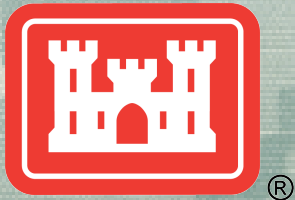


Combining Flood Risks from Snowmelt, Rain & Ice – The Platte River in Nebraska

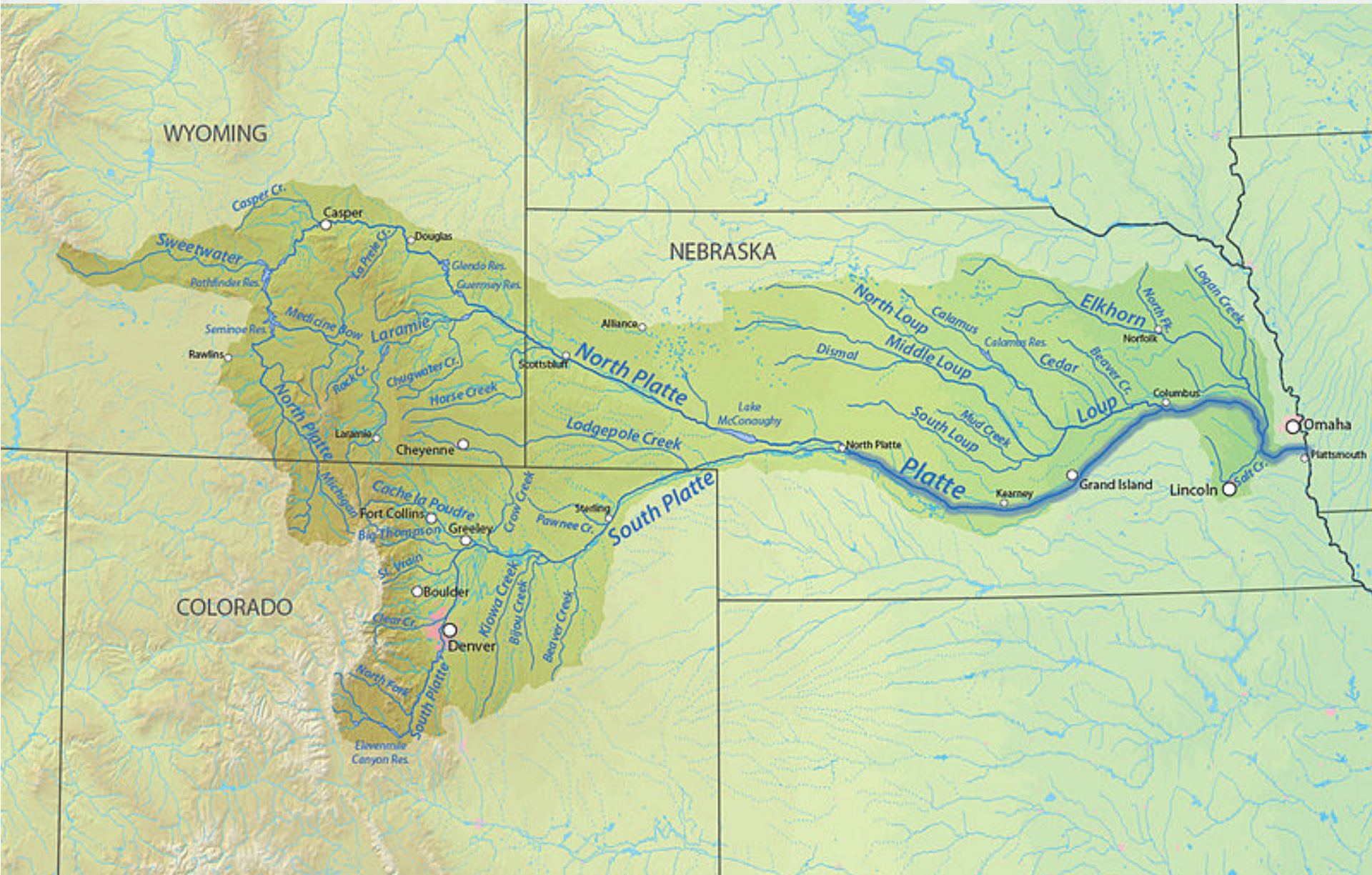
Douglas J. Clemetson, P.E.
Chief, Hydrology Section
USACE, Omaha District
Omaha, Nebraska
31 January 2013



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Platte River Basin





Causes of Lower Platte Floods

- Spring Snowmelt and or Rainfall
- Ice-Affected Spring Snowmelt/Rainfall
- Summer Rainfall



FEMA Publication 37

Federal Emergency Management Agency, "Flood Insurance Study Guidelines and Specifications for Study Contractors – Appendix 3 Analysis of Ice Jam Flooding", March 1993

$$P_s = P_{si} + P_{sq} - P_{si} \times P_{sq} \quad (1)$$

Where,

P_s = probability of a given stage being equaled or exceeded from either an ice-affected event or a free flow event

P_{si} = Probability of that stage being equaled or exceeded from an ice affected event

P_{sq} = Probability of that stage being equaled or exceeded from a open water event



If maximum annual stages in the snowmelt season are not always ice affected, the term P_{si} needs to be expanded as:

$$P_{si} = P_{wi} * N_i + P_{wo} * N_o \quad (2)$$

where,

P_{wi} = probability of a given stage in the snowmelt season that is ice-affected.

N_i = fraction of years during the snowmelt season that stages are ice-affected

P_{wo} = probability of a given stage in the snowmelt season from open water

N_o = fraction of years during the snowmelt season that stages are from open water

Combining Equations (1) & (2):

$$P_s = P_{wi} * N_i + P_{wo} * N_o + P_{sq} - [P_{wi} * N_i + P_{wo} * N_o] * P_{sq} \quad (3)$$

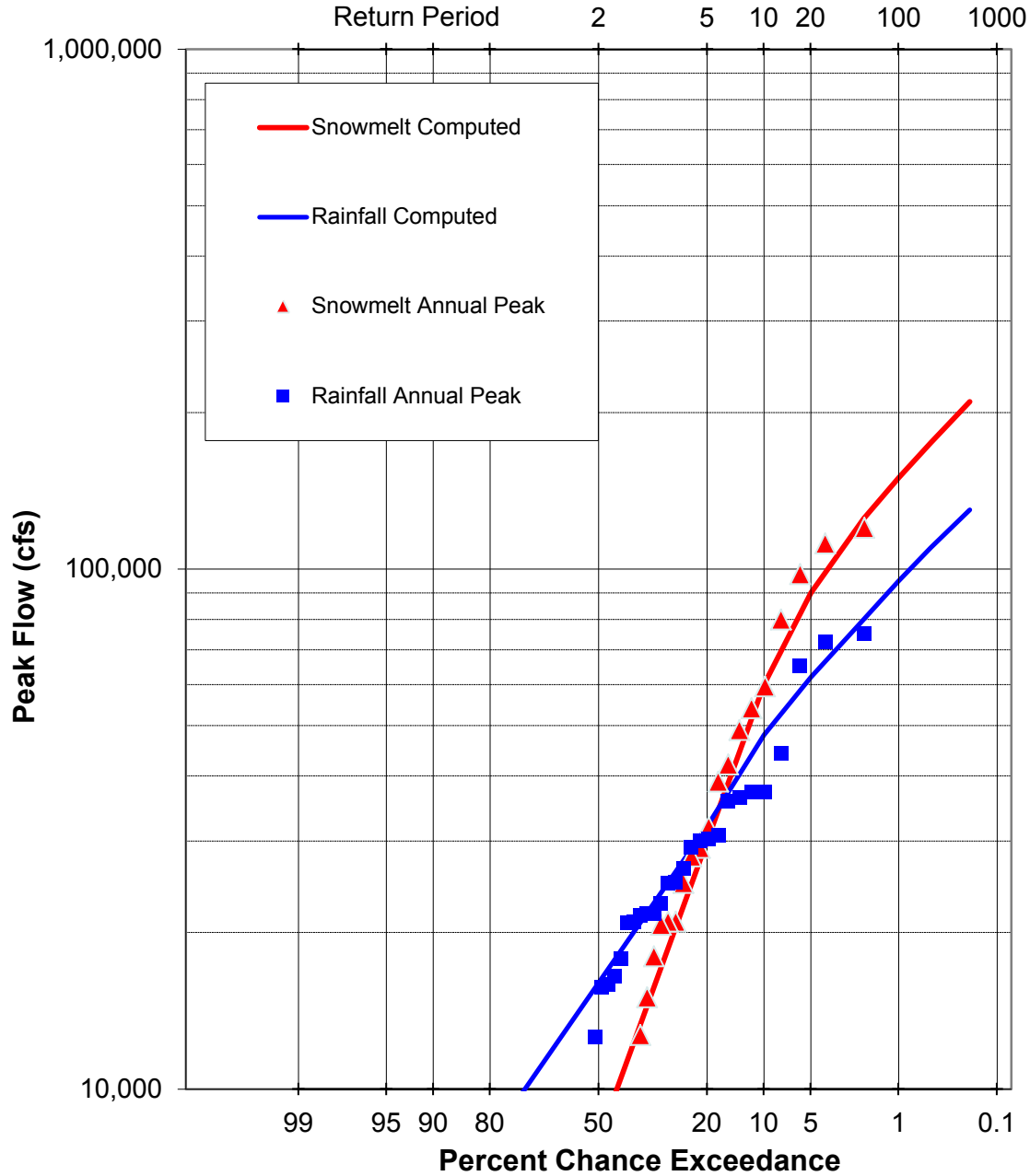


Hydrologic Data Needs

- Flow Frequency
 - ▶ Ice-Affected Season
 - ▶ Open Water Season
- Stage Discharge
 - ▶ Ice-Affected
 - ▶ Open Water
- Percent of Years Stages Ice Affected

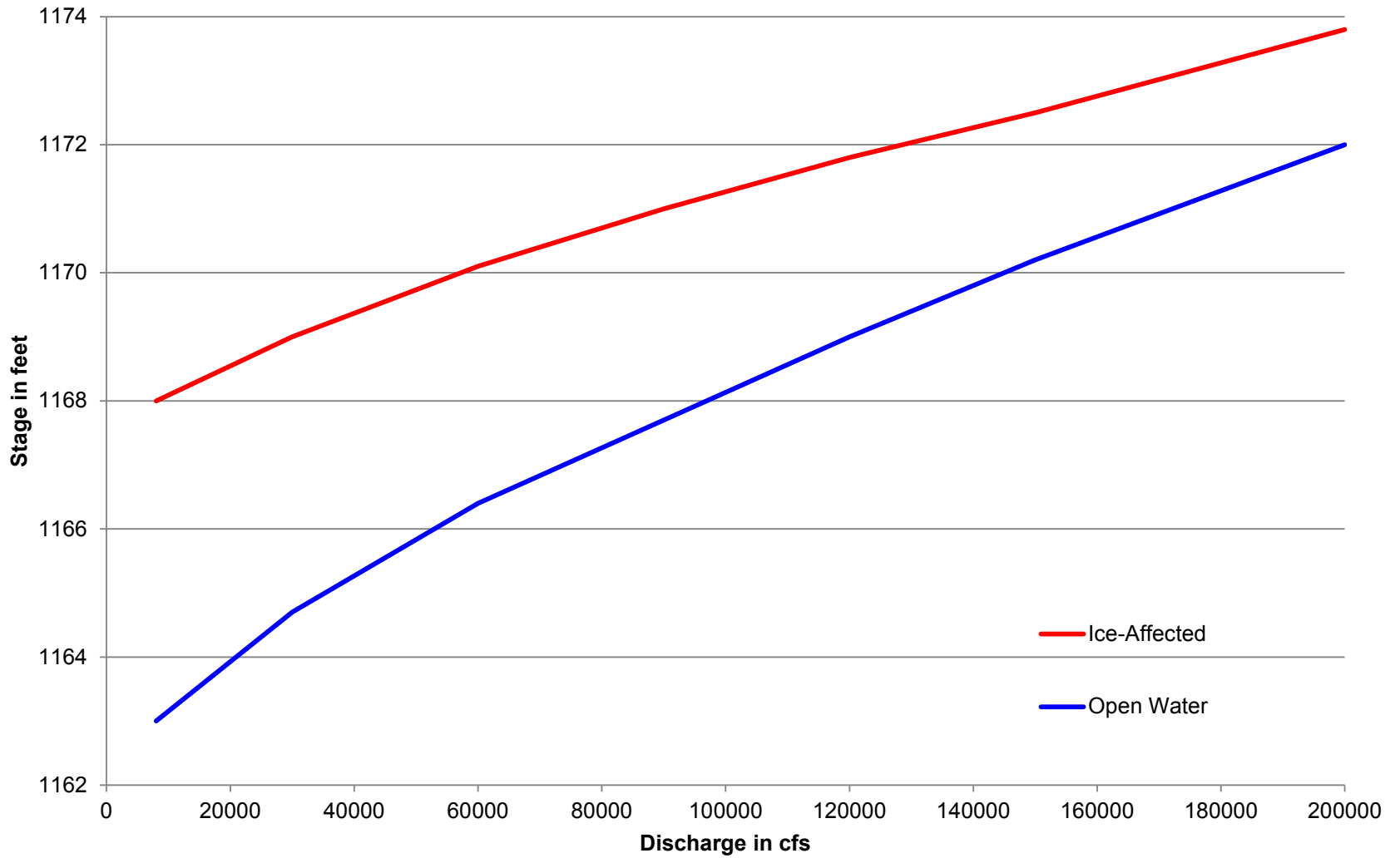


Platte River Flow Frequency

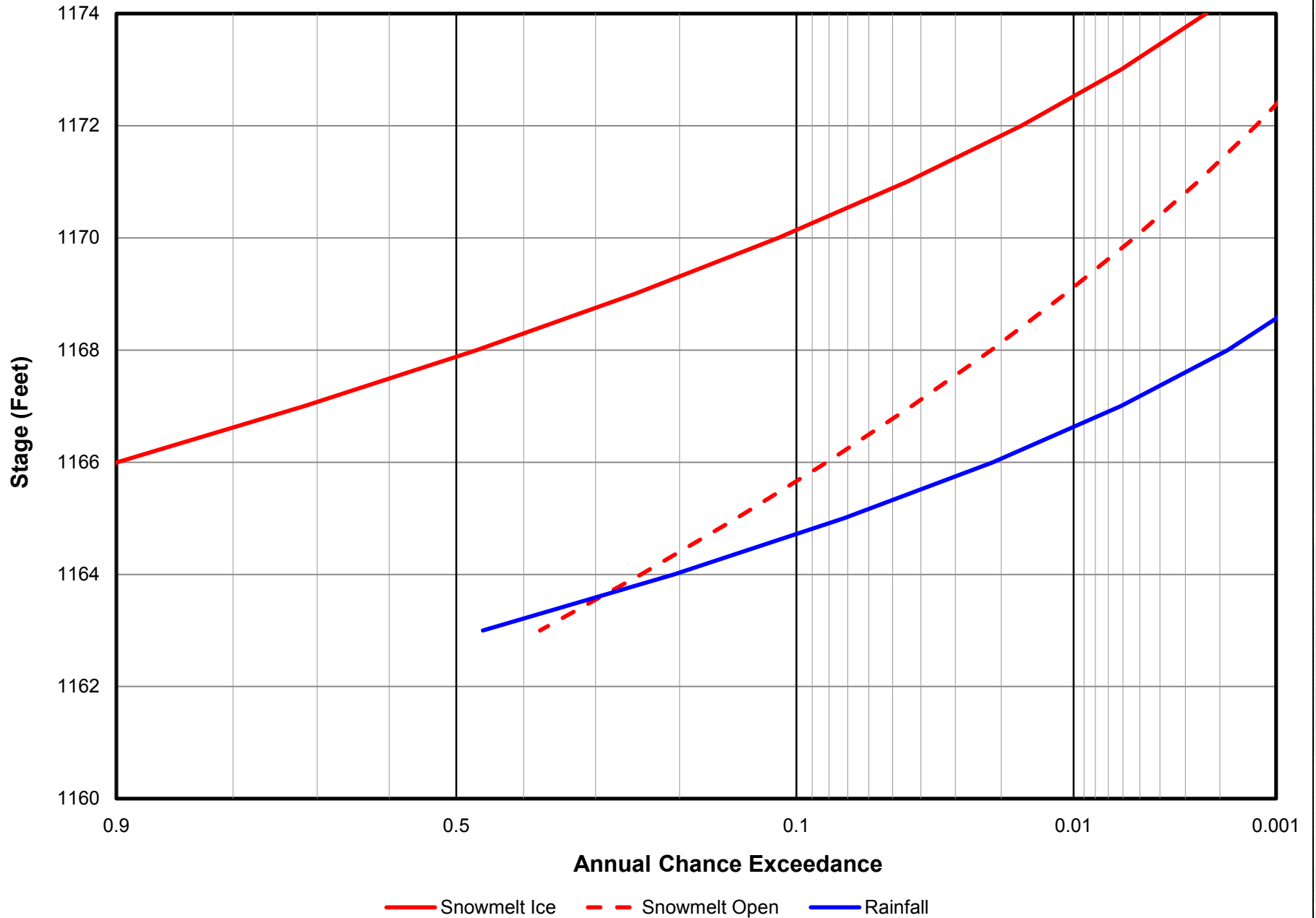


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Platte River Stage Discharge Relationship

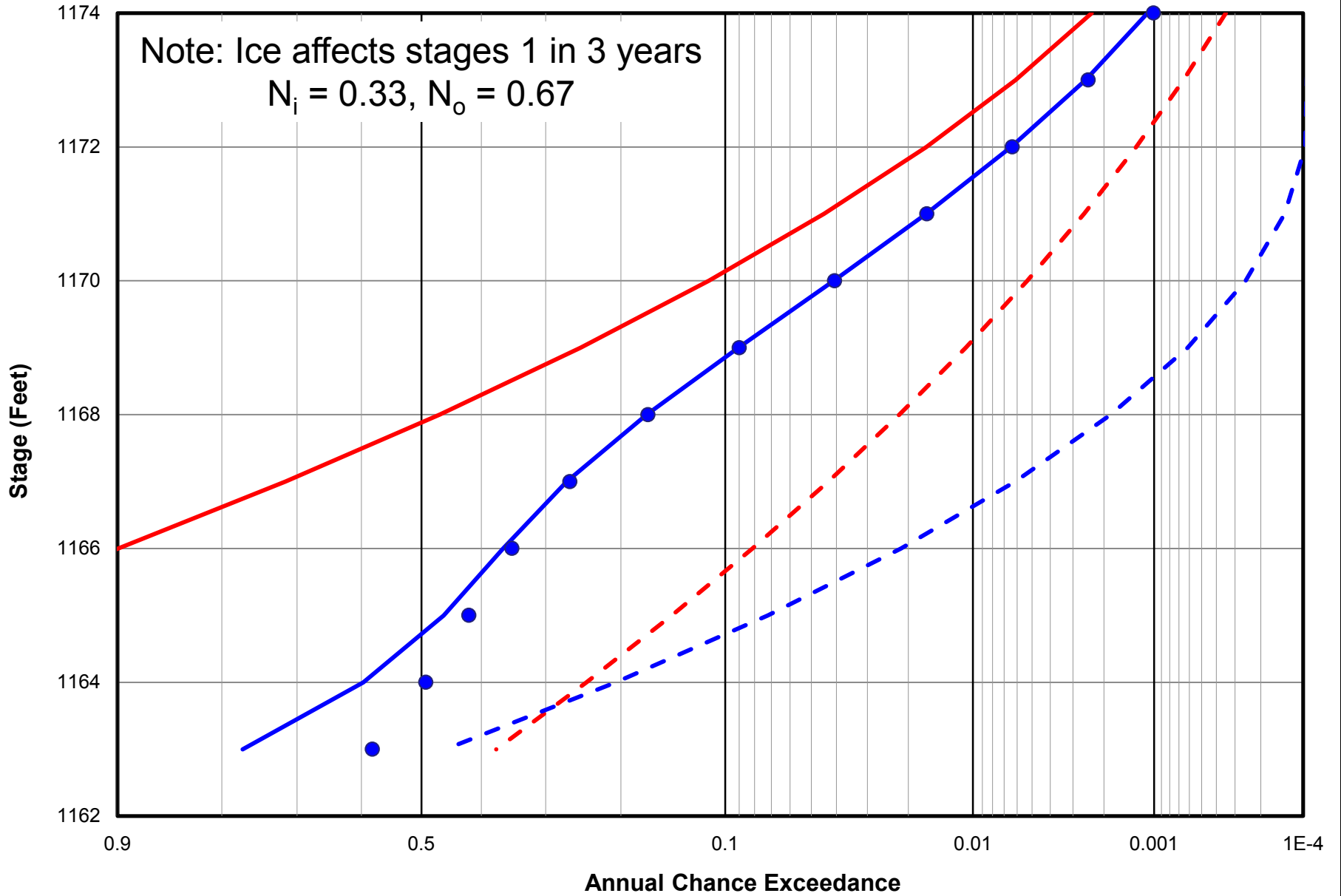


Platte River Stage-Frequency



Platte River Stage-Frequency

Note: Ice affects stages 1 in 3 years
 $N_i = 0.33$, $N_o = 0.67$



— Snowmelt-Ice - - - Snowmelt-Open - - - Rainfall ● Snowmelt Combined — Annual Combined

Map
MODERNIZATION

Federal Emergency Management Agency



FEMA's Flood Hazard Mapping Program

Guidelines and Specifications
for
Flood Hazard Mapping Partners

Appendix F: Guidance for Ice-Jam Analyses and Mapping



FEDERAL EMERGENCY MANAGEMENT AGENCY

www.fema.gov/fhm/dl_cgs.shtm

April 2003



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Questions/Discussion

