Appendix F

Option Development Process
ARSP Modeling and Analysis
of Lake Levels and River Flows

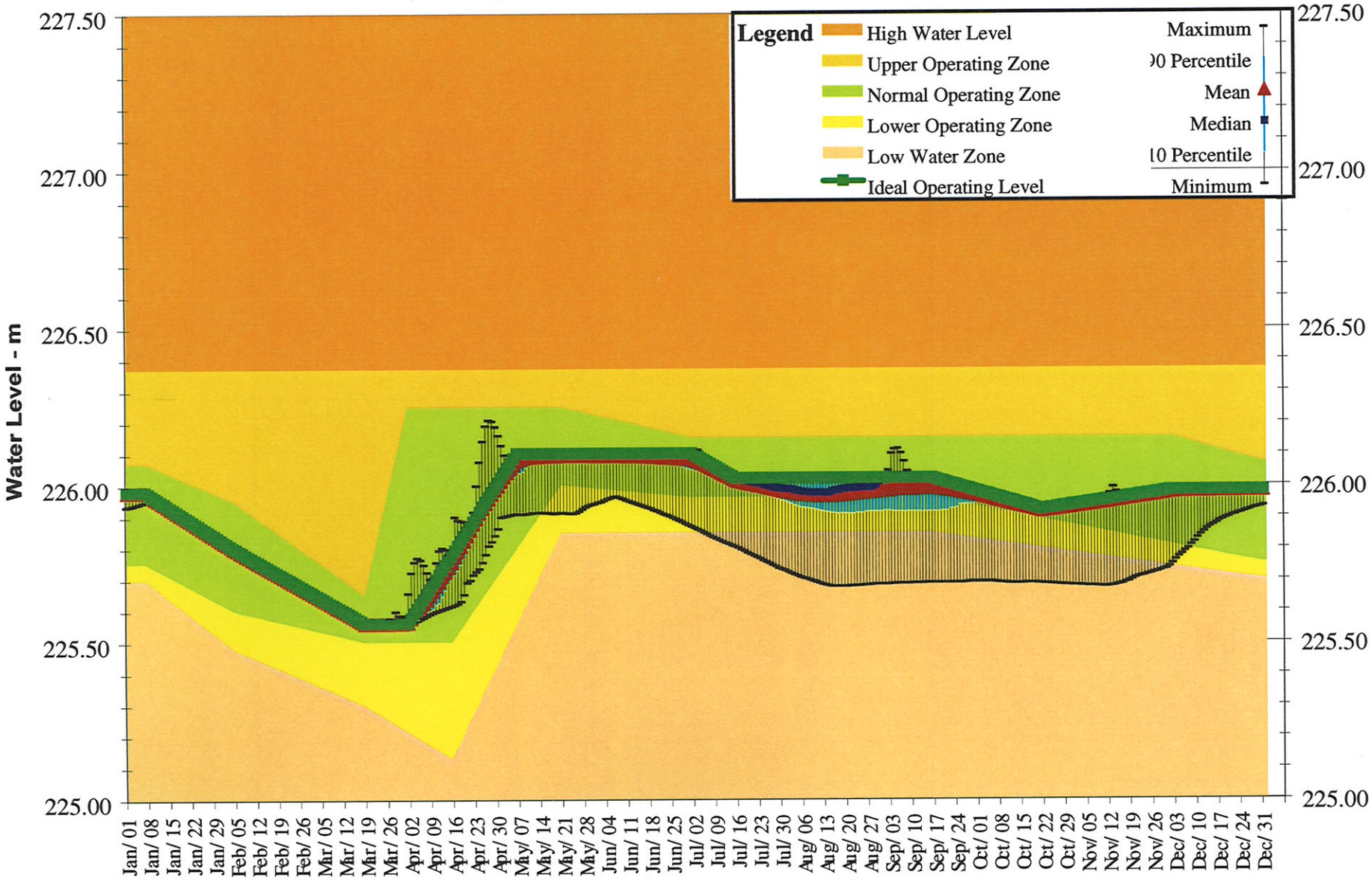
- **ARSP Base Case**
- **ARSP Case One**
- **ARSP Case Two**

Rosseau and Joseph Lakes

Rosseau & Joseph Lakes Water

ARSP Simulation Base Case

Operating Rules and Daily Water Level Statistics



Rosseau & Joseph Lakes Water Levels
ARSP Simulation Base Case

Peak Water Levels	
HWZ	226.37
No of Days in Exceedance	0
No of Years Exceeded	0
Maximum WL	226.21

Time of spring peak levels before April 30	
Percentile	0.90
Peak percentile WL	226.01
Date of peak	30-Apr
Tolerance	0
Tolerated WL	226.01
Date tolerated exceeded	30-Apr

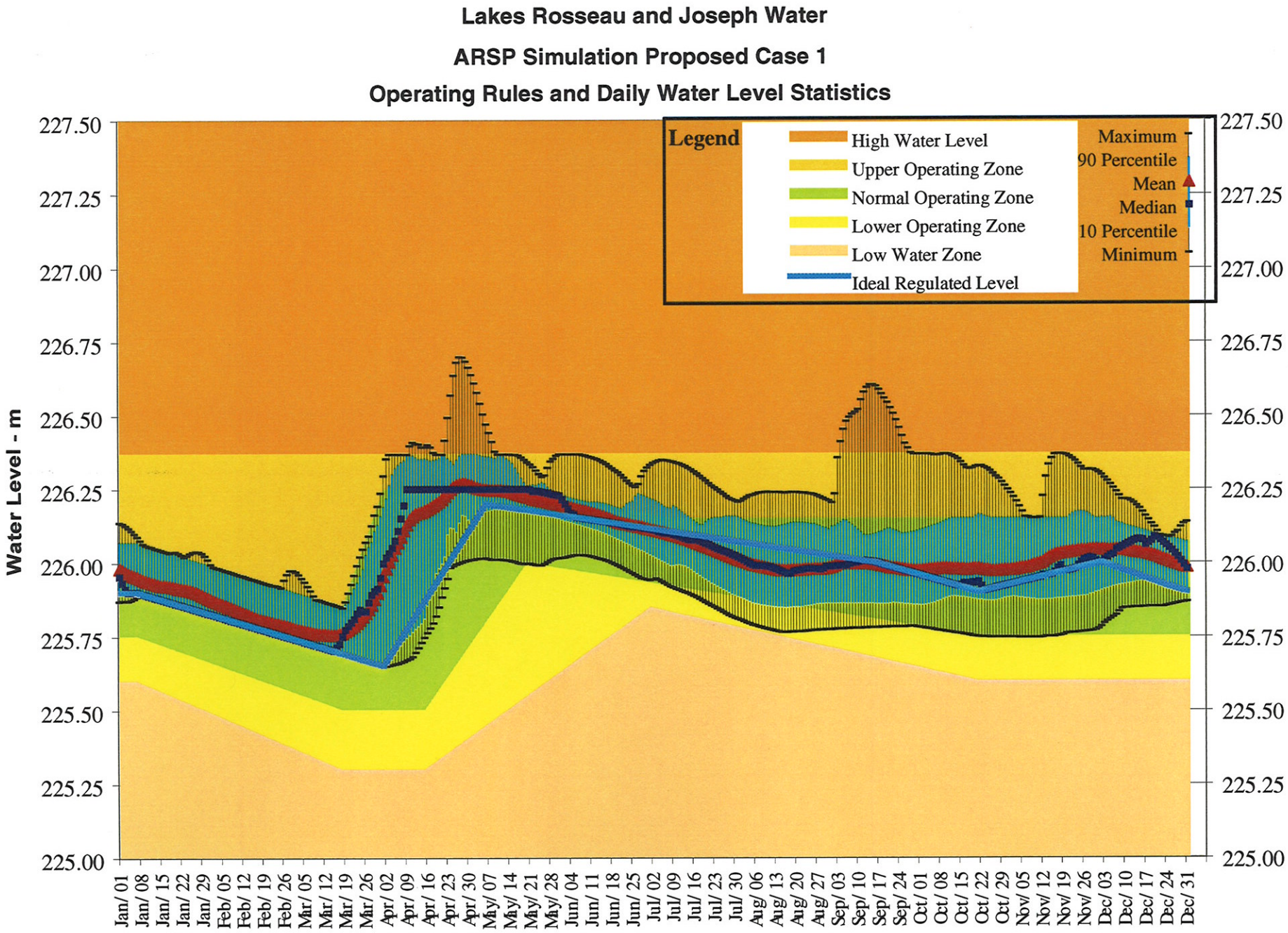
Summer recreation levels Jun-15 to Sep-30

90 and 10 percentile range

Max 90%	226.10
Min 10%	225.91
Range	0.19

Median range

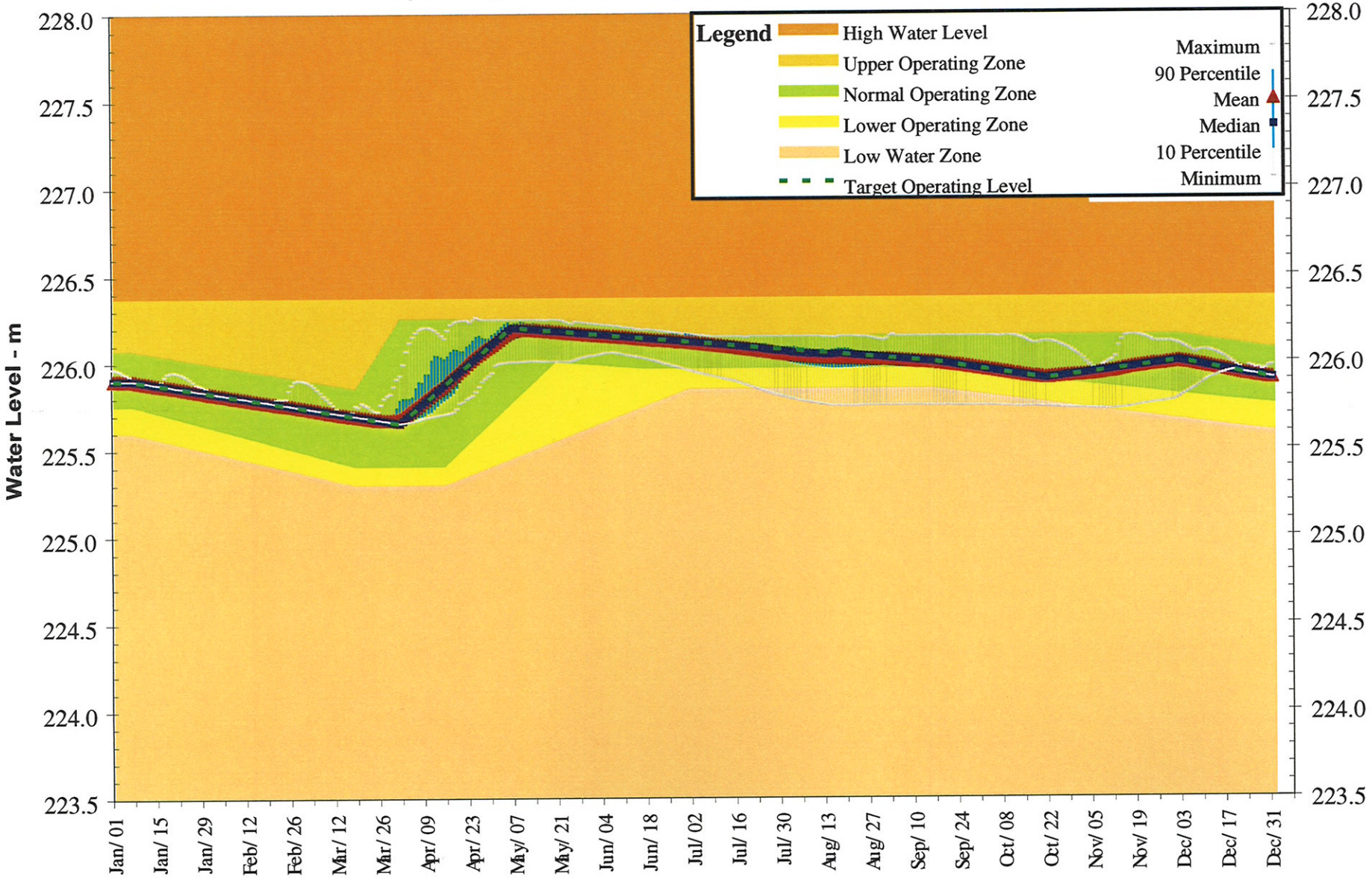
Max Median	226.10
Min Median	225.97
Range	0.13


Lakes Rosseau and Joseph Water
ARSP Simulation Proposed Case 1
Operating Rules and Daily Water Level Statistics
Water Level - m
227.50
227.25
227.00
226.75
226.50
226.25
226.00
225.75
225.50
225.25
225.00
Legend
High Water Level
Upper Operating Zone
Normal Operating Zone
Lower Operating Zone
Low Water Zone
Ideal Regulated Level
Maximum
90 Percentile
Mean
Median
10 Percentile
Minimum
Jan/ 01
Jan/ 08
Jan/ 15
Jan/ 22
Jan/ 29
Feb/ 05
Feb/ 12
Feb/ 19
Feb/ 26
Mar/ 05
Mar/ 12
Mar/ 19
Mar/ 26
Apr/ 02
Apr/ 09
Apr/ 16
Apr/ 23
Apr/ 30
May/ 07
May/ 14
May/ 21
May/ 28
Jun/ 04
Jun/ 11
Jun/ 18
Jun/ 25
Jul/ 02
Jul/ 09
Jul/ 16
Jul/ 23
Jul/ 30
Aug/ 06
Aug/ 13
Aug/ 20
Aug/ 27
Sep/ 03
Sep/ 10
Sep/ 17
Sep/ 24
Oct/ 01
Oct/ 08
Oct/ 15
Oct/ 22
Oct/ 29
Nov/ 05
Nov/ 12
Nov/ 19
Nov/ 26
Dec/ 03
Dec/ 10
Dec/ 17
Dec/ 24
Dec/ 31

Rosseau & Joseph Lakes Water

ARSP Simulation Case 2

Operating Rules and Daily Water Level Statistics



Rosseau & Joseph Lakes Water Levels
ARSP Simulation Case 2

Peak Water Levels	
HWZ	226.37
No of Days in Exceedance	0
No of Years Exceeded	0
Maximum WL	226.26

Time of spring peak levels before April 30	
Percentile	0.90
Peak percentile WL	226.16
Date of peak	26-Apr
Tolerance	0
Tolerated WL	226.16
Date tolerated exceeded	26-Apr

Summer recreation levels Jun-15 to Sep-30

90 and 10 percentile range

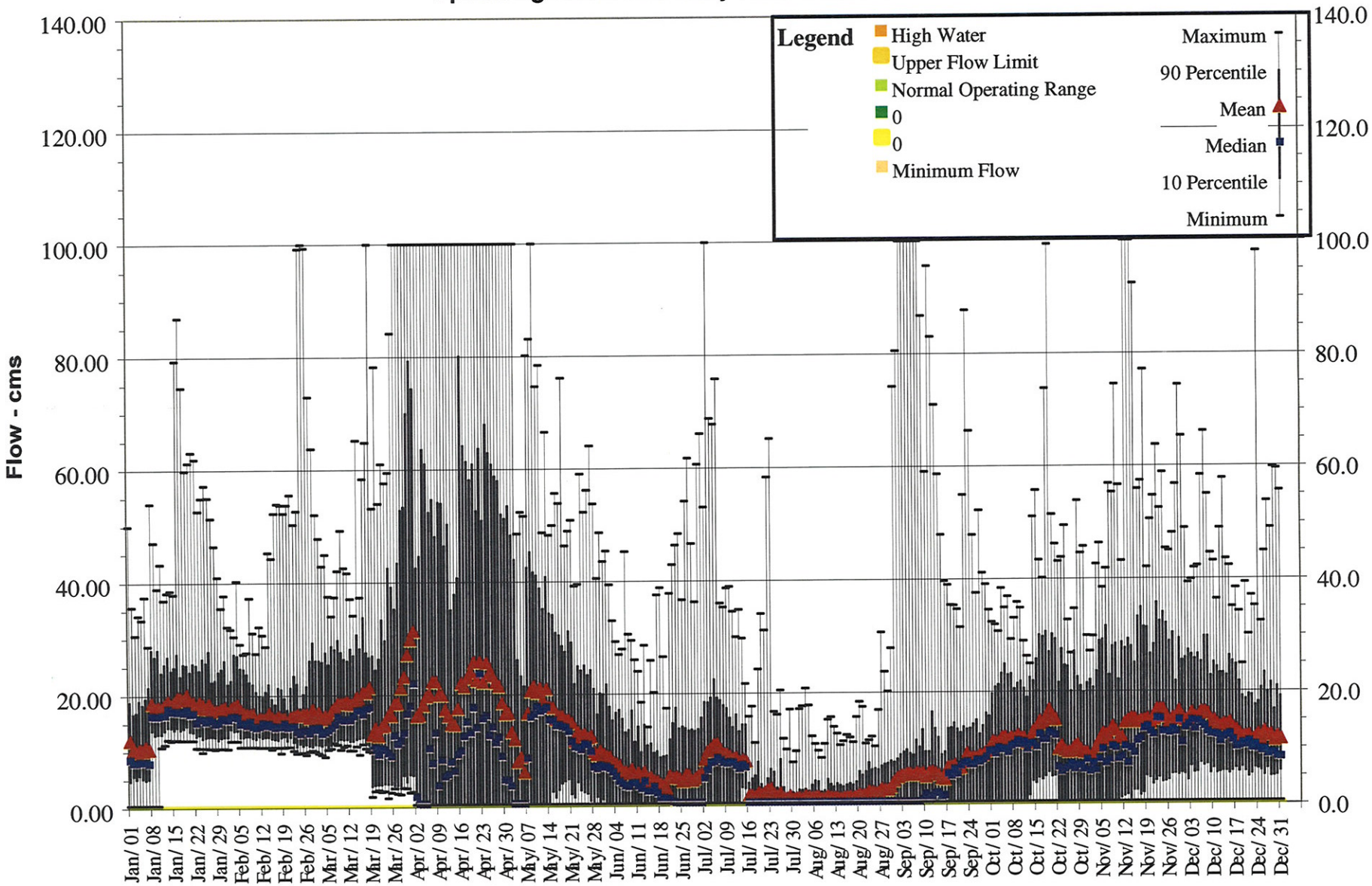
Max 90%	226.16
Min 10%	225.96
Range	0.20

Median range

Max Median	226.14
Min Median	225.96
Range	0.18

Spring Peak Water Level

Maximum - 50 yr Average	226.20
Date - 50 yr Average	7/May
Summer Average Level	226.06


Indian River below Lakes Rosseau-
ARSP Simulation Base Case
Operating Rules and Daily Flow Statistics
Legend
High Water
Upper Flow Limit
Normal Operating Range
0
0
Minimum Flow
Maximum
90 Percentile
Mean
Median
10 Percentile
Minimum
Flow - cms
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jan/ 01
Jan/ 08
Jan/ 15
Jan/ 22
Jan/ 29
Feb/ 05
Feb/ 12
Feb/ 19
Feb/ 26
Mar/ 05
Mar/ 12
Mar/ 19
Mar/ 26
Apr/ 02
Apr/ 09
Apr/ 16
Apr/ 23
Apr/ 30
May/ 07
May/ 14
May/ 21
May/ 28
Jun/ 04
Jun/ 11
Jun/ 18
Jun/ 25
Jul/ 02
Jul/ 09
Jul/ 16
Jul/ 23
Jul/ 30
Aug/ 06
Aug/ 13
Aug/ 20
Aug/ 27
Sep/ 03
Sep/ 10
Sep/ 17
Sep/ 24
Oct/ 01
Oct/ 08
Oct/ 15
Oct/ 22
Oct/ 29
Nov/ 05
Nov/ 12
Nov/ 19
Nov/ 26
Dec/ 03
Dec/ 10
Dec/ 17
Dec/ 24
Dec/ 31

Flow Evaluation

Yellow cells indicate values that can be changed for analysis

Indian River below Lakes Rosseau-Joseph
ARSP Simulation Base Case
Daily Flows Model Results 1951 to 2000

Walleye Spawning

Min Flow 0 m³/s Achieved #N/A of time

No of days above minumum flow

First half of season

Min	25	days
Avg	25	days
Years Provided	100%	

Last half of season

Min	24	days
Avg	24	days
Years Provided	100%	

For whole season

Min	49	days
Avg	49	days
Years Provided	100%	

From flow duration curve

%	Flow		*No of days*			
99%	0.45	m³/s	*min flow is achievd*		90%	*percentile peak flow*
95%	0.45	m³/s	49	days	41	m3/s

Summer Minimum 7-day Flow

	Maximum	2.64	m³/s
	Minimum	0.45	m³/s
90%	Percentile	0.45	m³/s
10%	Percentile	0.45	m³/s
	Median	0.45	m³/s
	Mean	0.53	m³/s

Maximum Flows

DOM Limit to Prevent D/S — No of years exceeded — Maximum Daily Flow

Flooding

42.5	m³/s	47		100.00	m³/s

Minumum Flows

Min Daily flow		*7-day minimums*			
0.45	m³/s	2	10	20	return period
		-yr 7Q2	-yr 7Q10	-yr 7Q20	
		0.45	0.45	0.45	m³/s

Summer Fluctuations

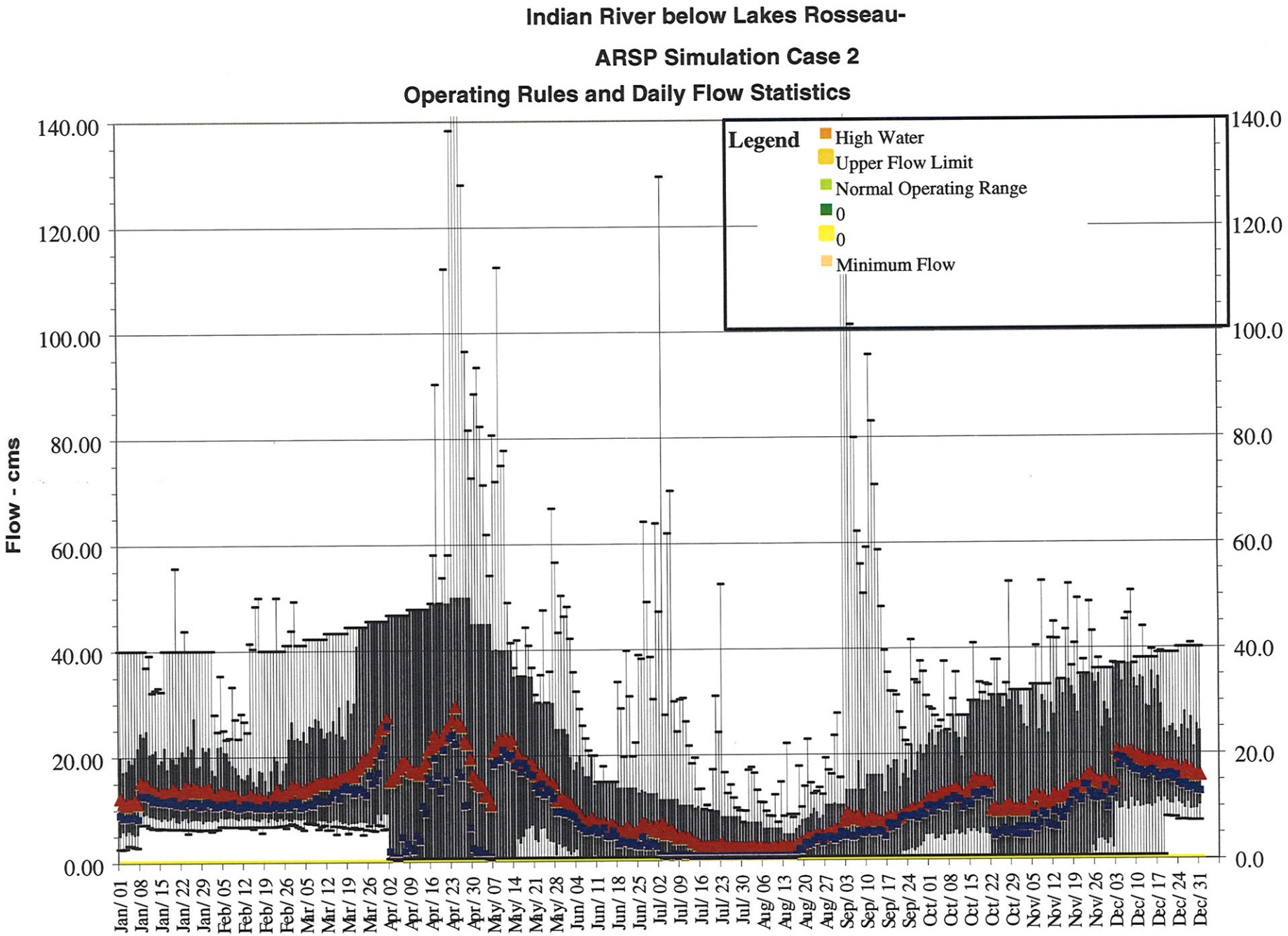
Delta Flow	Average number of daily flow fluctuations per year		
1	30.40		
3	15.42		
5	8.94		
>0.225	45.98	0.5	ratio of summer median

Water Usage

Median Flow		*10% Percentile*	
summer	winter	summer	winter
m³/s	m³/s	m³/s	m³/s
4.22	13.94	0.45	0.45

Power Generation

	Quarter					
	1	2	3	4	Annual	
Flow	17.17	13.59	4.51	13.00	12.03	m³/s


Indian River below Lakes Rosseau-
ARSP Simulation Case 2
Operating Rules and Daily Flow Statistics
Legend
High Water
Upper Flow Limit
Normal Operating Range
0
0
Minimum Flow
Flow - cms
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jan/ 01
Jan/ 08
Jan/ 15
Jan/ 22
Jan/ 29
Feb/ 05
Feb/ 12
Feb/ 19
Feb/ 26
Mar/ 05
Mar/ 12
Mar/ 19
Mar/ 26
Apr/ 02
Apr/ 09
Apr/ 16
Apr/ 23
Apr/ 30
May/ 07
May/ 14
May/ 21
May/ 28
Jun/ 04
Jun/ 11
Jun/ 18
Jun/ 25
Jul/ 02
Jul/ 09
Jul/ 16
Jul/ 23
Jul/ 30
Aug/ 06
Aug/ 13
Aug/ 20
Aug/ 27
Sep/ 03
Sep/ 10
Sep/ 17
Sep/ 24
Oct/ 01
Oct/ 08
Oct/ 15
Oct/ 22
Oct/ 29
Nov/ 05
Nov/ 12
Nov/ 19
Nov/ 26
Dec/ 03
Dec/ 10
Dec/ 17
Dec/ 24
Dec/ 31

Flow Evaluation

Yellow cells indicate values that can be changed for analysis

Indian River below Lakes Rosseau-Joseph
ARSP Simulation Case
2
Daily Flows Model Results 1951 to 2000

Walleye Spawning

Min Flow 0 m³/s Achieved #N/A of time

No of days above minumum flow

First half of season			*Last half of season*			*For whole season*		
Min	25	days	Min	24	days	Min	49	days
Avg	25	days	Avg	24	days	Avg	49	days
Years Provided	100%		Years Provided	100%		Years Provided	100%	

From flow duration curve

%	Flow		*No of days*		%	*percentile peak flow*
99%	0.70	m³/s	*min flow is achievd*		*90%*	
95%	0.70	m³/s	49	days	49	m3/s

Summer Minimum 7-day Flow

	Maximum	4.28	m³/s
	Minimum	0.70	m³/s
90%	Percentile	1.73	m³/s
10%	Percentile	0.70	m³/s
	Median	0.70	m³/s
	Mean	1.05	m³/s

Maximum Flows

DOM Limit to Prevent D/S Flooding

42.5	m^3/s	No of years exceeded	45

Maximum Daily Flow: 175.88 m^3/s

Minumum Flows

Min Daily flow: 0.70 m^3/s

7-day minimums

2-yr 7Q2	10-yr 7Q10	20-yr 7Q20	return period
0.70	0.70	0.70	m^3/s

Summer Fluctuations

Delta Flow	Average number of daily flow fluctuations per year
1	30.00
3	13.26
5	6.46
>1.465	23.80

0.5 ratio of summer median

Water Usage

Median Flow		*10% Percentile*	
summer	winter	summer	winter
m^3/s	m^3/s	m^3/s	m^3/s
5.56	12.03	0.70	0.70

Power Generation

	Quarter				
	1	2	3	4	Annual
Flow	14.21	14.89	5.00	14.12	12.03 m^3/s