



LAKE WALLENPAUPACK



Lake Target and Spill Operations Plan

**March 1, 2007 Presentation to the
Public Advisory Committee**

Plan Components



- **Proactive** – Adjust Lake Level Targets in spring based on snow pack conditions in the basin -> Uncertainty is representative snowpack measurements and percent run-off absent rain (NY City uses 50%)
- **Reactive** – Determine operations once rainfall is predicted -> Uncertainty is rainfall amount (NWS prediction) and percent run-off (ground saturation)
- **Living Model** – Future refinements are expected as additional data becomes available (Run-off coefficients and real-time information on ground saturation being discussed with NWS and DRBC)

Proactive Assessment of Snow Pack Conditions



- Monitor snowpack (snow water equivalent) in watershed starting December 1. (NWS data published for Hawley)
- Estimate potential impact on lake level (50% run-off coefficient used by NY City)
- Adjust winter/spring target levels within constraints and obligations imposed by the FERC license and the DRBC.

Reactive Operations During Rainfall Events



- Monitor forecast precipitation – QPF's
- Assess snowpack conditions
- Compute potential runoff impact on reservoir level
- Implement preemptive increases in discharge to minimize spill potential and rate
 - Considerations
 - Wallenpaupack Creek conditions
 - Hawley flood stage
 - River Ice conditions
 - Conditions in lower Delaware basin
- Implement notification procedures when spills anticipated

Decision Support Model



- Lake Target and Spill Decision Model developed
 - Developed using Microsoft Excel
 - Accounts for license obligations – PPL has no discretion on these matters
 - Decision logic based on perceived “acceptable risk” to meet licensing obligations (Can be readily adjusted based on additional discussions – future revisions possible)



Background – Licensing Obligations



- Summer Recreation Minimum
- Sufficient water for boating flow releases
- Sufficient water for trout thermal regulation program
- Delaware basin drought support – PPL has committed to manage lake to ensure near 100% refill probability on June 1 (EI 1187.0) in order to meet multiple objectives.

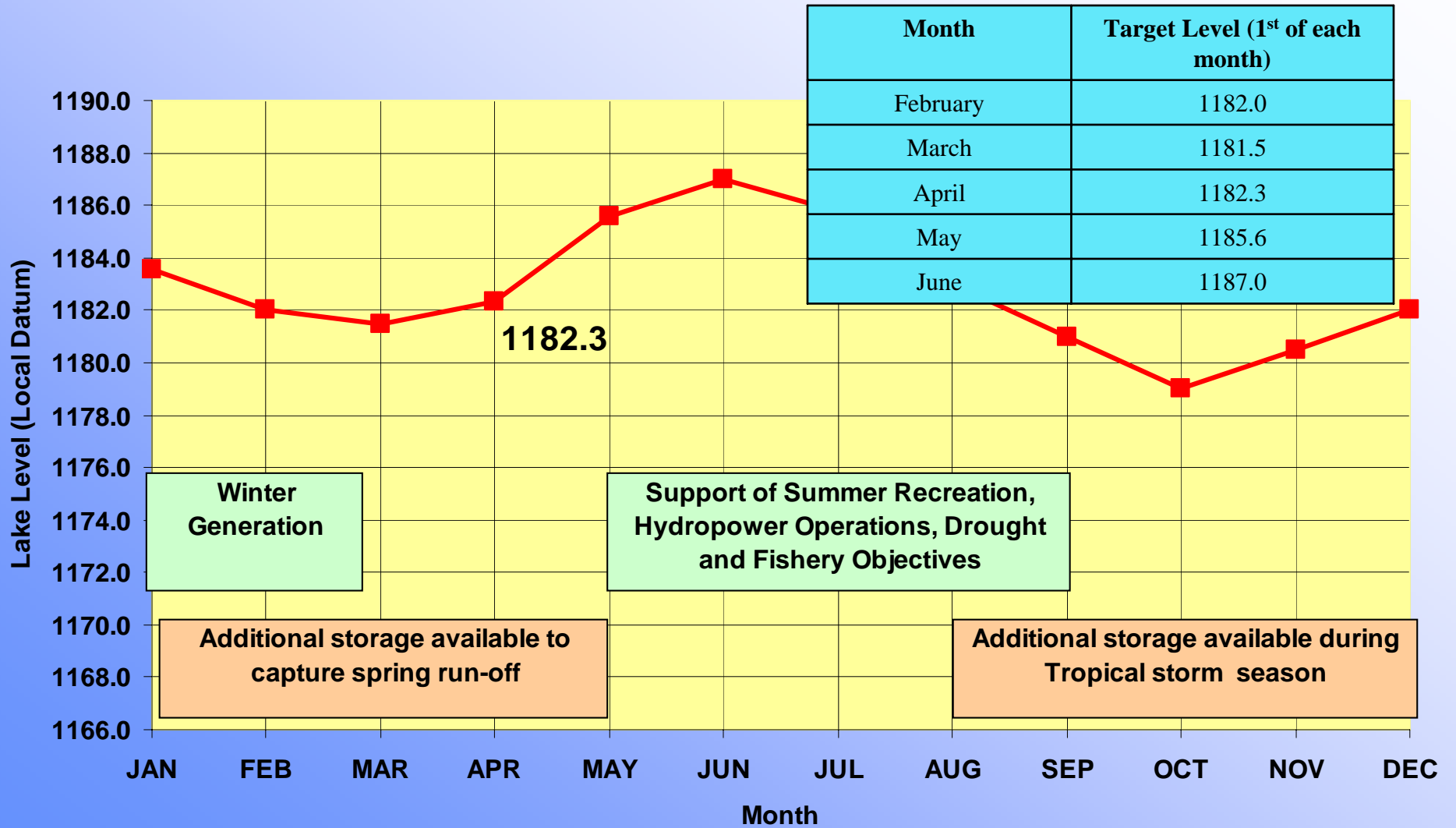
Model Status



- Discussions underway with the DRBC and NYC regarding snowpack lake target adjustments.
 - DRBC approved March 1 target adjustment
 - April 1 target adjustments and full DRBC approval pending
- PPL prepared to implement pre-storm drawdown procedure
- Discussions underway with DRBC and NWS regarding ground saturation data availability

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FIRST OF MONTH NORMAL LAKE LEVEL TARGETS



Establishment of Risk-Based Minimum Monthly Lake Targets



1st of Month	Normal Target Elev.	Minimum Target Elev. For Summer Refill/Oblig.
Dec	1182.00	1175.00
Jan	1183.00	1175.00
Feb	1182.00	1175.00
Mar	1181.50	1175.60
Apr	1182.30	1181.00
May	1185.60	1184.30
Jun	1187.00	1184.60
Jul	1185.75	1184.60
Aug	1182.00	1184.60
Sep	1181.00	1180.50
Oct	1179.00	1175.00
Nov	1181.00	1175.00

Model Data Requirements



- PPL data collection:
 - Weather, lake level and operational conditions at Project
 - Extended weather forecasts
 - On-site precipitation and meteorological station (to be installed)
 - NWS daily snow water equivalent and precipitation data at Hawley
 - Periodic NWS aerial snowpack surveys
 - NWS 48-Hr Quantitative Precipitation Forecasts (QPF's) – generally issued every 6 hours or at least daily
 - NWS 72-Hr unpublished QPF's potentially available in advance of extreme events.

Basic Model Logic



□ PROACTIVE

- With known snowpack → Adjust winter/spring lake targets down to “risk-based” minimums

□ REACTIVE

- Based on QPF's, evaluate potential lake level rise and need for increased plant discharge and spill operations
- Take proactive steps to minimize spill threat and to minimize peak spill rate within “risk-based” limits.
- Rerun model every 6 hours or when new QPF issued to determine operational adjustments (Iterative model pre-storm)

Reactive Model “Trigger Levels”



PLANT OPERATIONS

- Eliminate AR or initiate full load unit operations based on
 - projection of spill due to 48-Hr QPF's and 100% run-off assumption, and
 - projected rise above predetermined normal or adjusted lake targets based on 25% runoff assumption.

QPF TRACKING TRIGGERS

- Extended forecast suggests sufficient rain to raise lake above El 1187.5 with 50% runoff assumption, or
- Extended forecast suggests sufficient rain to raise lake above El 1189.9 with 100% runoff assumption,

SPILL TRIGGERS

- 48-Hr QPF suggests lake may rise above El 1189.9 with 100% runoff assumption with checks and balances,
- Extended forecast and 72-Hr QPF suggests extreme rainfall event in excess of 13 inches over 72 hours (including snow water equivalent).

Reactive Model Operational Constraints



- Permissible preemptive spills limited by risk-based minimums + 25% storm runoff assumption
- Permissible preemptive spills limited by perceived maximum “non-damaging” spill rate = 3000 cfs, if feasible
- Permissible preemptive spills during extreme rainfall events limited by Wallenpaupack Creek channel capacity (8000 cfs) until lake inflow > 50,000 cfs.

Model Results - Simulations of 2006 Flood Event



ACTUAL 2006 FLOOD EVENT

Maximum Water Surface Elevation	1192.0
Maximum Release	9750
Maximum Spill	8000

MODEL OF ACTUAL *

Maximum Water Surface Elevation	1192.1
Maximum Release	9,854
Maximum Spill	8,127

* Uses 4-hr average inflows & spill gate opening based on hard rules

NEW OPER. PROCEDURE - ACTUAL RAINFALL (ILLUSTRATES QPF's 100% ACCURRATE)

Maximum Water Surface Elevation	1189.5
Maximum Release	4,650
Maximum Spill	3,000

Spill Diff
-5,127

NEW OPER. PROCEDURE - NWS QPF's

Maximum Water Surface Elevation	1190.9
Maximum Release	5,709
Maximum Spill	4,059

Spill Diff
-4,068