Loading Patterns in Varved Pleistocene Sediment in the NYC Area

Cheryl J. Moss

Mueser Rutledge Consulting Engineers



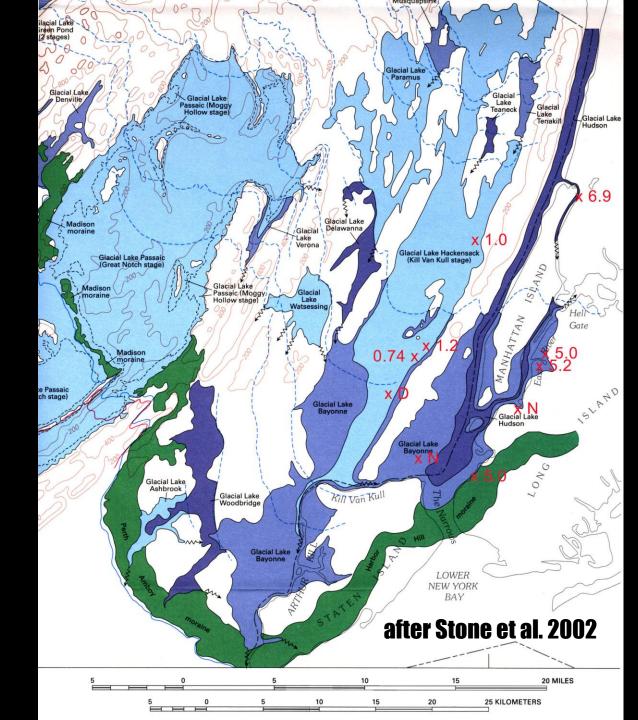
Charles Merguerian

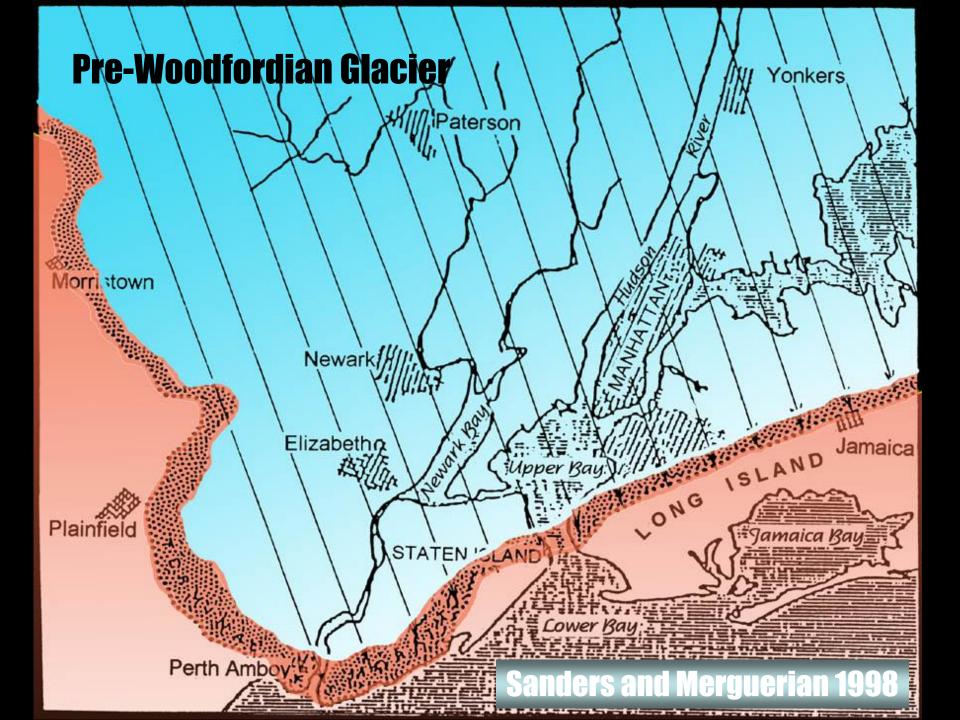
Hofstra Geology

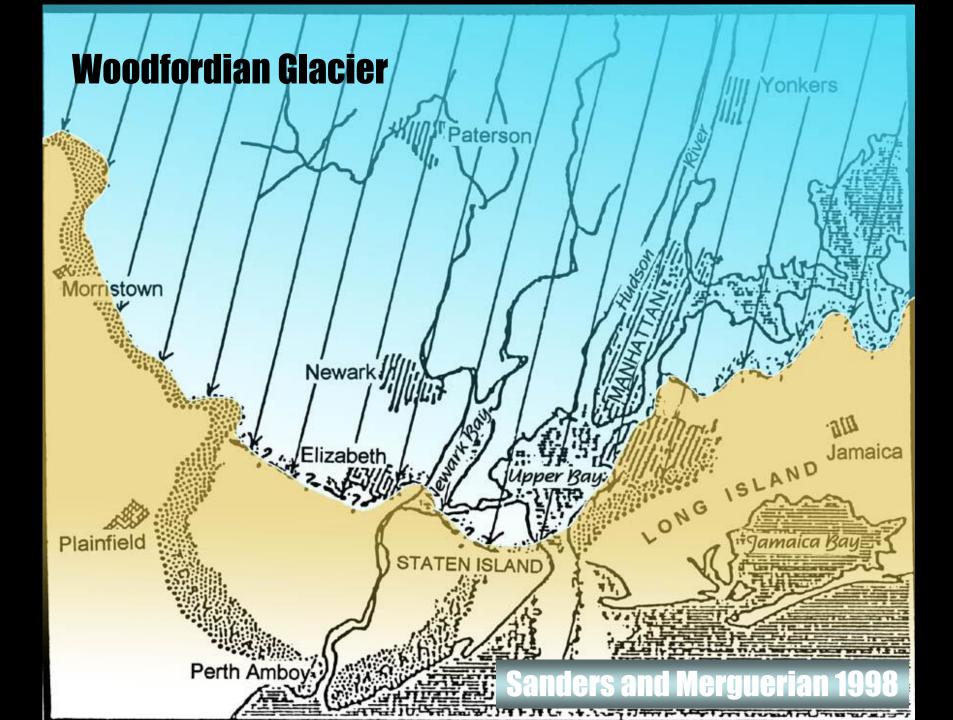


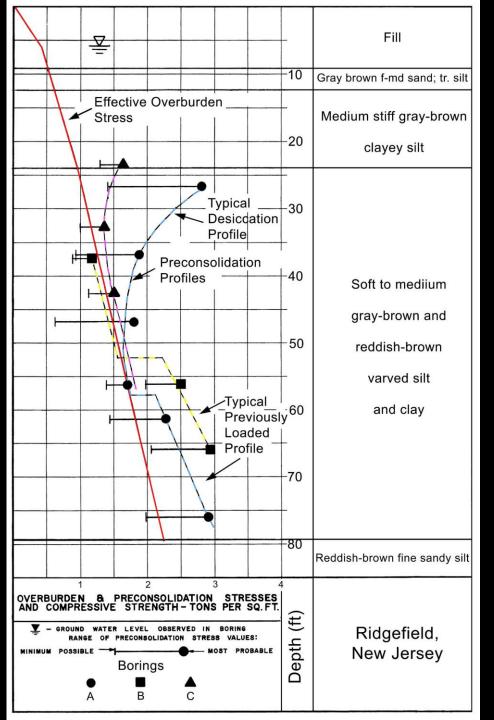
NYC's Varved Soils Experienced Loads 5-10 tsf > Existing Overburden

Concluded That A Younger Glacier Must Have Caused Excess Loading!









Loading Mechanisms

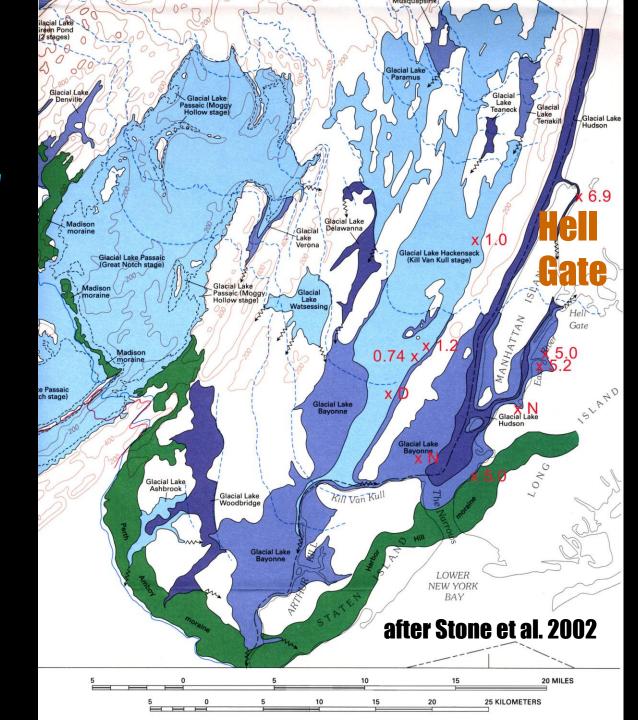
- 1. Loading By Deposition
 Of Sediments Or Loading
 By Glacial Ice
- 2. Lowering Water Table
- 3. Soil Desiccation
- **4. Extreme Long-Term Settlement**

Lake Bayonne

Hell Gate Spillway

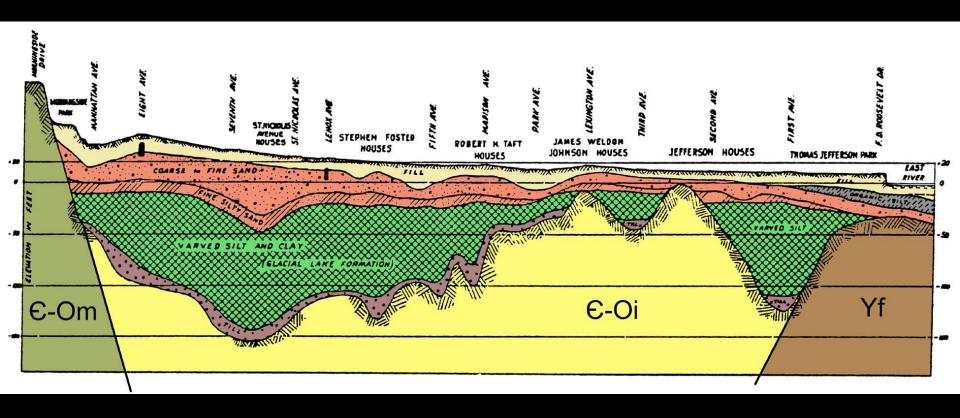
Lake Hackensack (West)

Lake Hudson (East)



Typical NYC Soil Profile

Fining Downward Sequence



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

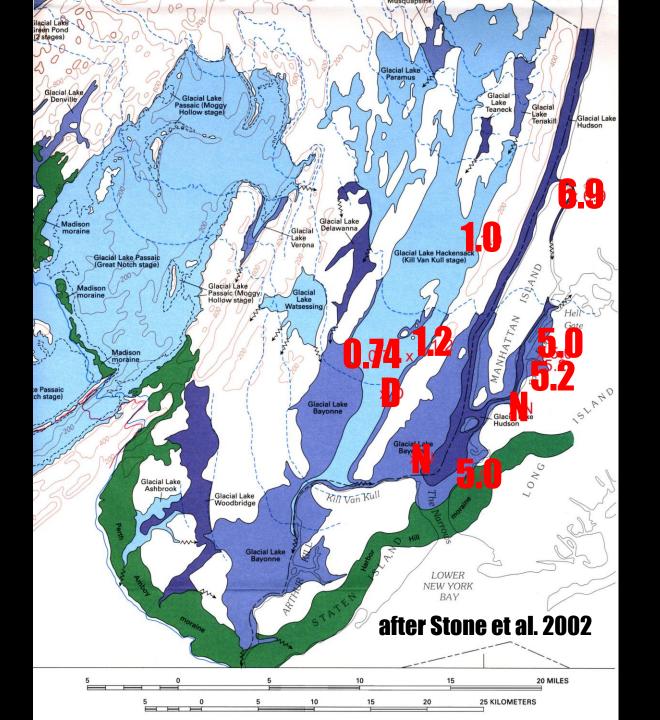
SITE INDEX 1. Dyckman Houses-Dyckman St. & 10th Avenue Colonial Park Houses - 159th St. Z & 8th Avenue Paterson Houses - Morris Ave. & 3rd Avenue 0 Lincoln Houses - 132nd St. & BROXX 5th Avenue 5. St. Nicholas Houses - 129th St. & 7th Avenue 6. General Grant Houses - 125th St. 0 & Amsterdam Avenue Wagner Houses - 120th St. & 2nd Avenue 13 8. Foster Houses - 112th St. & 5th Ave. James W. Johnson - 112th St. & Park Avenue Taft Houses - 112th St. & Park Ave. 11. Jefferson Houses - 112th St. & 1st Avenue (7) 12. Franklin Houses - 108th St. & 2nd Avenue 13. Madison Houses - 104th St. & Madison Avenue Carver Houses - 102nd St. & Madison Avenue 15. George Washington Houses - 97th St. & 3rd Avenue 4 Metropolitan Hospital - 97 St. & 2nd Ave. 17. N. Y. U. Bellevue - 30 to 32 St. . ●35 East River Drive Jacob Riis - 8th St. & East River Lillian Wald - Houston St. & East River Baruch Houses-Columbia St. & QUÉÉNS Rivington St. dson 21. Gompers Houses - Delancey St. & Columbia St. Vladeck Houses - Madison St. & Governeur St. 23. La Guardia Houses - Madison St. & Rutgers St. 1: Chase Manhattan Bank - Liberty St. Nassau, William & Cedar 4 Brooklyn Navy Yard Fort Green - Myrtle Ave. & Ft. Green 26. 27. N. Y. Port Authority- Brooklyn Piers 28. Red Hook Houses - King St. & TOWN THE LINCOLN Richards St. 29. Manhattanville Houses-129&B'way WEEHAWKEN 30. W. Wilson Houses-105&lst Ave. 7. 31. A. Hamilton Houses-142&8th Ave. 32. F.D. Roosevelt Houses-4th&lst Ave. -4 33. Fulton Houses, 17thSt. &9thAve. 34. D. Clinton Houses, 109&Park Ave. 35 ... 35. G. White Houses, 104&2nd Ave. 36. Polo Grounds Houses, 156&8th. Ave. 37. St. Nicholas Av. Houses, 117 Nich. Av. 38. Metro Plaza Houses, 101&1st. Ave. HOBOKEN 39. Cathedral Pk, 110&Cen. Pk. West 40. P. S. 180, 120t hSt . & Manhattan Ave. 41. N. Y.S. Office Bldg. 125 & 7th Ave. • 22 42. Frawley Plaza, 110 to 5th Aye. HOLL AND TYMMEL 43 Del ancy St. Subway Connection JERSEY 0 Approximate limits of rock outcrop

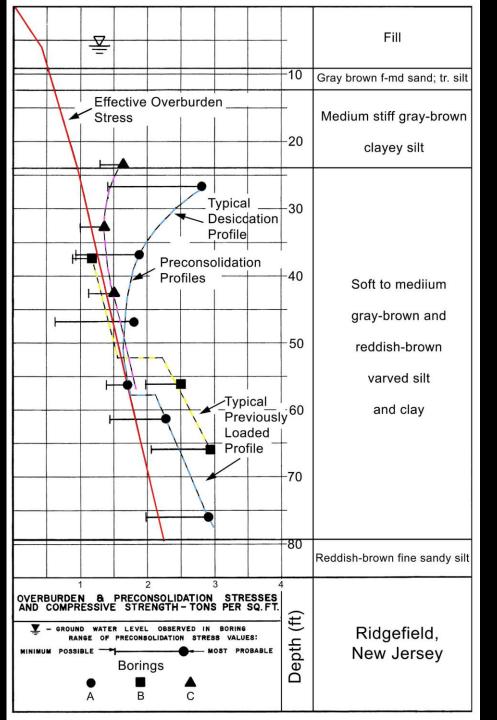
Parsons Studied NYC Housing Project Data Concentrated In Harlem Valley

NOTE: POINTS LOCATED ABOVE OR BELOW VARVED SILT STRATUM SHOWN ARE AT LOCATIONS WHERE BED EXISTS ABOVE OR BELOW LEVELS +10 FILL PRESENT AVERAGE CR.-F. SAND OVERBURDEN PRESSURE -10 042 011 MED. SAND 23033 SILTY F. SAND Φ42 40 50 20021 028 23 60 ZONE OF MOST PROBABLE PRECONSOLIDATION VALUES EVATION VARVED SILT & CLAY GLACIAL LAKE 36 36 1100 68 15 8 12 FORMATION) 28 37 90 0023 5.4 TONS/SQ.FT. 0300 100 110 280 F.-C. SAND-GRAVEL-BOULDERS 120 110 06 12 OVERBURDEN & PRECONSOLIDATION PRESSURE - TONS/SO. FT. PROJECT INDEX 5- ST. NICHOLAS HOUSES 29 - MANHATTANVILLE HOUSES 6 - GEN. GRANT 30 - WOODROW WILSON 7 - WAGNER 31 - ALEXANDER HAMILTON 8- FOSTER 32 - F. D. ROOSEVELT 10- SEN. TAFT 33 - FULTON 11 - JEFFERSON 34 - DE WITT CLINTON 12 - B. FRANKLIN 35 - GAYLOR WHITE 13 - JAMES MADISON " 36 - POLO GROUNDS 14 - CARVER 37 - ST. NICHOLAS AVE. 15 - WASHINGTON 38 - METRO PLAZA 17 - N.Y. U. BELLEVUE HOSP. 39 - CATHEDRAL PARK 20 - BARUCH HOUSES 40 - P. S. 120 MANHATTAN AVE. AT 120TH ST. 21 - COLUMBIA GOMPERS HOUSES 41 - N.Y. STATE OFFICE BLDG. 125 THST. & 7 TH AVE. 23- LA GUARDIA HOUSES 42 - FRAWLEY PLAZA HOTH ST. & 5TH AVE. 28- RED HOOK

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

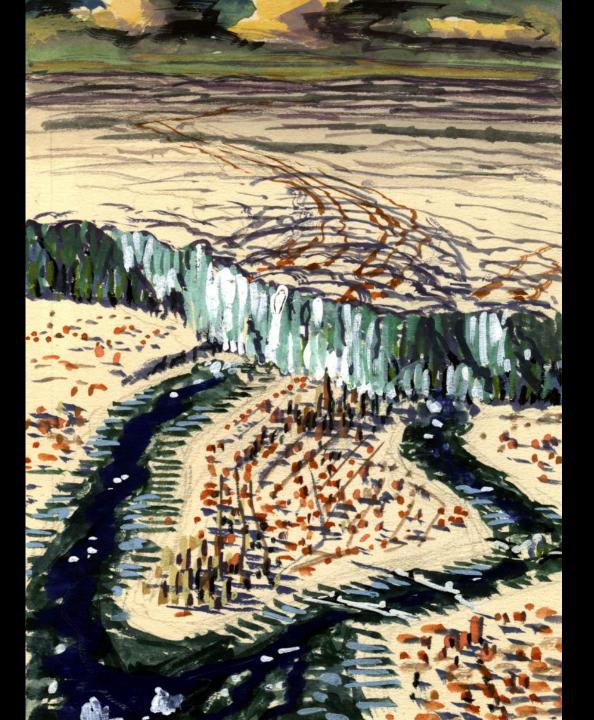




NJ Profile Different From NYC Profile

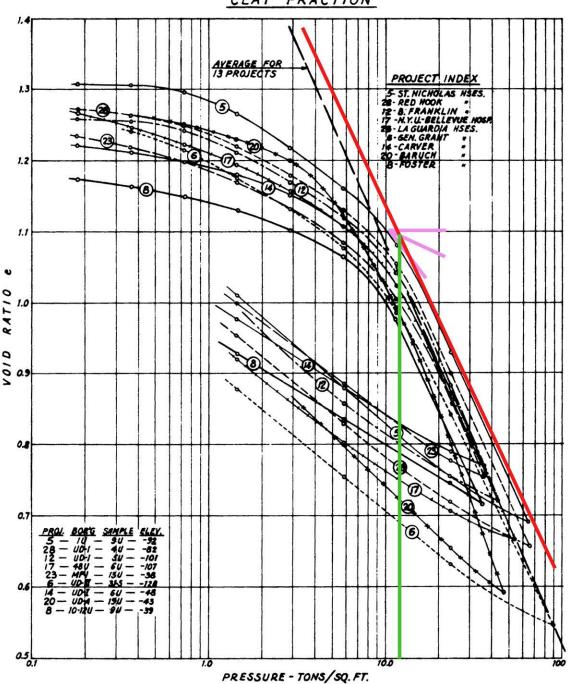
Desiccation Profile At Surface

Deeper Soil Previously Loaded By 0.75 - 1.0 tsf



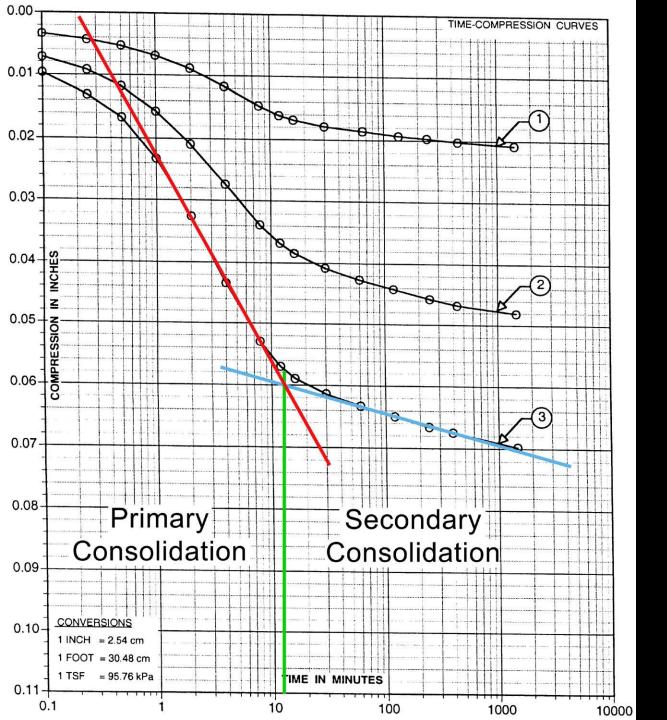
Future Loading Problems?

CLAY FRACTION



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

