative operation is in place while still avoiding or minimizing impacts to listed species and critical habitat in the river. When composite conservation storage falls below the bottom of Zone 3 into Zone 4 the drought contingency operations are "triggered" representing the most conservative operational plan. The spawning season fall rate provision is in place under normal and drought operations. A detailed description of the drought contingency operations is provided below. During the spawning season, a daily monitoring plan that tracks composite storage will be implemented in order to determine water management operations. Recent climatic and hydrological conditions experienced and meteorological forecasts will be used in addition to the composite conservation storage values when determining the appropriate basin inflow thresholds to utilize in the upcoming days.

Like the current RIOP, during the non-spawning season (June-November), one set of four basin inflow thresholds and corresponding releases exists based on composite conservation storage in Zones 1-3. However, the proposed action modifies the current RIOP basin inflow and minimum release provisions while operating in these composite conservation zones. The proposed action modifies the RIOP by further limiting storage opportunities when basin inflow is between 5,000 and 10,000 cfs. This change also requires slight adjustments to the basin inflow levels and minimum release provisions at basin inflows greater than 10,000 cfs. Table 1 reflects the proposed action with the modifications to the current RIOP. When composite conservation storage falls below the bottom of Zone 3 into Zone 4 the drought contingency operations are "triggered".

Like the current RIOP, during the winter season (December-February), there is only one basin inflow threshold and corresponding minimum release (5,000 cfs) while in composite conservation storage Zones 1-3. There are no basin inflow storage restrictions as long as this minimum flow is met under these conditions. When composite storage falls below the bottom of Zone 3 into Zone 4 the drought contingency operations are "triggered". It should be noted that the previous Amended BA included a modification during the winter season that limited storage opportunities when basin inflow is between 5,000 and 10,000 cfs and included a minimum flow release provision to match the basin inflow in this range. This previously proposed modification was removed based on additional analysis and discussions with the USFWS which resulted in the Corps' determination that the provision had little, if any, effect on minimizing or avoiding adverse effects to listed species. Given that this objective was not met, the Corps believes that maintaining operational flexibility to maximize storage opportunities during the winter season and potentially increase the amount of storage available for other authorized project purposes and augmenting releases above basin inflow during drought conditions is the prudent water management action.

Like the current RIOP, the flow rates included in Table 1 prescribe minimum, and not target, releases for Jim Woodruff Dam. During a given month and basin inflow rate, releases greater than the Table 1 minimum releases may occur consistent with the maximum fall rate schedule, described below, or as needed to achieve other project purposes, such as hydropower or flood control.

Maximum Fall Rate: Fall rate, also called down-ramping rate, is the vertical drop in river stage (water surface elevation) that occurs over a given period. The fall rates are expressed in units of ft/day, and are measured at the Chattahoochee gage as the difference between the daily average river stage of consecutive calendar days. Rise rates (*e.g.*, today's average river stage is higher than yesterday's) are not addressed. The proposed action includes a modification to the maximum fall rate schedule (Table 2) prescribed by the current RIOP. This modification was not included in the previously submitted Amended BA. However, it was developed from and is consistent with recommendations made by the USFWS in RPM 2011-2 of the Incidental Take Statement in the December 2011 Draft Biological Opinion on the RIOP. The proposed modification consists of limiting the maximum fall rate to 0.25 ft/day or less when releases are within powerhouse capacity and less than 10,000 cfs. When releases are within powerhouse capacity and greater than 10,000 cfs, the maximum fall rate is limited to 0.25 to 0.50 ft/day. No other modifications to the current maximum fall rate schedule are proposed. Unless otherwise noted, fall rates under the drought contingency operation would be managed to match the fall rate of the 1-day basin inflow. Matching the 1-day basin inflow fall rate during drought operations facilitates quicker recovery and a faster return to normal operations.

Table 1. Proposed Action Modified RIOP Releases From Jim Woodruff Dam				
Months	**Composite Storage Zone**	**Basin Inflow (BI) (cfs)**	**Releases from JWLD (cfs)**	**Basin Inflow Available for Storage[1]**
March - May	Zones 1 and 2	>= 34,000	>= 25,000	Up to 100% BI > 25,000
		>= 16,000 and < 34,000	>= 16,000 + 50% BI > 16,000	Up to 50% BI > 16,000
		>= 5,000 and < 16,000	>= BI	None
		< 5,000	>= 5,000	None – Augment releases from storage
	Zone 3	>= 39,000	>= 25,000	Up to 100% BI > 25,000
		>= 11,000 and < 39,000	>= 11,000 + 50% BI > 11,000	Up to 50% BI > 11,000
		>= 5,000 and < 11,000	>= BI	None
		< 5,000	>= 5,000	None – Augment releases from storage
June - November	Zones 1,2, and 3	>= 22,000	>= 16,000	Up to 100% BI > 16,000
		>= 10,000 and < 22,000	>= 10,000 + 50% BI > 10,000	Up to 50% BI > 10,000
		>= 5,000 and < 10,000	>= BI	None
		< 5,000	>= 5,000	None – Augment releases from storage
December - February	Zones 1,2, and 3	>= 5,000	>= 5,000 (Store all BI > 5,000)	Up to 100% BI > 5,000
		< 5,000	>= 5,000	None – Augment releases from storage
At all times	Zone 4	NA	>= 5,000	Up to 100% BI > 5,000
At all times	Drought Zone	NA	>= 4,500[2]	Up to 100% BI > 4,500

[1] Consistent with safety requirements, flood control purposes, and equipment capabilities.

[2] Once composite storage falls below the top of the Drought Zone ramp down to 4,500 cfs will occur at a rate no greater than 0.25 ft/day drop.

Table 2. Proposed Action Modified RIOP Maximum Fall Rate Schedule Composite Storage Zones 1,2, and 3*	
Release Range (cfs)	Maximum Fall Rate (ft/day), measured at Chattahoochee gage
> 30,000**	No ramping restriction***
> 20,000 and <= 30,000*	1.0 to 2.0
Exceeds Powerhouse Capacity (~ 16,000) and <= 20,000*	0.5 to 1.0
Within Powerhouse Capacity and >= 10,000*	0.25 to 0.5
Within Powerhouse Capacity and < 10,000*	0.25 or less

*Maximum fall rate schedule is suspended in Composite Zone 4
**Consistent with safety requirements, flood control purposes, and equipment capabilities.
***For flows greater than 30,000 cfs, it is not reasonable and prudent to attempt to control down ramping rate, and no ramping rate is required.

Drought Contingency Operations: Like the current RIOP, the proposed action incorporates a drought contingency operation (referred to as drought plan). The drought plan specifies a minimum release from Jim Woodruff Dam and temporarily suspends the other minimum release and maximum fall rate provisions until composite conservation storage within the basin is replenished to a level that can support them. The minimum discharge is determined in relation to composite conservation storage and not average basin inflow under the drought plan. The drought plan is "triggered" when composite conservation storage falls below the bottom of Zone 3 into Zone 4. At that time all the composite conservation storage Zone 1-3 provisions (seasonal storage limitations, maximum fall rate schedule, and minimum flow thresholds) are suspended and management decisions are based on the provisions of the drought plan. The drought plan includes a temporary waiver from the existing water control plan to allow temporary storage above the winter pool rule curve at the Walter F. George and West Point projects if the opportunity presents itself and/or begin spring refill operations at an earlier date in order to provide additional conservation storage for future needs as well as provide for a minimum releases less than 5,000 cfs from Jim Woodruff Dam.

The drought plan prescribes two minimum releases based on composite conservation storage in Zone 4 and an additional zone referred to as the Drought Zone (Figure 1). The Drought Zone delineates a volume of water roughly equivalent to the inactive storage in lakes Lanier, West Point and Walter F. George plus Zone 4 storage in Lake Lanier. However, the Drought Zone line has been adjusted to include a smaller volume of water at the beginning and end of the calendar year. When the composite conservation storage is within Zone 4 and above the Drought Zone, the minimum release from Jim Woodruff Dam is 5,000 cfs and all basin inflow above 5,000 cfs that is capable of being stored may be stored. Once the composite conservation storage falls below the Drought Zone, the minimum release from Jim Woodruff Dam is 4,500 cfs and all basin inflow above 4,500 cfs that is capable of being stored may be stored. When transitioning from a minimum release of 5,000 to 4,500 cfs, maximum fall rates will be limited to a 0.25 ft/day drop. The 4,500 cfs minimum release is maintained until composite conservation storage returns to a level above the top of the Drought Zone, at which time the 5,000 cfs minimum release is re-instated. Under the current RIOP, the drought plan provisions remain in place until conditions improve such that the composite conservation storage reaches a level above the top of Zone 3 (i.e., within Zone 2). At that time, the temporary drought plan provisions are suspended, and all the other provisions are re-instated. During the drought contingency operations a monthly monitoring plan that tracks composite conservation storage in order to determine water management operations (the first day of each month will represent a decision point) will be implemented to determine which operational triggers are applied. In addition, recent climatic and hydrological conditions experienced and meteorological forecasts will be used when determining the set of operations to utilize in the upcoming month. The proposed action modifies the current RIOP drought plan by increasing the composite conservation storage level "trigger" for re-instating the normal operations. Under the proposed action, the drought plan provisions remain in place until conditions improve such that the composite conservation storage reaches a level above the top of Zone 2 (i.e., within Zone 1). All other provisions of the current RIOP remain unchanged under the proposed action.

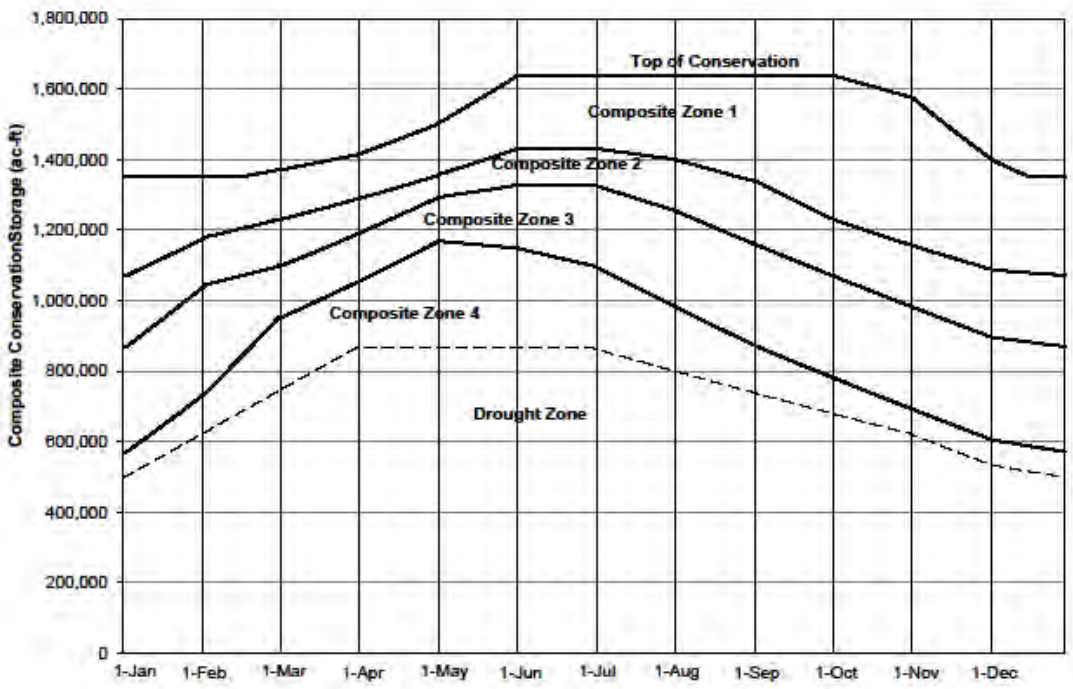


Figure 1. Proposed Action Drought Composite Conservation Storage Triggers.

ALTERNATIVES CONSIDERED

The alternatives described in the previously submitted BA, as well as, the proposed action described in the previously submitted BA describe the alternatives to this proposed action and are incorporated by reference.

STATUS OF THE SPECIES/CRITICAL HABITAT

Please refer to the STATUS OF THE SPECIES/CRITICAL HABITAT section (Section 2) of the June 1, 2008 *Biological Opinion on the U.S. Army Corps of Engineers, Mobile District, Revised Interim Operating Plan for Jim Woodruff Dam and the Associated Releases to the Apalachicola River* (USFWS 2008); and the 2010 Annual Report - January 31, 2011 (USACE 2011). The detailed information provided in Section 2 of the BO and the Annual Report (specifically the draft mussel study report) represent the best scientific information available on the listed species occurring in the action area and provided the basis for determining the flow regime characteristics identified as relevant to the listed species and their habitats during development of the RIOP and considered during development of the modifications to the RIOP. The FWS also has additional information regarding the status of the species that will be updated as part of this re-initiated consultation.

ENVIRONMENTAL BASELINE

As described in the 2008 BO, the environmental baseline is a "snapshot" of a species' health at a specified point in time. It does not include the effects of the proposed action, but rather provides an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem, within the action area. Section 3 of the BO provides a description of the environmental baseline prior to implementation of the RIOP. This detailed information represents the best scientific information available at that time regarding the listed species occurring in the action area. However, the environmental baseline for the proposed action must also consider the effects of operating under the RIOP for the past 36 months. Some of the factors contributing to the environmental baseline, such as the general description of the action area, have not changed significantly since the time the BO was written and we incorporate this information by reference to Section 3 of the BO. The FWS will update the Environmental Baseline section as part of this re-initiated consultation.

EFFECTS ANALYSIS

This section is an analysis of the effects of the proposed action on the species and critical habitat. The previous “Environmental Baseline” section described the effects of the current operations including the RIOP over the past three years. This section addresses the future direct and indirect effects of implementing the proposed action.

FACTORS CONSIDERED

In the "ENVIRONMENTAL BASELINE" section of the 2008 BO, FWS described three principal components of the species' environment in the action area: channel morphology, flow regime, and water quality. Physical habitat conditions for the listed species in the action area are largely determined by flow regime, and channel morphology sets the context for the flow regime. The FWS noted that channel morphology has changed relative to the pre-dam period in the Apalachicola River, but the rate of change has slowed and appears to have entered a somewhat dynamic equilibrium condition (USFWS 2008). We have no ability at this time to predict specific effects on channel morphology due to the influence of the proposed action on the flow regime. The proposed action relates to water management at federal projects in the ACF basin and includes limits on the extent to which the Corps alters basin inflow into the Apalachicola River via operations of the ACF dams and reservoirs; therefore, the primary focus of this analysis is the flow regime of the Apalachicola River with and without the proposed action. Consistent with the BO for the RIOP, our analysis of flow regime alteration relative to the listed species and critical habitats considers the following factors.

Proximity of the action: The proposed action may affect habitat occupied by all life stages of Gulf sturgeon in both the Apalachicola River and Bay, which are designated as critical habitat. The proposed action will also affect habitat known to be occupied by the purple bankclimber, Chipola slabshell, and fat threeridge mussels. These mussel species spend their entire lives within the action area, all of which is proposed as critical habitat for the mussels. The proposed action includes releases from Jim Woodruff Dam and affects some of the species' life history stages and habitat features from as close as immediately below the dam to more than 100 miles downstream.

Distribution: The proposed action could alter flows in the Apalachicola River and its distributaries downstream of the dam, and alter freshwater inflow to Apalachicola Bay. The Gulf sturgeon may occur throughout the river and bay in suitable habitats, and occasionally in the Chipola River downstream of Dead Lake. The Action area includes most of the known range of the fat threeridge, about one third of the range of the purple bankclimber, and a small fraction of the range of the Chipola slabshell. This analysis examines how the proposed action may variously affect different portions of the action area according to the distribution of the species and important habitat features in the action area.

Timing: The proposed action could alter flows in the Apalachicola River and into Apalachicola Bay at all times of the year. It will reduce flows when increasing composite conservation storage in the ACF reservoirs and increase flows when decreasing composite conservation storage. Gulf sturgeon occupy the Apalachicola River year-round as larval and juvenile fish, and then seasonally as subadults and adults, spawning in the Apalachicola River around May. Subadults and adult Gulf sturgeon likewise occupy Apalachicola Bay seasonally, during the coldest months of the year. The three mussel species occupy the action area year-round and during all life phases. The fat threeridge, a species that tends to occupy shallower waters, may be more susceptible to effects of low

flows during the breeding period, in late spring/early summer. Consistent with the 2008 BO, we examine how the proposed action may alter the seasonal timing of biologically relevant flow regime features in our analysis.

Nature of the effect: The proposed action will reduce flows in the Apalachicola River when increasing composite storage in the ACF reservoirs and increase flows when decreasing composite reservoir storage. Two of the Gulf sturgeon primary constituent elements of designated critical habitat may be affected by the actions: flow regime and water quality. Permanently flowing water and water quality are also two of five primary constituent elements of designated critical habitat for the fat threeridge, purple bankclimber, and Chipola slabshell. The proposed action may also affect a third element of designated critical habitat for the mussels: host fish. Consistent with the 2008 BO, we examine how the proposed action may affect the listed species and critical habitat elements through specific analyses focused on relevant habitat features, such as spawning substrate, floodplain inundation, and vulnerability to exposure by low flows.

Duration: This proposed action is a modification to the current interim operations plan (RIOP) at Jim Woodruff Dam and the operations described under the proposed action are applicable until revised or until an updated Water Control Plan is adopted. Although the duration of the proposed action is indefinite, the nature of its effects is such that none are permanent. The Corps can alter its reservoir operations at any time; therefore, flow alterations that may result from the proposed action will not result in permanent impacts to the habitat of any of the listed species. Consistent with the 2008 BO, we examine how implementation of the proposed action may alter the duration of high flows and low flows that are relevant to the listed species and critical habitats.

Disturbance frequency: The proposed action is applicable year round; therefore, changes to the flow regime and water quality parameters may occur at any time and/or continuously until such time as the proposed action is revised or until an updated Water Control Plan is adopted. Consistent with the 2008 BO, we examine how implementation of the proposed action may alter the frequency of high flows and low flows that are relevant to the listed species and critical habitats.

Disturbance intensity and severity: The proposed action may variously affect the flow regime depending on time of year, basin inflow, and composite conservation storage levels as defined in DESCRIPTION OF PROPOSED ACTION section above. Like the current RIOP, the proposed action maintains a minimum flow of 5,000 cfs except during extreme drought events more severe than have previously occurred and maintains a minimum flow of 4,500 cfs at all times. Consistent with the 2008 BO, we examine how the proposed action affects the magnitude of flow events relative to the baseline and to no action (RIOP).

ANALYSIS FOR EFFECTS OF THE ACTION

The Effects Analysis for the proposed action is generally consistent with that of the 2008 BO, with the exception of using the HEC-ResSim Model to simulate flow operations in

the ACF Basin rather than the HEC-5 model used in 2008 and changes to the assumptions regarding consumptive demands. Details about the ResSim model are provided below in the MODEL DESCRIPTION section. A description of the changes to the assumptions regarding consumptive demands follows.

Consistent with the 2008 BO, we determine the future effect of project operations, as prescribed by the proposed action, by comparing the environmental conditions expected to occur under the proposed action to the environmental baseline. In the BO for the RIOP, the flow regime of the environmental baseline was described using post-1975 flow records, because this period represented the complete hydrology of the current configuration of the ACF federal reservoir projects.

In the 2008 BO the USFWS compared the flow regime expected under the RIOP to this historic flow record to identify changes in flows that were relevant to the listed species and their habitats. The 2008 RIOP simulations, evaluated in the BO, were simulated with present-level consumptive demands (year 2000) occurring in all years. To isolate the effects of the present level of consumptive water use on the flow regime from the effects of implementing the RIOP, the USFWS also examined environmental conditions that would result if project operations were not continued, *i.e.,* discontinuing Corps' reservoir operations that alter the flow regime of the river. This flow regime was termed the run-of-river (RoR) regime. RoR is the expected flow regime if the Corps maintained a constant water surface elevation on all of the ACF federal reservoirs, never diminishing basin inflow by raising reservoir levels and never augmenting basin inflow by lowering reservoir levels. RoR is the constant release of basin inflow from Woodruff Dam. By comparing all three flow regimes, Baseline (1975-2007 observed flow), RIOP, and RoR, the USFWS identified effects relative to the baseline attributable to the RIOP apart from effects attributable to an increase in depletions due to consumptive losses in the basin since 1975 (USFWS 2008). In this effects analysis the definition for RoR remains the same, but the method for computing the RoR has changed along with its ability to differentiate effects attributable to the proposed action from those attributable to an increase in depletions due to consumptive losses in the basin since 1975.

In the 2008 BO, we used the same basin inflow time series (1-day basin inflow) upon which the model based its simulation of the RIOP to represent the RoR. As described in the 2008 BO, 1-day basin inflow is the sum of local inflow for each of the Corps' ACF reservoirs on a given day and does not reflect travel time through the basin; therefore, if is a rough approximation of an actual RoR operation. During this re-initiated consultation, the FWS and the Corps agreed that an HEC-ResSim simulation of a RoR operation (instead of 1-day basin inflow) that includes the same historic consumptive demands as used for synthesizing the unimpaired flows and simulating the RIOP and proposed action would allow us to better analyze operational differences between historic and simulated operations. For this analysis, the consumptive water demands used in the models are the actual reported municipal and industrial (M&I) depletions for the period of 1980-2008 and the estimated agricultural water use. Consumptive water-use values prior to 1980 were hindcasted based on census population data. The method for estimating agricultural water use which varied by month and by year (wet, normal, dry) is

consistent with the method utilized during the development of the RIOP and the effects analysis in the 2008 BO. However, the use of actual reported M&I depletions is an update to the previous method which applied an estimate of the highest demand year (2000) to the period of record simulation.

It was mutually agreed that this updated method for simulating the no action, proposed action, and RoR provides a more useful comparison to the baseline (observed) condition as these simulations more accurately reflect the influences of reservoir evaporative losses, inter-basin water transfers, and consumptive water uses, such as municipal/industrial water supply and agricultural irrigation that also influenced the observed Apalachicola River flows during the period of record. Therefore, the difference between the various flow regimes is the net effect of continued operation under each scenario including the effect of influences that are unrelated to project operations (hydrology, evaporation, land use and climate change). Additionally, there are occasional discretionary operational decisions such as water control plan deviations approved by the Division Commander, powerhouse and lockage outages, scheduled maintenance, special navigation releases and congressional requests that are not reflected in the model. By taking this approach, the RoR flow regime no longer differentiates whether an effect (either beneficial or adverse) is attributable to the Corps discretionary operations as it includes the same assumptions regarding reservoir evaporative losses, inter-basin water transfers, and consumptive water uses. It does still provide a useful frame of reference since the RoR simulation represents a flow regime with no Corps discretionary operations (i.e., Corps reservoirs maintain a constant water surface elevation during the period, such that the reservoirs only release the net inflow into the dam). The RoR is not the natural flow of the basin at the site of Jim Woodruff Dam, because it reflects the influences of reservoir evaporative losses, inter-basin water transfers, and consumptive water uses.

As described above, the principal factor examined in determining effects for the proposed action is the flow regime of the Apalachicola River and how the flow regime affects habitat conditions for the listed species. Differences between the Baseline, RIOP, and proposed action simulated flow regimes are generally attributable to the Corps discretionary operations. However, we recognize that the differences in the observed and simulated flows are also influenced by the nature of the ResSim tool and the assumptions it includes. The most relevant assumptions include those for consumptive water use. If the reported M&I depletions are not accurate, and the estimates for agricultural water use and reservoir evaporation differ significantly from the actual historic values, then the simulated river flows would be influenced accordingly. Regardless, the ResSim model is the best available tool for simulating reservoir and river conditions under variable operational sets. At this time we cannot differentiate between flow differences attributable to Corps discretionary operations and those attributable to potential inaccuracies in the model assumptions and thus we conservatively attribute all the differences to the RIOP operations. Consistent with the 2008 BO, if the proposed action does not alter the Baseline, its effect on the species/habitat is a continuation of the Baseline effect, if any. If the proposed action condition represents a beneficial or adverse alteration of the Baseline condition, the effect is accordingly beneficial or adverse.

MODEL DESCRIPTION

The HEC-ResSim model was used to simulate flow operations in the ACF Basin. HEC-ResSim is a state-of-the-art tool for simulating flow operations in managed systems. It was developed by the Corps' Hydrologic Engineering Center (HEC) to aid engineers and planners performing water resources studies in predicting the behavior of reservoirs and to help reservoir operators plan releases in real time during day-to-day and emergency operations. This effects analysis used HEC-ResSim Version 3.1 "Release Candidate 3, Build 42" (USACE, 2010a). The label "Release Candidate" means that the software is undergoing final testing before distribution as an official version.

HEC-ResSim has a graphical user interface designed to follow Windows® software development standards. The model's interface can be learned without extensive tutorials. Familiar data entry features make model development easy, and localized mini plots graph the data entered in most tables so that errors can be seen and corrected quickly. A variety of default plots and reports, along with tools to create customized plots and reports, facilitate output analysis.

HEC-ResSim provides a realistic view of the physical river/reservoir system using a map-based schematic. The program's user interface allows the user to draw the network schematic as a stick figure or as an overlay on one or more geo-referenced maps of the watershed. HEC-ResSim represents a system of reservoirs as a network composed of four types of physical elements: junctions, routing reaches, diversions, and reservoirs. By combining those elements, the HEC-ResSim modeler is able to build a network capable of representing anything from a single reservoir on a single stream to a highly developed and interconnected system like that of the ACF Basin. A reservoir is the most complex element of the reservoir network and is composed of a pool and a dam. HEC-ResSim assumes that the pool is level (i.e., it has no routing behavior), and its hydraulic behavior is completely defined by an elevation-storage-area table. The real complexity of HEC-ResSim's reservoir network begins with the dam.

Most reservoirs are constructed for one or more of the following purposes: flood risk management, power generation, navigation, water supply, recreation, and environmental quality. Those purposes typically define the goals and constraints that describe the reservoir's release objectives. Other factors that might influence the objectives include time of year, hydrologic conditions, water temperature, current pool elevation (or zone), and simultaneous operations by other reservoirs in a system. HEC-ResSim uses an original rule-based description of the operational goals and constraints that reservoir operators must consider when making release decisions.

To provide a potential range of flows that might be experienced while the proposed action scenarios are in effect, the ResSim model simulates river flow and reservoir levels using a daily time series of unimpaired flow data as input for a certain period of record. Whereas basin inflow is computed to remove the effects of reservoir operations from observed flow, unimpaired flow is developed to remove the effects of both reservoir operations and consumptive demands from observed flow. The ResSim model imposes

reservoir operations and consumptive demands onto the unimpaired flow time series to simulate flows and levels under those operations and demands. The unimpaired flow data set is the product of the Tri-State Comprehensive Study, in which the States of Alabama, Florida, and Georgia, participated.

The current unimpaired flow data set represents the years 1939 to 2008. The Corps has not yet computed unimpaired flow for 2009-current day. Unimpaired flow computations require actual water use data from the three States and 2008 is the most recent year of this data provided to the Corps. For purposes of evaluating the proposed action, a 70-year unimpaired flow hydrologic period of record (1939 through 2008) was used to run the simulations. However, for the purposes of this effects analysis, we focus on the data from 1975-2008, because this period represents the complete hydrology of the current physical configuration of the ACF federal and private reservoir projects with an unimpaired flow computation.

MODEL SIMULATIONS

The Corps has simulated the 1975 – 2008 ACF project operations under the RIOP, proposed action, and RoR using the HEC-ResSim hydrologic simulation software. As described above, the RoR simulation represents flow conditions without the influence of Corps project operations.

To ensure comparisons that are most likely to reveal anthropogenic differences between the sets of environmental conditions (RIOP, Proposed Action, RoR, and Baseline) and not hydrologic differences between years, we use the output from the ResSim models for the period that is also represented in the baseline, which is 1975 to 2008 (34 years). Using only the latter 34 years of the ResSim results removes 36 years of model results from our analysis, including a drought during the 1950's. However, the later 34 years of the simulated period appear to represent the most "critical" period for the model, as this is when reservoir levels and flows reach their lowest levels in the simulation. Further, the basin experienced below normal precipitation and basin inflow levels from 2006 through much of 2008 and record low composite conservation storage levels were recorded per calendar date in 2007 and 2008.

Throughout the re-initiated consultation the Corps has maintained that actual down-ramping operations are more conservative than those reflected in the ResSim simulation due to the limitations of the equipment and careful operations to avoid violating the maximum fall rate schedule when the most conservative fall rates are prescribed. These fall rates are associated with down-ramping events when releases are less than 10,000 cfs. Actual fall rates (based on observed data) in this range, since the maximum fall rate schedule has been in place (5 September 2006) have averaged 0.13 ft/day. The average fall rate when releases are less than 10,000 cfs during the Baseline period (1975-2008) is 0.16 ft/day. Therefore, at the request of the USFWS, the Corps simulated the proposed action and current RIOP utilizing a standard 0.13 ft/day fall rate when flows are less than 10,000 cfs. The 0.13 ft/day represents the average fall rate when Chattahoochee flows are less than 10,000 cfs during non-drought operation for the period 1975-2011. This

differs from previous model simulations which included a range of fall rate provisions in the lowest fall rate categories. The Corps is not eliminating the 0.25 ft/day fall rate provision for releases less than 10,000 cfs, described in the maximum fall rate schedule (Table 2) for the proposed action. Rather, due to the limitations of the simulation software to represent the actual conservative down-ramping operations for releases in this range, a flat fall rate that better simulates releases expected as operations are conducted in accordance with the maximum fall rate schedule has been adopted. This is consistent with previous and current simulations that establish a minimum flow slightly higher than 5,000 cfs (5,050 cfs) in the model simulation rules to better reflect actual conservative operations in place to avoid violating the 5,000 cfs minimum flow provision. The effects analysis below utilizes these new simulations for the proposed action and the current RIOP. Differences between the previously submitted current RIOP simulation and this current RIOP simulation are attributable to the revised simulation rules for the maximum fall rate schedule when flows are less than 10,000 cfs. The RoR and Baseline data sets are identical to those previously provided.

GENERAL EFFECTS ON THE FLOW REGIME

Consistent with the analysis conducted in the 2008 BO, the effects of the proposed action on the flow regime is evaluated by comparing the Apalachicola River flow frequencies for the various conditions (Proposed Action, RIOP, RoR, and Baseline).

Figure 3 displays the frequency analysis for flows that are exceeded at least 80% of the time (i.e., the lowest flows), to illustrate the low-flow differences between the various flow regimes. These low flow events represent the most severe flow conditions for the aquatic biota in the river. The RoR simulation consistently results in a higher frequency of lower flows during the driest conditions. The proposed action, RIOP, and Baseline flow regimes are all comparable with very little difference between the proposed action and RIOP. The proposed action curve crosses the Baseline curve at multiple locations, thus providing a mix of beneficial and adverse effects. The proposed action and RIOP simulations both result in one event where the 4,500 cfs minimum flow is triggered. However, the proposed action includes the added benefit of never resulting in flows less than 4,500 cfs, which occurred under the Baseline.

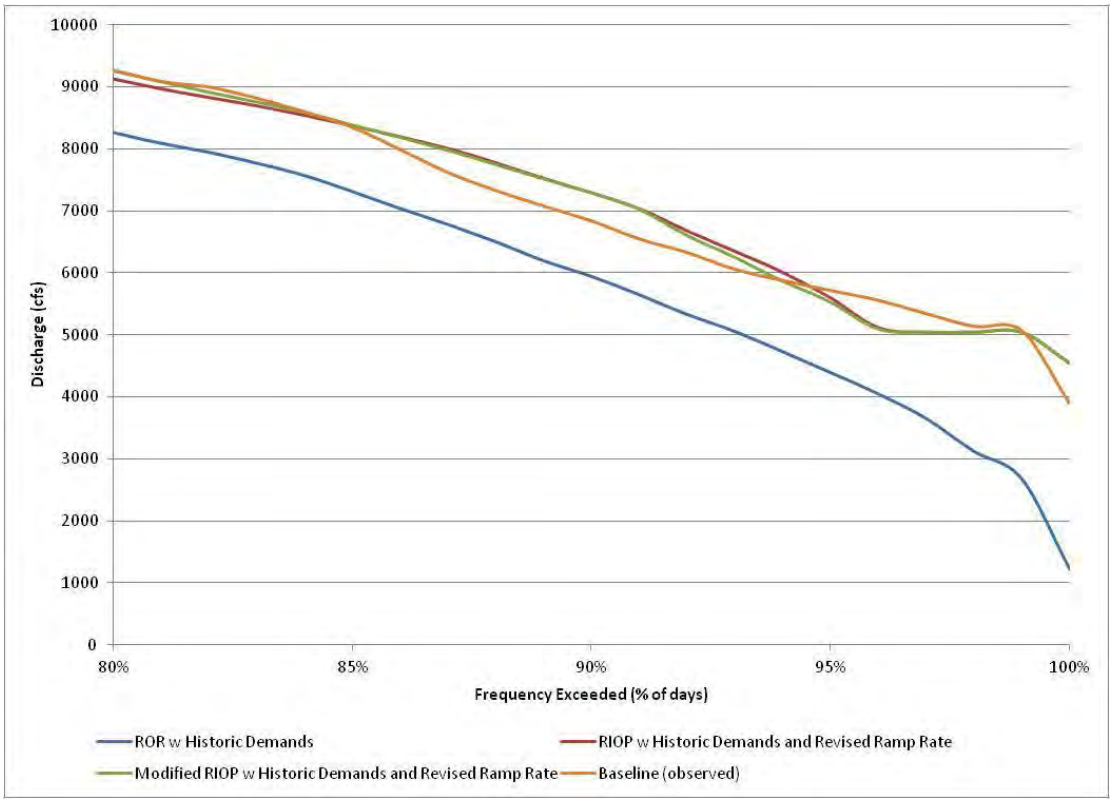


Figure 3. Observed and simulated flow frequency (% of days flow exceeded) of the Apalachicola River at the Chattahoochee gage under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

GULF STURGEON EFFECTS ANALYSIS

This section provides the effects analysis of the proposed action on flow dependent habitat characteristics relevant to Gulf sturgeon consistent with that utilized in the 2008 BO.

Submerged Hard Bottom

As described in the 2008 BO, the principal analysis for effects of the proposed action on Gulf sturgeon consists of comparing the amount of potential spawning habitat available under the various conditions. The method for calculating the amount of habitat and the frequency analysis in Figure 4 below is the same as the 2008 BO method. The four curves cross each other multiple times over the full range of 0 to a little over 20 acres of habitat, but generally provide for the same amount of habitat availability (median daily habitat availability of approximately 18 acres). Habitat availability under the proposed action scenario flow regime is nearly identical to that provided by the RIOP flow regime. The RoR flow regime generally results in slightly less habitat availability than the other three flow regimes. Given the similarities of all the flow regimes with regards to this flow-dependent habitat parameter, it appears effects (if any at all) are a continuation of the baseline condition.

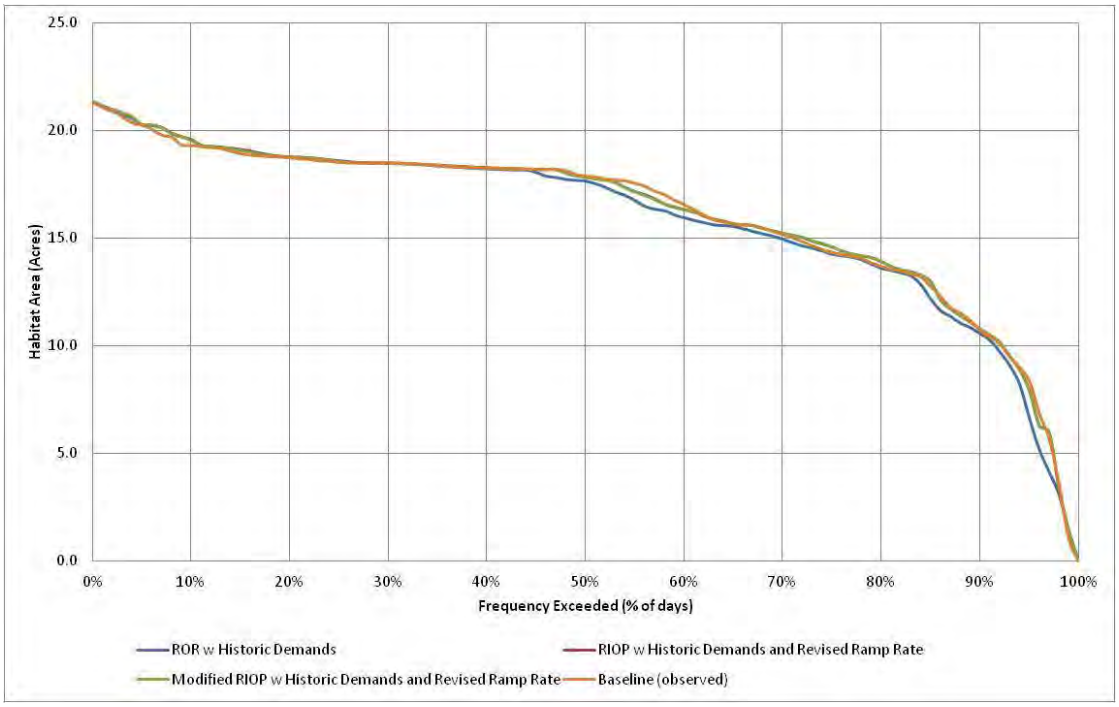


Figure 4. Frequency (% of days) of Gulf sturgeon spawning habitat availability (acres of potentially suitable spawning substrate inundated to depths of 8.5 to 17.8 feet), on each day March 1 through May 31, at the three sites known to support spawning, under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

The analysis shown in Figure 4 above, combines data from all years of each time series into a single dataset for frequency computations and does not examine differences between years or the changes in habitat availability within a year. However, as described in the 2008 BO, it is also important to determine whether the similarities in the average conditions between the proposed action and the baseline are the result of exceptionally low and high habitat availability between years or within a year. Again we use the 2008 BO method to analyze the effect of the proposed action on Gulf sturgeon spawning success by comparing the frequency (percent of years) of continuously available spawning habitat availability (maximum amount of habitat inundated to the 8.5 to 17.8 ft depth range for at least 30 consecutive days each year), March through May, under the four flow time series (Figure 5).

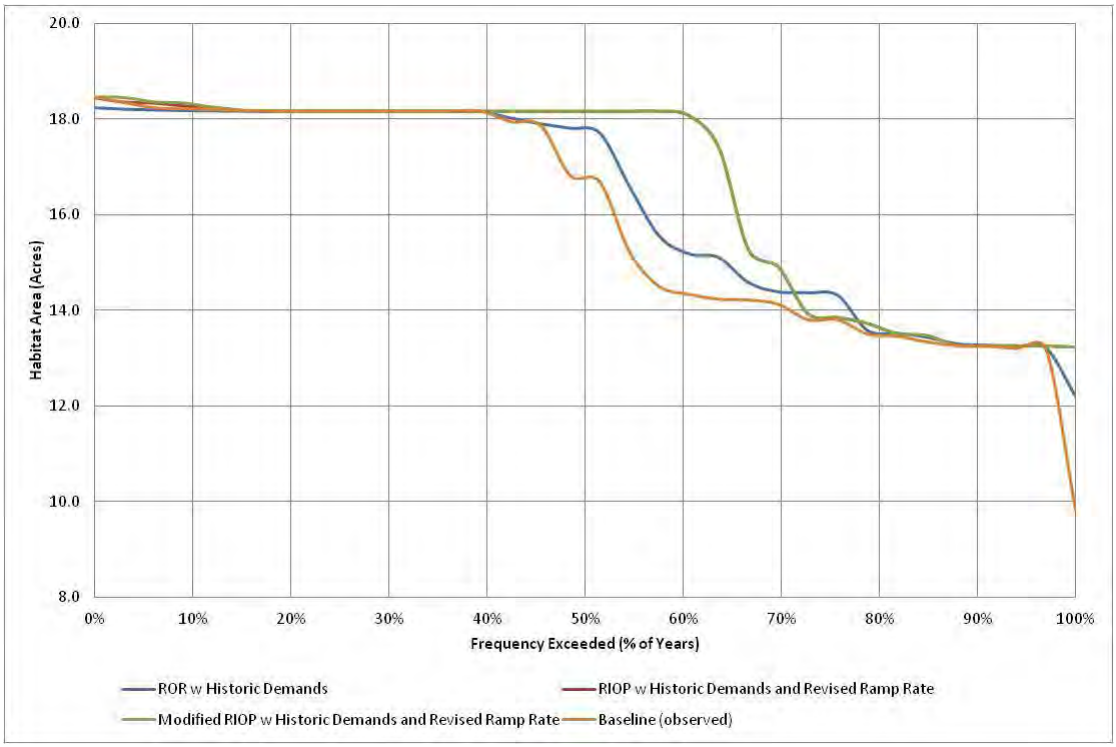


Figure 5. Frequency (% of years) of Gulf sturgeon spawning habitat availability (maximum acres of potentially suitable spawning substrate inundated to depths of 8.5 to 17.8 feet for at least 30 consecutive days each year), March 1 through May 31, at the three sites known to support spawning, under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

The habitat availability under the proposed action scenario flow regime is identical to that provided by the RIOP flow regime. The RIOP and Modified RIOP flow regimes generally provide for more 30-day continuous habitat availability than the Baseline and RoR, with median values of approximately 18.2 acres versus approximately 16.7 acres and approximately 17.7 acres respectively. All the time series provide for a minimum of about 10 acres of 30-day continuous habitat in the appropriate depth range, but the proposed action never provides less than approximately 13 acres. The RoR never provides less than approximately 12 acres. Regarding this flow-dependent habitat parameter, the proposed action continues to provide a beneficial effect to Gulf sturgeon realized by the RIOP by providing more 30-day continuous habitat in the appropriate depth range than the Baseline. This benefit may be the most biologically significant during the most extreme spring low flow events where the proposed action provides for approximately 3.5 acres more than the baseline condition.

In the 2008 BO the FWS determined that rapid declines in river stage (greater than 8 ft in a 14 day period) when flows are less 40,000 cfs may potentially result in take of Gulf sturgeon eggs and/or larvae. In accordance with RPM 2008-4 of the 2008 BO the Corps evaluated the circumstances leading to the two potential take events (one during the 2007 spawning season and the other during the 2008 spawning season) and determined that they can be avoided through minor proactive adjustments to releases from upstream

reservoirs and Jim Woodruff Dam. Like the RIOP, the proposed action includes provisions for these minor proactive adjustments and the simulated flow regimes do not include any of these potential take events.

Changes in Salinity and Invertebrate Populations in Apalachicola Bay

Very little is known about Gulf sturgeon feeding behavior and habitat selection in Apalachicola Bay. However, Gulf sturgeon studies in other systems, known life history patterns, and other studies of the role of freshwater inflow in estuarine ecology can be used to evaluate the possibility of effects of the proposed action on Gulf sturgeon in Apalachicola Bay (see discussion in the Water Quality section of the 2008 BO Environmental Baseline section).

Studies indicate that most adult and sub-adult sturgeon limit feeding almost exclusively to estuarine and marine environments upon departing the river and do not feed much, if at all, during the months of riverine residency. Juvenile Gulf sturgeon studies have also established that direct transition from fresh water into salinities greater than 30 ppt is lethal, and gradual acclimation to seawater with higher salinities (34 ppt) is required. Juvenile growth rates are highest at 9 ppt salinity (USFWS 2008).

Since Apalachicola Bay is the first estuarine habitat that both juvenile fish and older fish encounter upon departing the river, substantial alteration of flow regime features may directly relate to sturgeon and sturgeon critical habitat elements in the bay and should be minimized or avoided. Based on the analysis in the 2008 BO, adverse impacts to ecological processes in the bay critical to sturgeon can be evaluated by comparing the number of consecutive days per year that flows less than 16,000 cfs occurred for the various flow time series. Figure 6 illustrates this comparison and indicates that the proposed action is comparable to the Baseline flow regime; providing slightly lower maximum numbers of consecutive days per year less than 16,000 cfs on average. Given the similarities of the two flow regimes with regards to this flow-dependent habitat parameter, it appears effects (if any at all) are a continuation of the baseline condition.

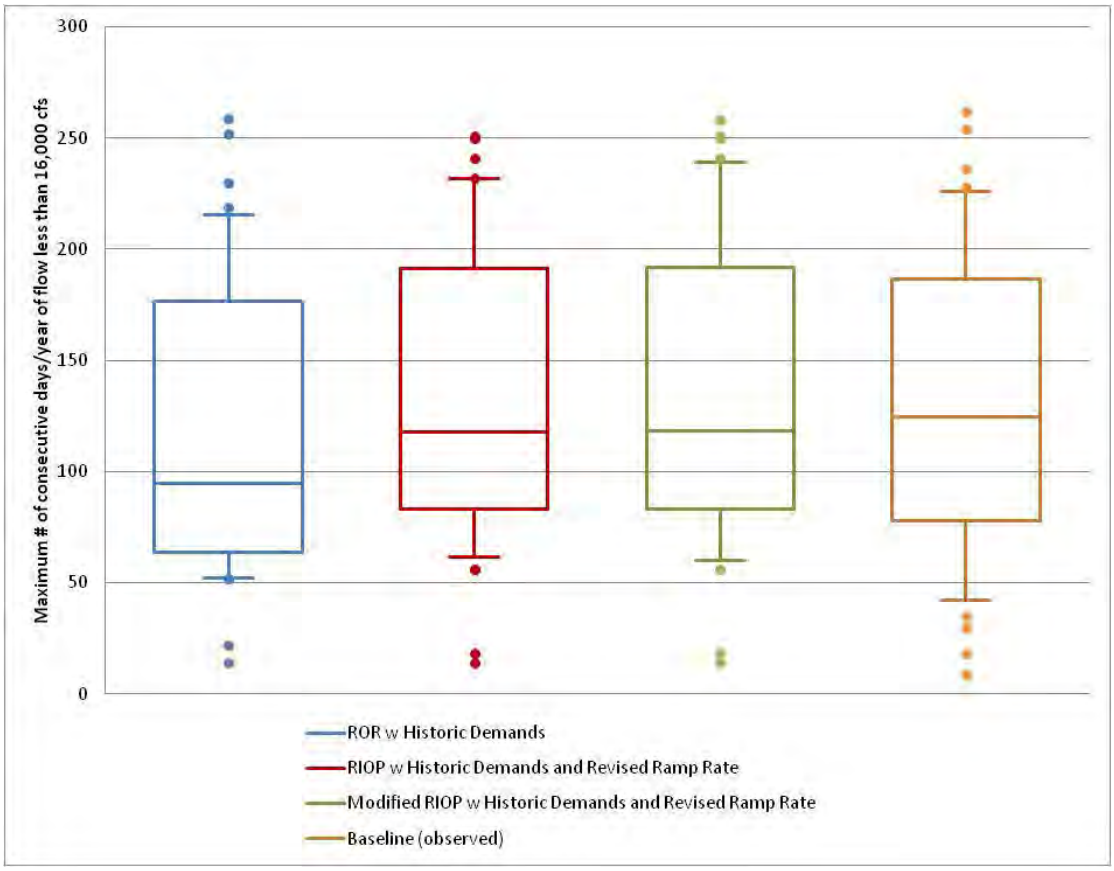


Figure 6. Maximum number of consecutive days/year of flow less than 16,000 cfs under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

Since Gulf sturgeon do not utilize the bay year-round, but rather occupy it seasonally (October through March), we also conducted this same evaluation but used only observed and simulated data from the months sturgeon are known to actively forage in the Apalachicola Bay. Since the October – March season includes data from two years; the results are presented as the maximum number of consecutive days per season of flow less than 16,000 cfs. This analysis was not conducted in the 2008 BO. Figure 7 presents the results of this analysis. Again, the RIOP and proposed action scenarios yield results consistent with those observed. However, when focusing on the months when sturgeon are known to utilize the bay, the proposed action reduces the maximum number of consecutive days with flows less than 16,000 cfs as compared to the baseline flow regime. This would be beneficial to Gulf sturgeon and their prey resources in the bay.

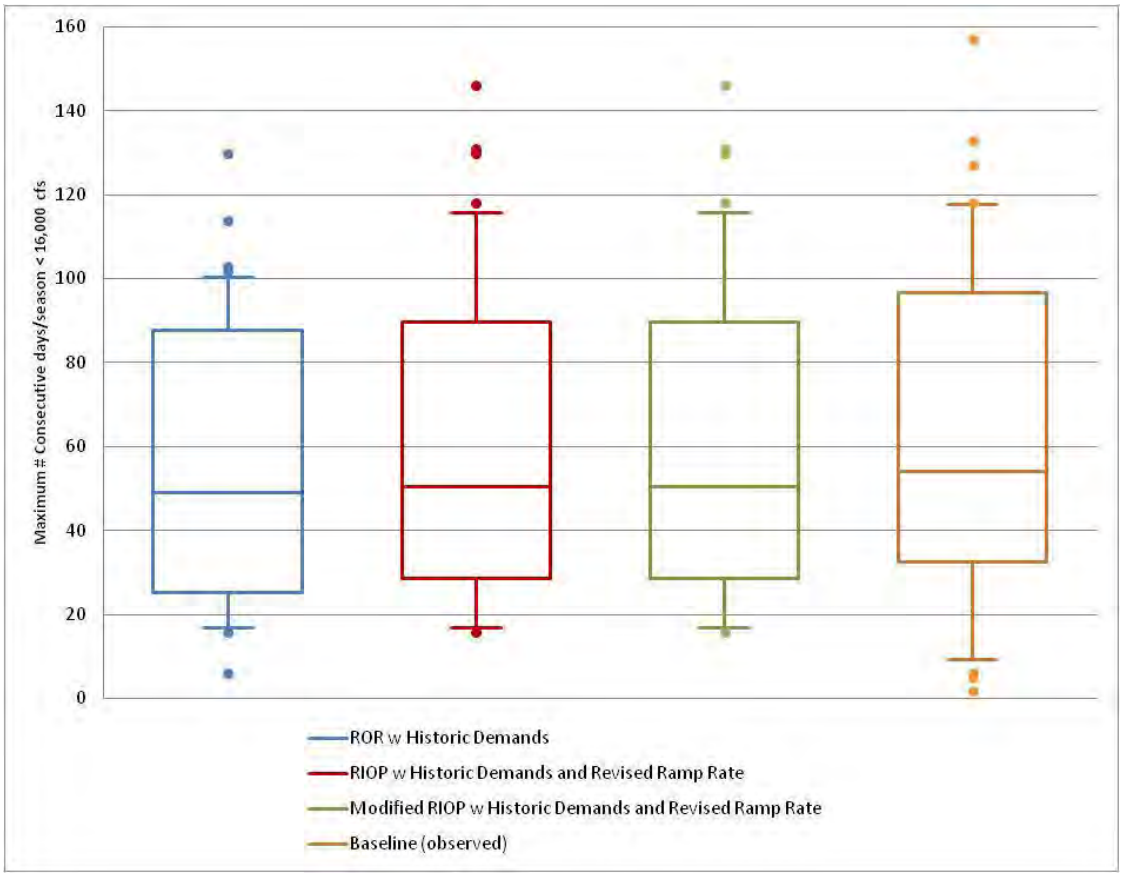


Figure 7. Maximum number of consecutive days/season of flow less than 16,000 cfs (October-March) under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

LISTED MUSSEL SPECIES EFFECTS ANALYSIS

This section focuses on direct effects to listed mussels by potential exposure during low-flow conditions. During the summer of 2006 and fall of 2010, listed mussels were found exposed and stranded at elevations up to approximately 10,000 cfs. Therefore, consistent with the 2008 BO, impacts to listed mussel species will be evaluated by analyzing the differences between the four flow regimes in the range of flow less than 10,000 cfs.

Table 4 lists the lowest daily flow each year for the RoR, RIOP, proposed action, and Baseline flow regimes. The RIOP and proposed action simulations result in quite similar annual 1-day minimum flows and each include one year (2007) with flows less than 5,000 cfs which occurs in approximately half (44%) of the years under the RoR simulation and approximately a quarter (21%) of the Baseline. However, the proposed action does result in a lower 1-day minimum flow than the Baseline in half of the years. With regards to this flow-dependent habitat parameter, the proposed action provides a mix of beneficial and adverse effects.

Year	Min of ROR w Historic Demands	Min of RIOP w Historic Demands and Revised Ramp Rate	Min of Modified RIOP w Historic Demands and Revised Ramp Rate	Min of Baseline (observed)
1975	14816	15077	15077	12400
1976	7999	9322	9322	11600
1977	6646	7964	7171	9220
1978	4485	7222	7222	8190
1979	7161	8176	8176	9590
1980	5088	6952	6952	8790
1981	3689	5146	5169	4980
1982	7107	8824	9090	11500
1983	7699	8877	8877	10800
1984	7739	8324	8324	10300
1985	5283	7088	7087	8550
1986	3099	5049	5049	4430
1987	4026	6228	6228	3900
1988	3414	5268	5398	4430
1989	7297	8482	8482	9140
1990	5211	6356	6307	5540
1991	7572	9082	9082	6580
1992	7625	8596	8915	7650
1993	4631	6258	6258	5150
1994	10275	8898	9165	7590
1995	5572	7040	7238	7130
1996	6383	7732	7827	6350
1997	4366	6076	6076	6250
1998	7094	8416	8449	8130
1999	2572	5050	5050	5280
2000	1227	5050	5050	4530
2001	2827	5050	5050	5360
2002	2362	5050	5050	5250
2003	7250	8617	9012	8050
2004	4921	7147	7147	7360
2005	5635	9228	9228	8670
2006	2988	5050	5012	5030
2007	2124	4550	4550	4760
2008	3376	5050	5050	4940
Count <5000 cfs	15	1	1	7
% of Years	44	3	3	21

Table 4. Annual 1-day Minimum Flow (cfs) of the Apalachicola River at the Chattahoochee Gage for the RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

Submerged Habitat Below 10,000 cfs

Figure 8 shows the inter-annual frequency (percent of years) of flow rates less than 5,000 to 10,000 cfs in the four flow regimes. The proposed action results in a lower occurrence of flows less than about 7,500 cfs and limits flows less than 5,000 cfs to only one year (3%). Flows less than 5,000 cfs occurred in approximately 20% of the years under the Baseline flow regime. The inter-annual frequency of flow events less than 10,000 cfs is higher in the proposed action flow regime than in the Baseline regime for the remainder of the flow categories. However, the proposed action does lower the occurrence of flows less than 8,000 – 10,000 cfs resulting from the RIOP flow regime. In this regard, the proposed action achieves the desired goal of minimizing adverse effects to listed mussel species by more closely matching the occurrence of these flows under the Baseline regime. The RIOP, proposed action, and Baseline flow regimes all generally provide for a lower inter-annual frequency of flow events less than 10,000 cfs than the RoR flow regime. With regards to this flow-dependent habitat parameter, the proposed action again provides a mix of beneficial and adverse effects as compared to the Baseline.

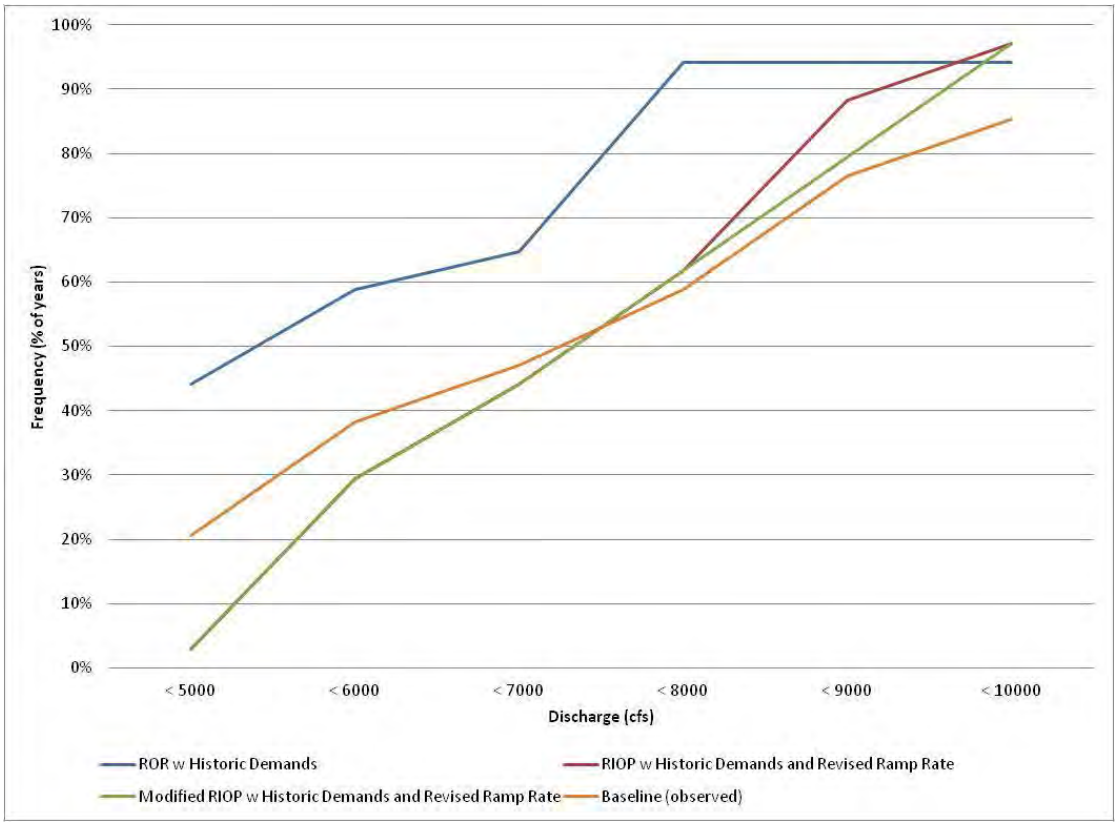


Figure 8. Inter-annual frequency (% of years) of discharge events less than 5,000 to 10,000 cfs under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

Consistent with the 2008 BO, we use the maximum number of days per year with flows less than 5,000 to 10,000 cfs as a measure of the most severe year for aquatic biota under

each flow scenario (Figure 9). The RIOP and proposed action have nearly identical results with regard to this flow-dependent habitat parameter. A mix of beneficial and adverse effects is realized. All of the flow regimes include more than 200 days during the driest year at all flow levels except the <5,000 cfs level. The maximum annual duration of flow less than 5,000 cfs is approximately 190 days and occurs in the RoR flow regime. The proposed action flow regime includes a maximum annual duration of 30 days with flows less than 5,000 cfs compared to the Baseline value of 34 days, which is a benefit to mussels. However, the proposed action flow regime includes the highest maximum annual durations of flows less than 6,000 cfs (216 days) of the four flow regimes; with an additional 10 days at flows less than 6,000 cfs over the Baseline flow regime. This represents an adverse effect to mussels with respect to this flow-dependent habitat parameter. At all of the other flow categories 7,000-10,000 cfs the proposed action flow regime provides for slightly lower maximum annual durations than the Baseline flow regime, which is a benefit to mussels. At flows in this range, the Baseline flow regime includes the highest maximum number of days per year. The RoR flow regime provides comparable values to the proposed action in this range.

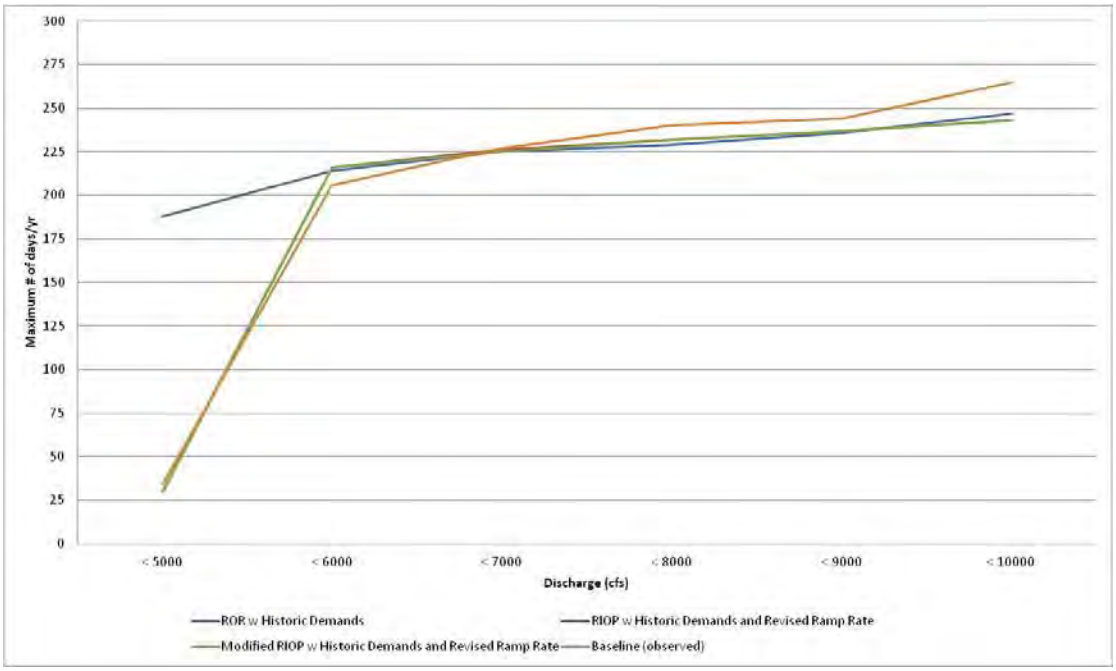


Figure 9. Maximum number of days per year of discharge less than 5,000 to 10,000 cfs under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

On multiple occasions in recent years, FWS has observed mussels surviving brief periods of exposure by closing their shells tightly or burrowing into the substrate (USFWS 2008; K. Herrington Pers. Comm. 2011). Typically, unless water temperature is extreme, the stress of exposure is most likely a function of exposure duration. Figure 10 illustrates a most-severe event analysis, consistent with the 2008 BO, by computing the maximum number of consecutive days of flow less than the 5,000 to 10,000 cfs. Again, the RIOP and proposed action have nearly identical results with regard to this flow-dependent

habitat parameter. All of the flow regimes include periods of consecutive days with flows less than 5,000 cfs. The proposed action provides for a slightly higher maximum number of consecutive days less than 5,000 cfs than the Baseline (30 and 26 days respectively). The RoR includes a maximum number of consecutive days with flows less than 5,000 cfs of 127 days. The proposed action flow regime has an adverse effect at the 6,000 cfs level, because it substantially increases the maximum number of consecutive days per year for flows at 6,000 cfs over the Baseline. For all the other flow categories the proposed action yields a lower maximum number of consecutive days than the Baseline flow regime. This is a benefit to listed mussels. The RoR shows the lowest maximum number of consecutive days per year for flows ranging from 7,000 to 10,000 cfs. However, all of the flow regimes have an extreme effect on mussels at the 6,000 cfs level and greater, because it is unlikely that mussels would survive an exposure under even the best of the flow regimes, the Baseline, with 104 consecutive days.

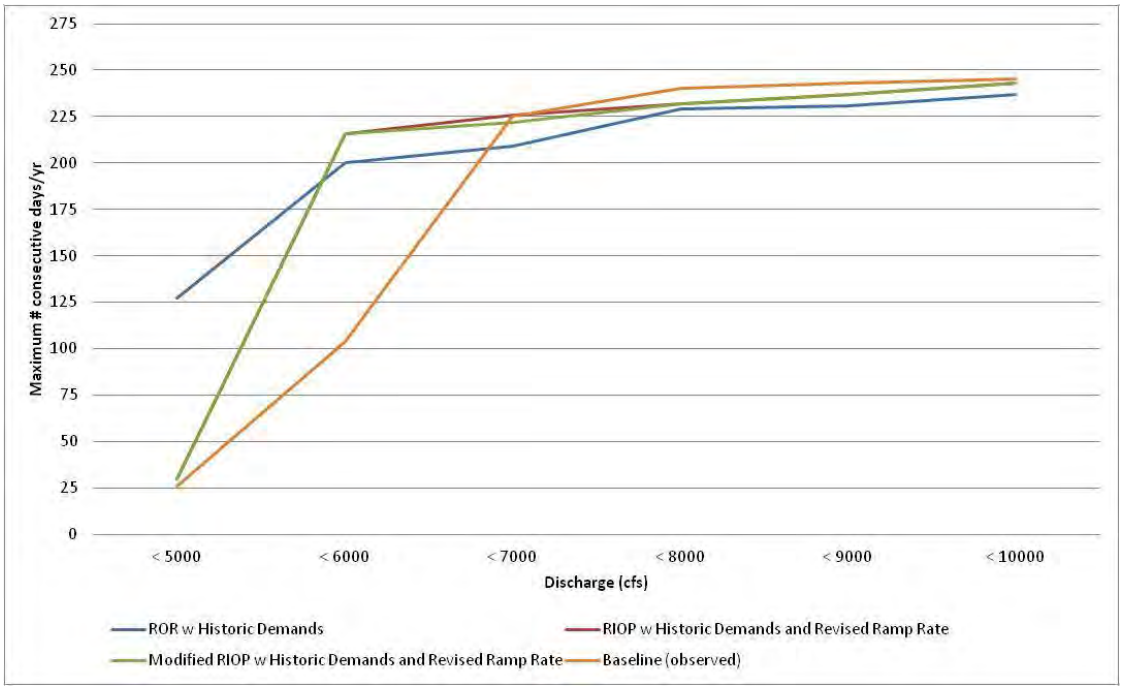


Figure 10. Maximum number of consecutive days per year of discharge less than 5,000 to 10,000 cfs under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

Since the maximum number of consecutive days per year of discharge less than 5,000 to 10,000 cfs analysis only focused on the most-severe event and included extensive durations of low flows for all the flow regimes at the 6,000 cfs level and greater, we decided it would be advantageous to analyze the less severe, but more frequent exposure events, to determine if the proposed action was comparable or improved upon the Baseline condition. This analysis was not conducted in the 2008 BO and consisted of computing the median number of consecutive days of flow less than the 5,000 to 10,000 cfs. Figure 11 displays the results of this analysis. Unlike the maximum number of consecutive days analysis above, the RoR simulation resulted in the most severe potential exposure events. However, all of the flow regimes resulted in event durations short

enough to potentially allow mussels to survive exposure by closing their shells tightly or burrowing into the substrate (less than approximately 40 days). The RIOP, proposed action, and Baseline flow regimes provide for the greatest likelihood of this occurring by significantly lowering the median number of consecutive days of flows at all levels compared to the RoR. The RIOP, proposed action, and Baseline flow regimes are identical at flow categories including less than 7,000 cfs and lower. The RIOP and proposed action result in slightly lower median number of consecutive days than the Baseline for the less than 8,000 cfs flow category.

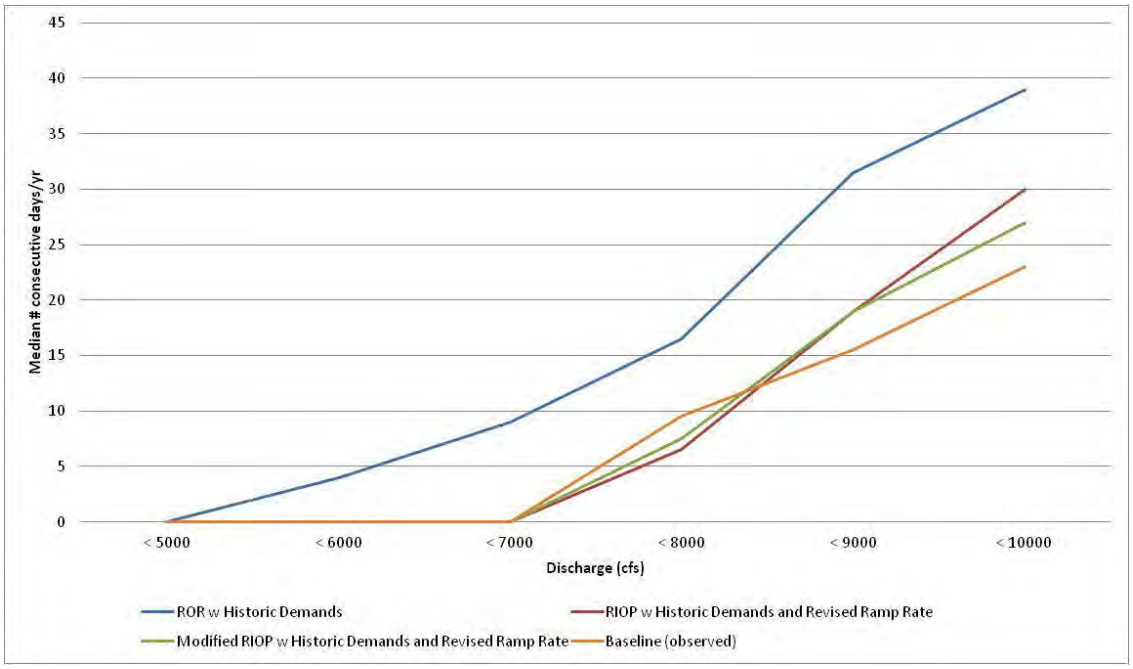


Figure 11. Median number of consecutive days per year of discharge less than 5,000 to 10,000 cfs under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

The proposed action results in a higher median number of consecutive days per year than the Baseline for the flow categories of less than 9,000 and 10,000 cfs. Like the current RIOP, the proposed action has a lower value at the less than 8,000 cfs category, but the proposed action results in a higher median number of consecutive days per year than the RIOP when flows are approximately 7,000 cfs - 9,000 cfs. Although both the RIOP and proposed action flow regimes result in a mix of adverse and beneficial effects to listed mussels, this shift represents a slightly more adverse effect than occurs under the current operations. At flow levels greater than approximately 9,000 cfs the proposed action results in a lower median number of days per year than the RIOP flow regime, which was the intent of the proposed modifications to the RIOP. In order to evaluate whether the adverse effects realized under the proposed action are a reflection of how the median values are calculated or are truly a more adverse effect than the RIOP, we also analyzed the average number of consecutive days per year of discharge less than 5,000 to 10,000 cfs under the various flow regimes. Figure 12 displays the results of this analysis. As suspected, the average number of consecutive days per year of discharge less than 5,000

to 10,000 cfs for the proposed action and RIOP are essentially the same for all the flow categories. This analysis also shows that the proposed action generally provides a comparable or lower average number of consecutive days per year across all the flow categories as compared to the Baseline. Therefore, with regards to this flow-dependent variable, the proposed action likely provides a beneficial effect to the listed mussel species.

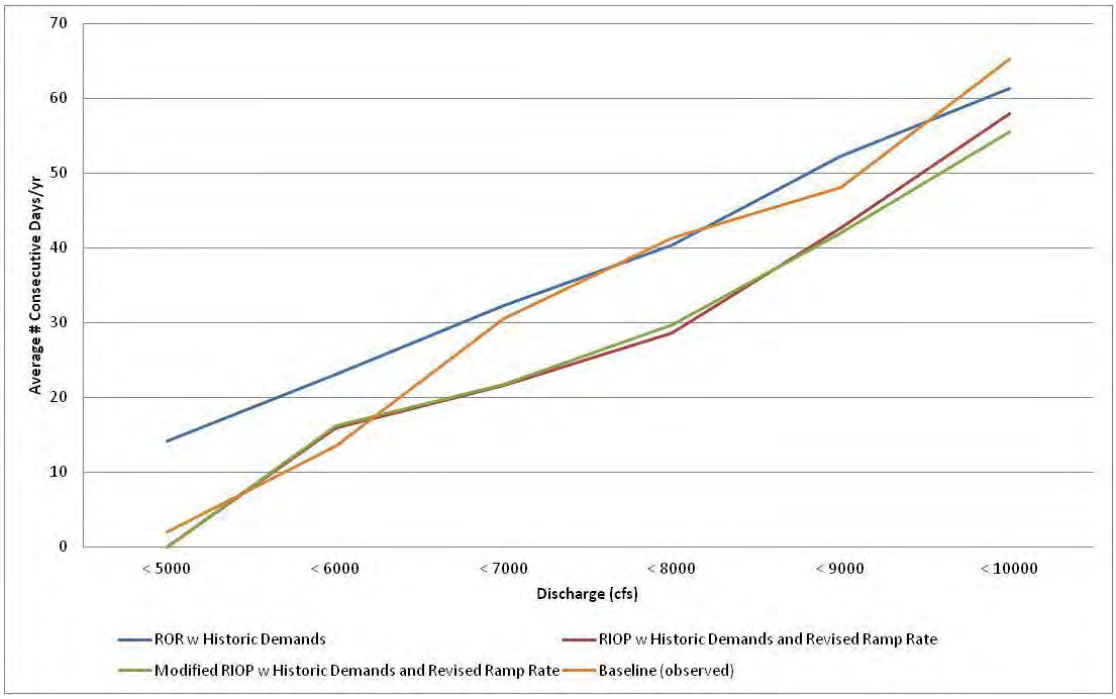


Figure 12. Average number of consecutive days per year of discharge less than 5,000 to 10,000 cfs under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

In the 2008 BO, the FWS determined that "Because moderately low flows, not just the most extreme events, constrict aquatic habitat availability and are generally stressful to mussels and other aquatic biota, it is appropriate to also consider the more common low-flow condition, *i.e.*, the magnitude and duration of low flows that occur in half the years of the flow regime. If the common low-flow conditions become even more common or more severe, it would reduce the amount of habitat available to mussels and would increase their vulnerability to exposure-related mortality, including increased predation by terrestrial predators" (USFWS 2008). Consistent with the 2008 BO, Figure 13 displays the median number of days per year less than the thresholds of 5,000 to 10,000 cfs. The RoR flow regime results in a more common low flow condition at all flows below 10,000 cfs than either the proposed action or the Baseline. The proposed action results in a higher median number of days per year for flows between 7,000 cfs and about 9,500 cfs than the Baseline. At flow levels greater than approximately 9,500 cfs the proposed action results in a lower median number of days per year than the Baseline and RIOP flow regimes, which was the intent of the proposed modifications to the RIOP. However, the proposed action also results in a slightly higher median number of days per

year for flows between 7,000 cfs and about 8,500 cfs than the RIOP flow regime. Although both the RIOP and proposed action flow regimes result in an adverse effect to listed mussels at these flow levels, this represents a slightly more adverse effect than occurs under the current operations.

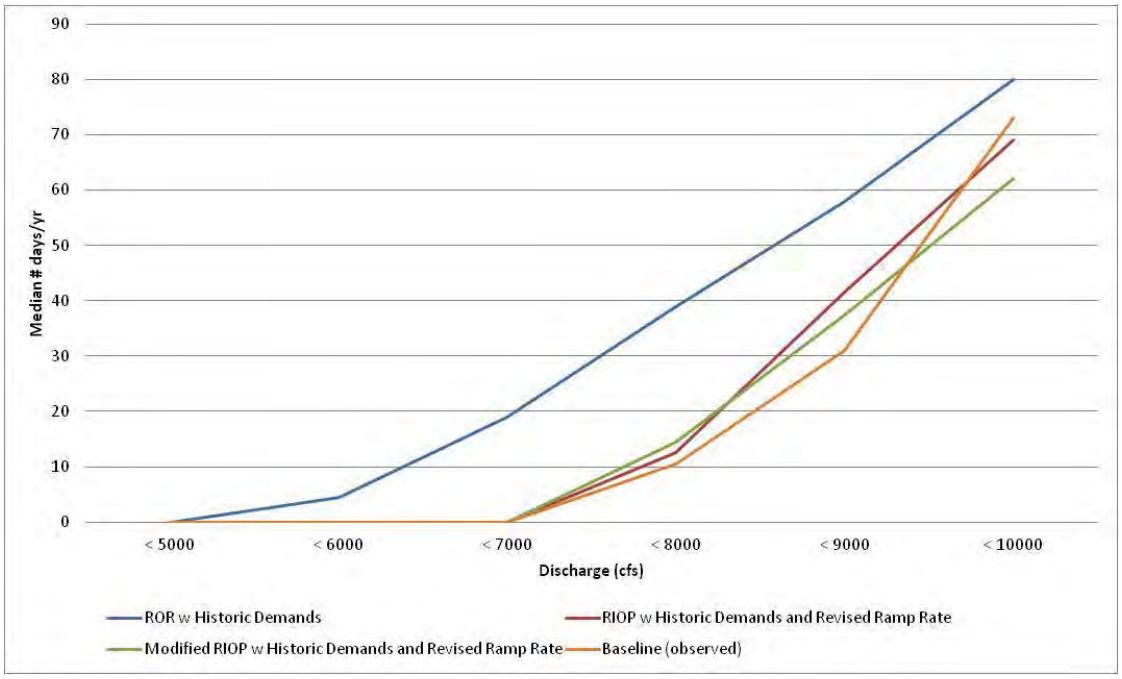


Figure 13. Median number of days per year of discharge less than 5,000 to 10,000 cfs under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

This is similar to what we observed when analyzing the median number of consecutive days per year of flow for the various flow categories. Therefore, we once again analyzed the average values in addition to the median values in order to determine whether this phenomenon was a reflection of how the median values are calculated or truly a more adverse effect with regards to the number of days per year of discharge less than 5,000 to 10,000 cfs under the various flow regimes. Figure 14 displays the results of this analysis. As suspected, the average number of days per year of discharge less than 5,000 to 10,000 cfs for the proposed action and RIOP are essentially the same. The proposed action generally provides a lower average number of days per year of discharge less than 5,000 cfs to approximately 8,500 cfs than the Baseline and nearly mirrors the Baseline values for discharge levels greater than 8,500 cfs. The RIOP flow regime results in a slightly higher average number of days per year than the proposed action and Baseline at flows greater than approximately 8,500 cfs. This is not surprising since the RIOP includes provisions to store some of the basin inflow between 8,000 and 10,000 cfs, which is eliminated under the proposed action. As intended, the proposed action more closely matches the Baseline conditions in this range. With regards to this flow-dependent variable, the proposed action likely provides a beneficial effect to the listed mussel species.

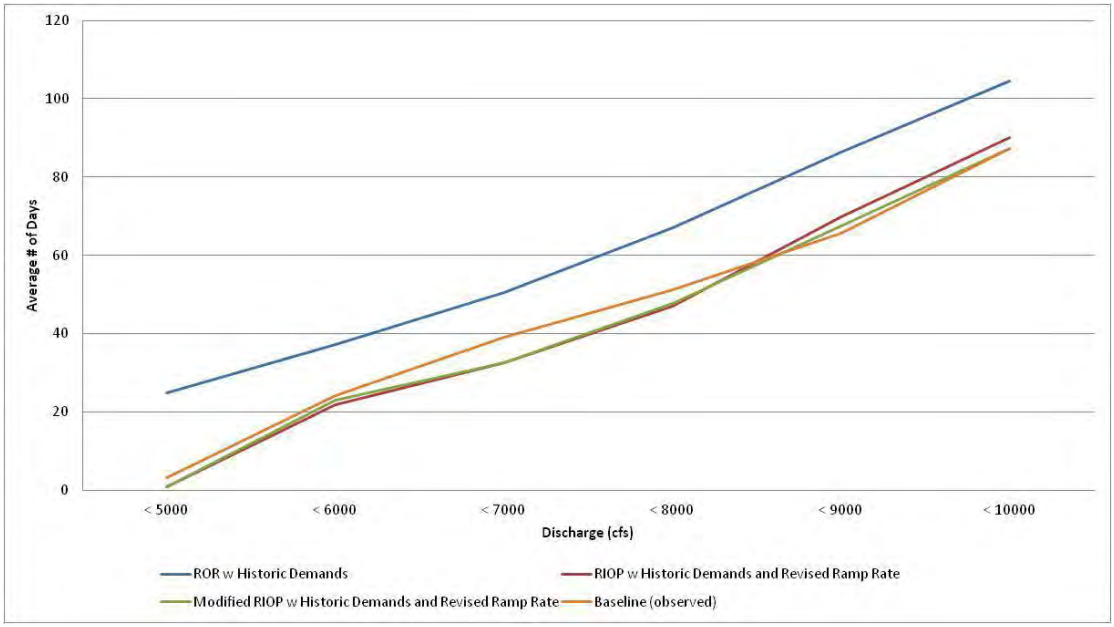


Figure 14. Average number of days per year of discharge less than 5,000 to 10,000 cfs under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

As described in the DESCRIPTION OF PROPOSED ACTION section above, the proposed action continues to utilize the RIOP maximum fall rate schedule, with the exception of implementing the most conservative fall rates (less than 0.25 ft/day) sooner. The schedule limits operations to more gradual fall rates as flow declines to the river stages where listed mussels may occur in order to facilitate, as much as possible, the movement of mussels and other aquatic biota from higher to lower elevation habitats. The general intent of the schedule is to avoid extreme daily declines in river stage and thereby lessen the potential for exposing or stranding listed mussels, their host fish, and other aquatic biota. Consistent with the 2008 BO, the effects of altered fall rates were analyzed by comparing the daily average fall rates observed at the Chattahoochee gage (Baseline) to those computed for the simulated daily flows. The methodology for computing the daily average fall rates is the same.

Figure 15 is a frequency histogram of the rate of change results, which lumps all stable or rising days into one category and uses the ranges that correspond to the maximum fall rate schedule as categories for the falling days (<=0.25 ft/day, > 0.25 to <= 0.50 ft/day, > 0.50 to <= 1.00 ft/day, > 1.00 to <= 2.00 ft/day, and > 2.00 ft day). The proposed action includes the current maximum fall rate schedule with the previously described modification. Since the listed mussels are known to occur at flows between 5,000 and 10,000 cfs, preservation of the more conservative maximum fall rates should facilitate the movement of mussels as river stages decline. The most critical fall rate category is likely the 0.25 or less ft/day category which corresponds to the maximum fall rate provision for flows $\leq$ 10,000 cfs in the proposed action (in the current RIOP the threshold is $\leq$ 8,000 cfs). Among the falling days, rates less than 0.25 ft day are the most common occurrence

in all of the flow regimes. The proposed action and the RIOP have a higher frequency of days when fall rates are in the <= 0.25 ft/day range than the Baseline, but the proposed action results in a slightly lower frequency than the RIOP. The proposed action and the RIOP have a higher frequency of days when fall rates are in the > 0.25 to <= 0.50 ft/day range than the Baseline, but the proposed action results in a slightly lower occurrence than the RIOP.

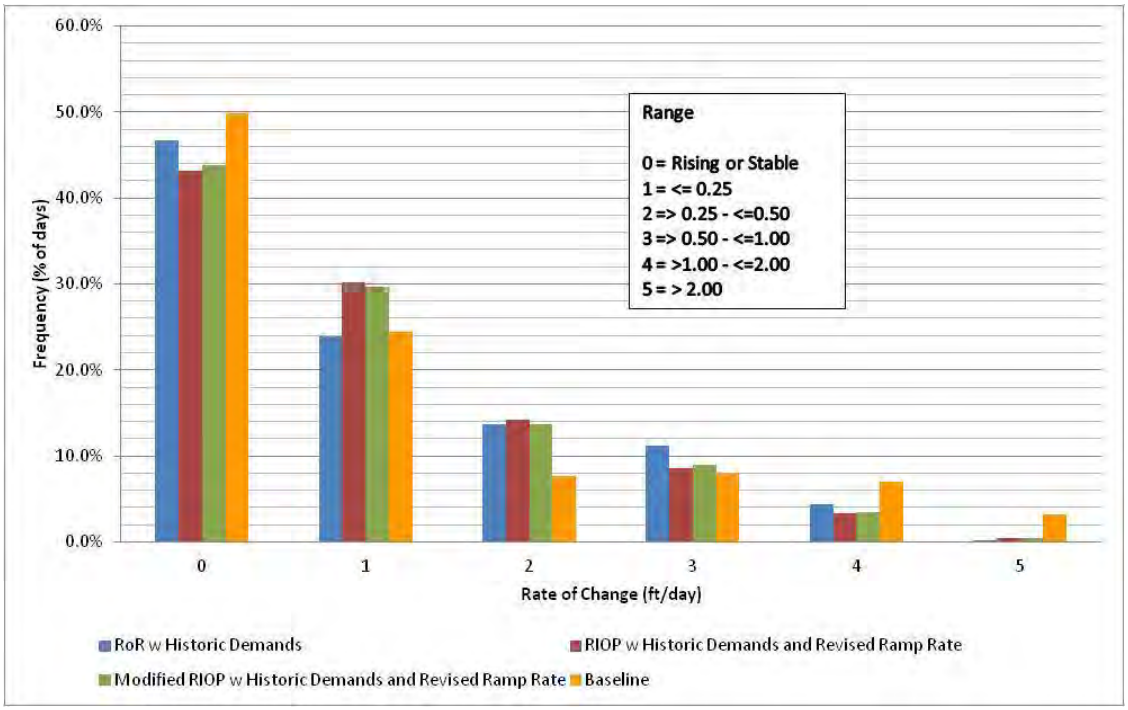


Figure 15. Frequency (percent of days) of daily stage changes (ft/day) under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

The RIOP, proposed action, and Baseline share comparable frequencies when fall rates are in the >= 0.50 to <= 1.00 ft/day range. In the most extreme fall rate categories, the proposed action and RIOP result in lower frequencies than the Baseline, which may reduce the risk of stranding to host fish species for the listed mussels that utilize floodplain habitat. This is a beneficial effect.

As noted in the 2008 BO, the USFWS has observed mussels exposed at stages as high as about 10,000 cfs (USFWS 2008). Therefore, listed mussels could potentially be directly impacted by increases in the number of days that fall rates greater than 0.25 ft/day occur and flows are less than 10,000 cfs. Figure 16 shows a count of days in the various rate-of-change categories when flow was less than 10,000 cfs. The methodology for conducting the analysis is the same as that used in the 2008 BO.

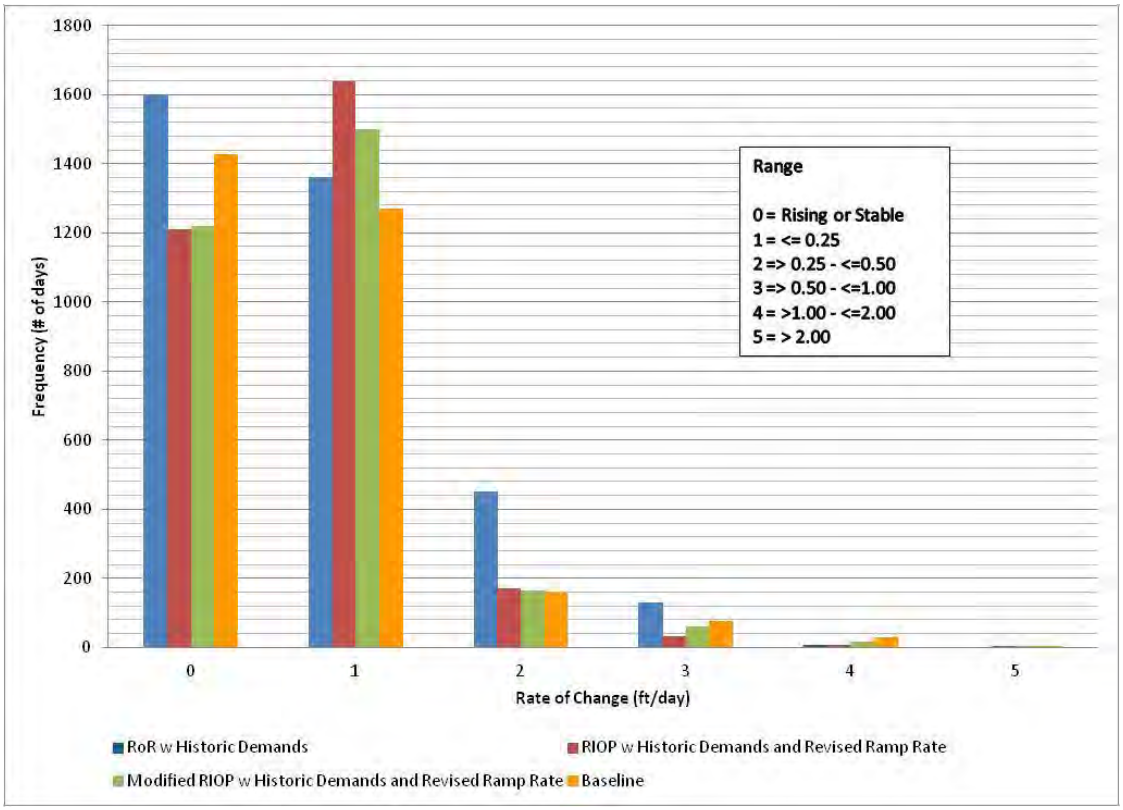


Figure 16. Frequency (number of days) of daily stage changes (ft/day) when releases from Woodruff Dam are less than 10,000 cfs under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

Similar to the previous analysis, among the falling days, rates less than 0.25 ft day are the most common occurrence in all of the flow regimes. The number of days in the greater than 0.25 ft/day categories for the proposed action is less than the Baseline (246 and 269 days respectively). This is a benefit to the listed mussels as it reduces the number of days that the more extreme fall rates are occurring. Table 5 presents a comparison of the maximum and average daily fall rates for each fall rate category under the proposed action simulation and the Baseline flow regimes. The maximum and average daily fall rates under both scenarios are comparable.

	Modified RIOP		Baseline (observed)	
Fall Rate Range (ft/day)	Maximum Fall Rate (ft/day)	Average Fall Rate (ft/day)	Maximum Fall Rate (ft/day)	Average Fall Rate (ft/day)
<=0.25	0.25	0.12	0.25	0.07
>0.25 - <=0.5	0.50	0.33	0.50	0.34
>0.5 - <=1.0	0.92	0.68	1.00	0.70
>1.0 - <=2.00	1.87	1.25	1.98	1.37
>2.00	2.97	2.79	2.37	2.21

Table 5. Maximum and average daily fall rates (ft/day) for each fall rate category when releases from Woodruff Dam are less than 10,000 cfs under Modified RIOP (ResSim simulated flow 1975-2008) and Baseline (observed flow 1975-2008).

MUSSEL RE-COLONIZATION ABOVE 5,000 CFS

As evidenced by previous studies, field observation, and the recent mortality events in 2006 and 2010, the listed mussel species (particularly the fat threeridge) will re-colonize habitat at stages equivalent to flows higher than 5,000 cfs (max about 10,000 cfs). The USFWS believes that fat threeridge located in moderately depositional habitat are likely moving upbank in response to changing water levels to maintain an optimal depth. It is this re-colonization which led to re-initiating the RIOP consultation. In collaboration with the USFWS, we examined the observed flow data prior to the observed mortality events in 2006 and 2010. Similar trends in flow conditions prior to the two events suggested that criteria for defining potential mortality events could be developed. The criteria agreed upon are 1) at least 22 consecutive months or at least two full spawning periods with average monthly flows at the Chattahoochee Gage greater than 8,000 cfs and 2) at least 24 days at bankfull discharge (72,100 cfs). However, observations by USFWS during 2011 suggested that limited fat threeridge re-colonization to higher stages could occur with sustained flows greater than 8,000 cfs over a shorter period of time. Therefore, we also conducted the potential mortality event frequency utilizing an additional criteria; at least 12 consecutive months with average monthly flows at the Chattahoochee Gage greater than 8,000 cfs. The intent of developing all of these criteria was to determine the frequency of the potential mortality events for the 34 year period of record (1975-2008) and determine how the proposed action changed this frequency, if any at all. The results of the analysis are provided below in Table 6.

Potential Mortality Event Criteria	**RIOP w Historic Demands and Revised Ramp Rate**	**Modified RIOP w Historic Demands and Revised Ramp Rate**	**Baseline (observed)**
Years with >= 22 consecutive months >8,000 cfs	5	5	5
Percent of Years	15%	15%	15%
Years with >=24 bankful events/year	3	3	3
Percent of Years	9%	9%	9%
Years with >= 12 consecutive moths >8,000 cfs	6	6	6
Percent of Years	18%	18%	18%

Table 6. Potential mortality event frequency under RIOP (ResSim simulated flow 1975-2008), Modified RIOP (ResSim simulated flow 1975-2008) and Baseline (observed flow 1975-2008)

The results of this analysis demonstrate that the current RIOP and proposed action do not change the frequency of potential mortality events associated with fat threeridge re-colonizing habitat at higher stages following relatively long periods of continuous discharge greater than 8,000 cfs. With regards to this flow dependent habitat parameter, it appears that adverse affects, if any at all, are a continuation of the baseline condition and not attributable to Corps' discretionary operations.

FLOODPLAIN CONNECTIVITY AND SYSTEM PRODUCTIVITY

The Apalachicola River floodplain is a highly productive area that likely provides spawning and rearing habitats for one or more of the host fishes of the purple bankclimber and fat threeridge. Floodplain inundation is also critical to the movement of organic matter and nutrients into the riverine feeding habitats of both the mussels and juvenile sturgeon, and into the estuarine feeding habitats of juvenile and adult sturgeon (USFWS 2008). Therefore, listed mussels and sturgeon can be indirectly affected by changes to the frequency, timing, and duration of floodplain habitat connectivity and inundation.

To assess these effects we compare the four flow regimes on the timing and duration of floodplain habitat connectivity and inundation. Consistent with the 2008 BO, this is accomplished by utilizing the relationship documented by Light *et al.* (1998) between total area of non-tidal floodplain area inundated and discharge at the Chattahoochee gage (USFWS 2008). Figure 17 displays a frequency analysis of the results of transforming the four daily discharge time series during the growing season months (April – October) to connected floodplain area. All four flow regimes provide for essentially the same frequency of floodplain habitat inundation, with the RIOP and proposed action resulting in nearly identical frequencies. The median amount of connected habitat under the proposed action (acres inundated for half of the growing season days 1975-2008) is 1,835 acres, compared to 2,286 and 1,780 acres for the Baseline and RoR flow regimes. However, the curves for the proposed action and the Baseline flow regimes cross each other several times. Therefore, with regards to this flow dependent habitat parameter, it appears that effects (if any at all) are likely a continuation of the Baseline effect.

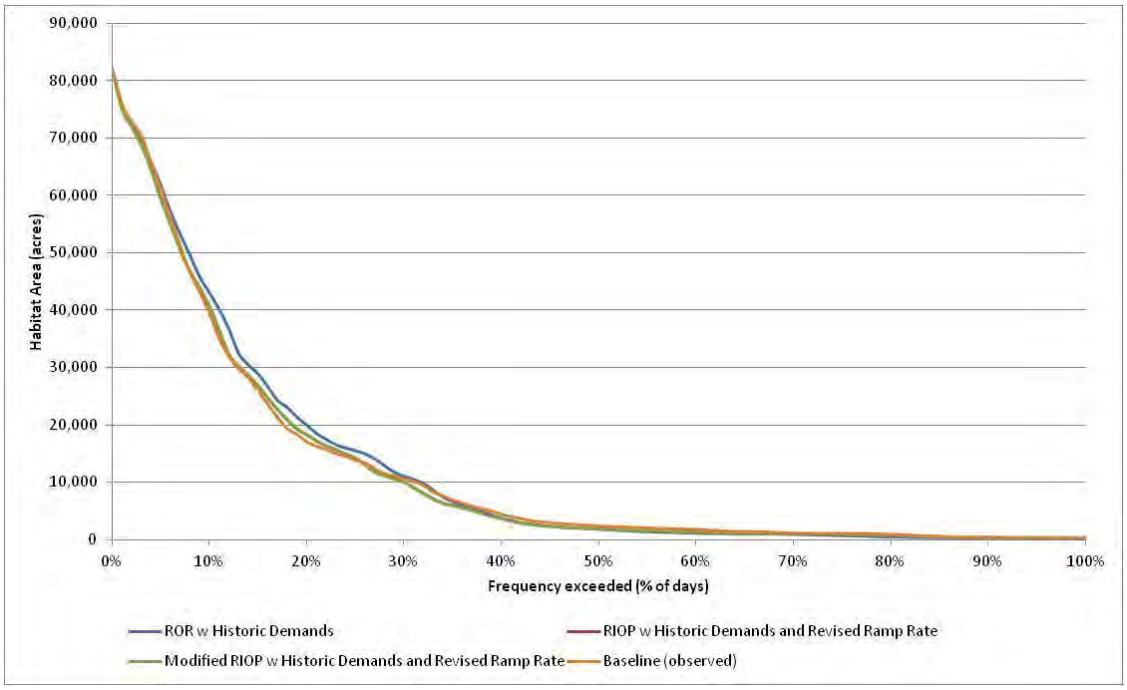


Figure 17. Frequency (percent of days) of growing-season (April-October) floodplain connectivity (acres) to the main channel under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

In order to interpret biological effects related to the temporal pattern of floodplain inundation we evaluate the annual 30-day continuous floodplain habitat inundation consistent with the methodology described in the 2008 BO. Figure 18 displays the results of this analysis. The proposed action and RIOP provide for nearly identical annual 30-day continuous connectivity. Annual 30-day continuous connectivity is roughly comparable between the proposed action and RoR, which suggests that refilling reservoirs to summer pool levels following the winter drawdown has little effect with regards to this flow dependent habitat parameter. The proposed action almost always results in more annual 30-day continuous connectivity than the Baseline flow regime. The median amount of 30-day continuous connected habitat under the proposed action (acres inundated for at least 30 days in half of the years 1975-2008) is 27,601 acres, compared to 22,169 and 30,295 acres for the Baseline and RoR flow regimes, respectively. Therefore, with regards to this flow dependent habitat parameter, the proposed action provides a beneficial effect.

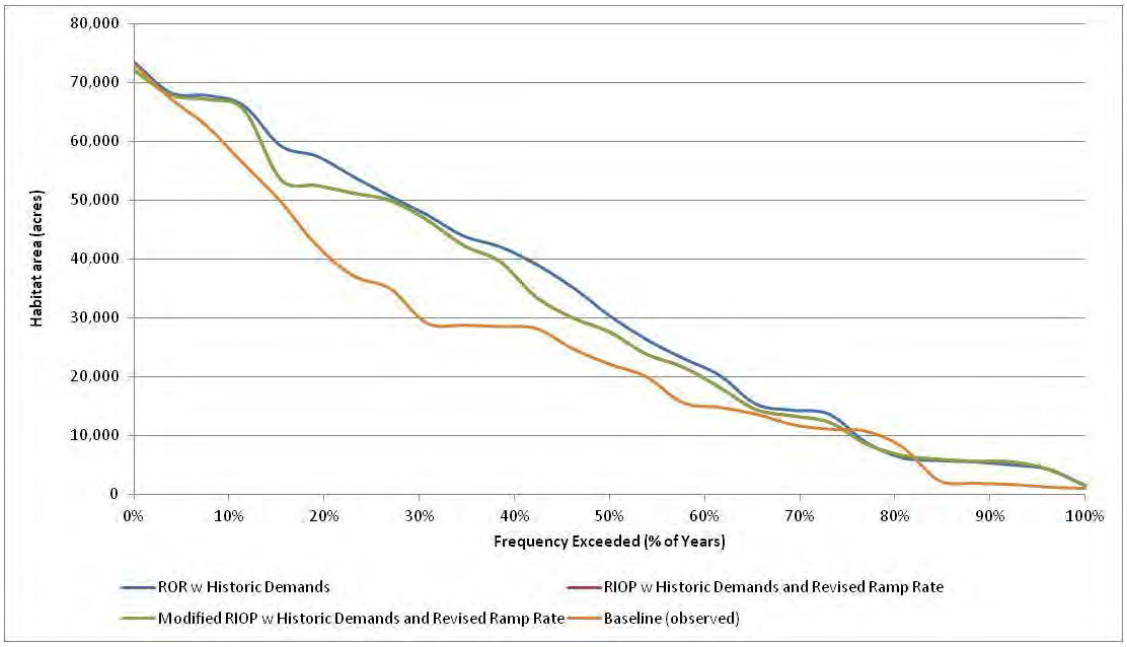


Figure 18. Inter-annual frequency (percent of years) of growing season (April-October) floodplain connectivity (maximum acres inundated for at least 30 consecutive days each year) to the main channel under RoR (ResSim simulated flow 1975-2008); RIOP (ResSim simulated flow 1975-2008); Modified RIOP (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

CUMULATIVE EFFECTS

Consistent with the 2008 BO, we also considered the cumulative effects of implementing the proposed action by focusing on the effects of increased water depletions due to an increase in M&I use. Like the analysis in the 2008 BO, the 2017 projection is based on an increase in M&I use only and it could occur sooner or later than 2017, depending on population growth and other factors. It could also result from a combination of increased M&I and agricultural demands. The Corps used the same approach to simulate the proposed action using the 2017 depletions (+27% for M&I). In order to fully evaluate the effects to the listed species, all of the figures created above in the EFFECTS ANALYSIS section were recreated using the 2017 simulations for the RoR and proposed action. For comparison, the Modified RIOP with Historic Demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008) flow regimes were included as well. These figures are included in Appendix A.

The various Gulf sturgeon cumulative effects analyses (Figures 2,3,4,14, and 15) indicate that increased water depletions would not appreciably affect Gulf sturgeon beyond any effects that occur under the proposed action simulation (with historic demands) and the Baseline. The remaining figures in Appendix A address cumulative effects on the listed mussel species. All of the listed mussels' cumulative effects analyses indicate that increased water depletions result in reduced low flows during drought periods. In general, this results in a continuation of the adverse effects realized under the proposed action simulations that utilized historic demands, but at greater intensity. The proposed action with 2017 demands simulation resulted in an additional event with flows less than

5,000 cfs due to implementation of the drought plan minimum flow provision of 4,500 cfs during severe drought conditions. However, the proposed action continues to offset the impact of an increase in depletions by maintaining minimum releases of 5,000 cfs in all the simulated years except 2000 and 2007 (when releases dropped to 4,500 cfs). Both of these years represent critical droughts for the basin. The 2007 drought was a 1-in-200 year event and is unlikely to occur again during the implementation period of the proposed action (until an updated WCP is approved). Furthermore, water conservation programs implemented by the State of Georgia, should reduce the risk of water depletions reaching the estimated 2017 demand levels during the implementation period of the proposed action.

CONCLUSIONS

Gulf Sturgeon

Based on the effects analyses described above, the Corps has determined that the proposed action may affect but is not likely to adversely affect Gulf sturgeon and that it may affect but is not likely to adversely modify Gulf sturgeon critical habitat. Therefore, we request concurrence with this determination per section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*).

Fat Threeridge

The Corps re-initiated consultation on the RIOP in September 2010 based on new information about the distribution and mortality of endangered fat threeridge mussels in the Apalachicola River. Through the consultation process, it was determined that modifications to the RIOP should be evaluated to further minimize the potential for "take" of fat threeridge mussels when releases are between 5,000 and 10,000 cfs. In the 2008 BO, "take" of listed mussel species only occurred when releases were less than 5,000 cfs. The proposed action still includes a provision for releases as low as 4,500 cfs and implements minimization measures, but does not eliminate adverse effects to the species when releases are between 5,000 and 10,000 cfs and mussels have re-colonized at stages in this flow range. The period of record simulation (1975-2008) of the proposed action includes one year with releases less than 5,000 cfs which occurs in multiple years under the RoR and Baseline flow regimes. Like the RIOP, this is a beneficial effect. "Take" of fat threeridge when releases are between 5,000 and 10,000 cfs is dependent upon re-colonization of the species at stages in this flow range and discretionary operations by the Corps that influence these flows. As FWS will describe in the STATUS OF THE SPECIES section of the BO, the 2006 and 2010 mussel mortality events suggest that re-colonization is dependent on several hydrology driven variables that do not necessarily occur every year. Based on the observed data, we believe they include 1) at least 24 days of bankfull flow (defined as 72,100 cfs) and 2) a prolonged period of monthly average flows greater than 8,000 cfs (22 consecutive months or at least two full spawning periods). The effects analyses above do not presume that mussels are always present at river stages equivalent to flows between 5,000 and 10,000 cfs, but rather evaluate to what extent Corps operations are influencing flows as compared to the

Baseline. The effects analyses above, illustrate that the proposed action results in a mix of beneficial and adverse effects to fat threeridge mussels when releases are between 5,000 and 10,000 cfs. Therefore, we have determined that the proposed action may adversely affect fat threeridge. However, it is not evident that the proposed action would appreciably change the quantity or quality of the designated Critical Habitat primary constituent elements (PCE) compared to the Baseline. Droughts substantially change the nature of all of these PCEs compared to normal flows. Therefore, we have determined that the proposed action may affect but is not likely to adversely modify fat threeridge mussel designated Critical Habitat.

PURPLE BANKCLIMBER

The flow regime changes discussed in the effects analyses for listed mussel species apply to the purple bankclimber as well, but probably to a lesser extent, because the data suggests that this species appears to occur more often in deeper portions of the stream channel than the fat threeridge. Purple bankclimber exposure was not observed during 2006 or 2010 when exposed fat threeridge were observed at stages greater than 5,000 cfs. The proposed action simulation did result in one year with a reduction of flows below 5,000 cfs. A small number of purple bankclimber could be exposed under this condition and this is an adverse effect that is also applicable to the current RIOP. Therefore, we have determined that the proposed action may adversely affect purple bankclimber. The PCE discussion above also applies to purple bankclimber and therefore, we have determined that the proposed action may affect but is not likely to adversely modify purple bankclimber mussel designated Critical Habitat.

CHIPOLA SLABSHELL

Like the purple bankclimber, Chipola slabshell exposure was not observed during 2006 or 2010 when exposed fat threeridge were observed at stages greater than 5,000 cfs. The Chipola slabshell known range within the action area is limited to the Chipola River downstream of the Chipola Cutoff. As discussed in the 2008 BO, channel morphology appears less altered in the Chipola River than the Apalachicola River and the Corps' influence on flow regime in the Chipola River is likely reduced due to the narrower channel and contributions from the Chipola River upstream of the cutoff (approximately 132 miles). Flowing water from the Apalachicola River influences flow in the Chipola River and Chipola Cutoff under the full range of flows simulated in the proposed action flow regime. Therefore, the effects analyses above for the fat threeridge apply also to the Chipola slabshell, but probably to a lesser extent. The proposed action simulation did result in one year with a reduction of flows below 5,000 cfs. A small number of Chipola slabshell could be exposed under this condition and this is an adverse effect that is also applicable to the current RIOP. Therefore, we have determined that the proposed action may adversely affect Chipola slabshell. The PCE discussion above also applies to Chipola slabshell and therefore, we have determined that the proposed action may affect but is not likely to adversely modify Chipola slabshell mussel designated Critical Habitat.

CITATIONS

Light, H.M, M.R. Darst, and J.W. Grubbs. 1998. Aquatic habitats in relation to river flow in the Apalachicola River floodplain, Florida. U.S. Geological Survey Professional Paper 1594.

United States Fish and Wildlife Service (USFWS). 2008. Biological Opinion on the U.S. Army Corps of Engineers, Mobile District, Revised Interim Operating Plan for Jim Woodruff Dam and the Associated Releases to the Apalachicola River.

APPENDIX A

CUMULATIVE EFFECTS ANALYSES

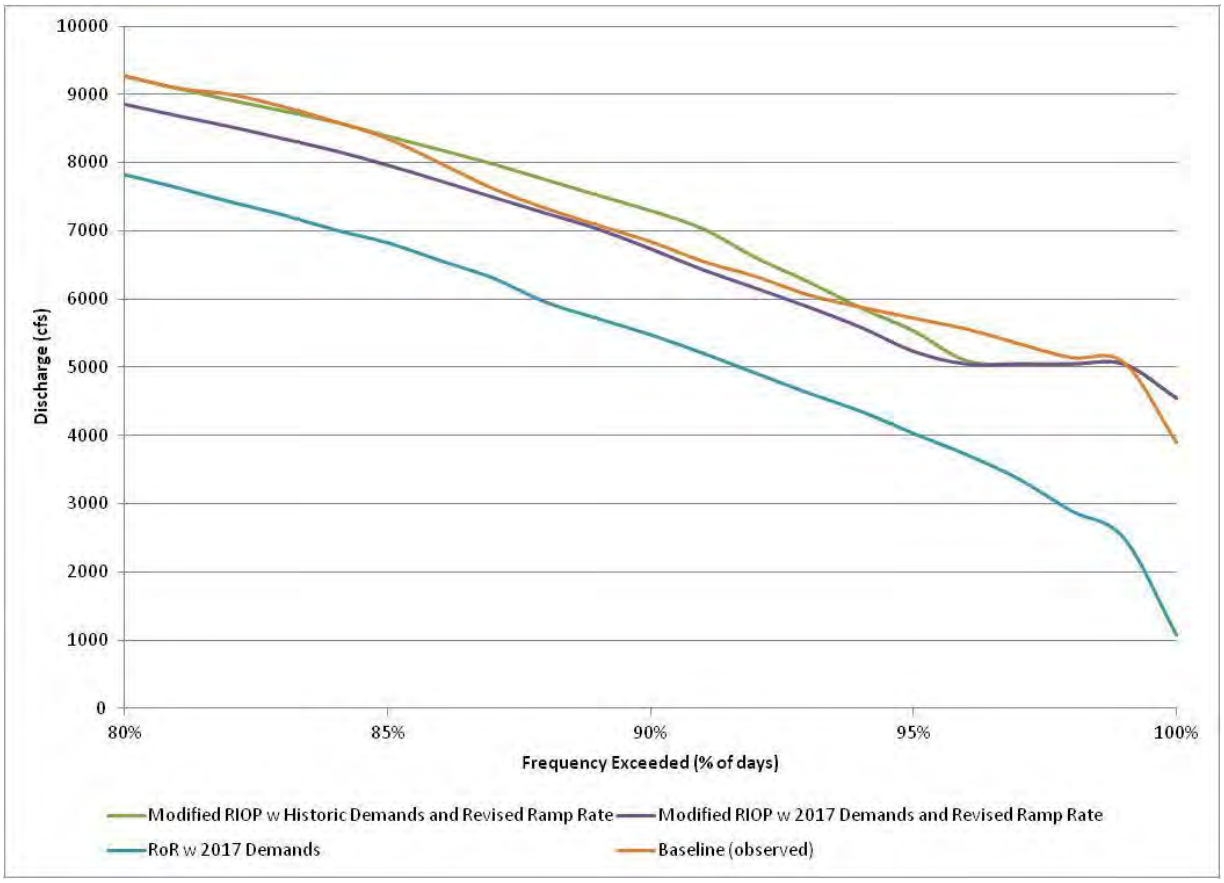


Figure 1. Observed and simulated flow frequency (% of days flow exceeded) of the Apalachicola River at the Chattahoochee gage under Modified RIOP w Historic Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); Modified RIOP w 2017 Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

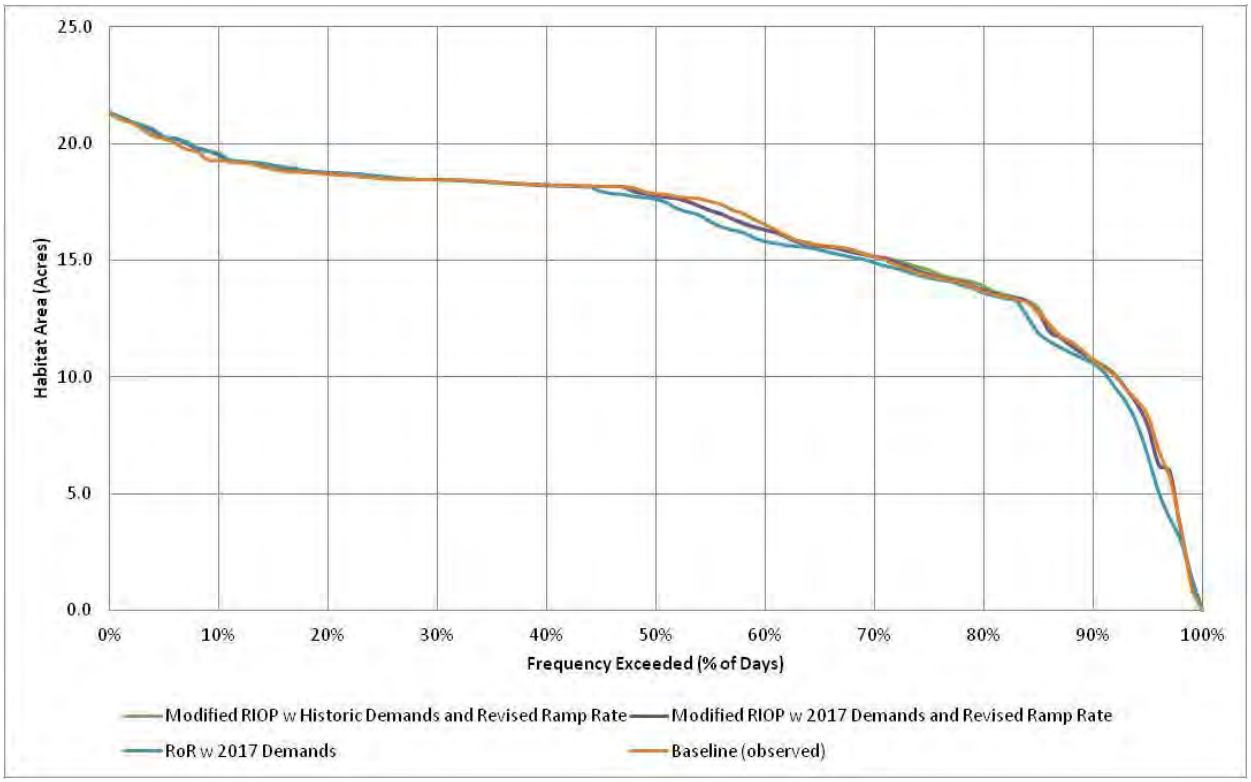


Figure 2. Frequency (% of days) of Gulf sturgeon spawning habitat availability (acres of potentially suitable spawning substrate inundated to depths of 8.5 to 17.8 feet), on each day March 1 through May 31, at the three sites known to support spawning, under Modified RIOP w Historic Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); Modified RIOP w 2017 Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

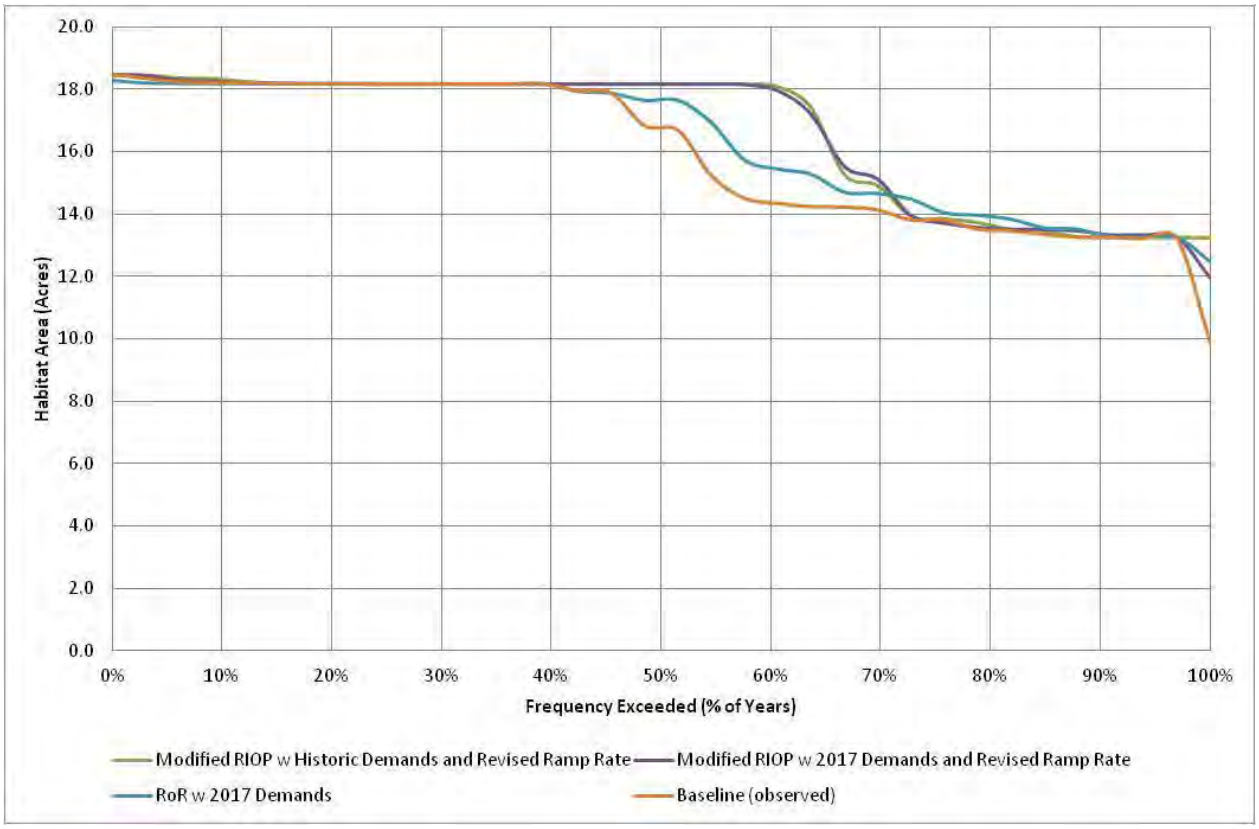


Figure 3. Frequency (% of years) of Gulf sturgeon spawning habitat availability (maximum acres of potentially suitable spawning substrate inundated to depths of 8.5 to 17.8 feet for at least 30 consecutive days each year), March 1 through May 31, at the three sites known to support spawning, under Modified RIOP w Historic Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); Modified RIOP w 2017 Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

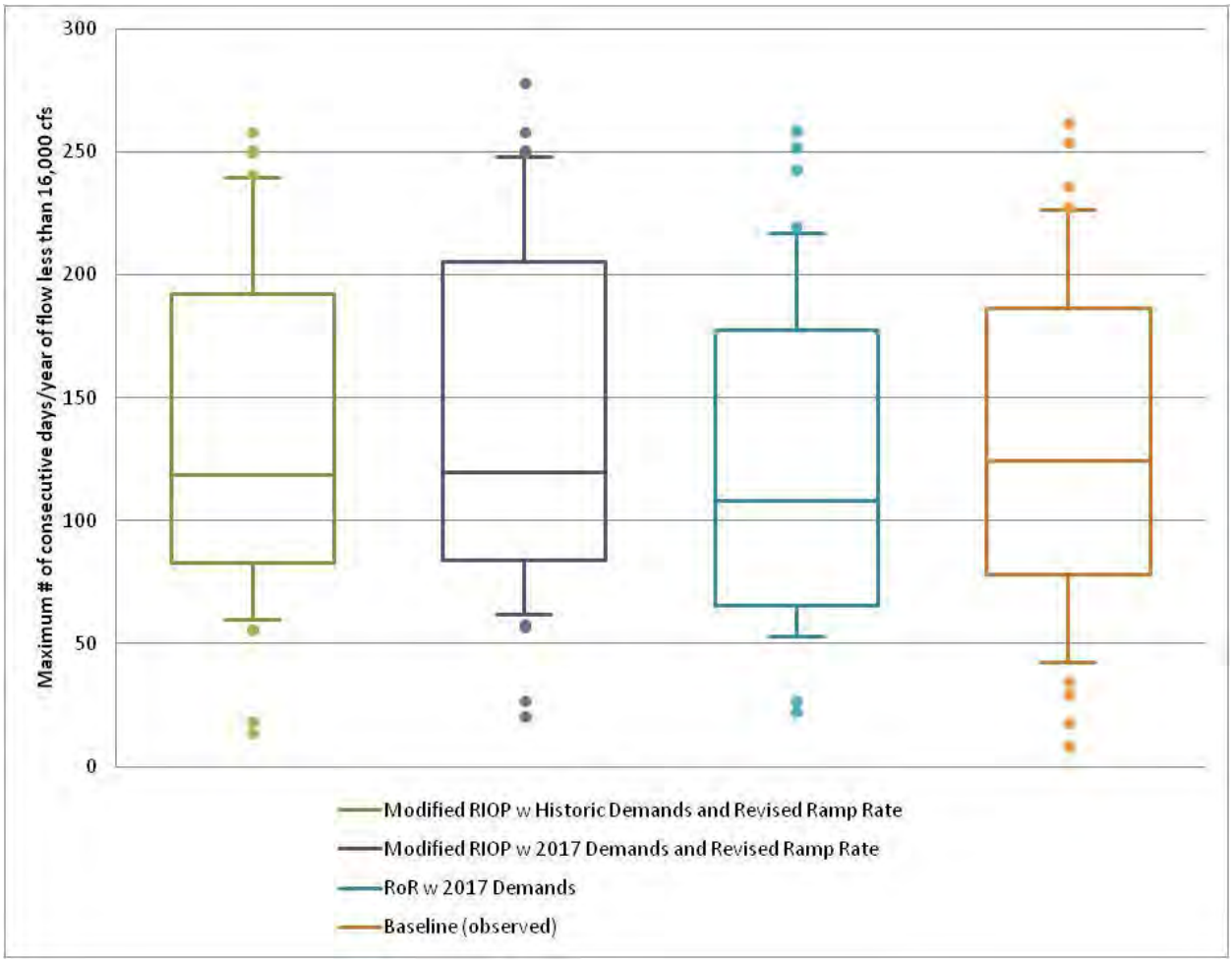


Figure 4. Maximum number of consecutive days/year of flow less than 16,000 cfs under Modified RIOP w Historic Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); Modified RIOP w 2017 Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

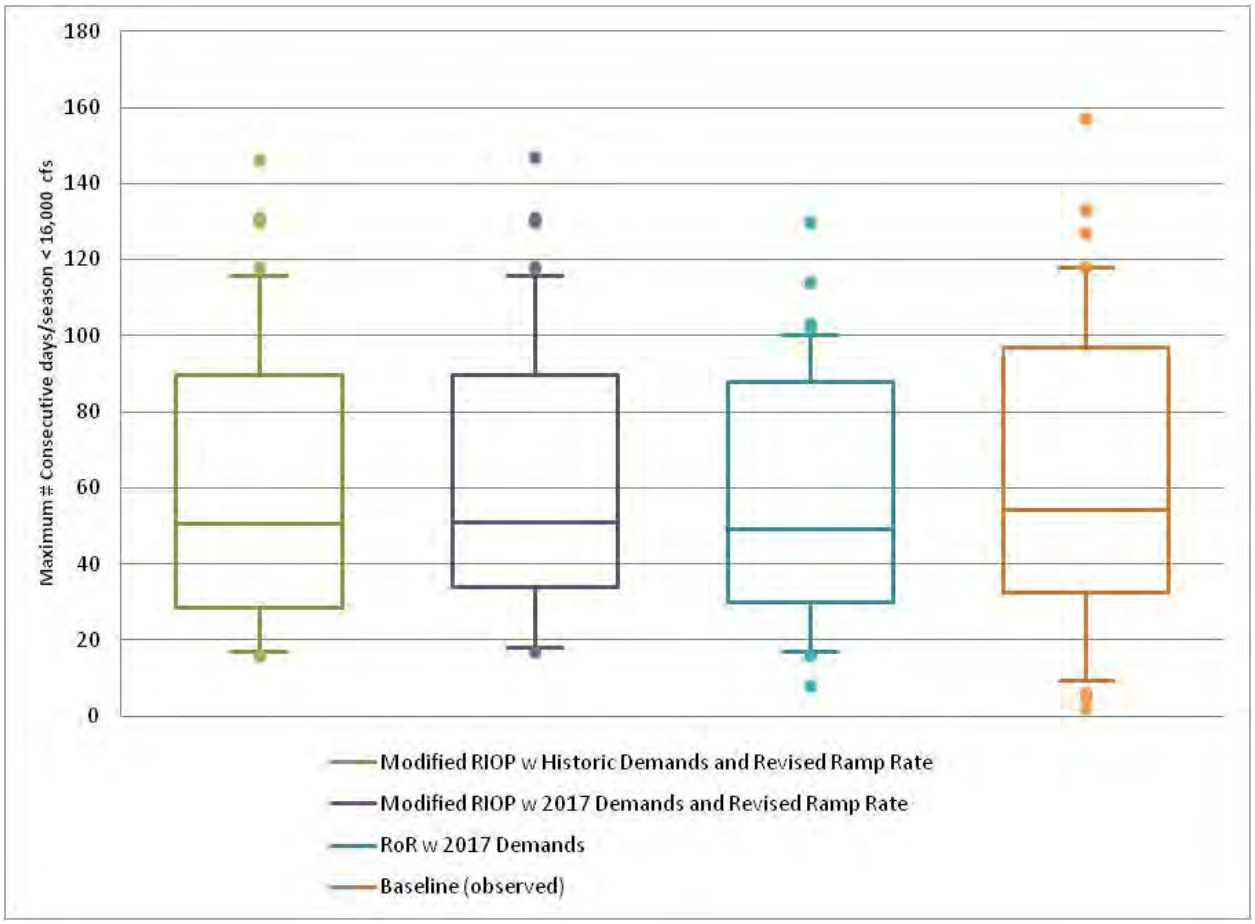


Figure 5. Maximum number of consecutive days/year of flow less than 16,000 cfs (October-March) under Modified RIOP w Historic Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); Modified RIOP w 2017 Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

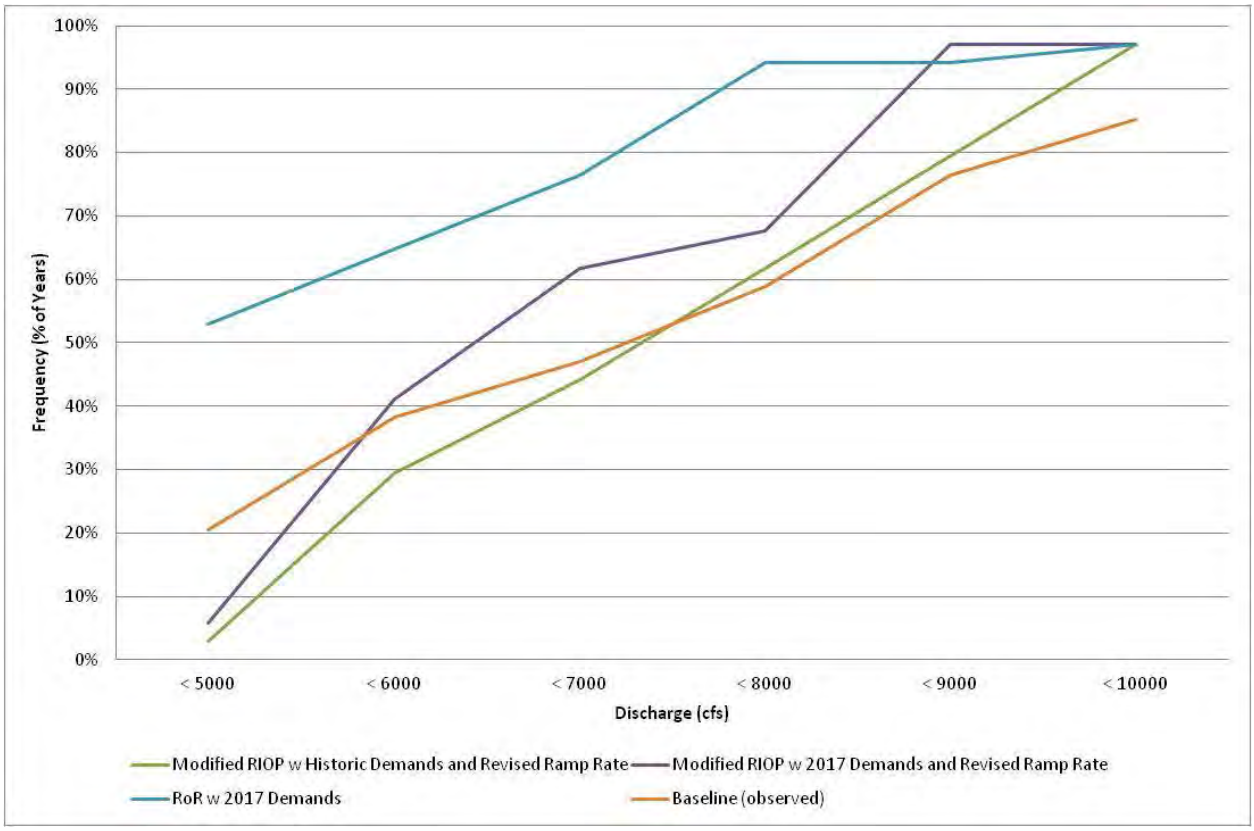


Figure 6. Inter-annual frequency (% of years) of discharge events less than 5,000 to 10,000 cfs under Modified RIOP w Historic Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); Modified RIOP w 2017 Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

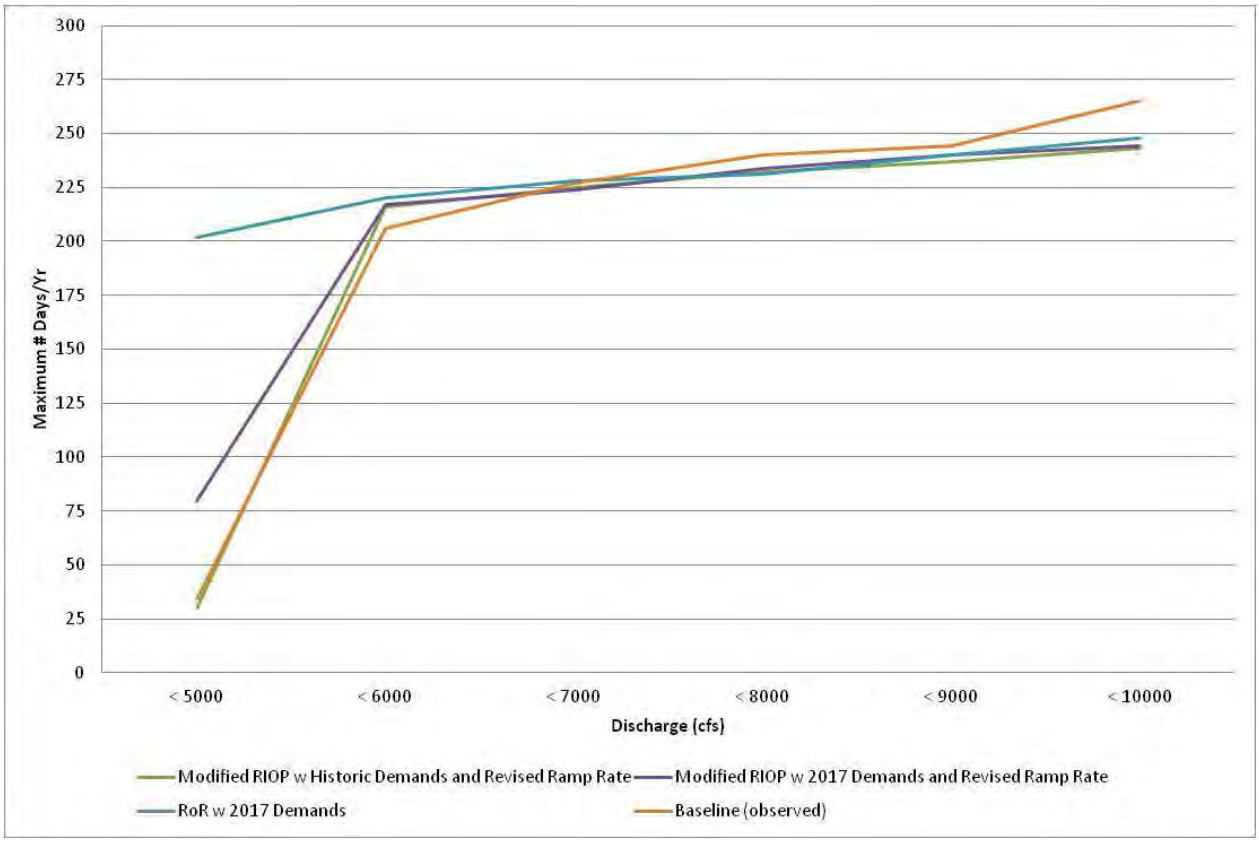


Figure 7. Maximum number of days per year of discharge less than 5,000 to 10,000 cfs under Modified RIOP w Historic Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); Modified RIOP w 2017 Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

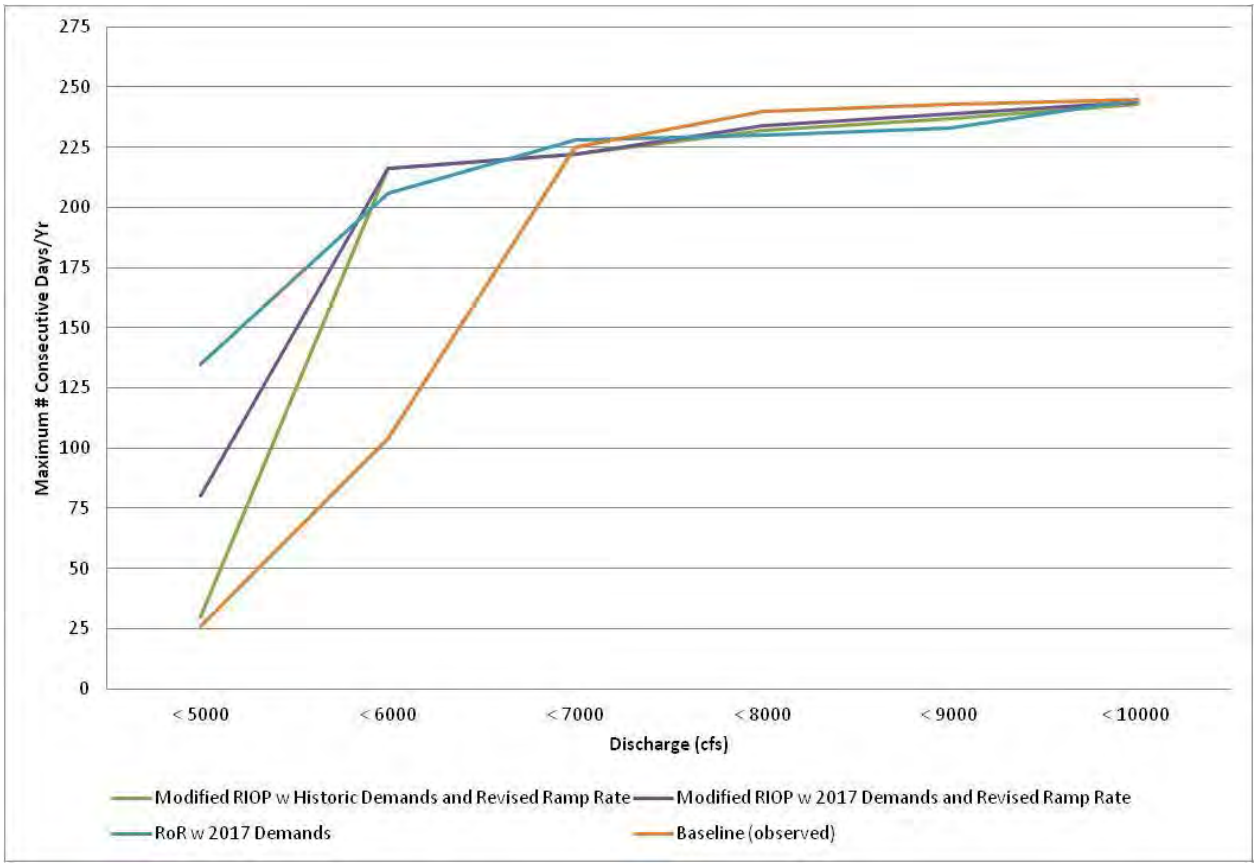


Figure 8. Maximum number of consecutive days per year of discharge less than 5,000 to 10,000 cfs under Modified RIOP w Historic Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); Modified RIOP w 2017 Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

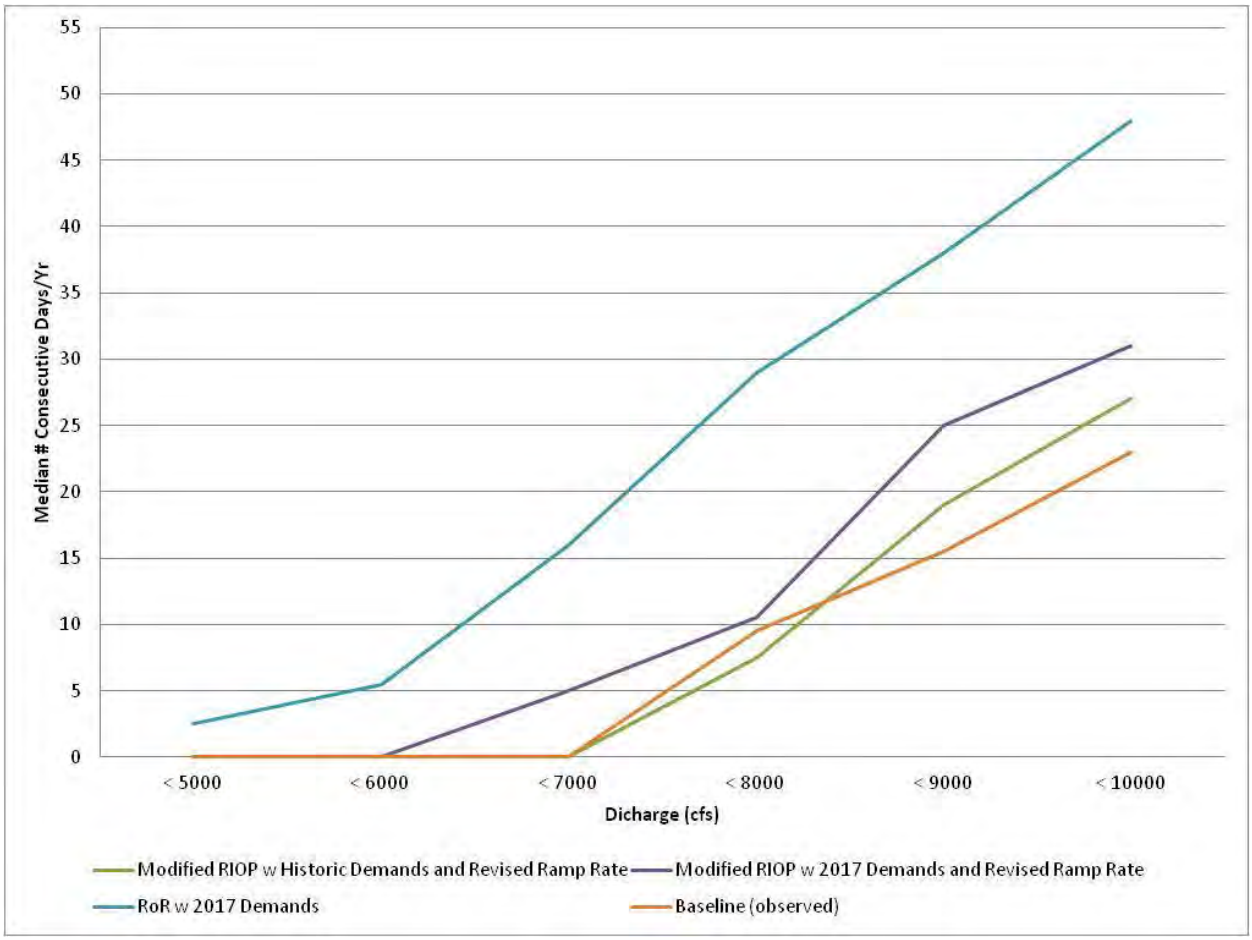


Figure 9. Median number of consecutive days per year of discharge less than 5,000 to 10,000 cfs under Modified RIOP w Historic Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); Modified RIOP w 2017 Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

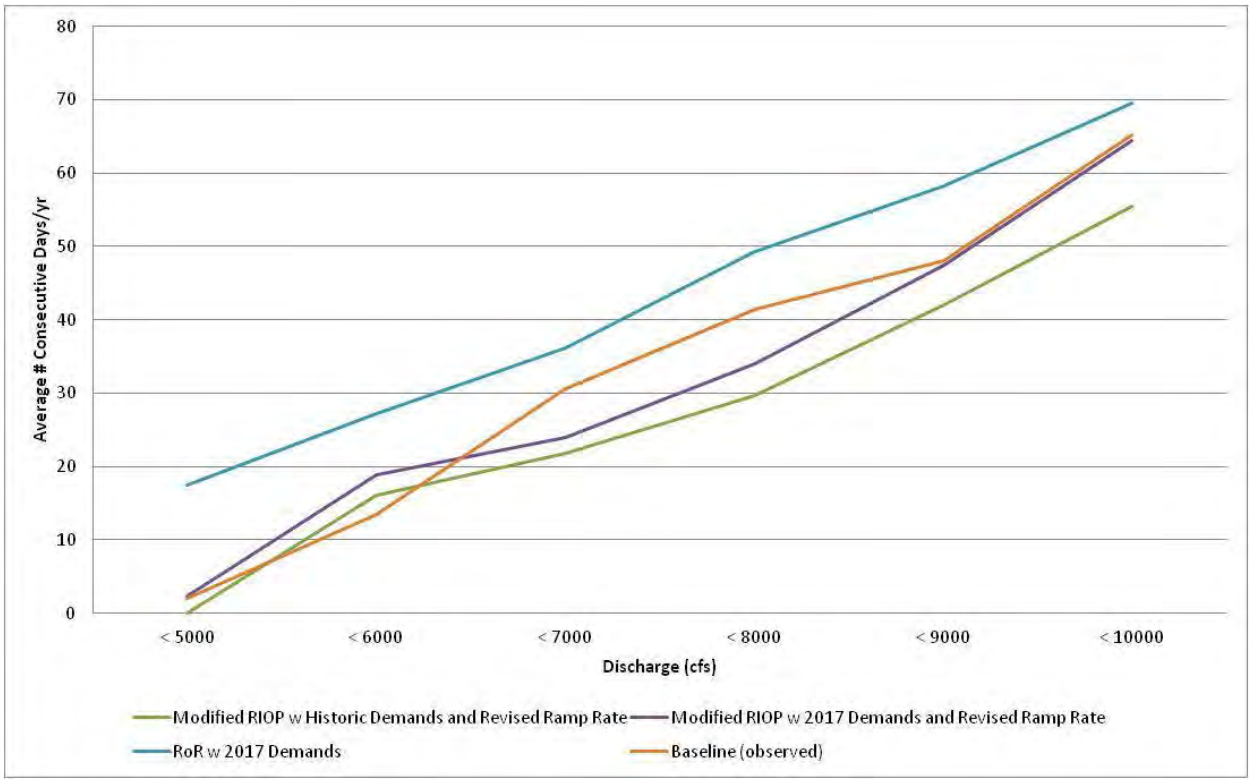


Figure 10. Average number of consecutive days per year of discharge less than 5,000 to 10,000 cfs under Modified RIOP w Historic Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); Modified RIOP w 2017 Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

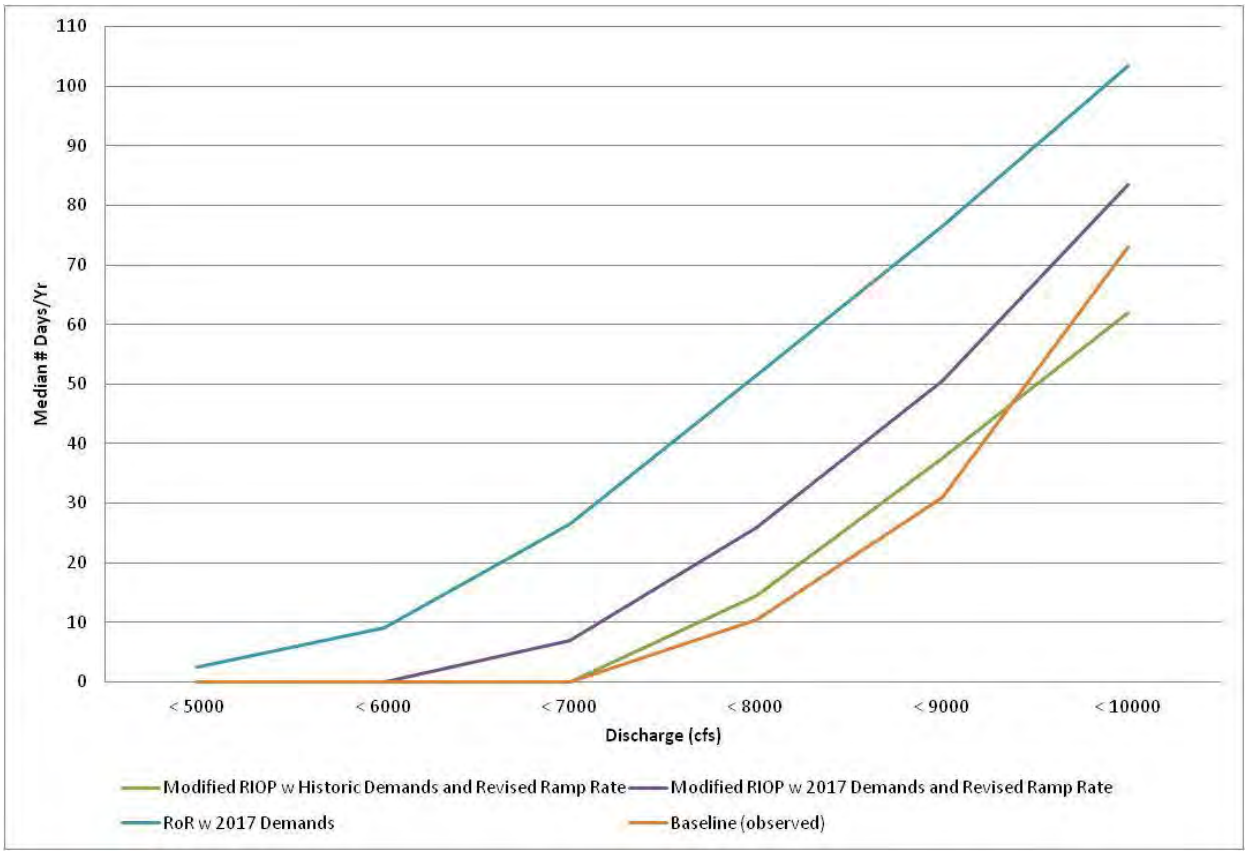


Figure 11. Median number of days per year of discharge less than 5,000 to 10,000 cfs under Modified RIOP w Historic Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); Modified RIOP w 2017 Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

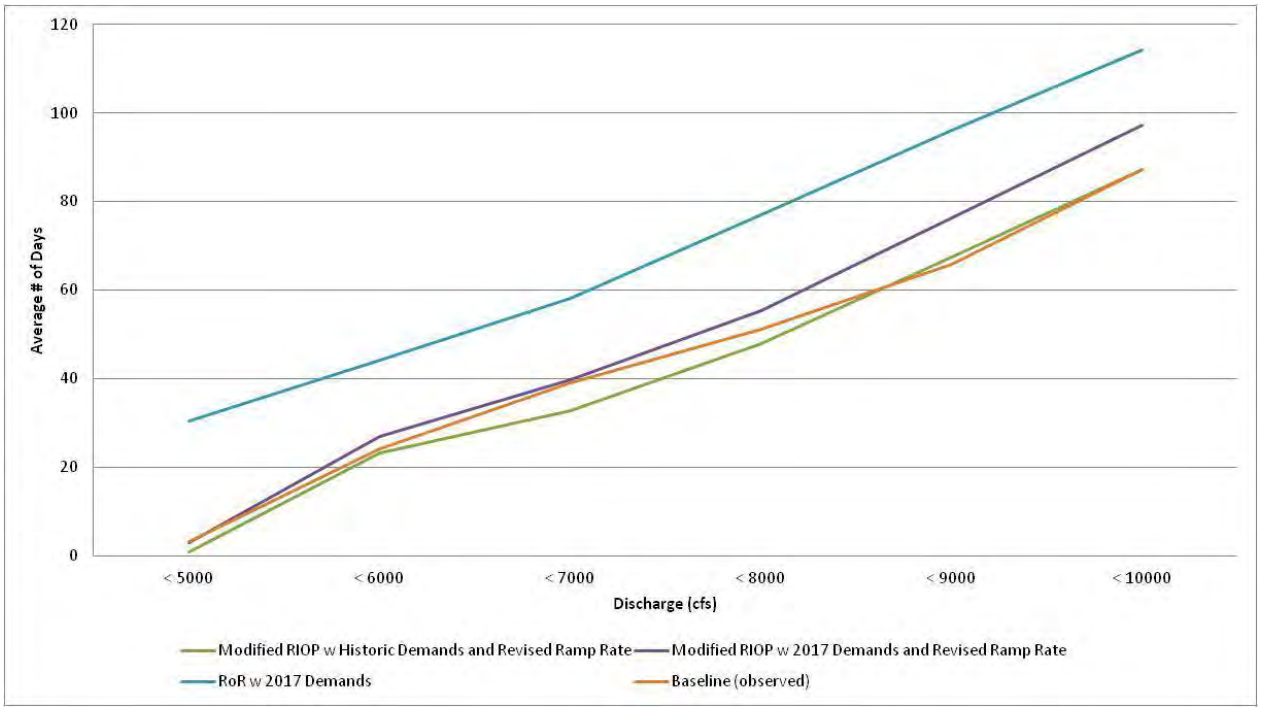


Figure 12. Average number of days per year of discharge less than 5,000 to 10,000 cfs under Modified RIOP w Historic Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); Modified RIOP w 2017 Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

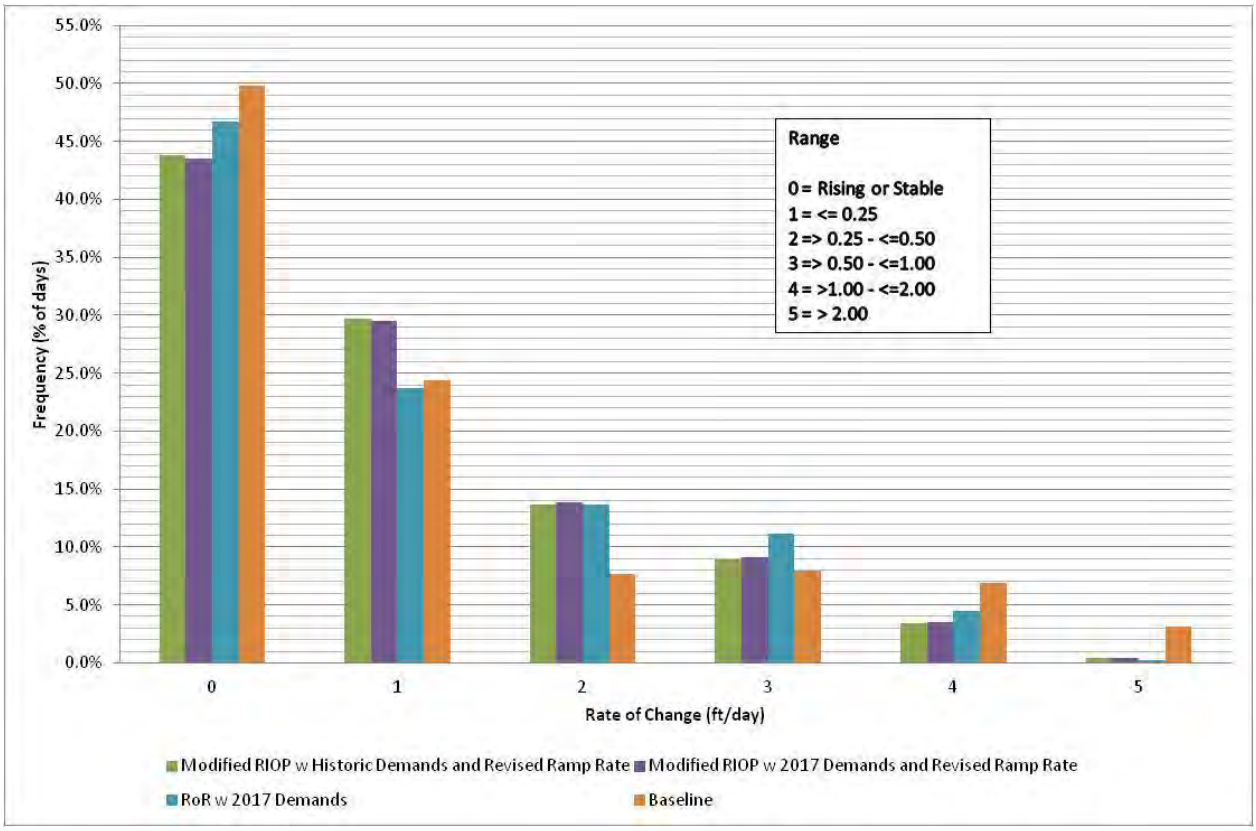


Figure 13. Frequency (percent of days) of daily stage changes (ft/day) under Modified RIOP w Historic Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); Modified RIOP w 2017 Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

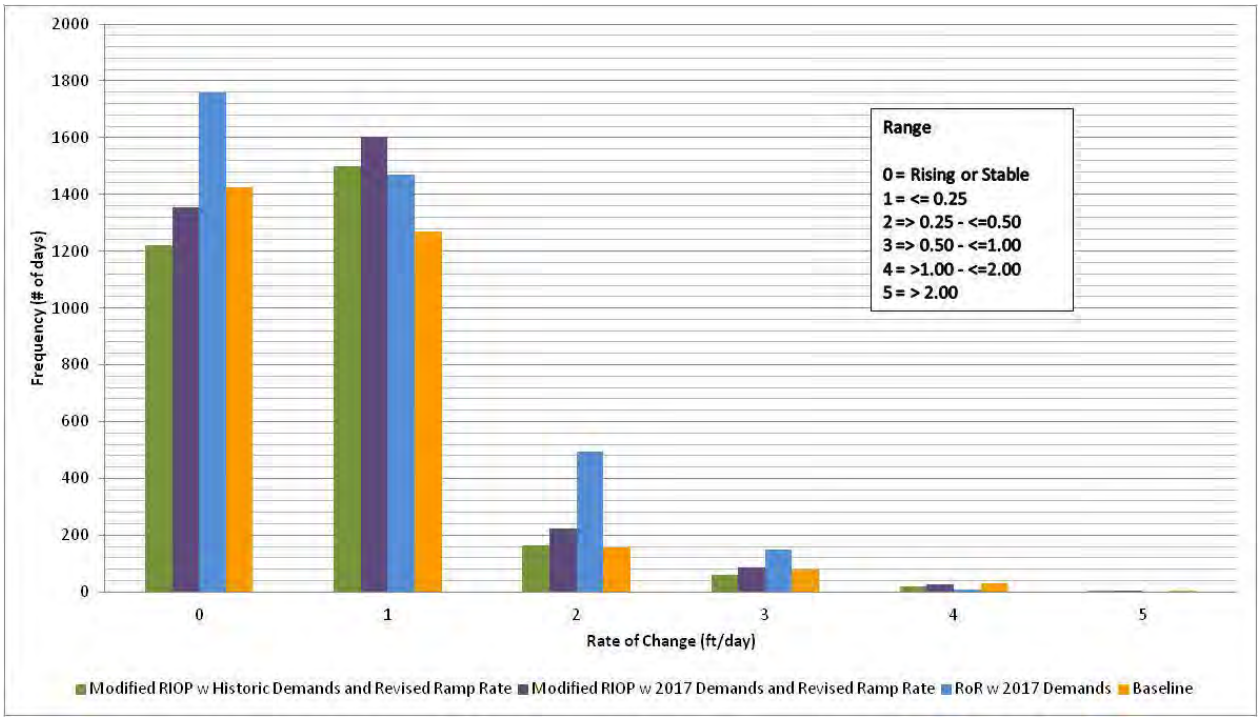


Figure 14. Frequency (number of days) of daily stage changes (ft/day) when releases from Woodruff Dam are less than 10,000 cfs under Modified RIOP w Historic Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); Modified RIOP w 2017 Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

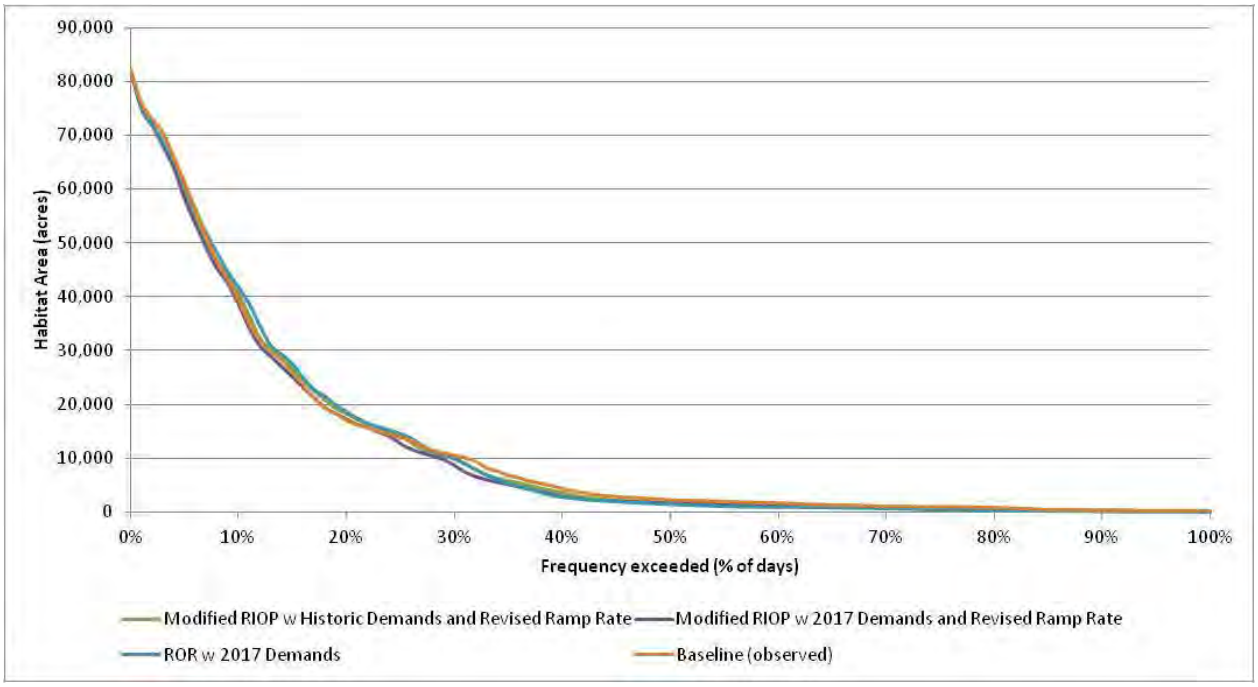


Figure 15. Frequency (percent of days) of growing-season (April-October) floodplain connectivity (acres) to the main channel under Modified RIOP w Historic Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); Modified RIOP w 2017 Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

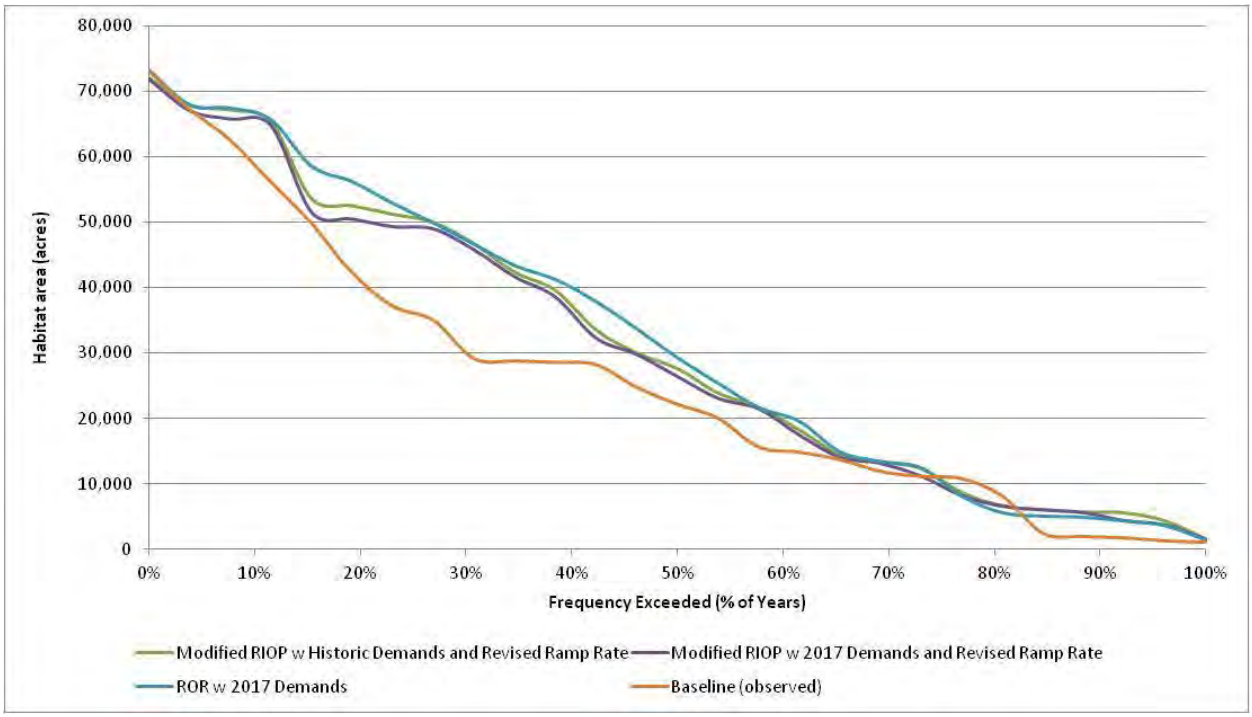


Figure 16. Inter-annual frequency (percent of years) of growing season (April-October) floodplain connectivity (maximum acres inundated for at least 30 consecutive days each year) to the main channel under Modified RIOP w Historic Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); Modified RIOP w 2017 Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); RoR w 2017 demands (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

United States Department of the Interior

IN REPLY REFER TO:

FISH AND WILDLIFE SERVICE
Field Office
1601 Balboa Avenue
Panama City, FL 32405-3721
Tel: (850) 769-0552
Fax: (850) 763-2177

February 22, 2012

Curtis Flakes
Chief, Planning and Environmental Division
U.S. Army Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628-0001

Dear Mr. Flakes:

This is in response to your letter of February 13, 2012, which included an amended biological assessment for the Revised Interim Operations Plan (RIOP) for Jim Woodruff Dam. Your letter also requested an extension of the formal consultation period for the RIOP, per section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). The extension was requested to allow the U.S. Fish and Wildlife Service (Service) sufficient time to review the biological assessment and prepare a biological opinion. The Service agree it is appropriate to extend the formal consultation period for an additional 90 days from the previously agreed to date of February 22, 2012 to May 22, 2012.

If you have any questions or comments, please contact myself or Karen Herrington at extension 247 or 250.

Sincerely,

//s//Dr. Donald W. Imm

Dr. Donald W. Imm
Project Leader

cc:
DOI Solicitors Office, Atlanta, GA
DOJ, Washington DC
USFWS, Regional Director, Atlanta GA
USFWS, Field Supervisor, Athens, GA and Daphne, AL

DEPARTMENT OF THE ARMY
MOBILE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 2288
MOBILE, AL 36628-0001

April 12, 2012

REPLY TO
ATTENTION OF

Planning and Environmental Division

Dr. Donald W. Imm
Field Supervisor
U.S. Fish and Wildlife Service
1601 Balboa Avenue
Panama City, Florida 32405-3721

Dear Dr. Imm:

The U.S. Corps of Engineers recently became aware of a paper documenting evidence of Gulf sturgeon (*Acipenser oxyrinchus desotoi*) autumn spawning in the Suwannee River, Florida (Randall and Sulak, 2012). Although, autumn spawning has not been documented in the Apalachicola River, it is common for tagged fish from the Suwannee River and other Gulf drainages to be found there and thus it is possible that some limited autumn spawning occurs in the Apalachicola River also. In our February 2012 revised amended biological assessment evaluating the effects of the proposed modifications to the Revised Interim Operations Plan (RIOP) we determined that the proposed action may affect but is not likely to adversely affect Gulf sturgeon and that it may affect but is not likely to adversely modify Gulf sturgeon critical habitat. The biological assessment did not specifically consider the possibility of autumn spawning. Therefore, we analyzed the September through November monthly flow durations of the simulated flow regimes under the current RIOP and proposed modifications as compared to the baseline (observed flows 1975-2008). The results of this analysis are illustrated in the enclosed figures. The proposed modifications to the RIOP generally provide flows consistent with those occurring under the Baseline flow regime during these months.

The median flow values for the current RIOP, Proposed Action, and Baseline are provided in Table 1 below. The median flow values for all three flow regimes are generally comparable with the Modified RIOP providing slightly lower median flows in September and October and greater median flows in November as compared to the Baseline.

Table 1. Median monthly Apalachicola River flow (Sep-Nov) under the RIOP w Historic Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); Modified RIOP w Historic Demands and Revised Ramp Rate (ResSim simulated flow 1975-2008); and Baseline (observed flow 1975-2008).

	RIOP (cfs)	Modified RIOP (cfs)	Baseline (cfs)
September	9,799	9,919	11,100
October	10,276	10,370	10,800
November	13,152	13,099	11,700

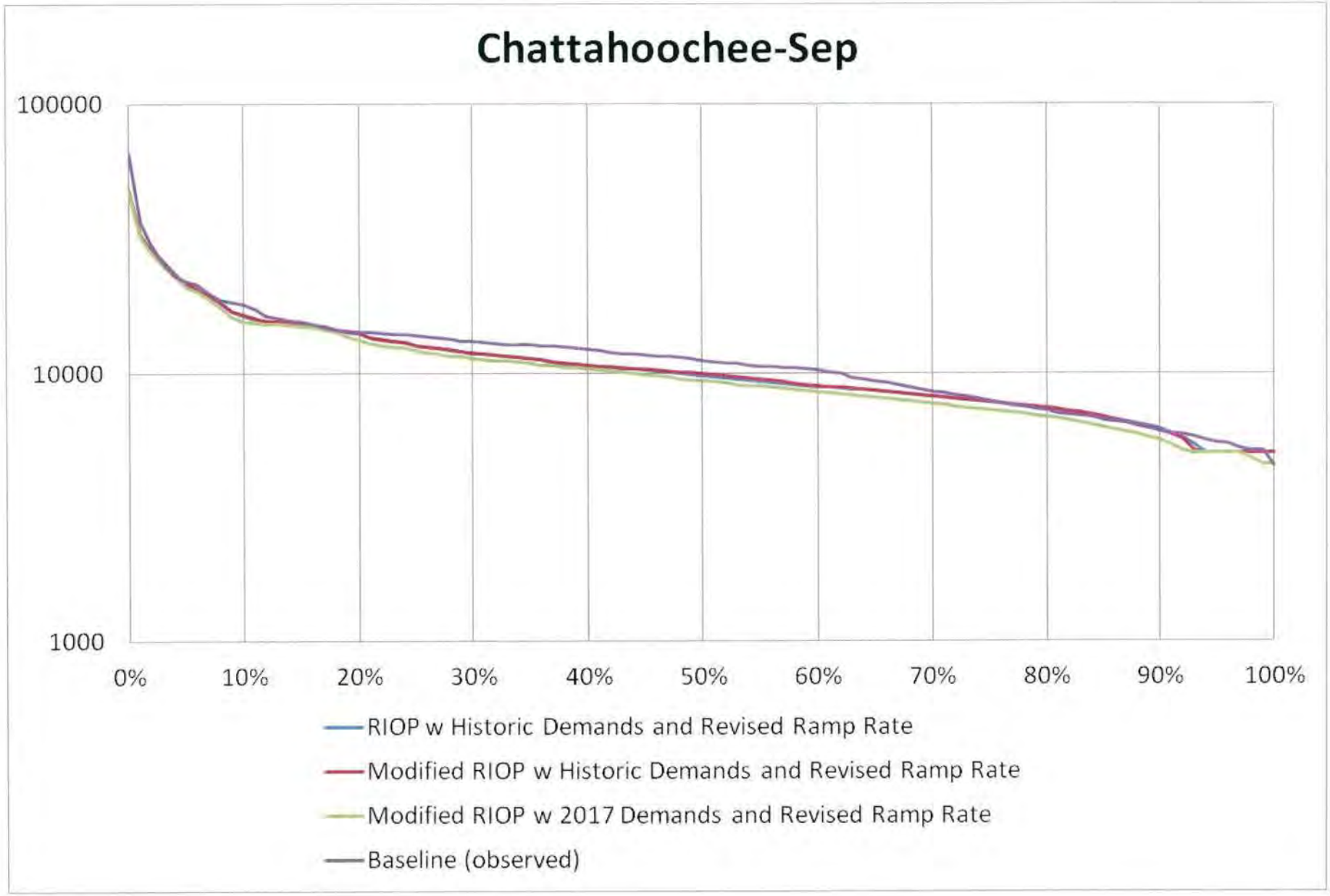
All of these median flow values yield about 20 acres of potentially suitable sturgeon spawning habitat that is at least eight feet deep according to Figure 4.2.3.C in the 2008 RIOP Biological Opinion. It is unlikely that the September through November flow regime expected to occur under the Modified RIOP will affect Gulf sturgeon autumn spawning activity if it occurs in the Apalachicola River. Therefore, we have concluded that our previous determination that the Modified RIOP may affect but is not likely to adversely affect Gulf sturgeon and that it may affect but is not likely to adversely modify Gulf sturgeon critical habitat is still valid.

If you have any questions regarding the autumn spawning analysis or information provided, please contact Mr. Brian Zettle, of the Inland Environment Team, (251) 690-2115, or Email:brian.a.zettle@sam.usace.army.mil. We look forward to continued progress as we work with you and your staff to complete our respective consultation responsibilities.

Sincerely,

Curtis M. Flakes
Chief, Planning and Environmental
Division

Enclosures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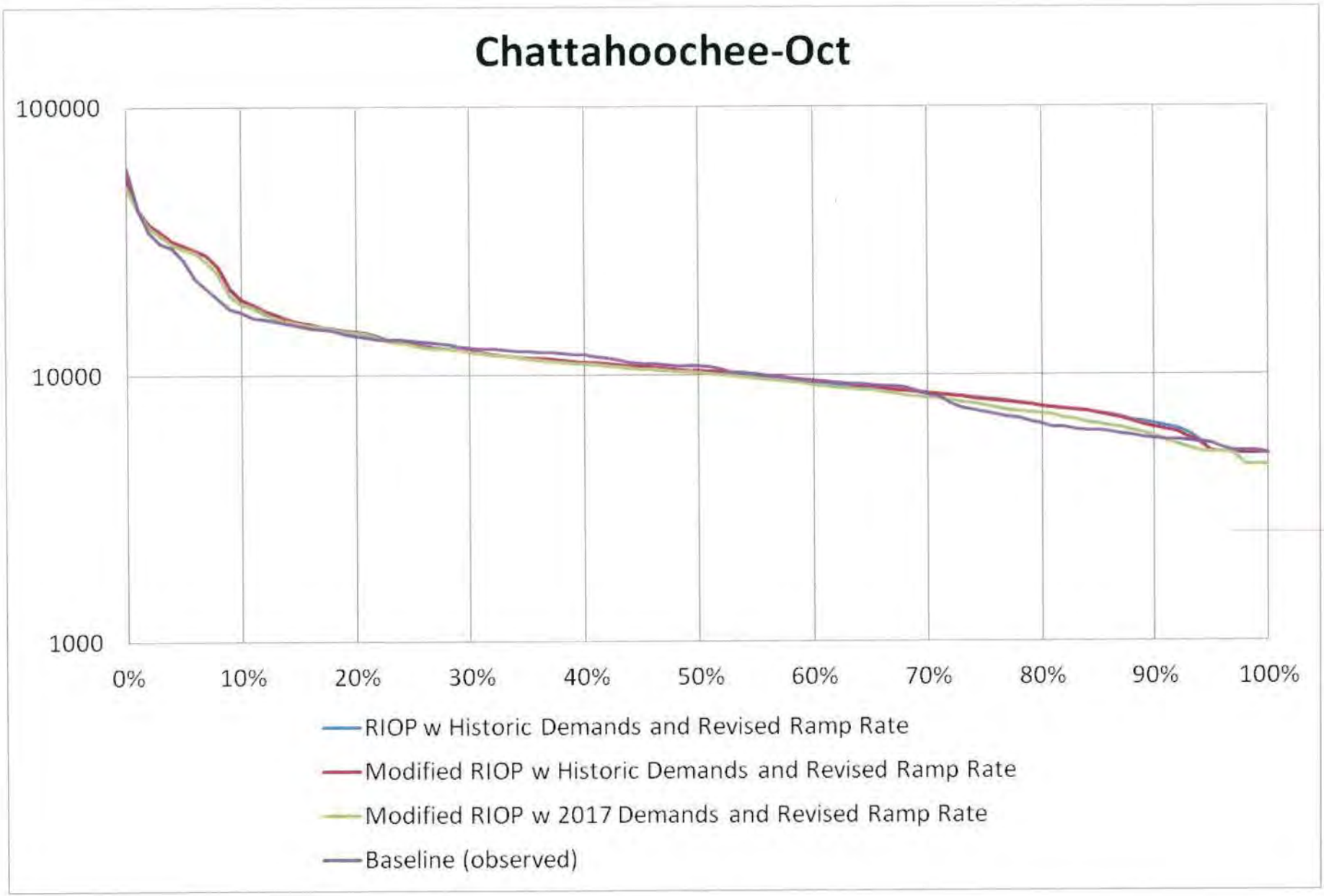
RIOP w Historic Demands and Revised Ramp Rate
Modified RIOP w Historic Demands and Revised Ramp Rate
Modified RIOP w 2017 Demands and Revised Ramp Rate
Baseline (observed)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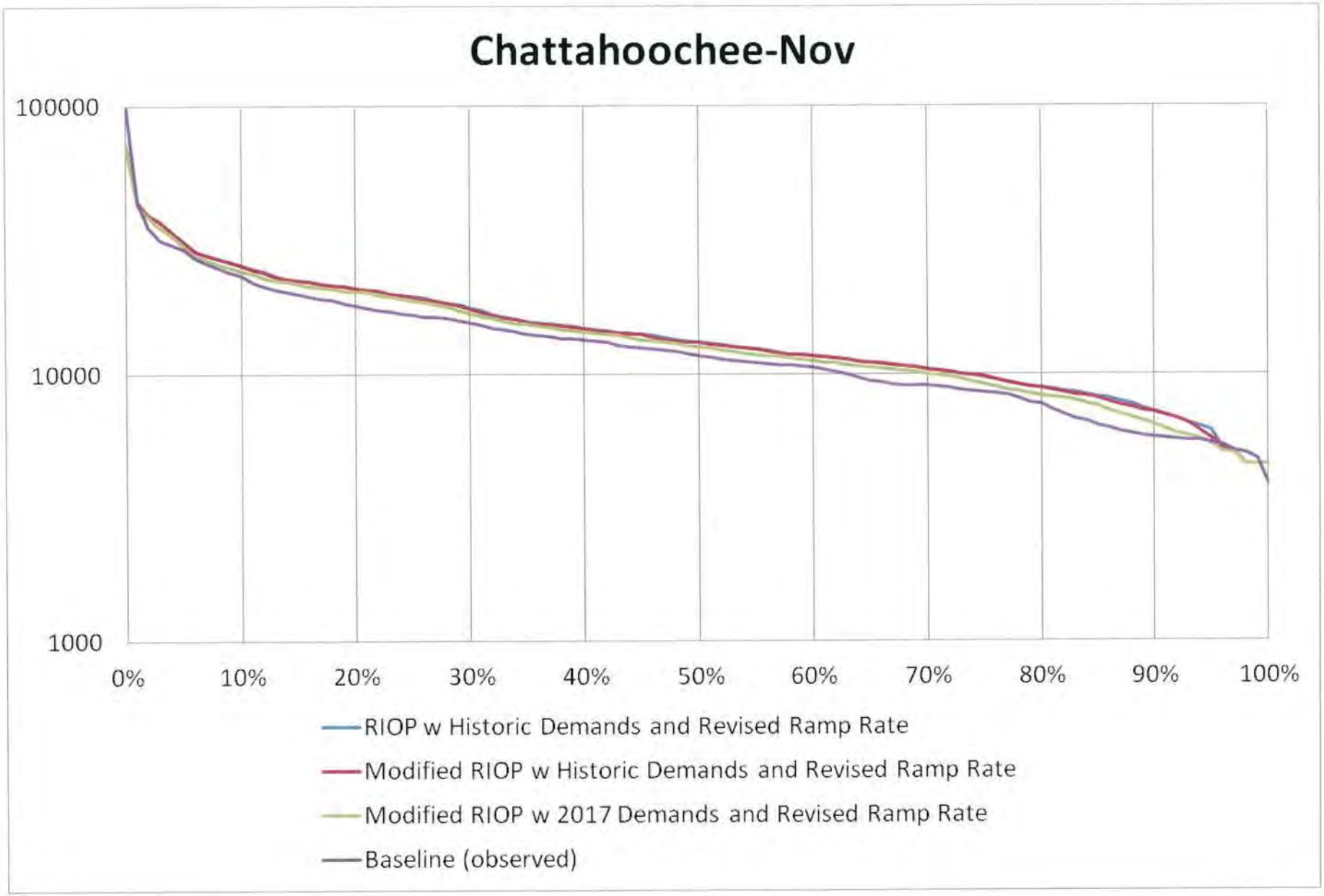
Modified RIOP w Historic Demands and Revised Ramp Rate
Modified RIOP w 2017 Demands and Revised Ramp Rate
Baseline (observed)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Modified RIOP w Historic Demands and Revised Ramp Rate
Modified RIOP w 2017 Demands and Revised Ramp Rate
Baseline (observed)