INTERNATIONAL RAINY LAKE BOARD OF CONTROL
IRLBC

RAINY-NAMAKAN STUDY

TIMING OF REFILL
NATURAL LEVEL MODELLING

October 30, 1997

RAINY-NAMAKAN RULE CURVE STUDY

TIMING OF REFILL / NATURAL LEVEL MODELLING

1. Introduction

A model was written to simulate the daily levels and outflows of Rainy and Namakan lakes in a state of nature, as if the dams had never been built. The primary purpose was to assess the natural timing of the spring refill, in order to verify the claim by the Steering Committee (SC) that the lakes would have refilled earlier under natural conditions.

2. Model Operation

The model is a simple routing model, working on a daily basis, and using lake elevation-storage curves and natural elevation-discharge curves taken from reports for the Rainy Lake Reference (1929, 1931). No lag is assumed between the lakes. The same inflow data set as used for the REGUSE runs, for years 1958-96, was used.

3. Model Results

The model runs are presented as level plots on Figures 1 to 8 (Namakan and Rainy levels, 5 years per figure). They are plotted with the historic regulated levels and the existing IJC rule curves and the proposed SC rule curves.

Initially the intent was to statistically summarize and compare the timing of refill that would have occurred naturally versus that which has actually occurred under regulation and those which are imposed by the existing and by the proposed rule curves. However, due to the great irregularity of the natural water level cycle (little or no refill, several refill peaks of differing magnitude, refill peaks late in season, etc), it is virtually impossible to define an objective algorithm (to compute the date and magnitude of refill) that would not be subject to bias. However, by simply viewing the graphs for the full 1958-1996 period, certain observations, albeit subjective, appear to be clear.

4. Observations

Observations drawn from the graphs are:

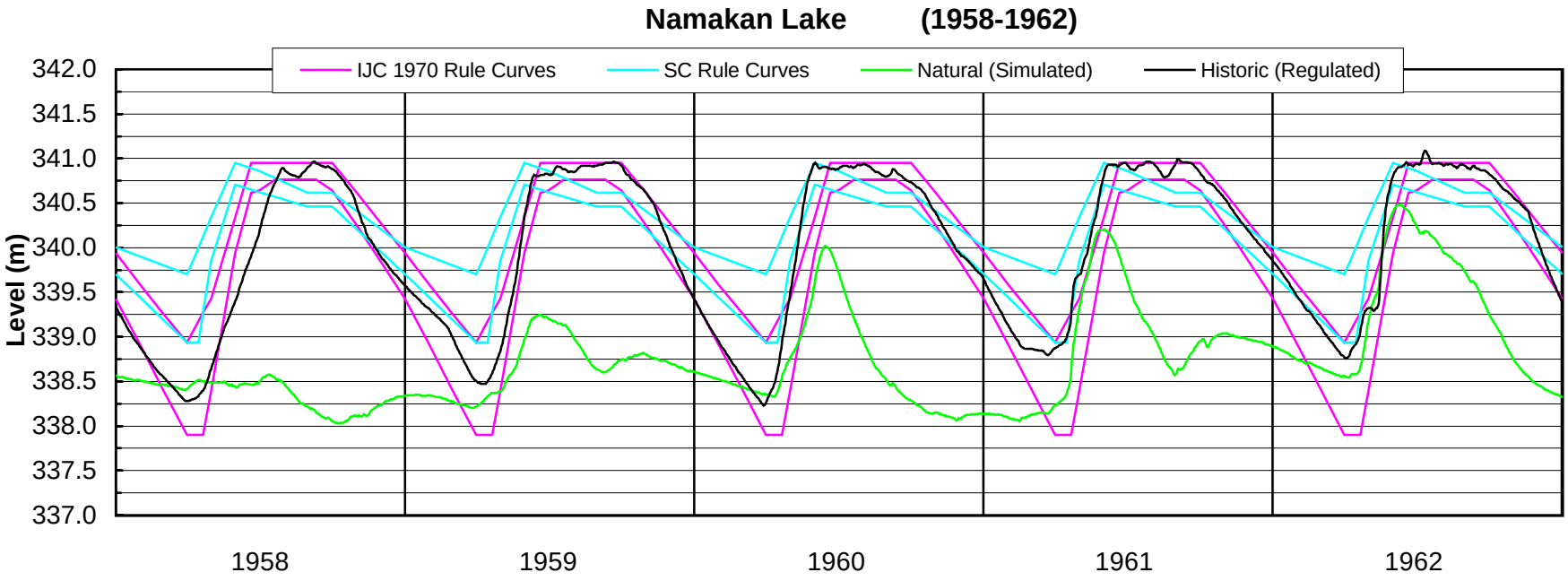
- on Namakan Lake:
  - the actual historic refill under regulation has typically occurred about the same time as the natural refill would have occurred - in some years it has been earlier and in some years it has been later but there is no regular pattern of it being either earlier or later - in fact, they are virtually superimposed for a number of years
  - although there is wide variation in the timing of the natural refill, and in fact the time span of the natural refill period is wider than both the IJC and SC rule curve bands put together, the earlier refill of the SC band appears to be a better fit to the natural refill in a number of years
  - the above two observations are not contradictory because, under historic regulation, the water level was often permitted to rise in advance of the IJC band if the inflow was “early”
- on Rainy Lake:
  - the actual historic refill under regulation has typically occurred earlier than it would have occurred naturally
  - although there is wide variation in the timing of the natural refill, the timing of the IJC rule curve band refill appears to better fit the natural timing than does the SC rule curve band. The SC rule curve band refill is typically earlier than the natural refill, and even the IJC band may

be on the early side.

- on both lakes:
  - both the IJC and the SC rule curves provide a much narrower time slot for refill than would be experienced naturally
  - both in refill timing and in overall lake level range and year-to-year variability, the IJC and SC rule curves are much more similar to each other than either is to the state of nature

Regarding timing, and based on the above observations, it would appear that:

- the earlier refill proposed by the SC for Namakan Lake is more natural. However, it would be questionable whether past regulation has been actually detrimental with respect to timing (relative to natural) since it has often duplicated the natural timing
- the earlier refill proposed by the SC for Rainy Lake is less natural rather than more natural as claimed, and is therefore not something that the fish stocks would have typically experienced under natural conditions


Namakan Lake (1958-1962)
IJC 1970 Rule Curves
SC Rule Curves
Natural (Simulated)
Historic (Regulated)
Level (m)
342.0
341.5
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337.0
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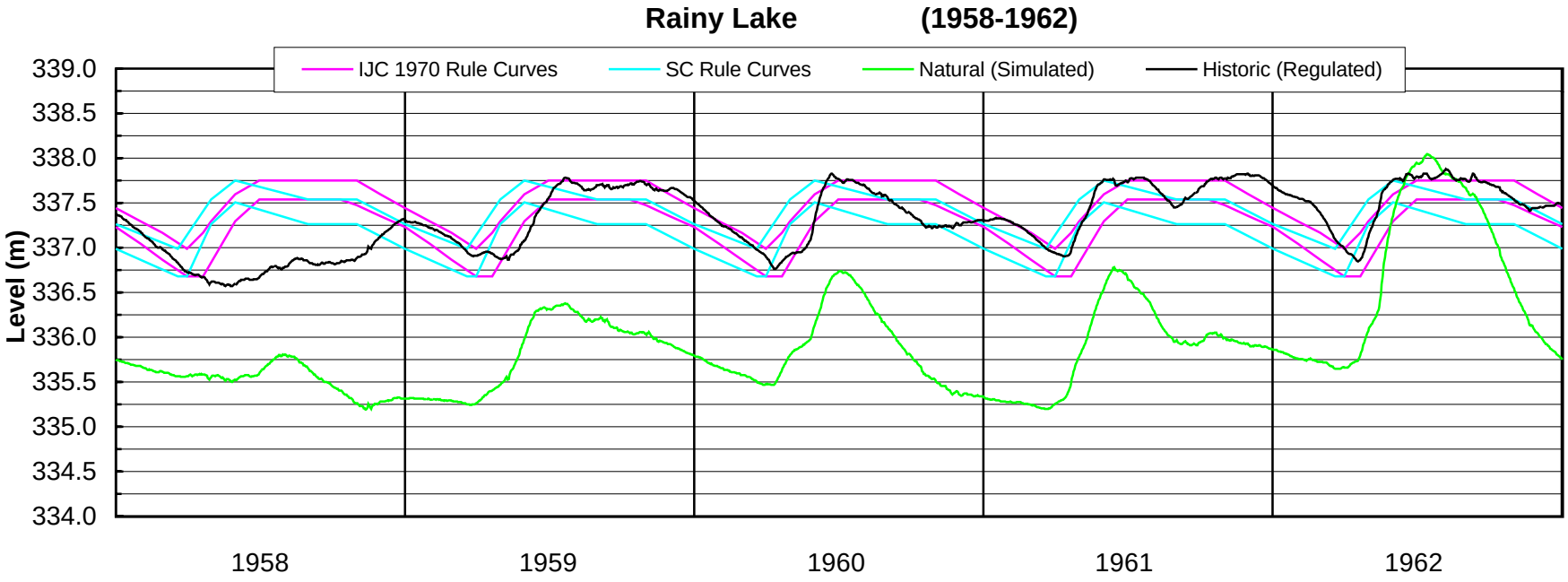
1960
1961
1962


Rainy Lake (1958-1962)
IJC 1970 Rule Curves
SC Rule Curves
Natural (Simulated)
Historic (Regulated)
Level (m)
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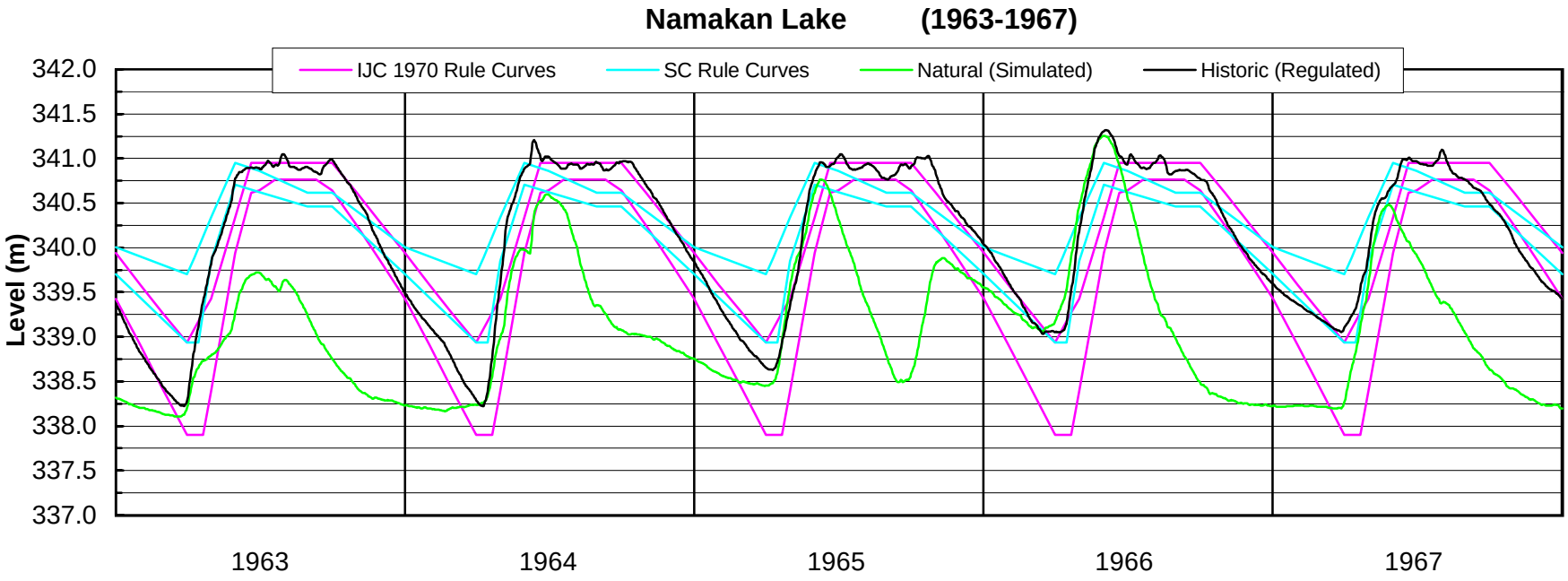
Namakan Lake (1963-1967)
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SC Rule Curves
Natural (Simulated)
Historic (Regulated)
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1965
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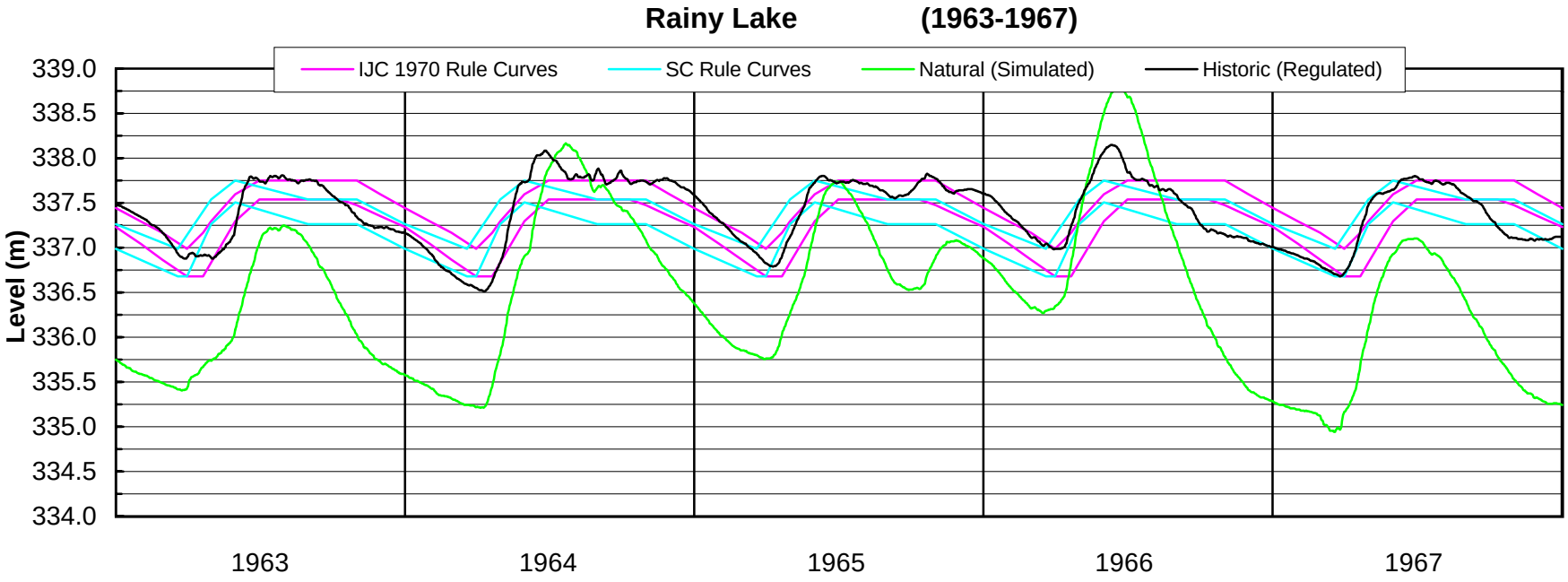
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Natural (Simulated)
Historic (Regulated)
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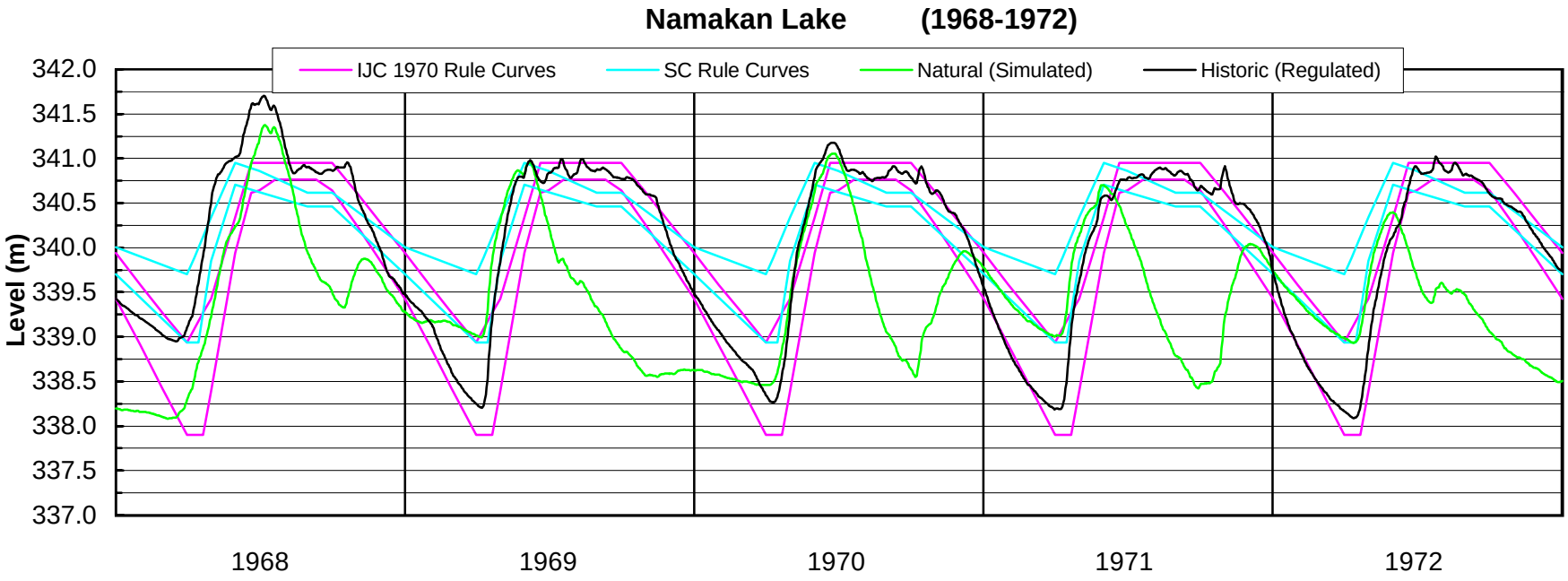
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SC Rule Curves
Natural (Simulated)
Historic (Regulated)
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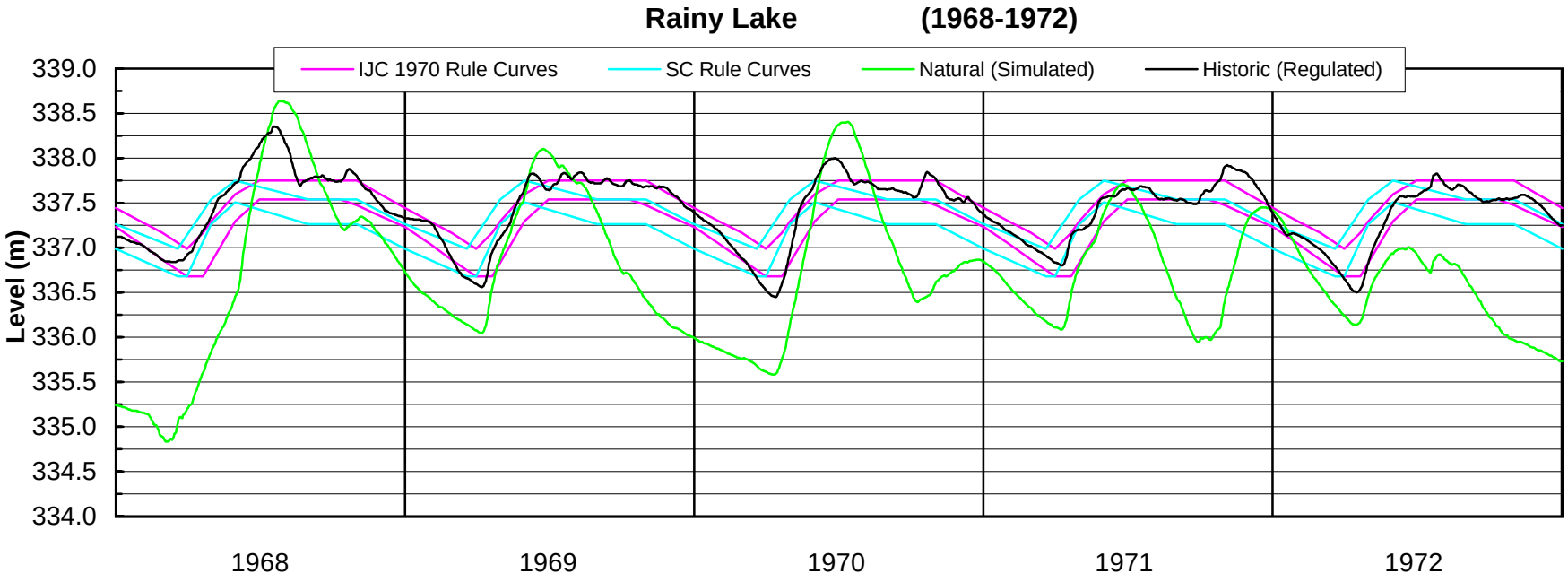
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Natural (Simulated)
Historic (Regulated)
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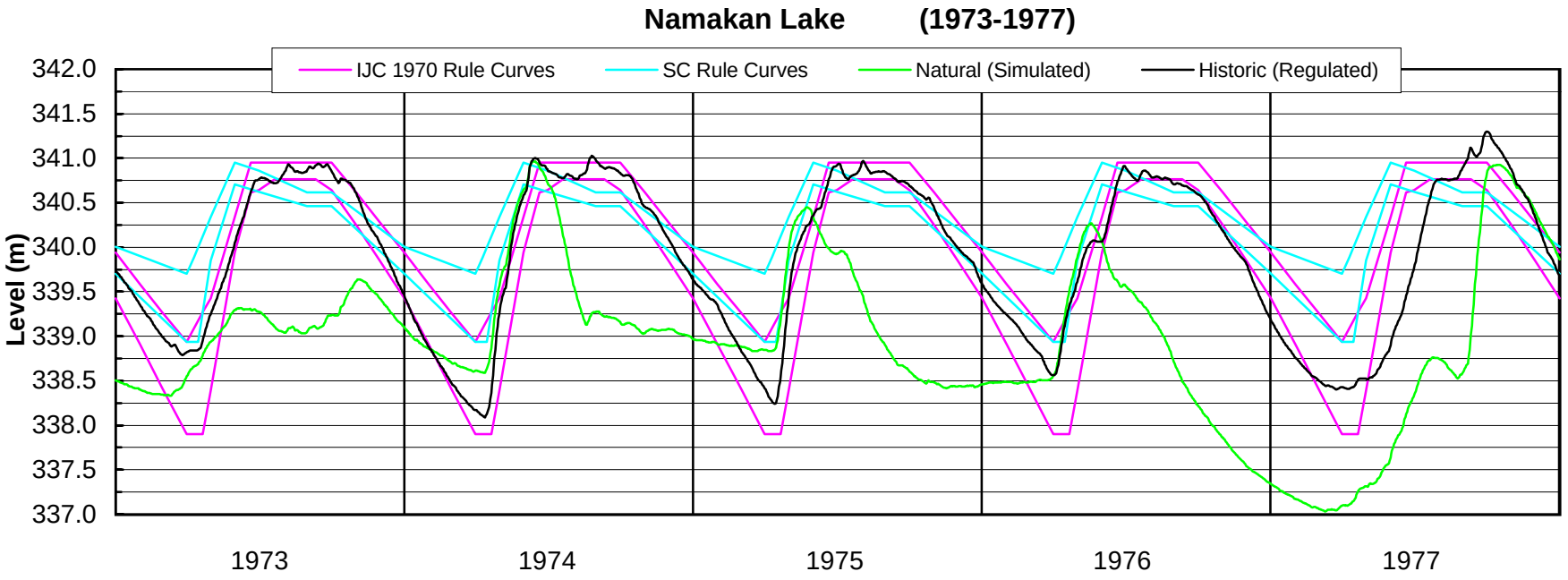
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Natural (Simulated)
Historic (Regulated)
Level (m)
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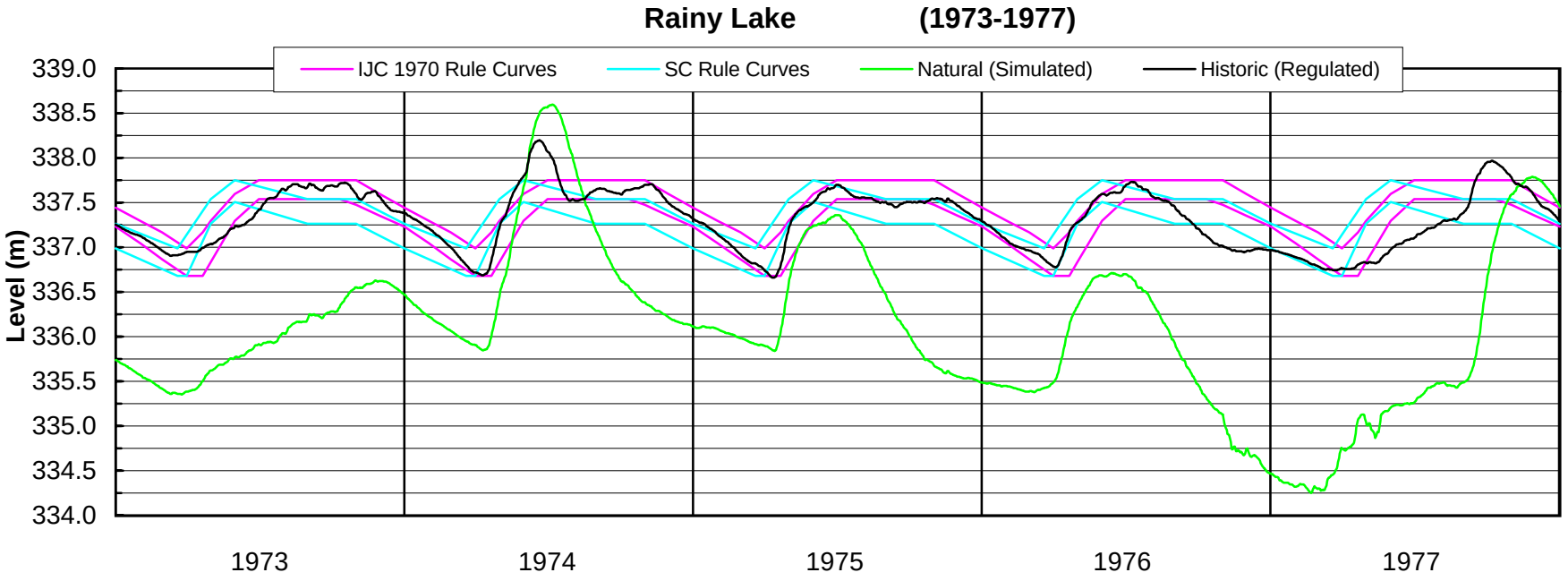
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Natural (Simulated)
Historic (Regulated)
Level (m)
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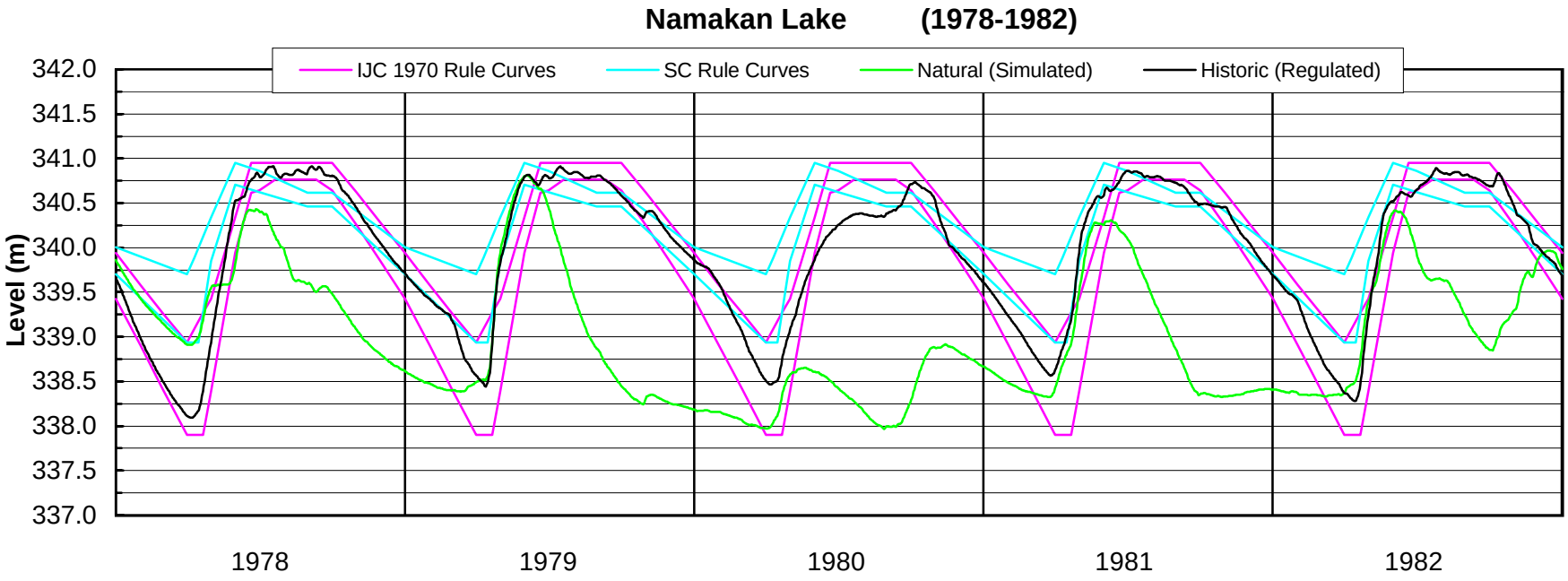
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Natural (Simulated)
Historic (Regulated)
Level (m)
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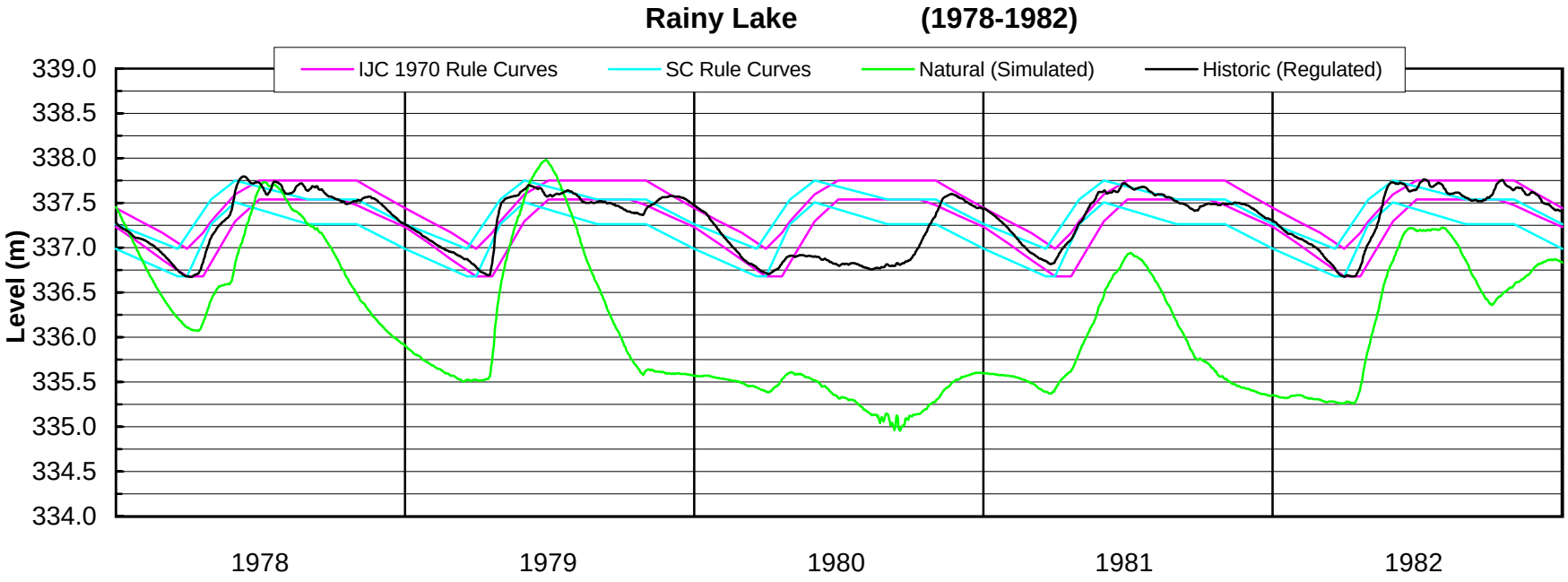
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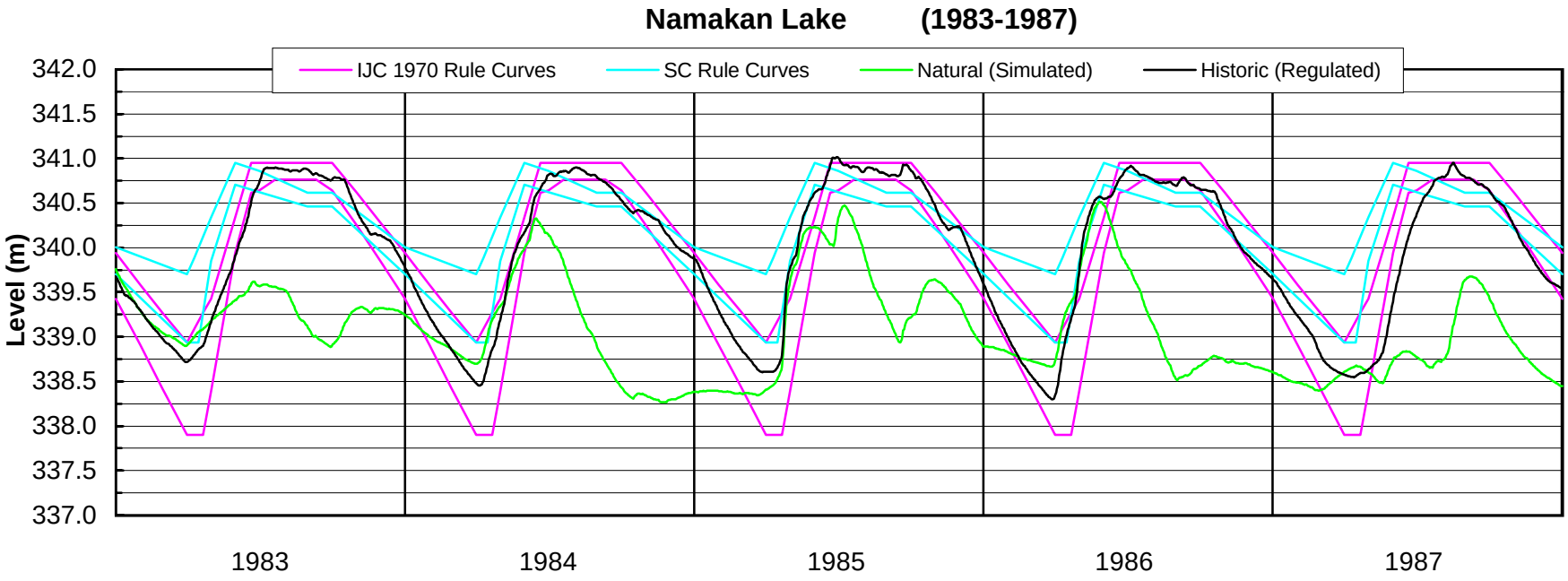
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SC Rule Curves
Natural (Simulated)
Historic (Regulated)
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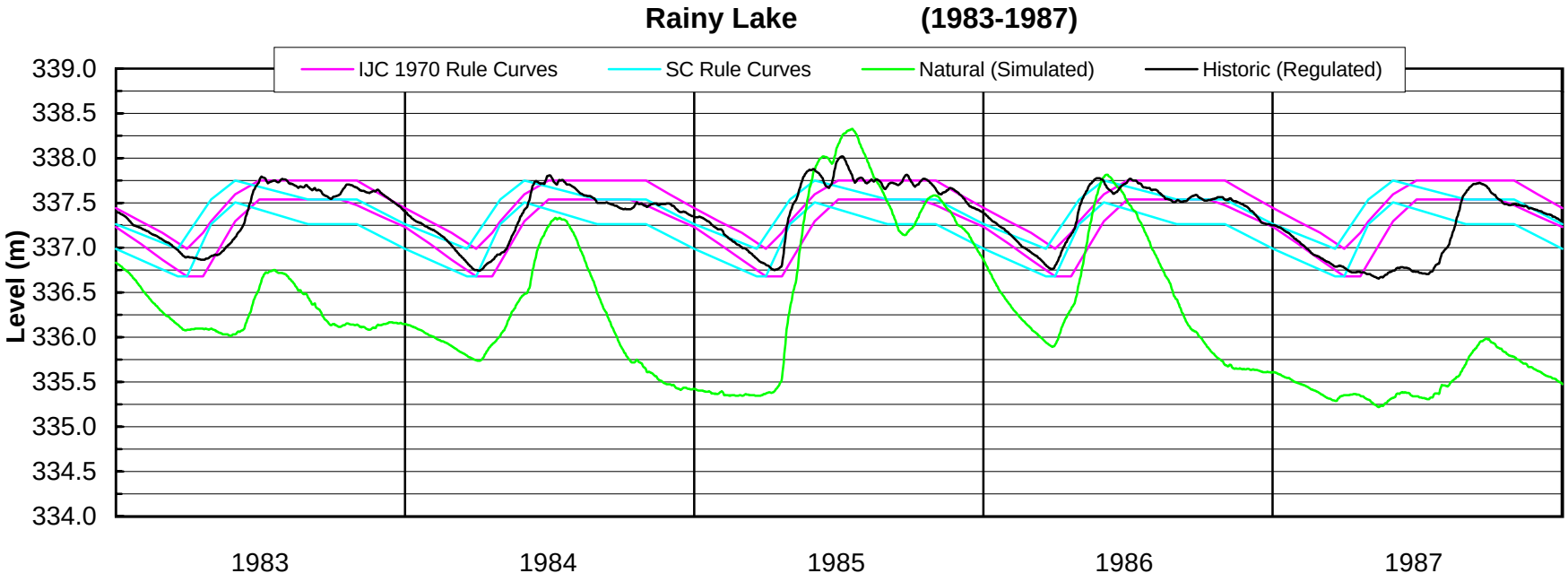
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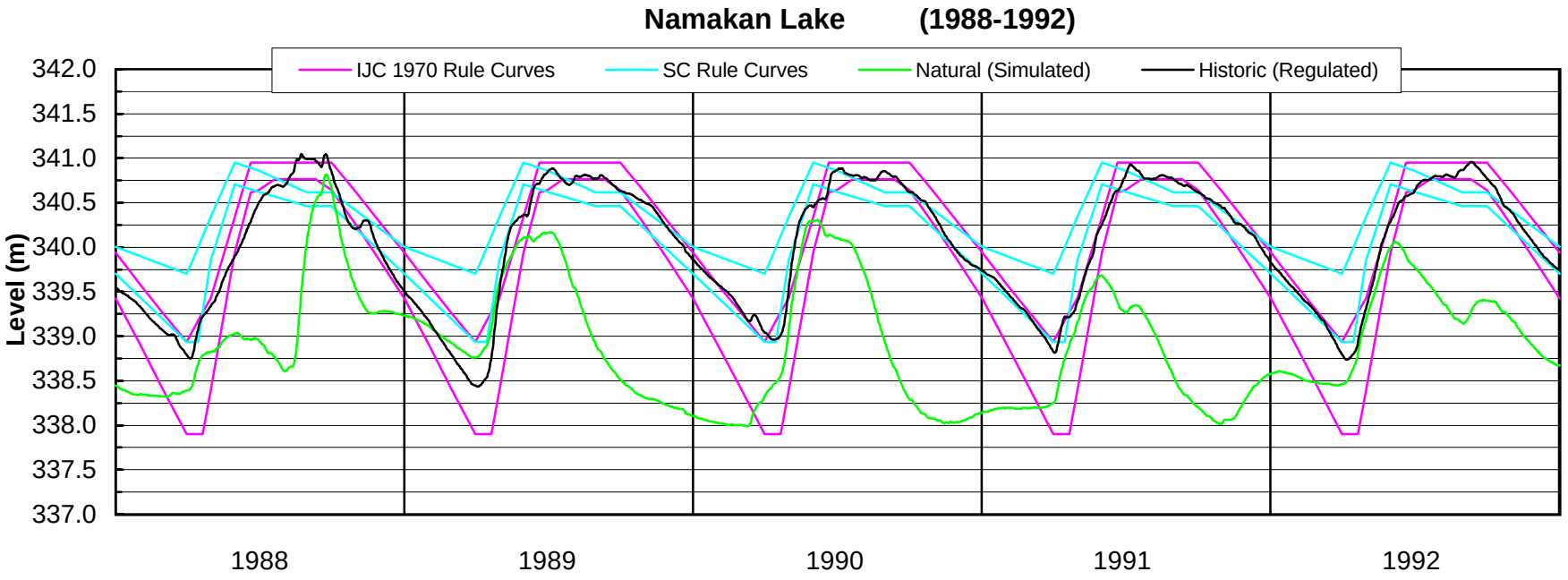
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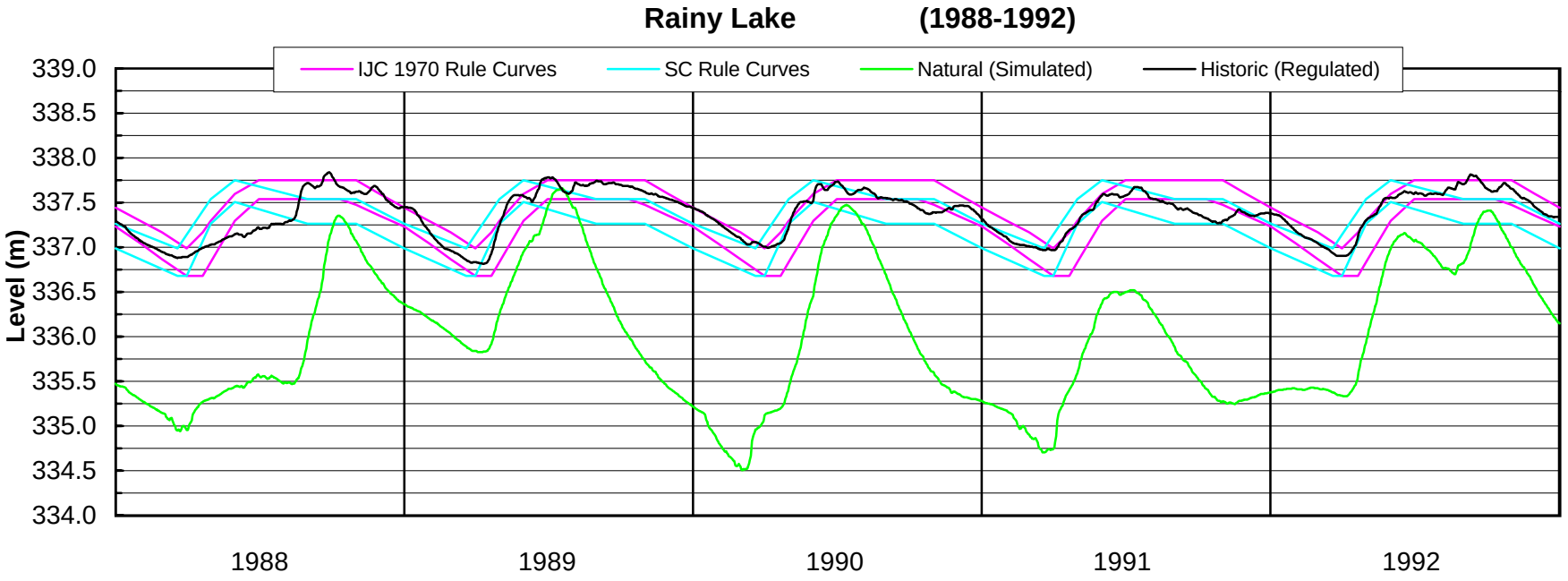
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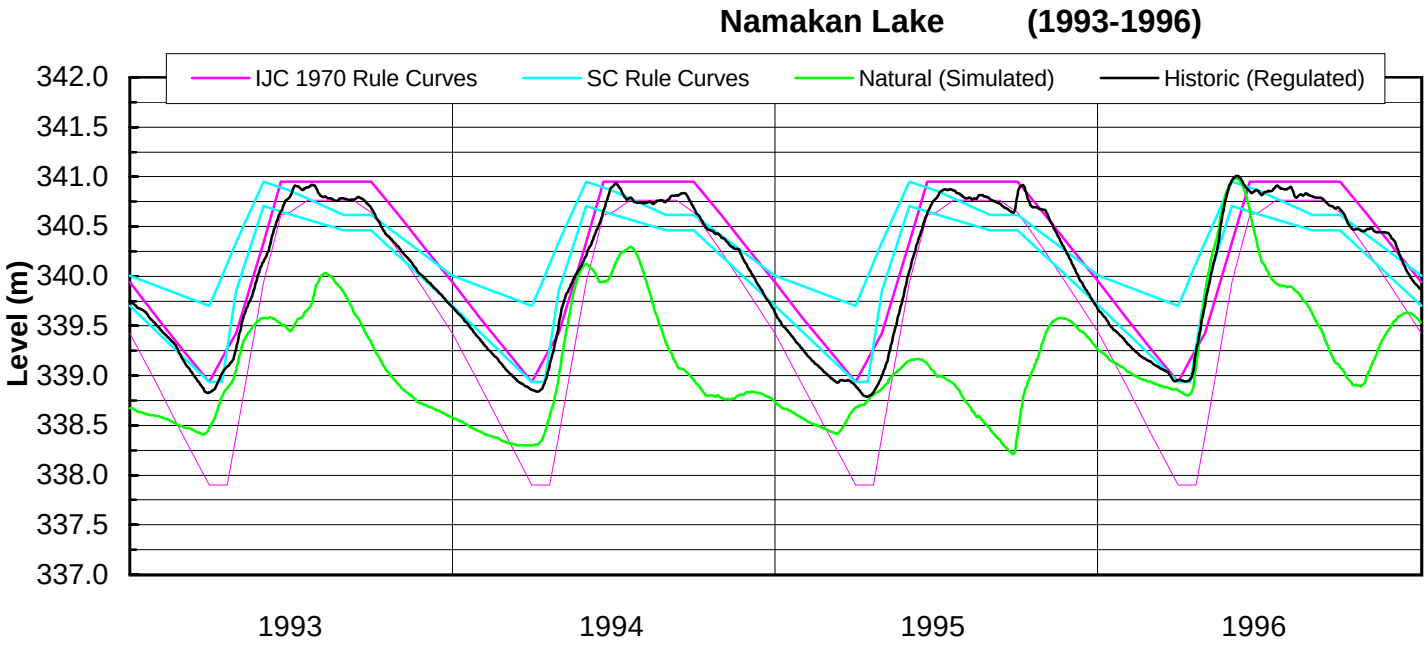
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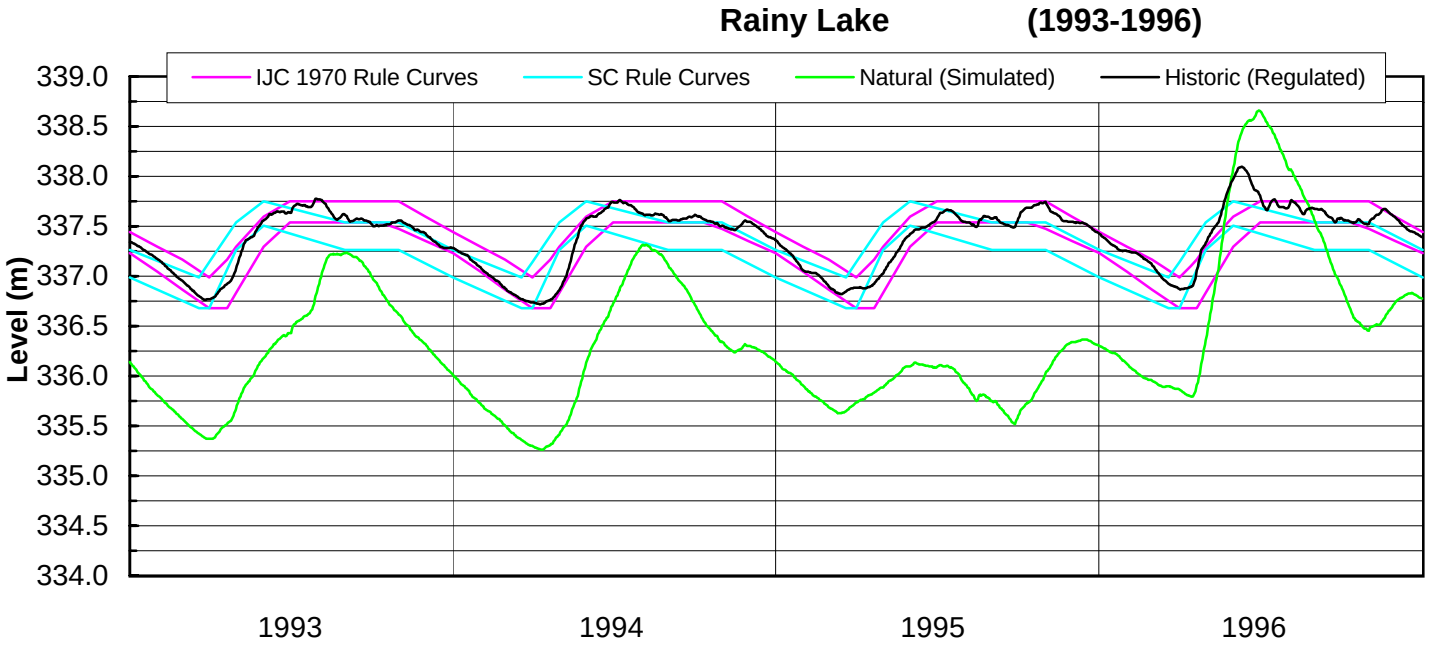
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