Appendix F

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

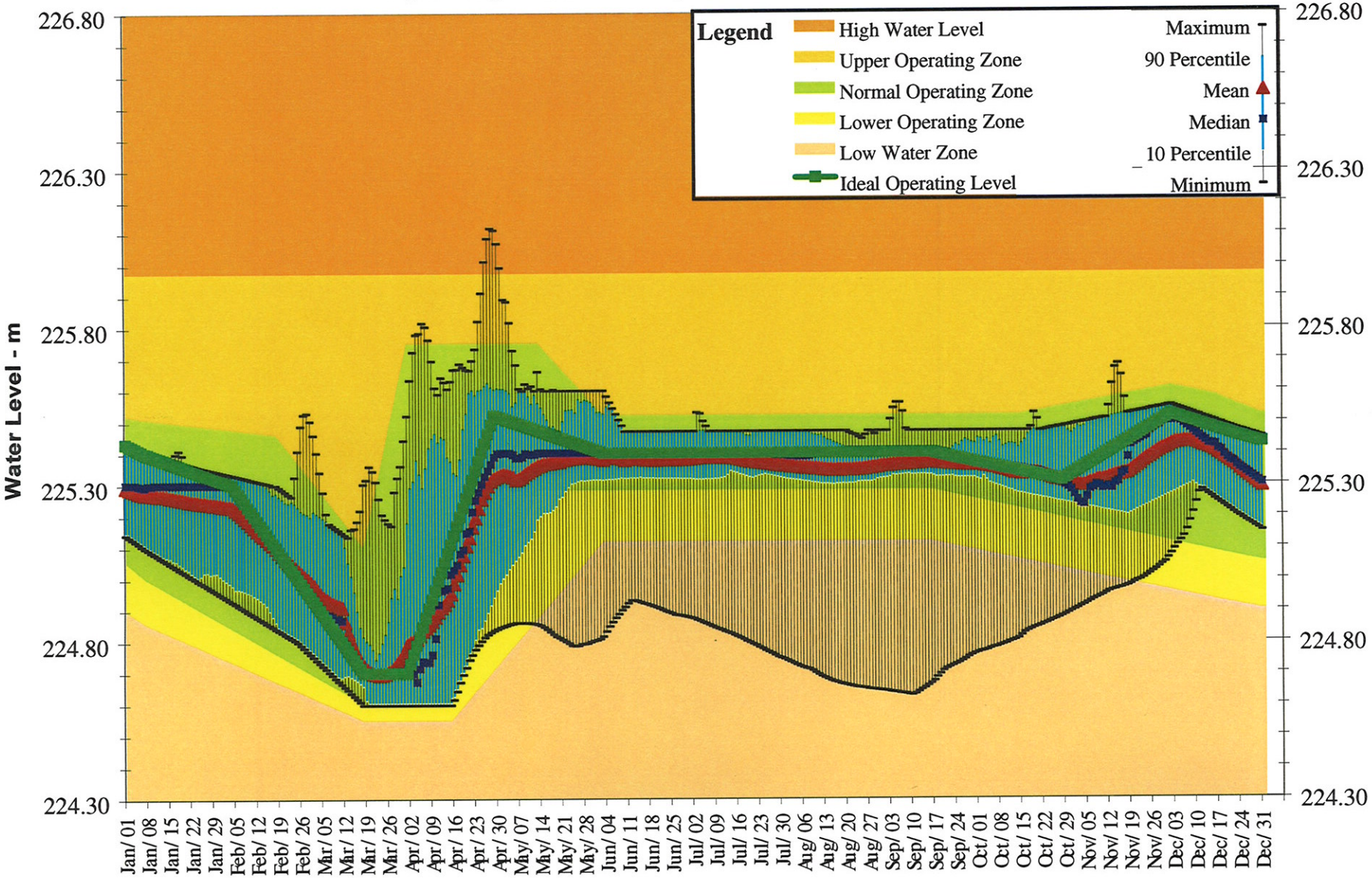
- **ARSP Base Case**
- **ARSP Case One**
- **ARSP Case Two**

Lake Muskoka

Muskoka Lake Water Levels

ARSP Simulation Base Case

Operating Rules and Daily Water Level Statistics



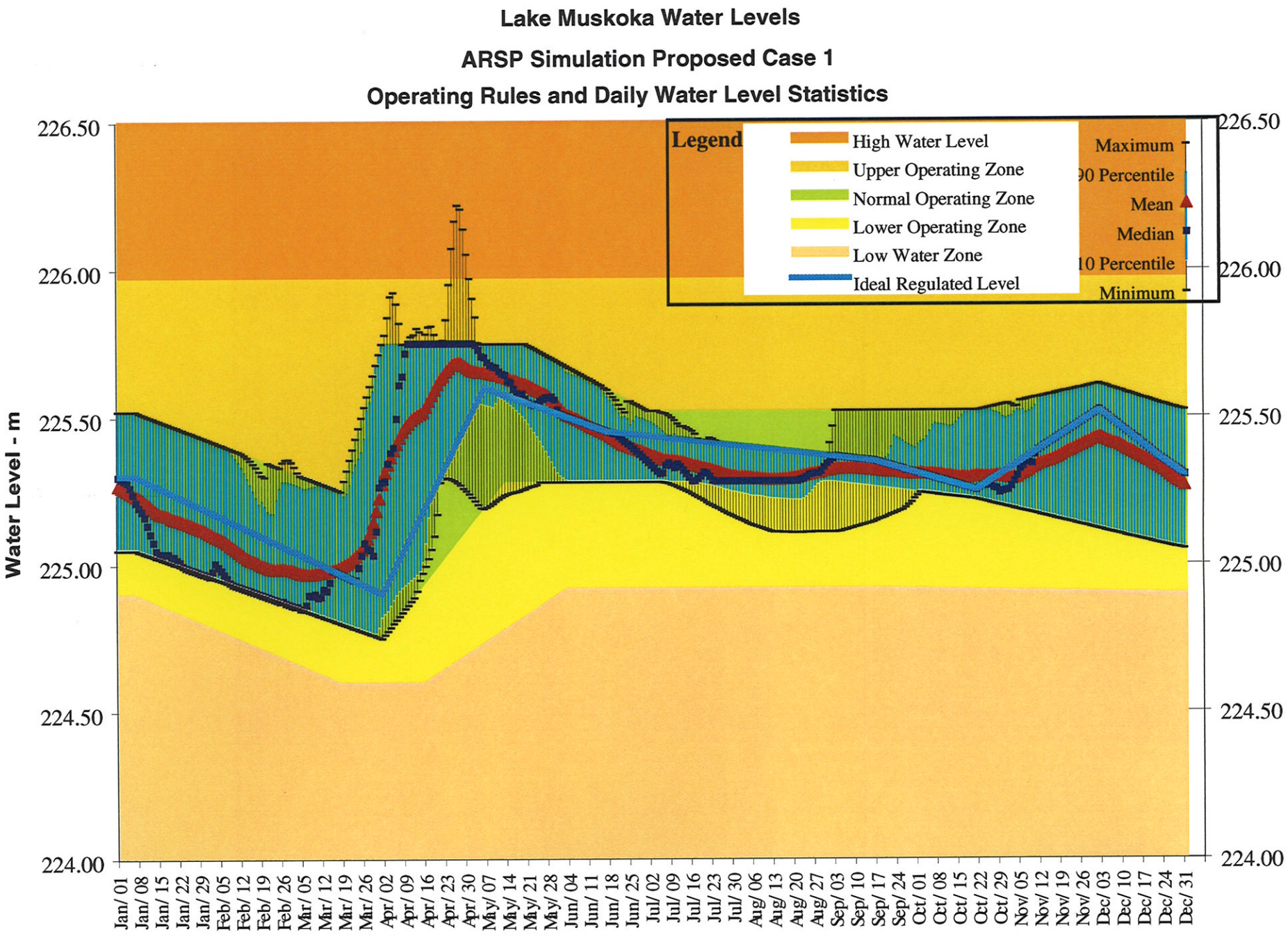
Muskoka Lake Water Levels
ARSP Simulation Base Case

Peak Water Levels	
HWZ	225.97
No of Days in Exceedance	6
No of Years Exceeded	1
Maximum WL	226.12

Time of spring peak levels before April 30	
Percentile	0.90
Peak percentile WL	225.62
Date of peak	27-Apr
Tolerance	0
Tolerated WL	225.62
Date tolerated exceeded	27-Apr

Summer recreation levels Jun-15 to Sep-30	
90 and 10 percentile range	
Max 90%	225.47
Min 10%	225.30
Range	0.17

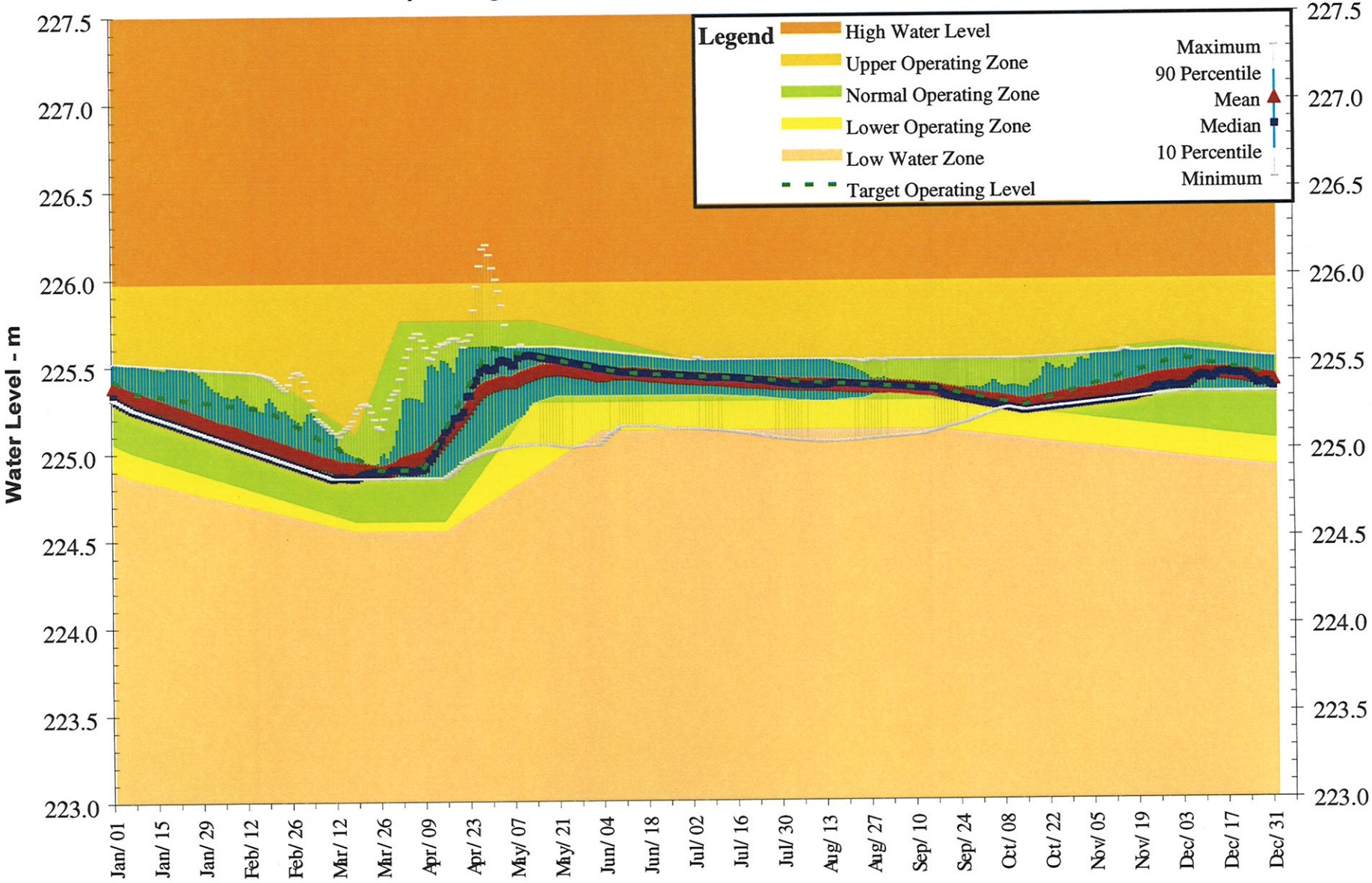
Median range	
Max Median	225.40
Min Median	225.37
Range	0.03


Lake Muskoka Water Levels
ARSP Simulation Proposed Case 1
Operating Rules and Daily Water Level Statistics
Water Level - m
226.50
226.00
225.50
225.00
224.50
224.00
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

Muskoka Lake Water Levels

ARSP Simulation Case 2

Operating Rules and Daily Water Level Statistics



Muskoka Lake Water Levels
ARSP Simulation Case 2

Peak Water Levels	
HWZ	225.97
No of Days in Exceedance	6
No of Years Exceeded	1
Maximum WL	226.19

Time of spring peak levels before April 30	
Percentile	0.90
Peak percentile WL	225.60
Date of peak	20-Apr
Tolerance	0
Tolerated WL	225.60
Date tolerated exceeded	20-Apr

Summer recreation levels Jun-15 to Sep-30

90 and 10 percentile range

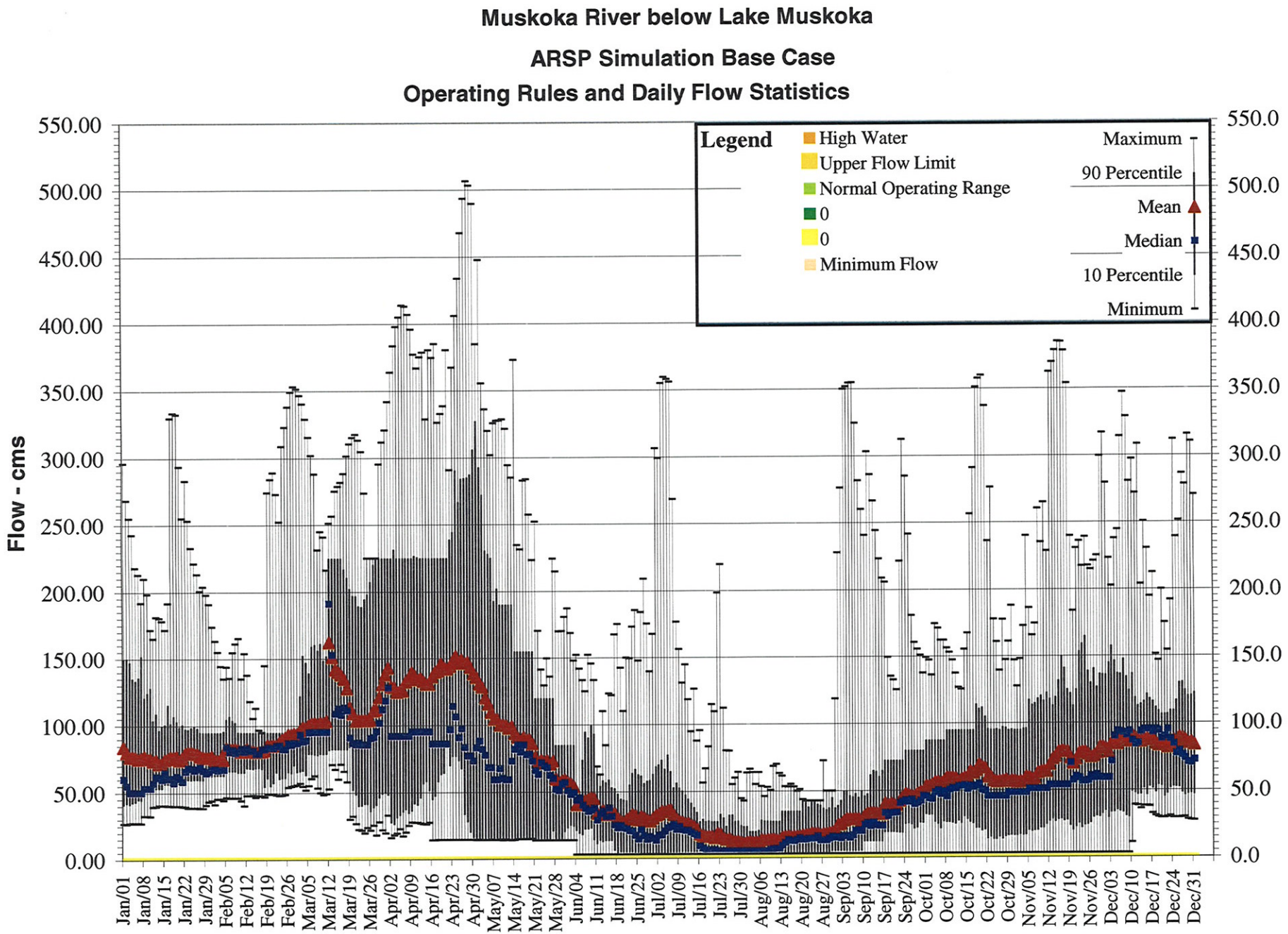
Max 90%	225.55
Min 10%	225.27
Range	0.28

Median range

Max Median	225.45
Min Median	225.27
Range	0.18

Spring Peak Water Level

Maximum - 50 yr Average	225.53
Date - 50 yr Average	1/May
Summer Average Level	225.38


Muskoka River below Lake Muskoka
ARSP Simulation Base Case
Operating Rules and Daily Flow Statistics
Flow - cms
Legend
High Water
Upper Flow Limit
Normal Operating Range
0
0
Minimum Flow
Maximum
90 Percentile
Mean
Median
10 Percentile
Minimum
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
550.0
500.0
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
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

Muskoka River below Lake Muskoka
ARSP Simulation Base Case
Daily Flows Model Results 1951 to 2000

Walleye Spawning

Min Flow 3 m^3/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	
99%	14.48	m^3/s
95%	14.88	m^3/s

No of days min flow is achievd
49 days

90% *percentile peak flow*
225 m3/s

Summer Minimum 7-day Flow

	Maximum	22.60 m^3/s
	Minimum	3.00 m^3/s
90%	Percentile	14.35 m^3/s
10%	Percentile	3.00 m^3/s
	Median	5.00 m^3/s
	Mean	7.34 m^3/s

Maximum Flows

DOM flow limit to prevent flooding No of years exceeded Maximum Daily Flow

283 m³/s	30		506.57 m³/s

Minumum Flows

Min Daily flow	*7-day minimums*		
3.00 m³/s	2	10	20 return period
	-yr 7Q2	-yr 7Q10	-yr 7Q20
	5.00	3.00	3.00 m³/s

Summer Fluctuations

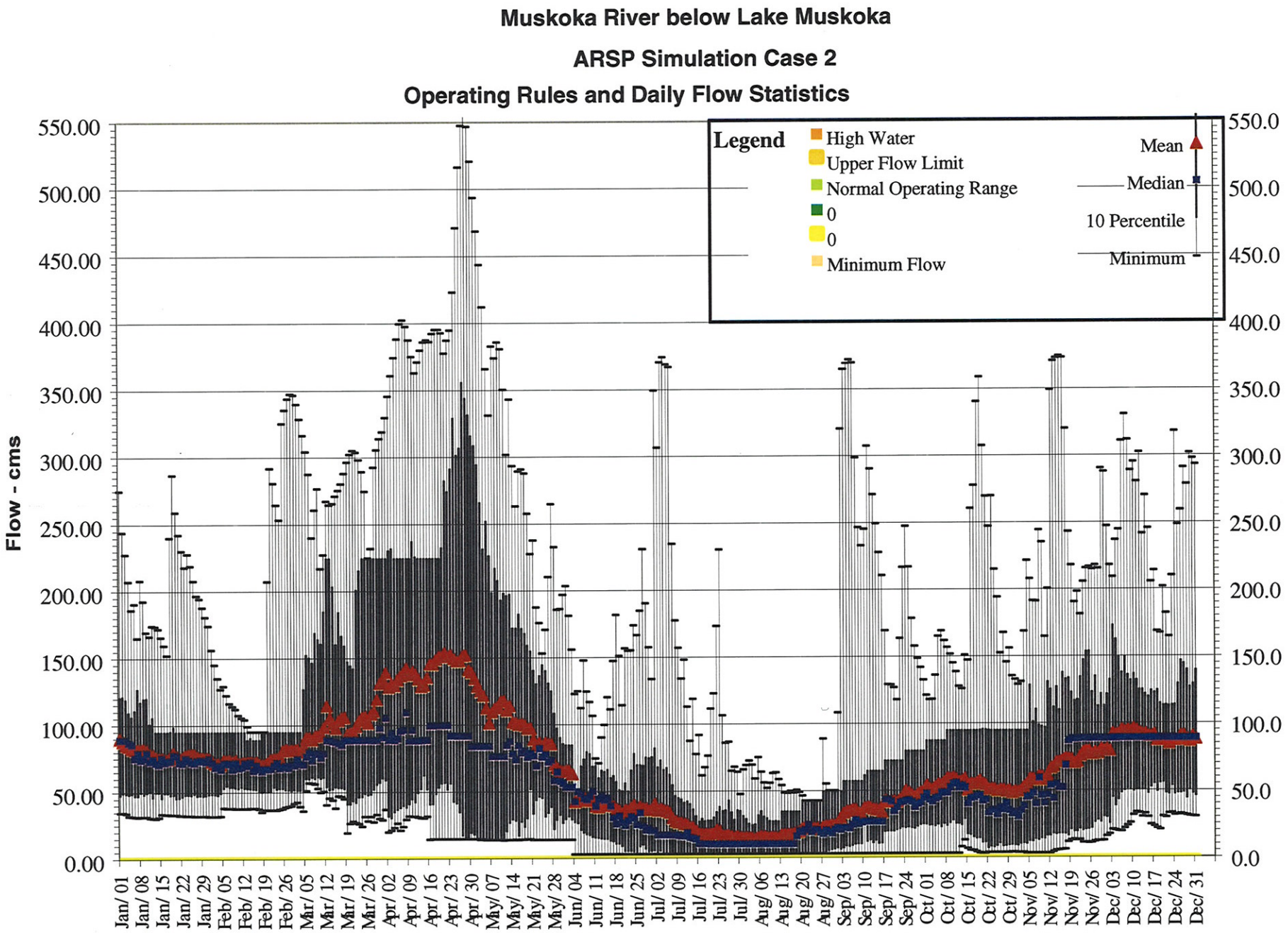
Delta Flow	Average number of daily flow fluctuations per year		
1	50.30		
3	32.14		
5	21.98		
>8.49725	11.98	0.5	ratio of summer median

Water Usage

Median Flow		*10% Percentile*	
summer m³/s	winter m³/s	summer m³/s	winter m³/s
29.66	83.84	5.00	3.00

Power Generation

	Quarter				
	1	2	3	4	Annual
Flow	91.77	88.40	24.41	71.71	68.90 m³/s


Muskoka River below Lake Muskoka
ARSP Simulation Case 2
Operating Rules and Daily Flow Statistics
Legend
High Water
Upper Flow Limit
Normal Operating Range
0
0
Minimum Flow
Mean
Median
10 Percentile
Minimum
Flow - cms
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
550.0
500.0
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
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

Muskoka River below Lake Muskoka
ARSP Simulation Case
2
Daily Flows Model Results 1951 to 2000

Walleye Spawning

Min Flow 3 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%	13.90	m³/s	*min flow is achievd*		90%	*percentile peak flow*
95%	14.60	m³/s	49	days	225	m3/s

Summer Minimum 7-day Flow

	Maximum	31.27	m³/s
	Minimum	3.00	m³/s
90%	Percentile	21.27	m³/s
10%	Percentile	3.00	m³/s
	Median	9.92	m³/s
	Mean	10.16	m³/s

Maximum Flows

DOM flow limit to prevent | No of years exceeded | Maximum Daily Flow

flooding

283	m^3/s	33	558.44 m^3/s

Minumum Flows

Min Daily flow		*7-day minimums*			
		2	10	20	return period
		-yr 7Q2	-yr 7Q10	-yr 7Q20	
3.00	m^3/s	7.78	3.00	3.00	m^3/s

Summer Fluctuations

Delta Flow	Average number of daily flow fluctuations per year		
1	43.78		
3	30.06		
5	19.88		
>11.63	7.72	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
31.25	88.08	5.44	3.00

Power Generation

	Quarter					
	1	2	3	4	Annual	
Flow	84.65	94.20	26.86	70.43	68.88	m^3/s