Loading Patterns in Varved Pleistocene Sediment in the NYC Area

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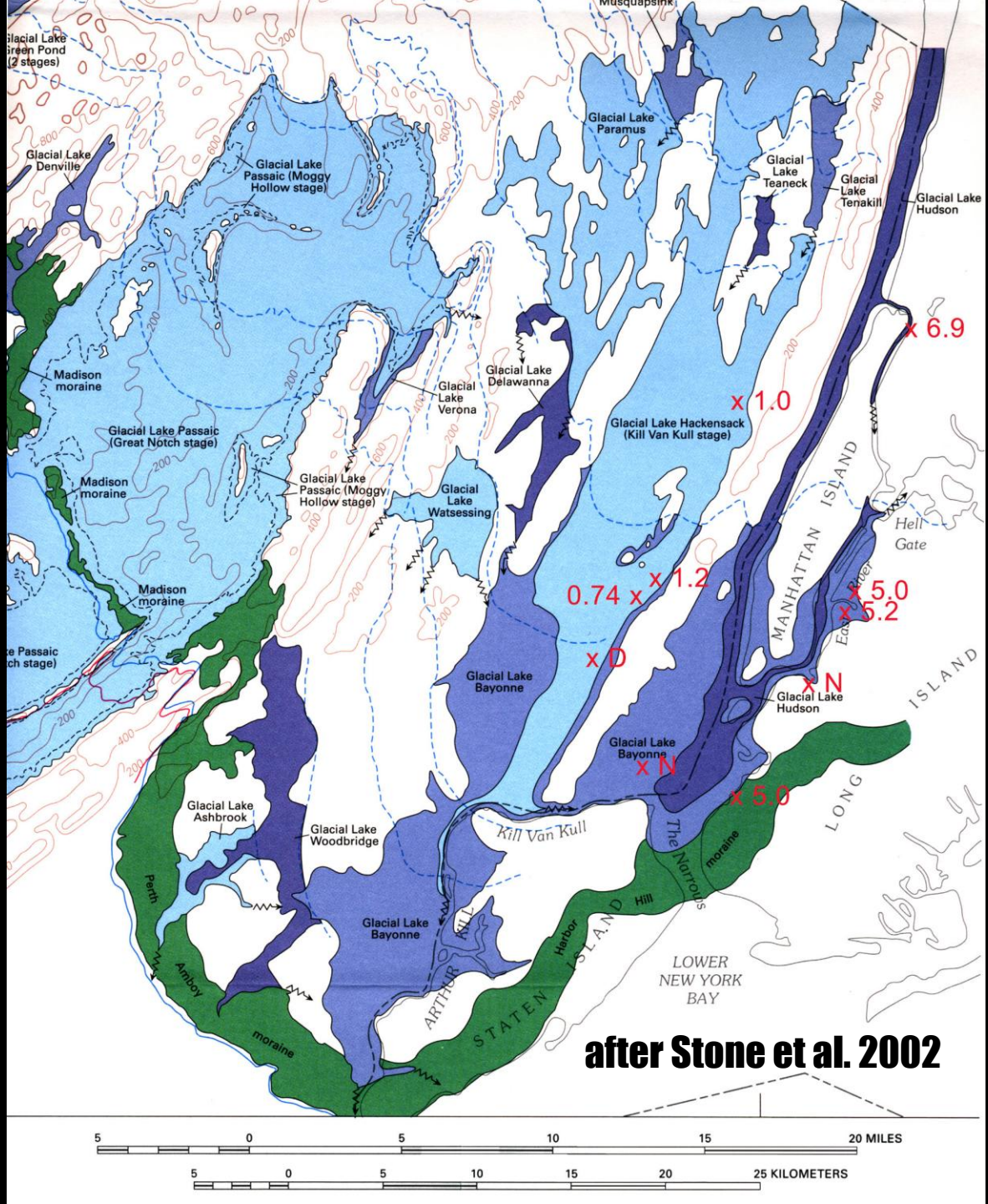
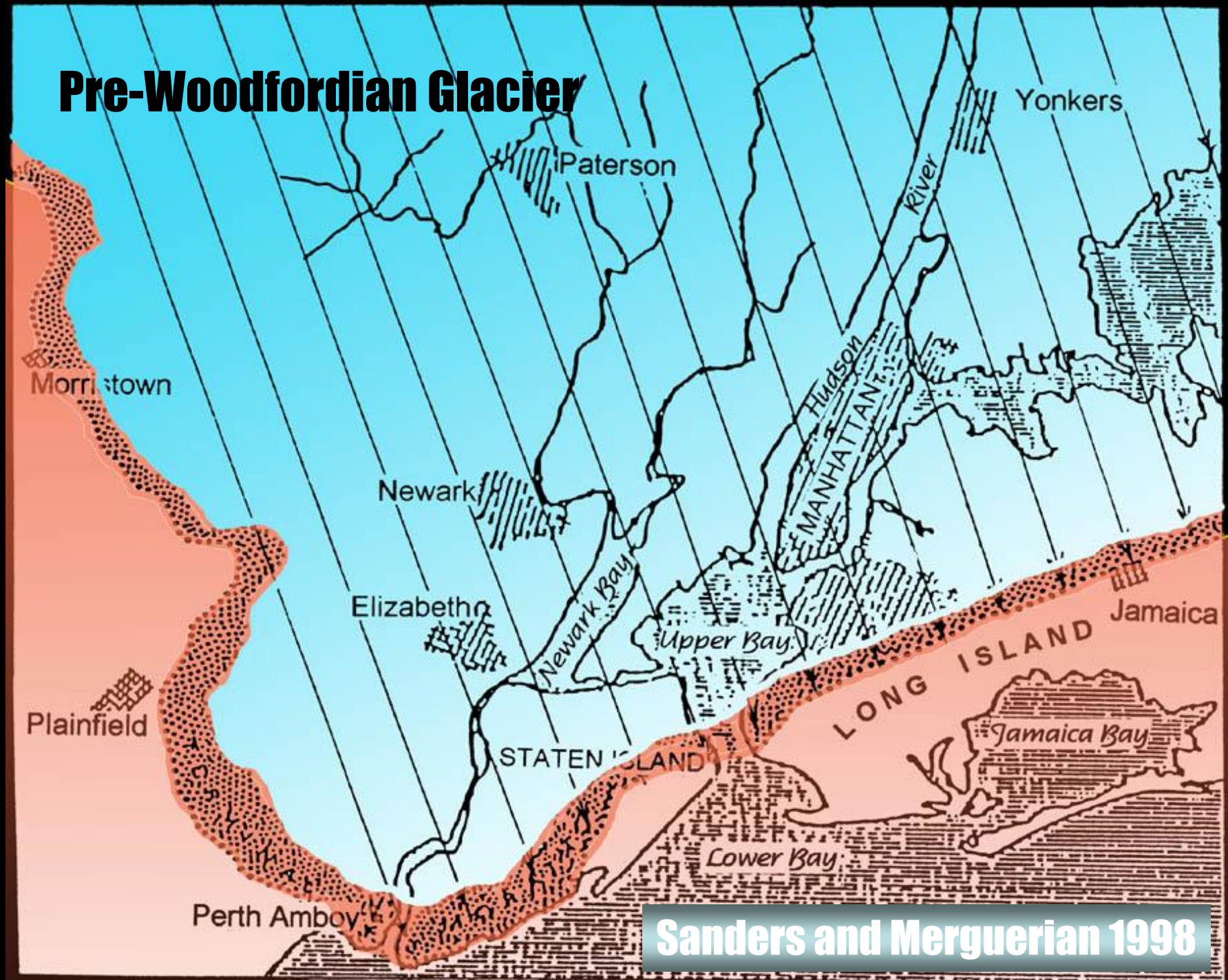
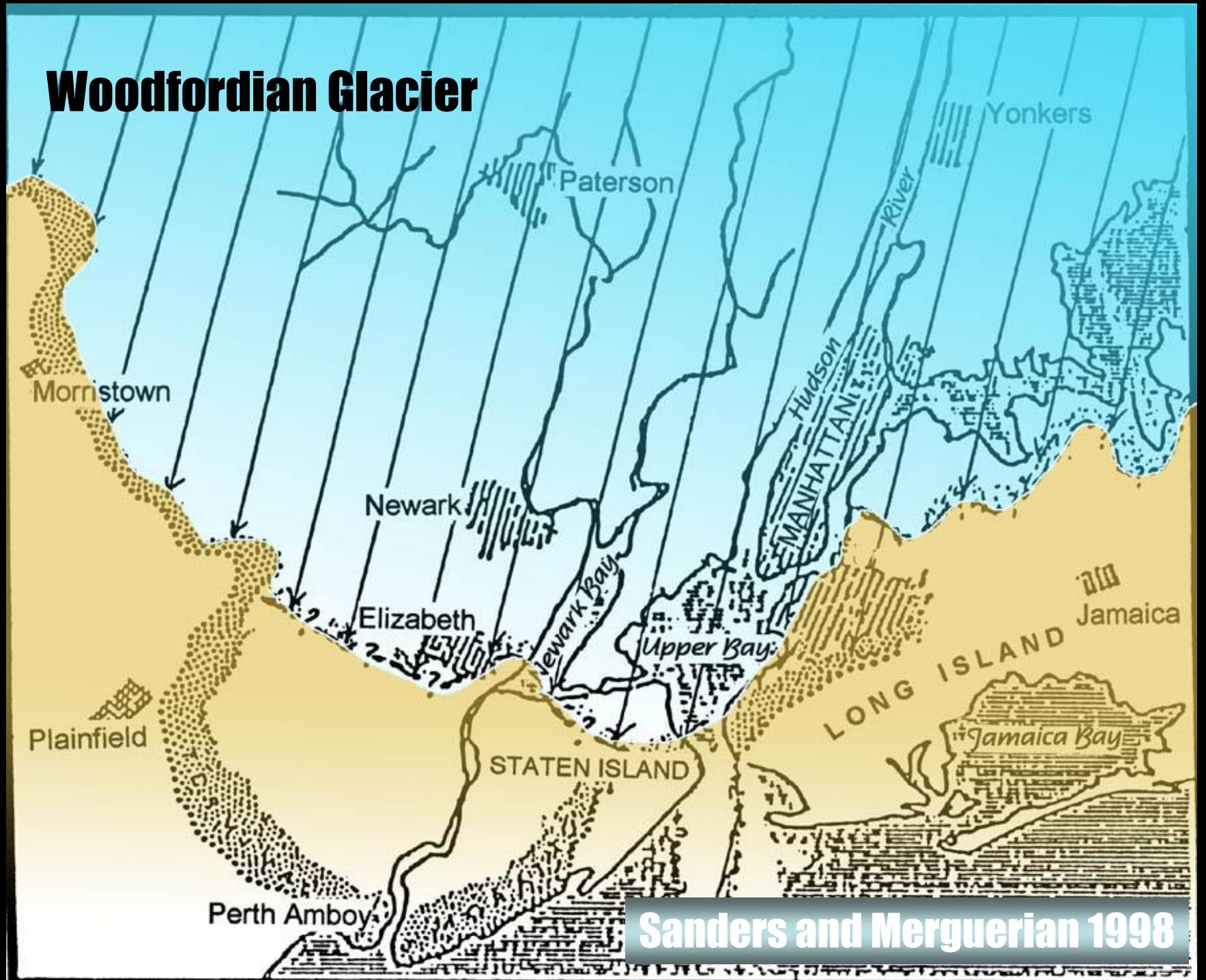
NYC's Varved Soils Experienced Loads 5-10 tsf > Existing Overburden

Concluded That A Younger Glacier Must Have Caused Excess Loading!




Pre-Woodfordian Glacier
Yonkers
Paterson
Hudson River
MANHATTAN
Morristown
Newark
Elizabeth
Newark Bay
Upper Bay
Jamaica
LONG ISLAND
Plainfield
Jamaica Bay
STATEN ISLAND
Lower Bay
Perth Amboy
Sanders and Merguerian 1998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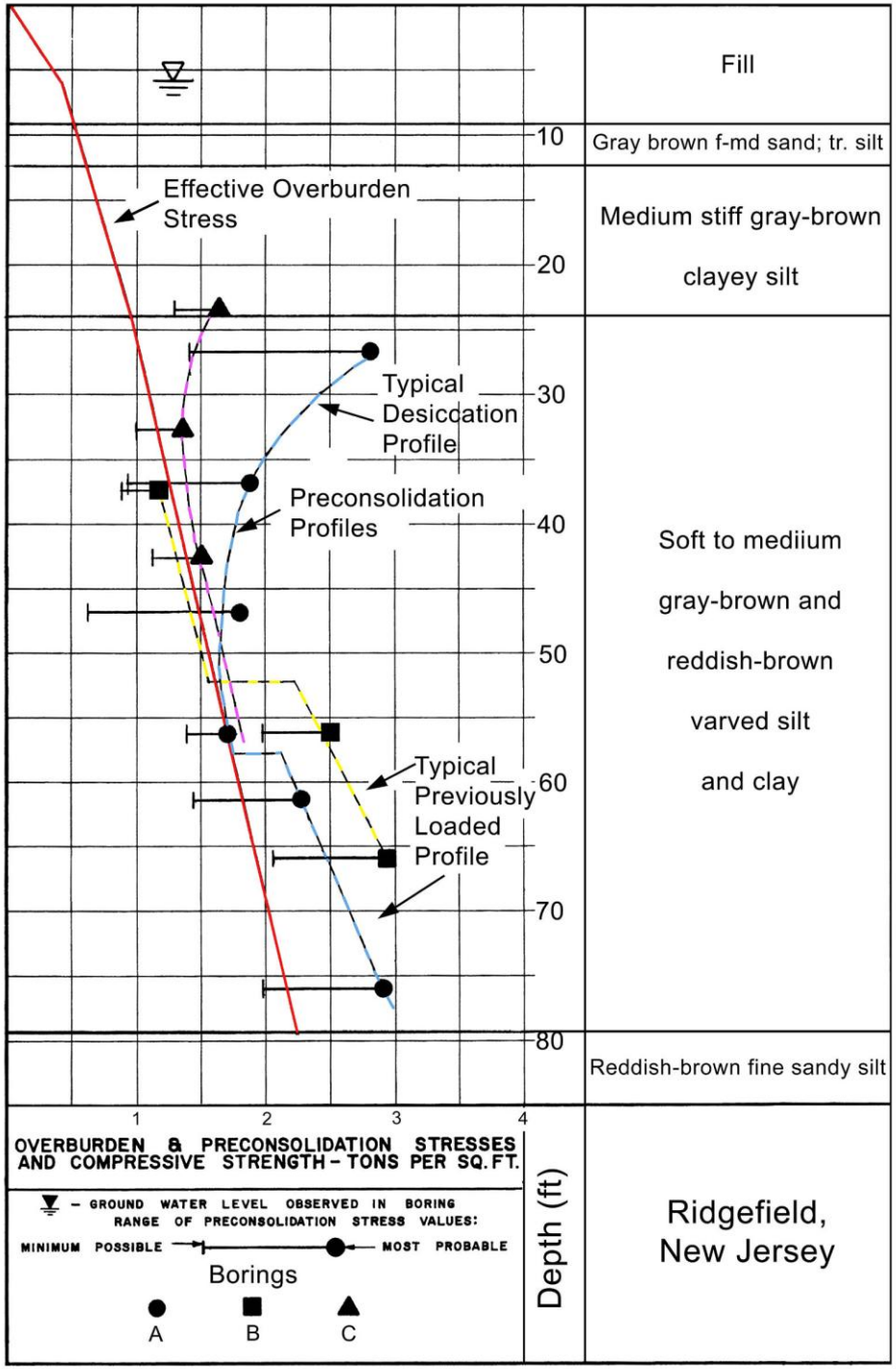


Loading Mechanisms

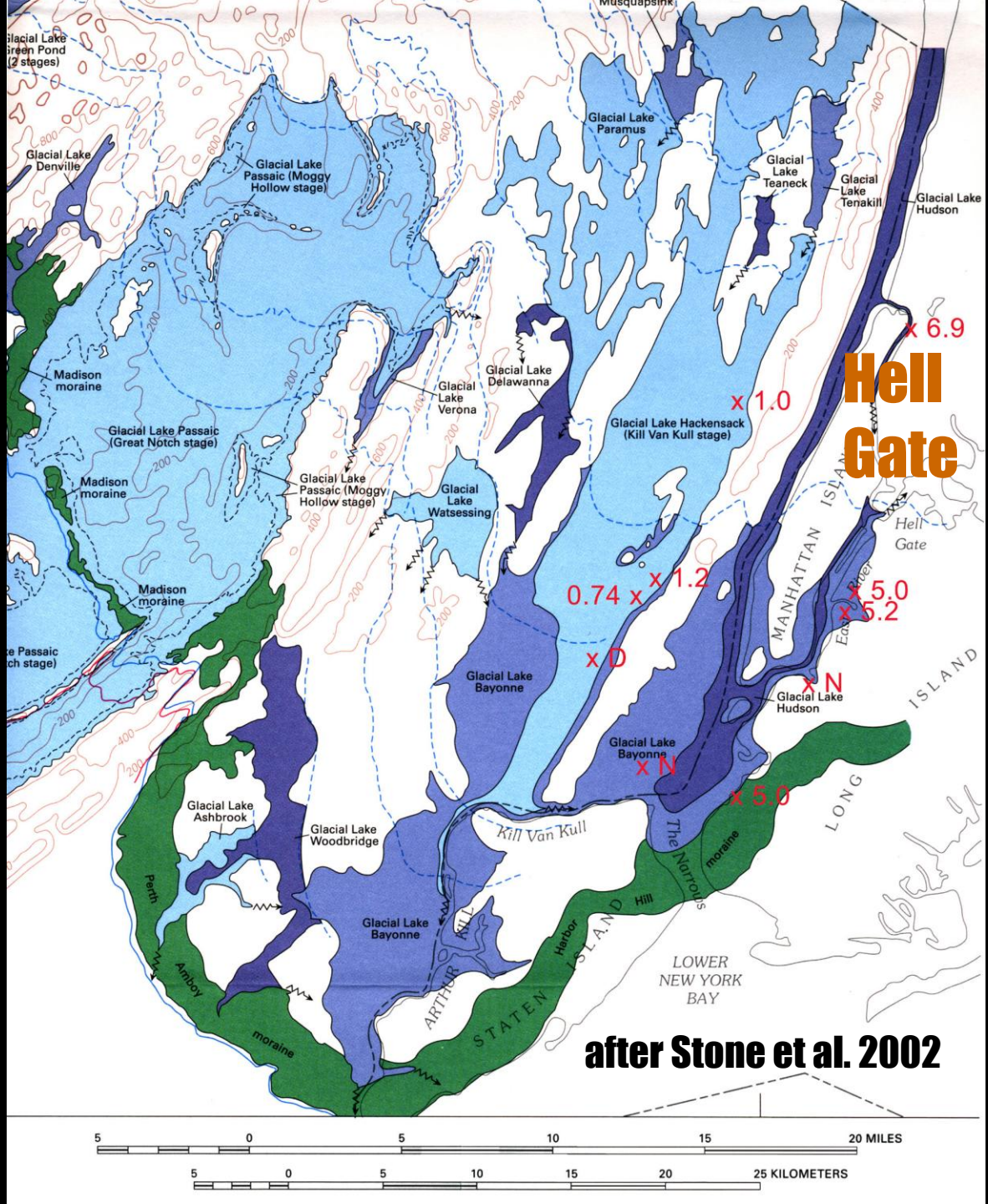
1. Loading By Deposition Of Sediments Or Loading By Glacial Ice
2. Lowering Water Table
3. Soil Desiccation
4. Extreme Long-Term Settlement

Lake Bayonne

Hell Gate Spillway

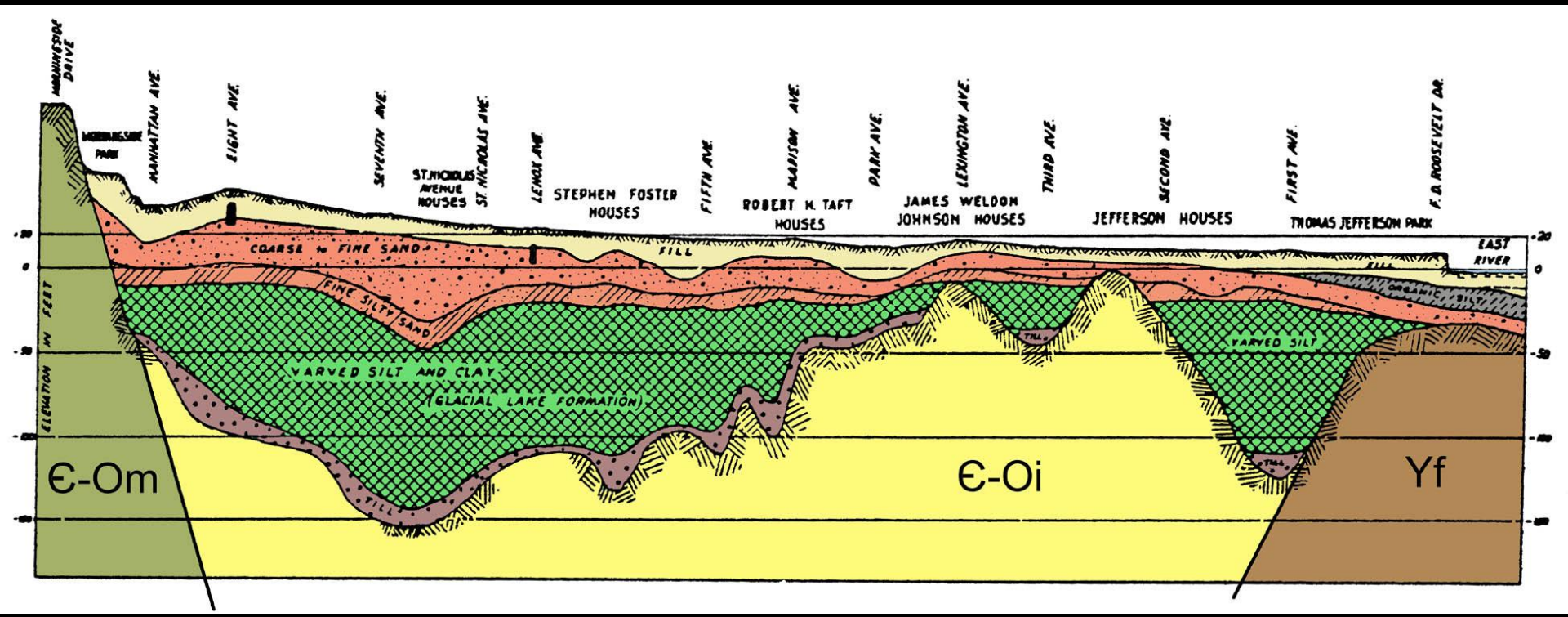
Lake Hackensack (West)

Lake Hudson (East)

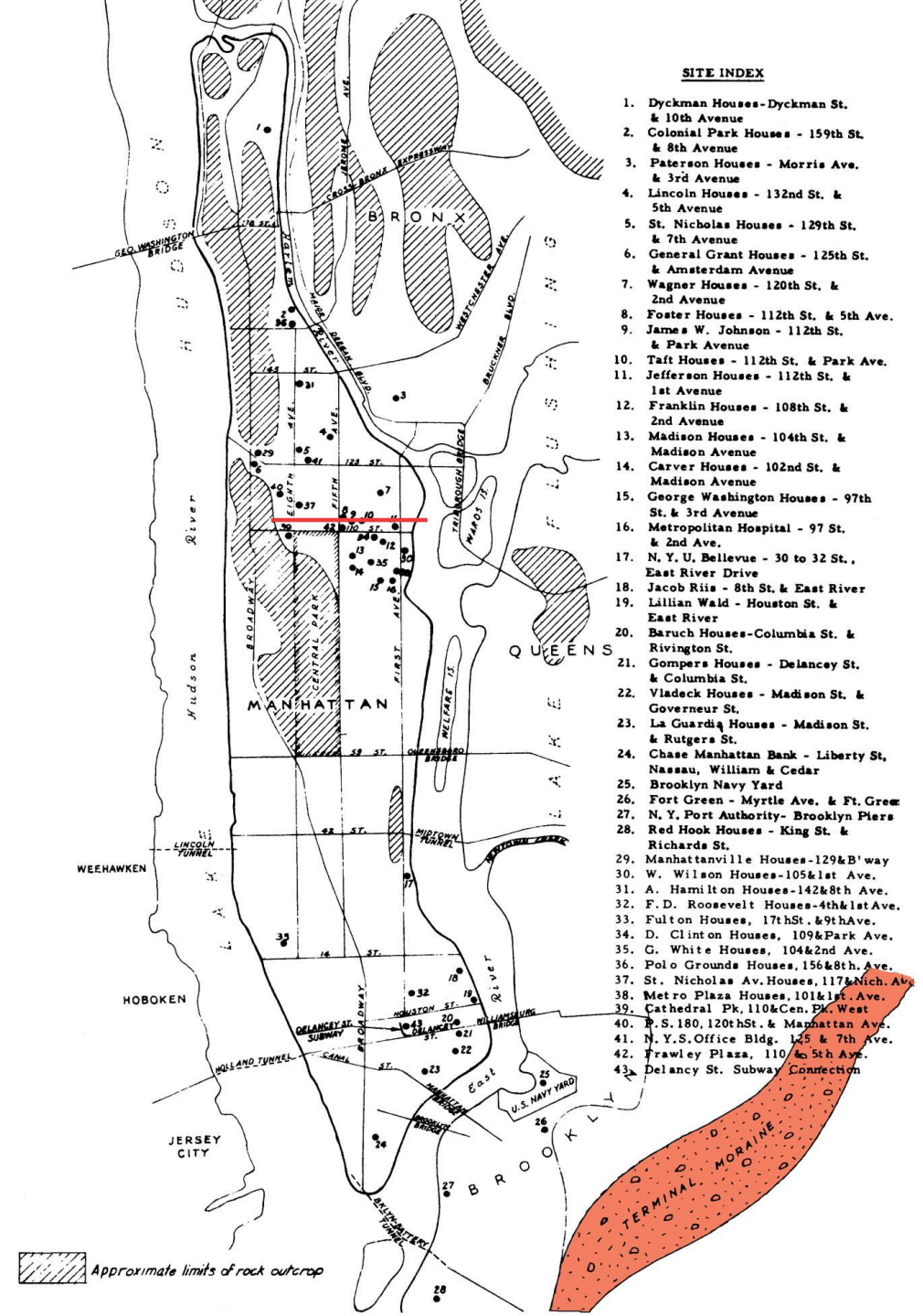


Typical NYC Soil Profile

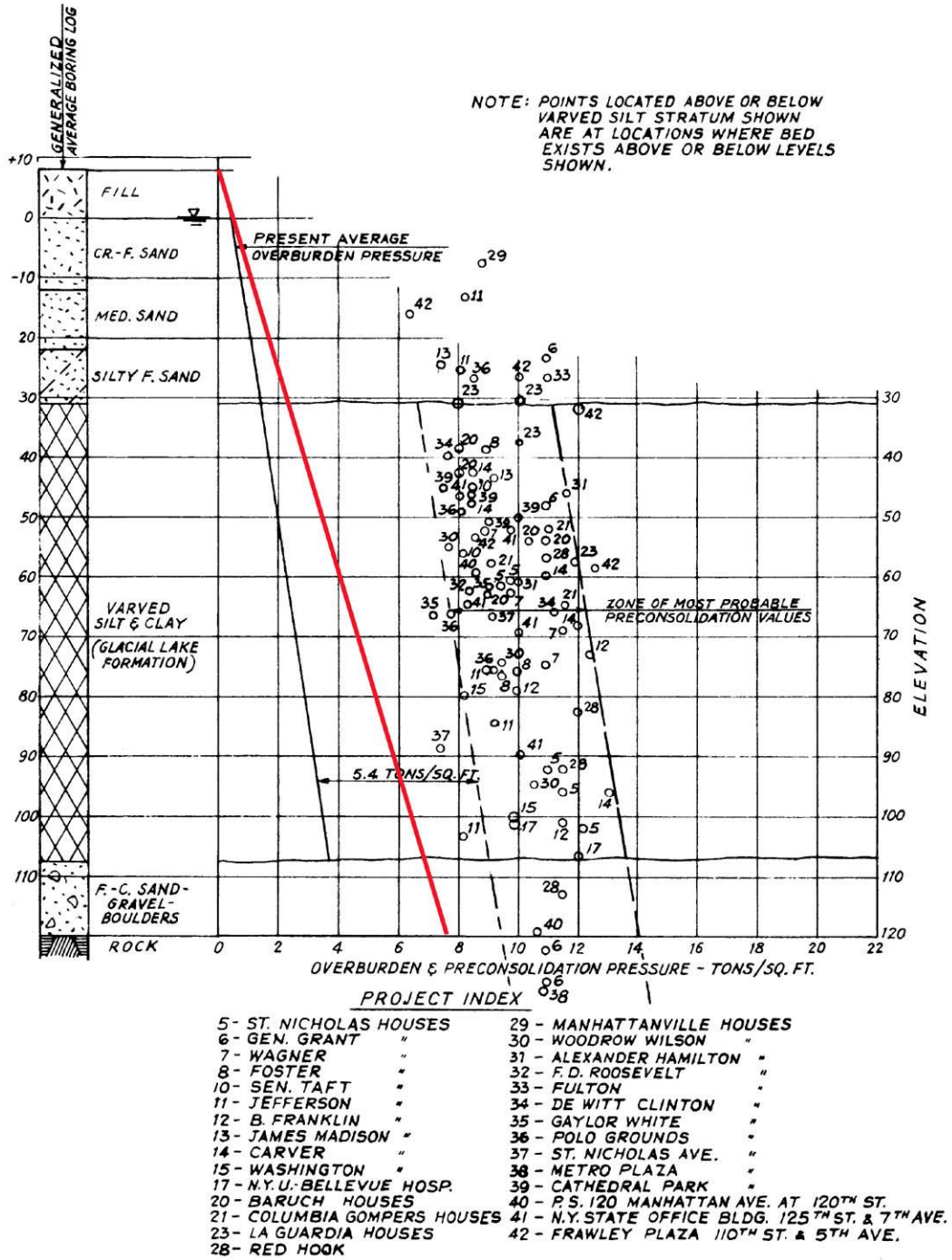
Fining Downward Sequence



W-E Section Across 113th Street (Parsons 1976)

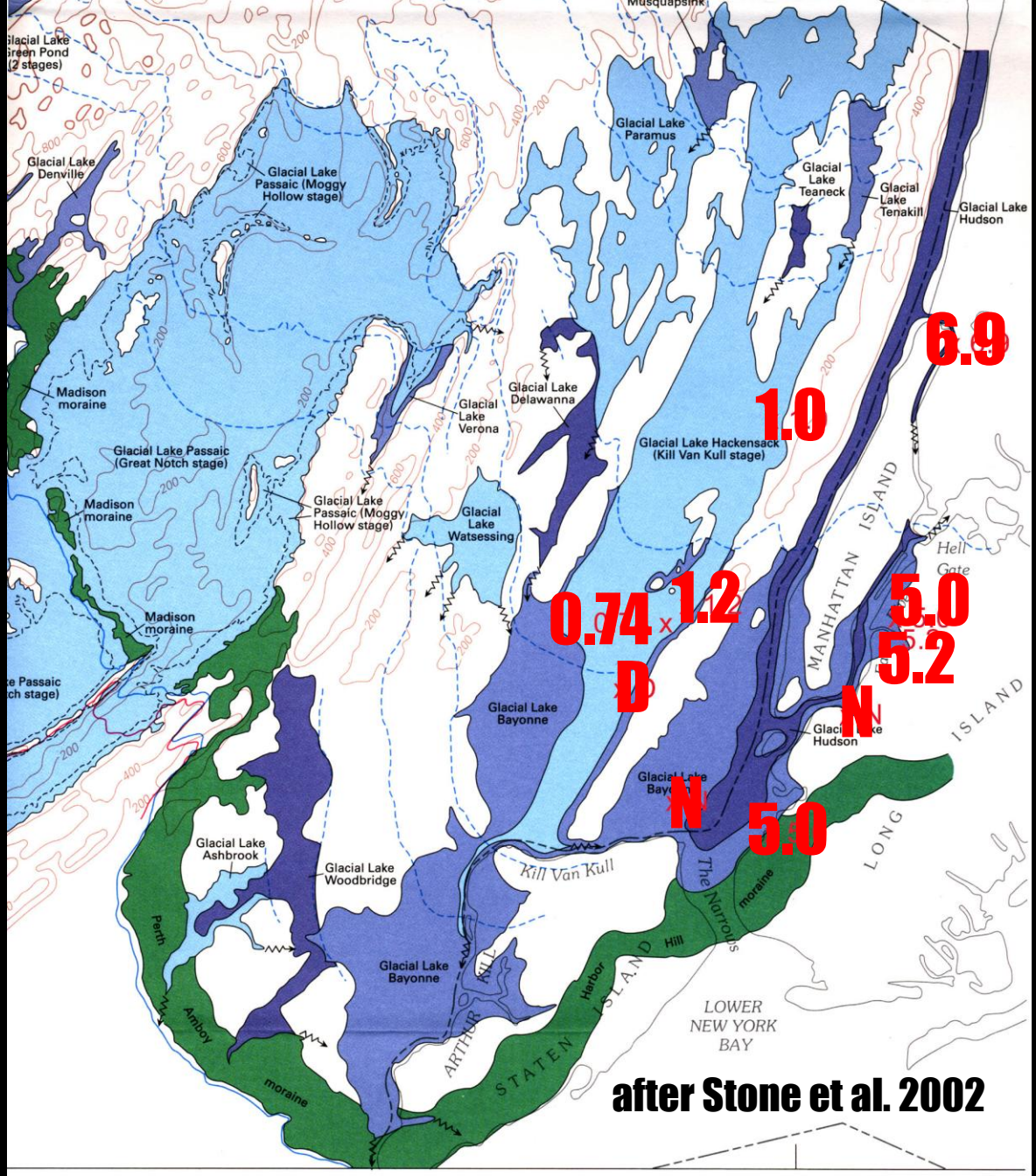


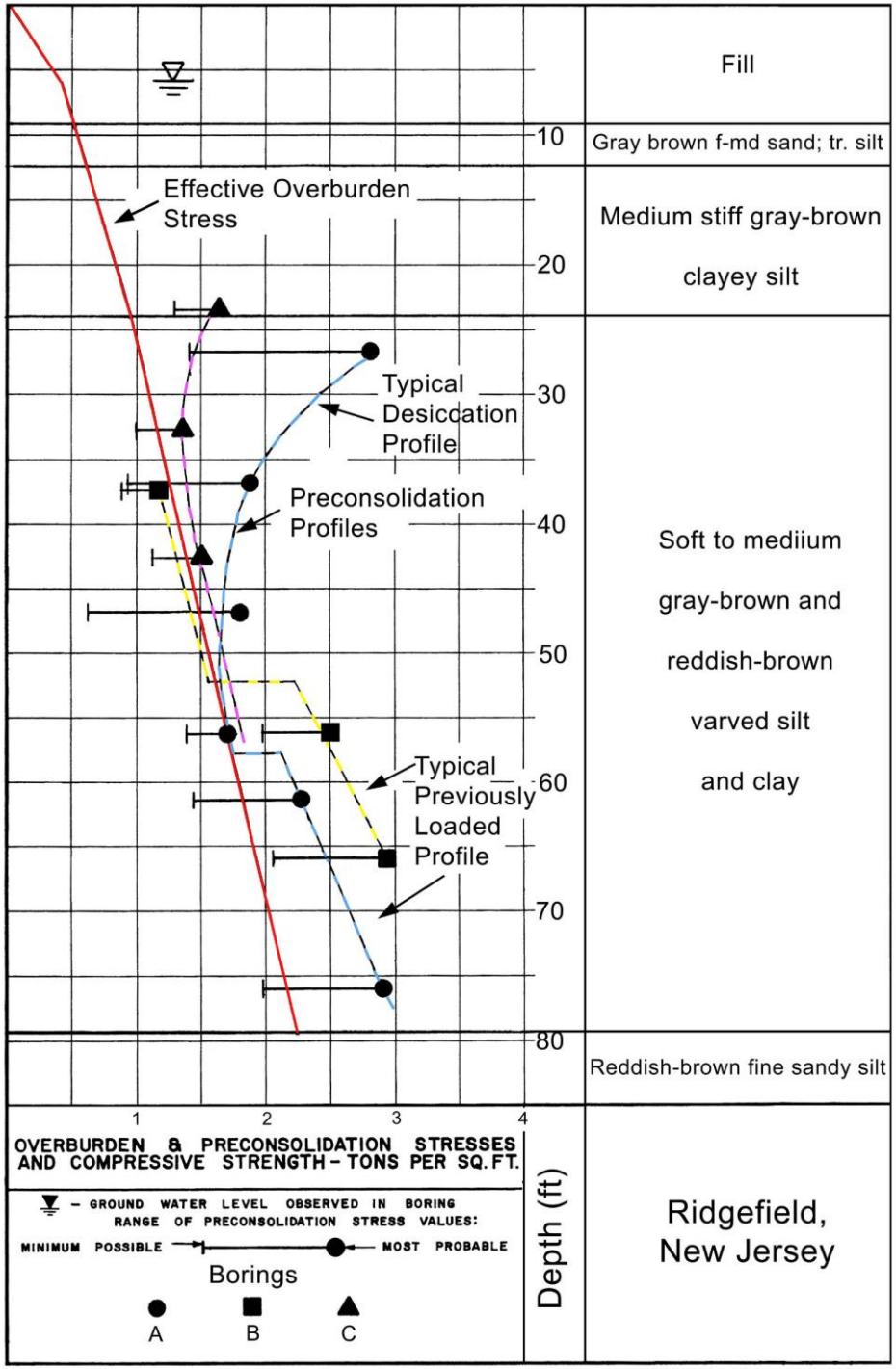
Parsons Studied NYC Housing Project Data Concentrated In Harlem Valley



NYC PROFILE

- Overconsolidated by 5-10 tsf
- Equivalent to 80' - 350' of Eroded Soil
- Dropping Water Level To Bedrock Increases Load by Only 3.5 tsf!
- Points Do Not Follow Curves For Desiccation or Long-Term Settlement

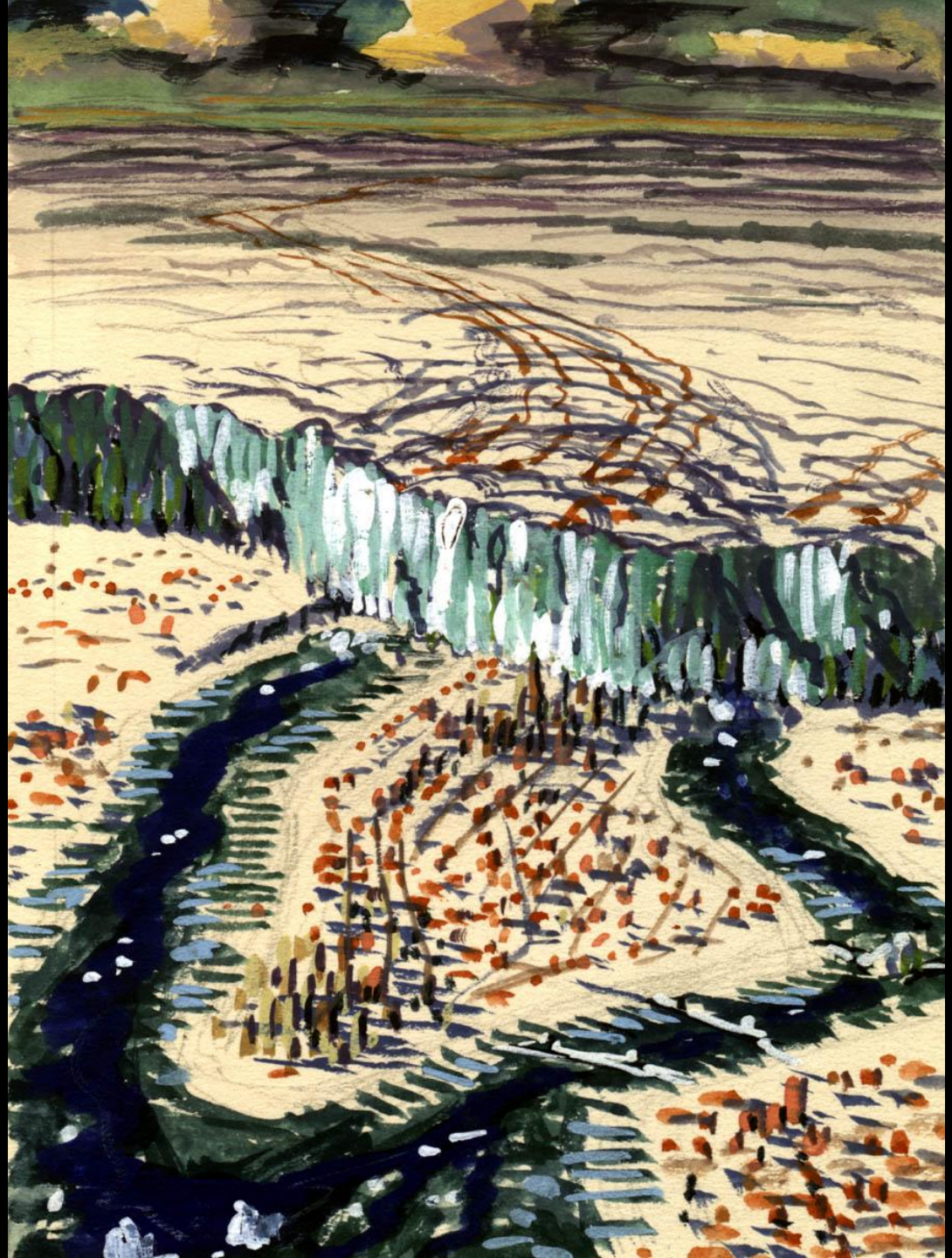

Glacial Lake Green Pond (2 stages)
Glacial Lake Denville
Glacial Lake Passaic (Moggy Hollow stage)
Glacial Lake Paramus
Glacial Lake Teaneck
Glacial Lake Tenakill
Glacial Lake Hudson
Madison moraine
Glacial Lake Delawanna
Glacial Lake Verona
Glacial Lake Hackensack (Kill Van Kull stage)
Glacial Lake Passaic (Great Notch stage)
Glacial Lake Passaic (Moggy Hollow stage)
Glacial Lake Watsessing
Madison moraine
Madison moraine
Glacial Lake Bayonne
MANHATTAN ISLAND
Hell Gate
Glacial Lake Hudson
Glacial Lake Ashbrook
Glacial Lake Woodbridge
Kill Van Kull
The Narrows
moraine
Perth Amboy moraine
Glacial Lake Bayonne
ARTHUR KILL
STATEN ISLAND
Harbor Hill
LONG ISLAND
LOWER NEW YORK BAY
6.9
1.0
0.74 x 1.2
D
5.0
5.2
N
N
5.0
after Stone et al. 2002
5 0 5 10 15 20 MILES
5 0 5 10 15 20 25 KILOMETERS



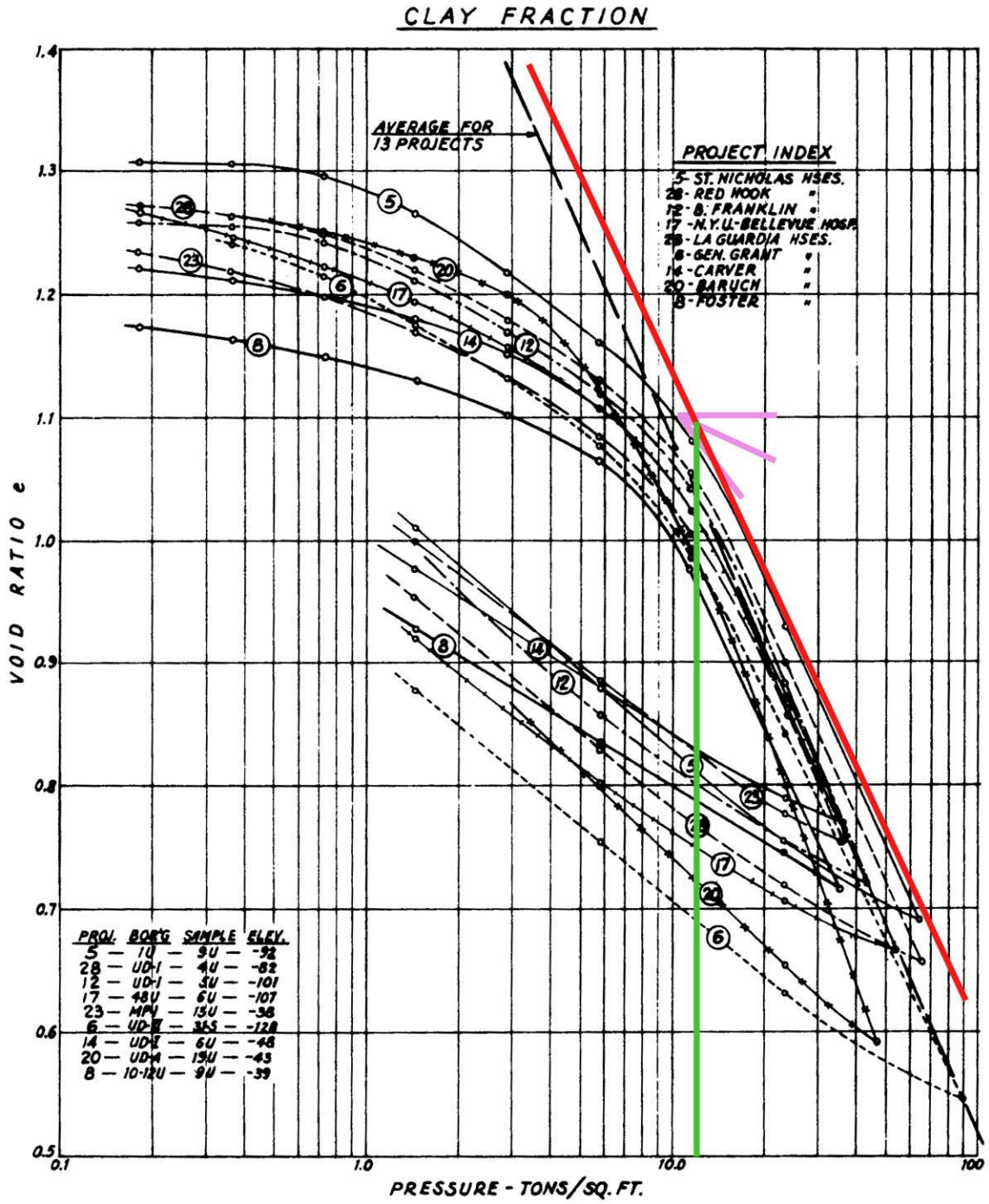
NJ Profile Different From NYC Profile

Desiccation Profile At Surface

Deeper Soil Previously Loaded By 0.75 - 1.0 tsf

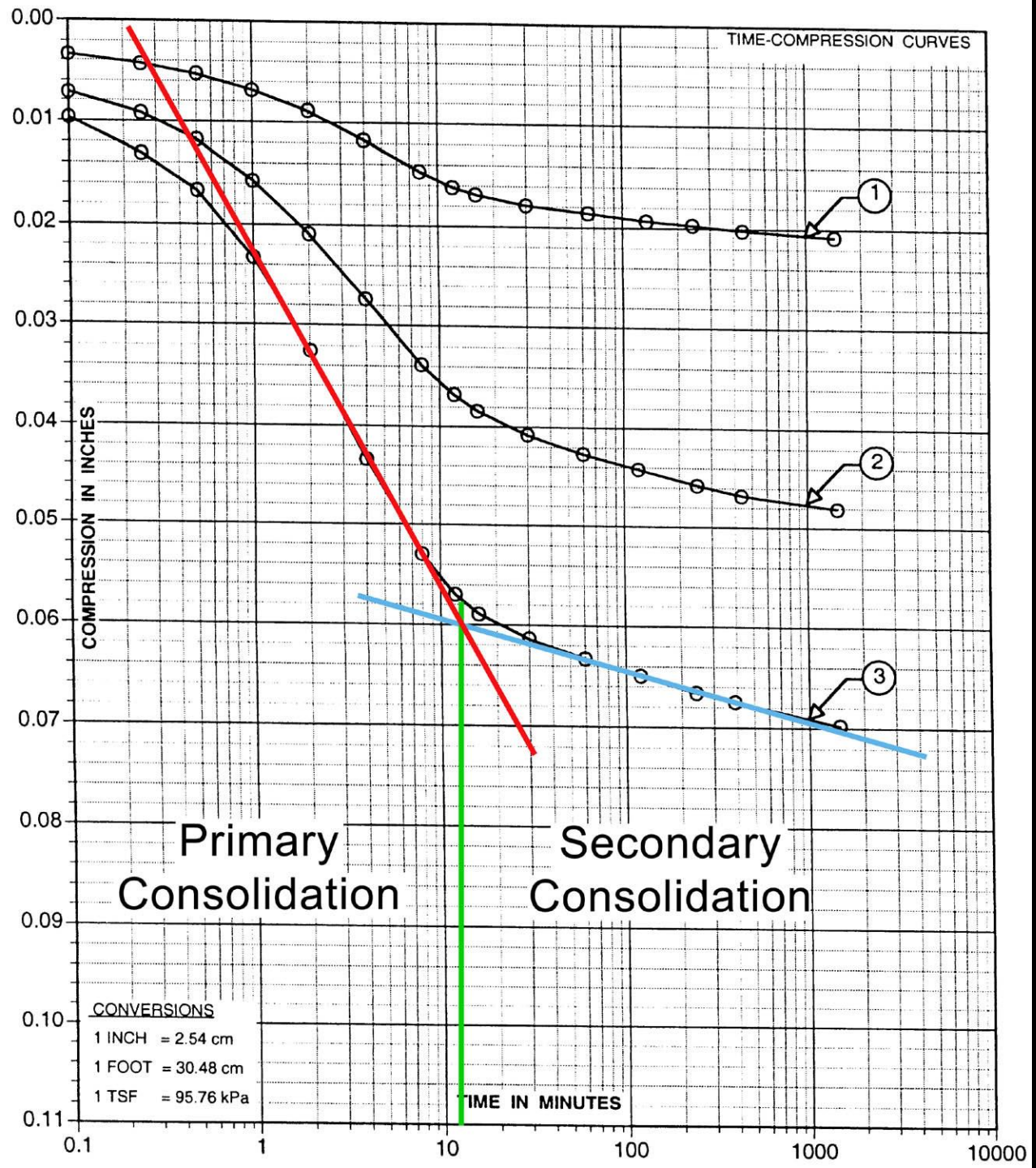


Future Loading Problems?



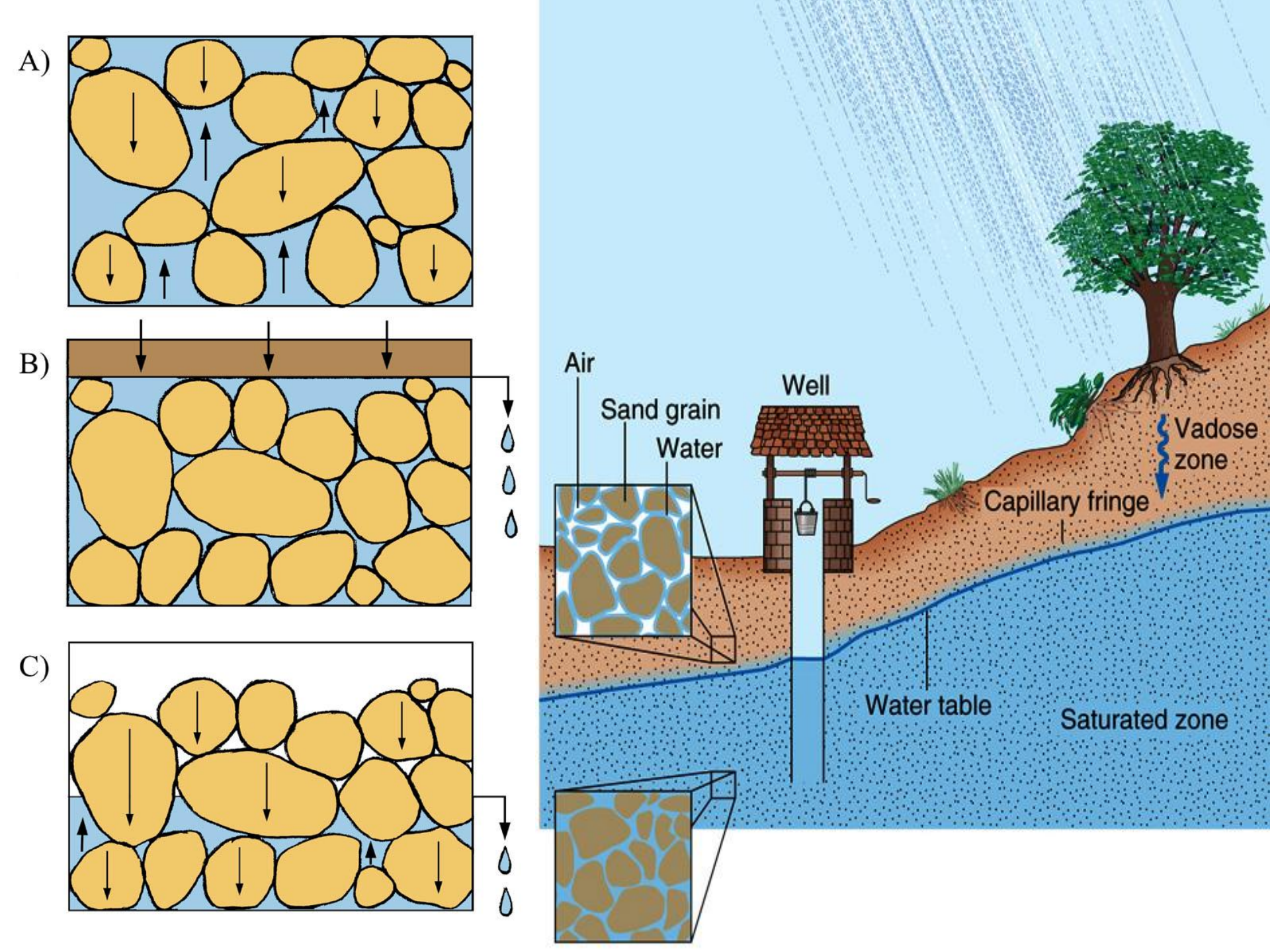
Typical Consolidation Curves for NYC Varved Clays

Used to Determine the Maximum Pressure Soil Was Previously Loaded



Typical Time-Compression Curves for a Varved Silty Clay

Rapid Initial Compression Followed by Slow Long-Term Compression


A)
B)
C)
Air
Sand grain
Water
Well
Vadose zone
Capillary fringe
Water table
Saturated zone