Soil Restoration

in Accordance with

The NYSDEC 2010 Stormwater Management Design Manual

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Implementation of Soil Restoration as a Green Infrastructure Practice

- Soil Restoration
- Soil Characteristics
- Soil Restoration Methods
- Where Not to Initiate Soil Restoration
- When Should Soil Restoration Be Done
- Things to Look for to Confirm Soil Restoration was Done Correctly
- Keys to Success
- Maintenance of Restored Areas

Soil Restoration

- Goal is to restore soil porosity and permeability and improve infiltration rate that were affected during construction/earth disturbance work that resulted in compaction of the soil


Does the finished grade of your site look like this?

Soil Restoration

- REQUIRED practice applied across areas of a development site where soils have been disturbed and will be vegetated to recover the original properties and porosity of the soil (Page 5-21 NYSDEC Design Manual).

- Soil restoration or modification of curve numbers is a REQUIRED practice (Page 5-23, NYSDEC Design Manual).

Table 5.3 Soil Restoration Requirements			
Type of Soil Disturbance	**Soil Restoration Requirement**		**Comments/Examples**
No soil disturbance	Restoration not permitted		Preservation of Natural Features
Minimal soil disturbance	Restoration not required		Clearing and grubbing
Areas where topsoil is stripped only - no change in grade	HSG A &B	HSG C&D	Protect area from any ongoing construction activities.
	apply 6 inches of topsoil	Aerate* and apply 6 inches of topsoil	
Areas of cut or fill	HSG A &B	HSG C & D	
	Aerate and apply 6 inches of topsoil	Apply full Soil Restoration **	
Heavy traffic areas on site (especially in a zone 5-25 feet around buildings but not within a 5 foot perimeter around foundation walls)	Apply full Soil Restoration (de-compaction and compost enhancement)		
Areas where Runoff Reduction and/or Infiltration practices are applied	Restoration not required, but may be applied to enhance the reduction specified for appropriate practices.		Keep construction equipment from crossing these areas. To protect newly installed practice from any ongoing construction activities construct a single phase operation fence area
Redevelopment projects	Soil Restoration is required on redevelopment projects in areas where existing impervious area will be converted to pervious area.		

*Aeration includes the use of machines such as tractor-drawn implements with coulters making a narrow slit in the soil, a roller with many spikes making indentations in the soil, or prongs which function like a mini-subsoiler.

** Per "Deep Ripping and De-compaction, DEC 2008".

Page 5-22 of Design Manual

New York State
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Water

Deep-Ripping and Decompaction

April 2008

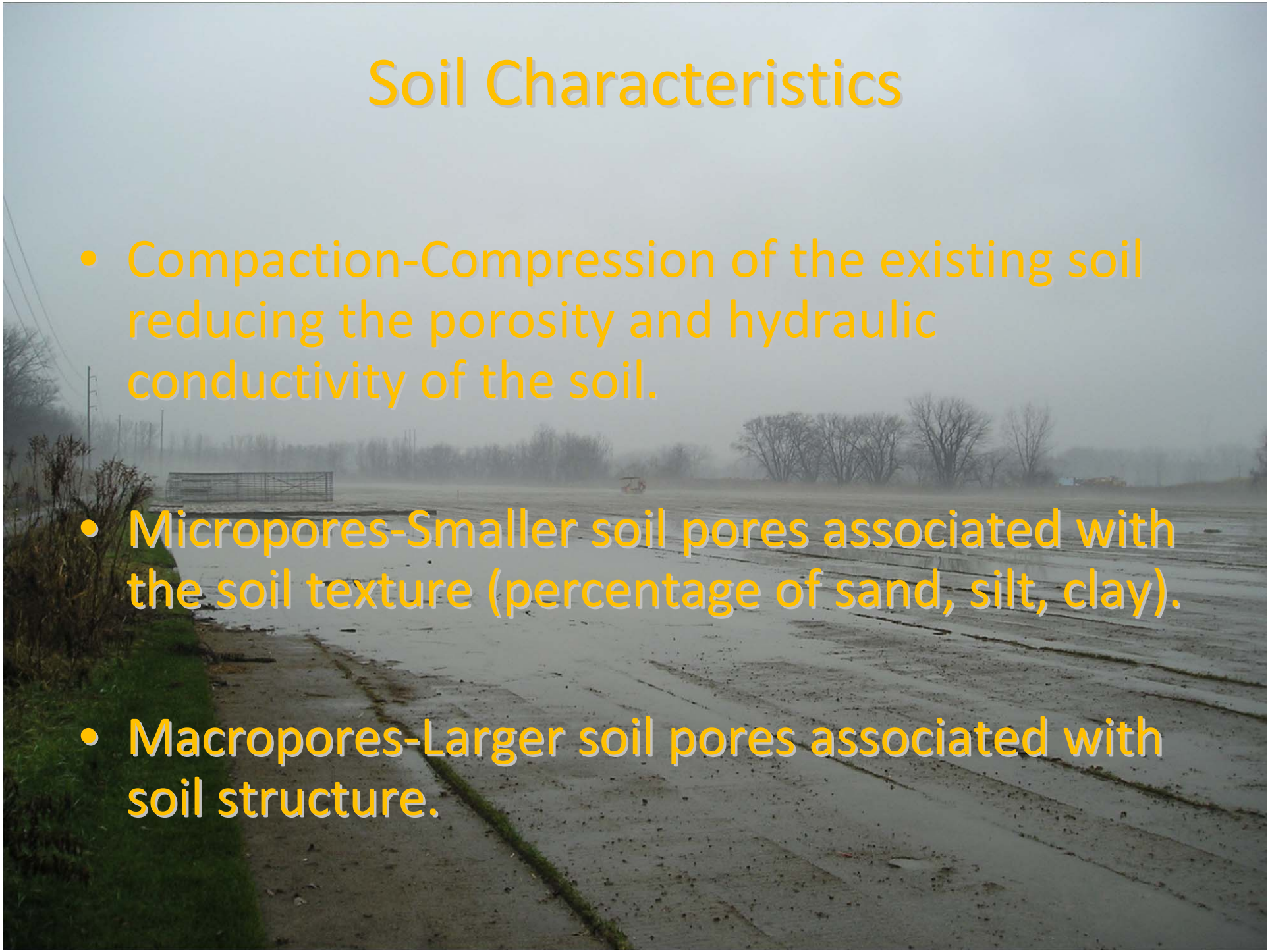
"http://www.dec.ny.gov/docs/water_pdf/infildecom08.pdf"

New York State
Department of Environmental Conservation

Soil Characteristics

- Soil is generally 50% solids and 50% pore space.
- Porosity is a measure of the amount of pores in relation to the total volume.

Soil Characteristics

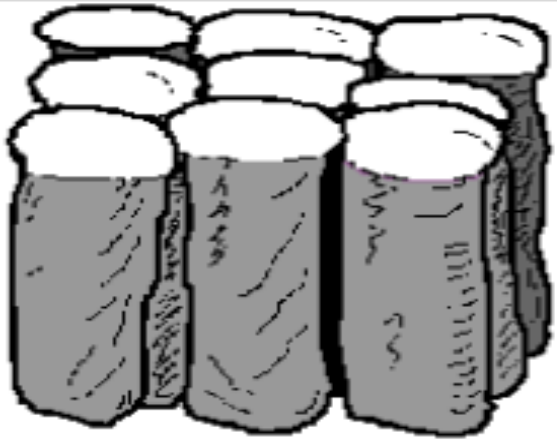


- Compaction-Compression of the existing soil reducing the porosity and hydraulic conductivity of the soil.
- Micropores-Smaller soil pores associated with the soil texture (percentage of sand, silt, clay).
- Macropores-Larger soil pores associated with soil structure.

Soil Structure

- Aggregation of sand, silt and clay particles in soil into individual structural units (peds).
- Naturally occurs over time.
- Aggregating agents that create soil structure:
  - Water
  - Organic matter
  - Calcium (divalent cations)
  - Iron oxides
- Structure can be easily destroyed by:
  - Compaction
  - Tillage


• Strong Granular Structure

		
Granular: Resembles cookie crumbs and is usually less than 0.5 cm in diameter. Commonly found in surface horizons where roots have been growing.	**Blocky**: Irregular blocks that are usually 1.5 - 5.0 cm in diameter.	**Prismatic**: Vertical columns of soil that might be a number of cm long. Usually found in lower horizons.
		
Columnar: Vertical columns of soil that have a salt "cap" at the top. Found in soils of arid climates.	**Platy**: Thin, flat plates of soil that lie horizontally. Usually found in compacted soil.	**Single Grained**: Soil is broken into individual particles that do not stick together. Always accompanies a loose consistence. Commonly found in sandy soils.

Soil Restoration Methods

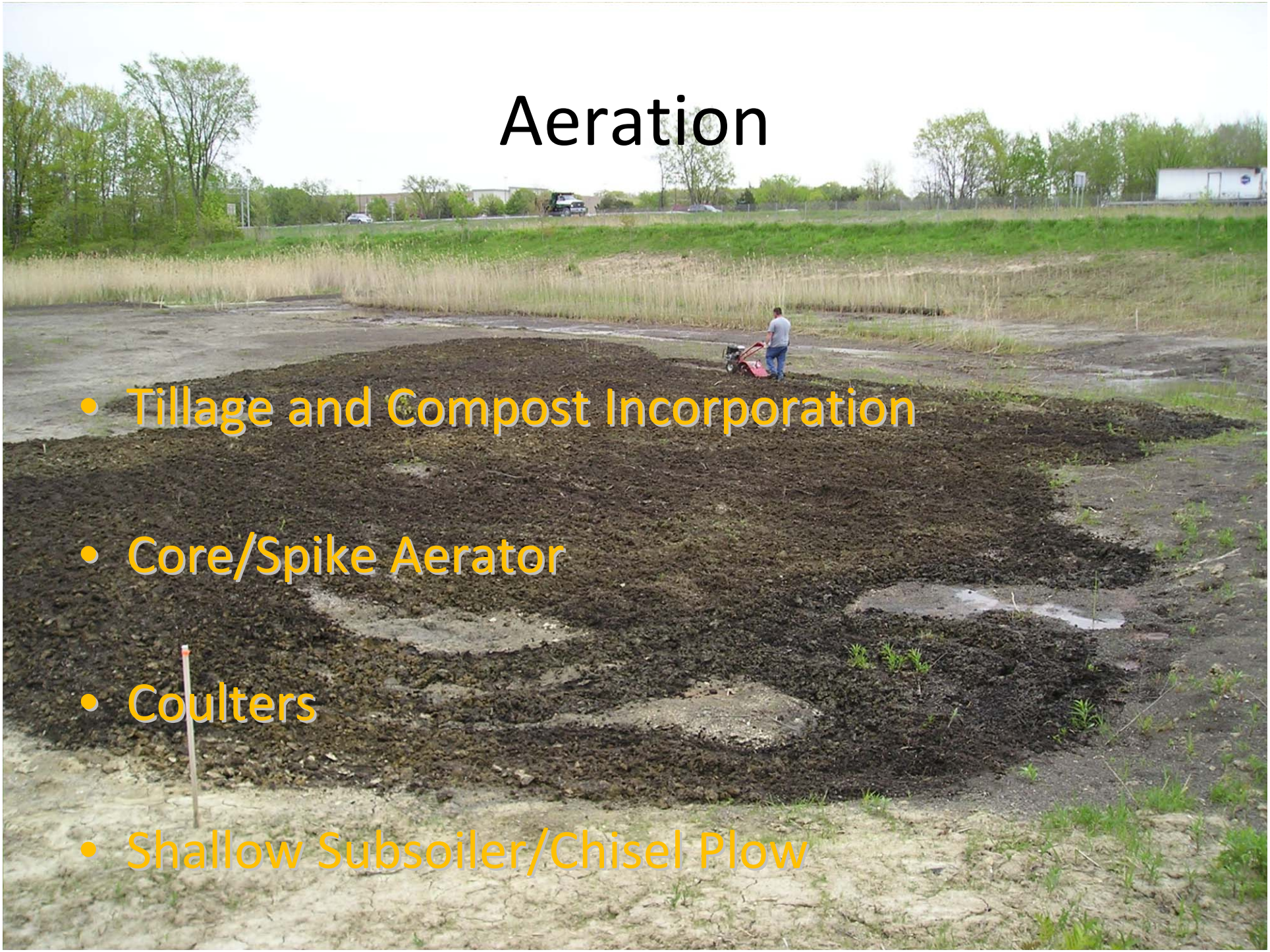
as per Design Manual and “Deep Ripping and Decompaction”

- Topsoil Application
- Aeration
- Full Soil Restoration
  - Deep Ripping
  - Topsoil/Compost Enhancement
  - Decompaction/Deep Subsoiling
- Grow Some Grass On It

Topsoil Application

- Add 6” of topsoil (not much to say)
- Done also after Deep Ripping for Full Restoration

Aeration



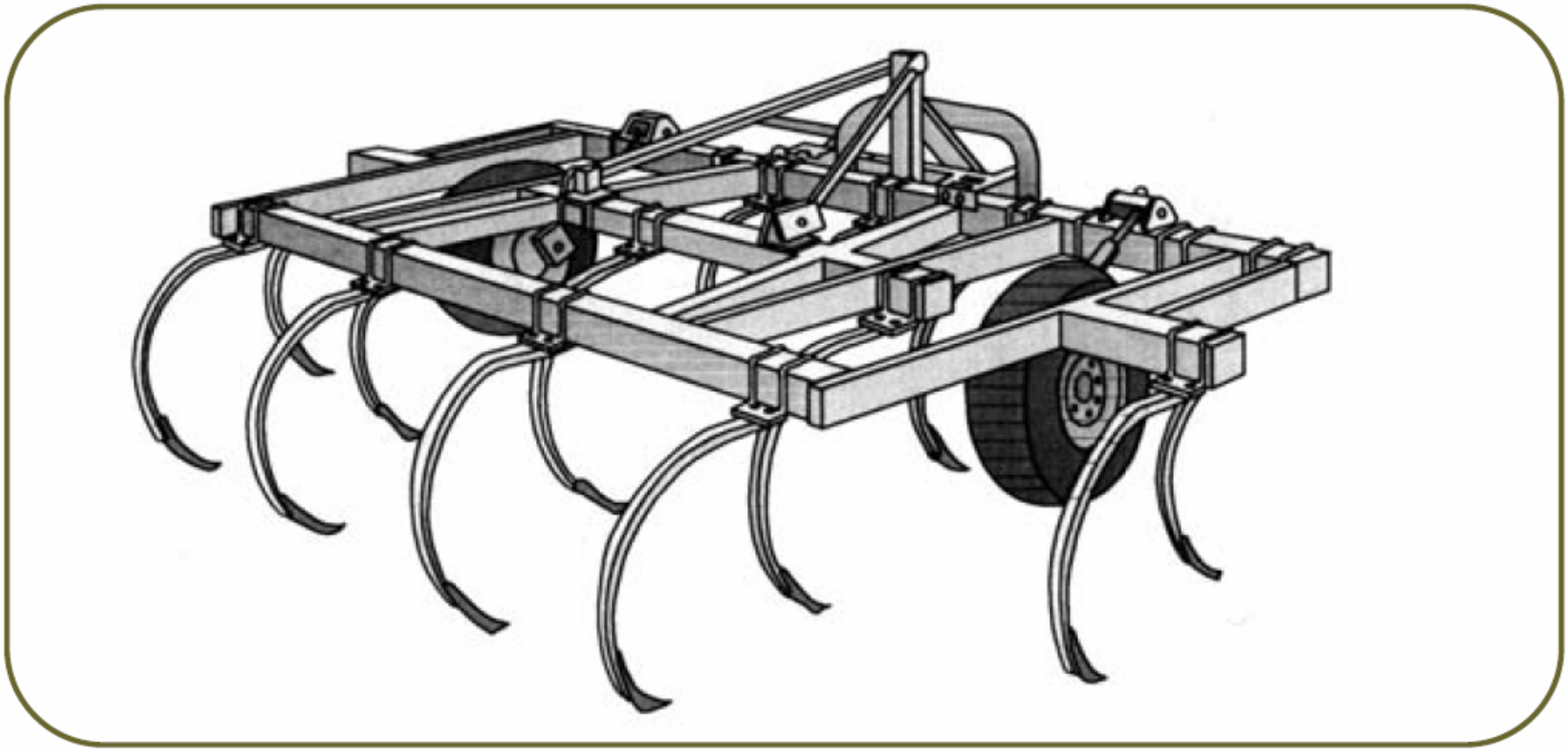
- Tillage and Compost Incorporation
- Core/Spike Aerator
- Coulters
- Shallow Subsoiler/Chisel Plow


Core Aerator

Spike Aerator

Coulters

Chisel Plow



Deep Ripping

first part of "Full Soil Restoration"

- Typically done to a 12" to 24"+ depth. Be sure to specify what depth is needed and confirm equipment can reach that depth.
- Recommended tool to be used is a "heavy duty" agricultural ripper and a BIG TRACTOR. 40HP per deep ripper shank.
  - Nobody rents this equip. Purchase cost varies $4,000-$10,000 new agricultural ripper.
- Use the correct equipment to suit the site.
- Tillage is slow (2 to 3 mph recommended), intent is to fracture soil.
- Typically takes multiple passes to get full depth. Perpendicular pathways are recommended.
- Do not plow when too wet!!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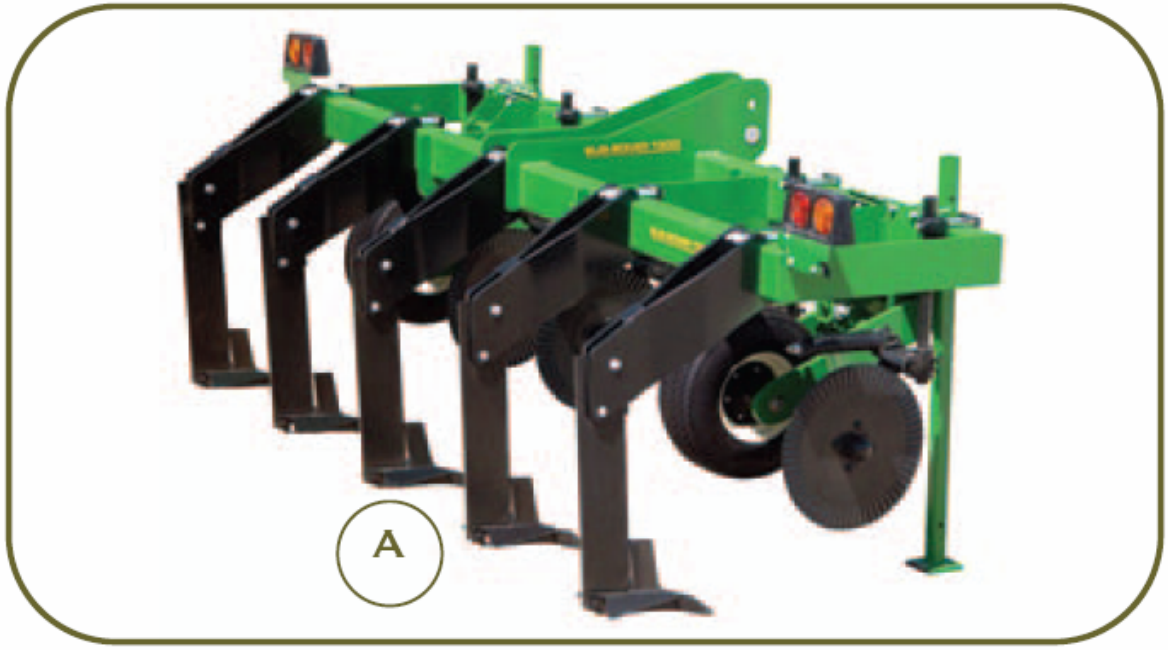
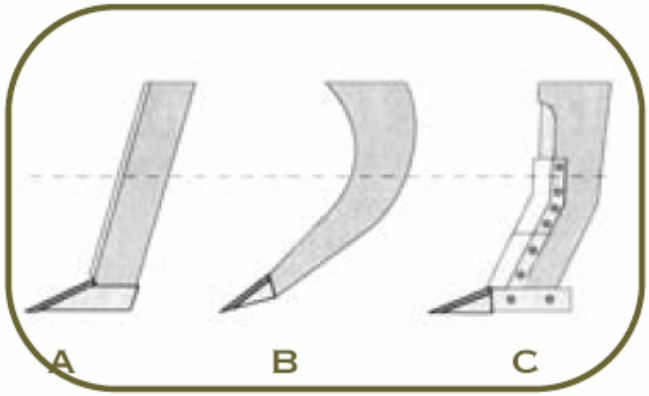
Decompaction

second part of “Full Soil Restoration”

- After deep ripping is done and topsoil applied, conduct decompaction. Compost can be added during this step.
  - Recommended tool to be used is a deep subsoiler.
- This tillage does not have to be as deep as the heavy duty agricultural ripper.
- Goal is to alleviate the compaction that may have occurred from applying the topsoil over the ripped soil.
- Mixes the topsoil with the upper portion of the subsoil.
- Uplifts surface, incorporates compost and topsoil.





Subsoiler shanks: (A) straight, (B) parabolic, and (C) bent leg.

Where Not to Apply Soil Restoration

- Undisturbed Areas
- Steep Slopes (15% or greater, soil dependent)
- Bedrock, Large Amounts of Rock or Severe Natural Hardpan
- Soils too Wet (poor man's Atterberg test)
- Wetlands (HSG D Soils)
- Drip-line of Existing Trees
- Over Buried Utilities
- Confined Spaces Where Equipment Cannot Fit


Wet Tillage

Poor Man's Atterberg Test

- Get sample of soil at depth proposed for restoration
- Roll the sample into a cylinder between the palms of your hand to 1/8" in diameter
- If the sample breaks into pieces smaller than 3/8" long when it is rolled to a 1/8" diameter, it is suitable for plowing/restoration. If it stays together in pieces longer than 3/8" and feels "plastic" (like silly putty), the soil is too wet to plow.

When Should Soil Restoration Occur

- After Construction is Complete and Traffic Will Not Go Through Restored Area.
- During Construction Site Restoration/Landscaping
- Do Not Drive Over Restored Areas!!
  - Landscapers Will Want to Disk or Cultipack Area for Lawn Areas.

The cultipacker firms the seed bed. This contributes to better seed soil contact and is important for establishment small seeded crops like forages.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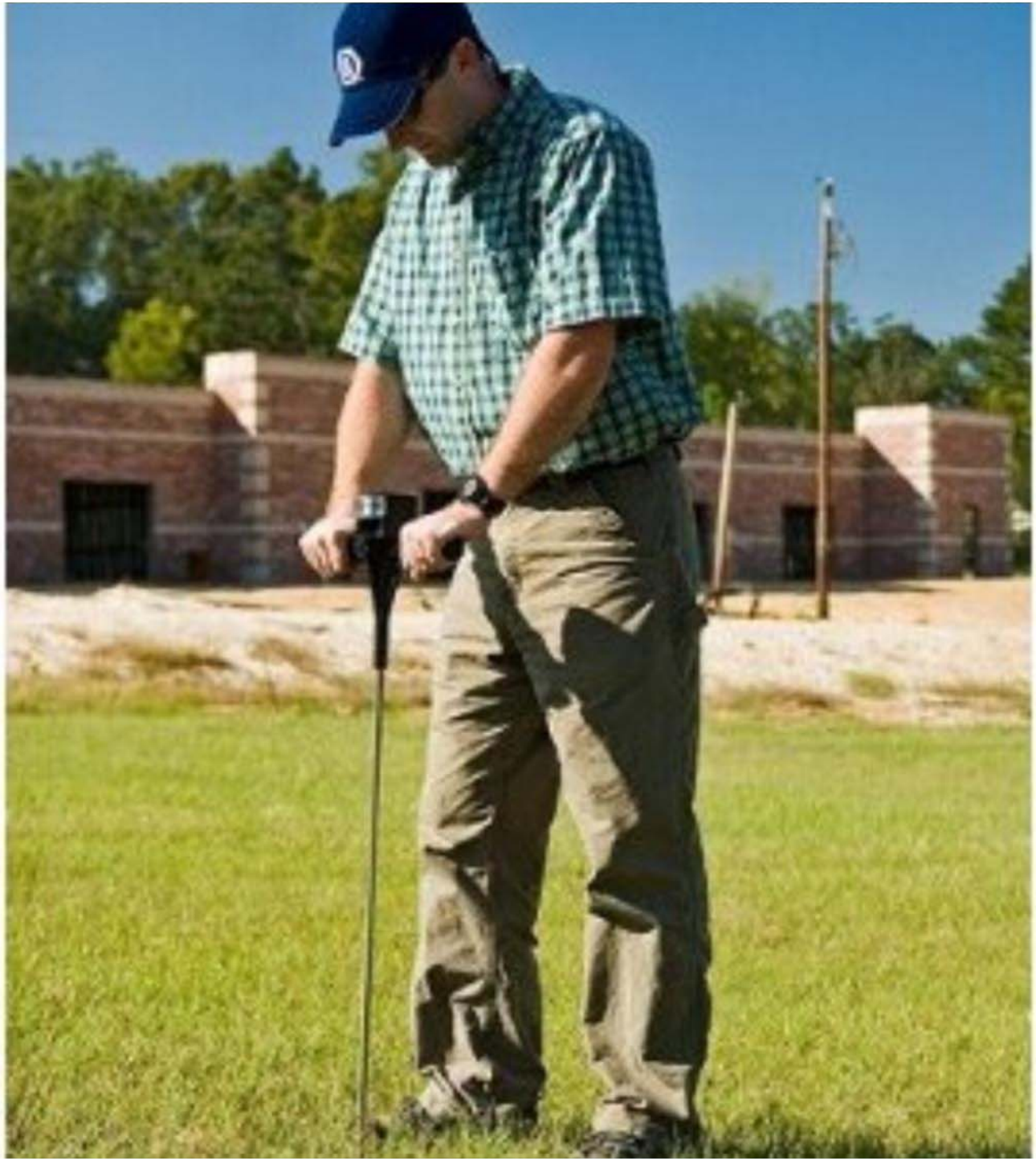
Was it Done Right?

- NYSDEC Design Manual page 5-23

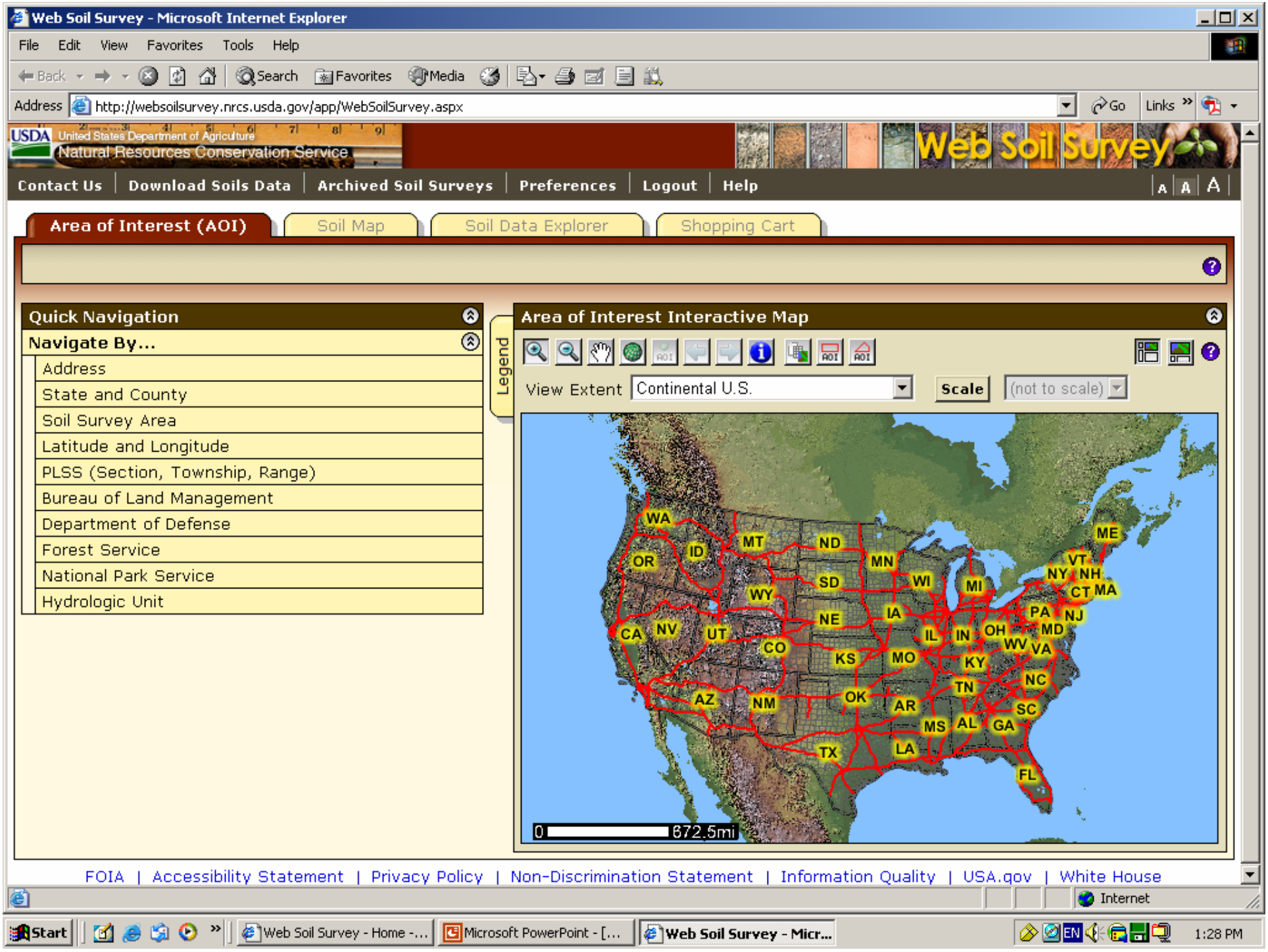
"An inspector should be able to push a 3/8" metal bar into the soil with body weight."

- Penetrometer reading of around 200 not to exceed 400 pounds per square inch (psi). Root growth is reduced above 300 psi, (Cornell Soil Health Training Manual 2nd Edition, 2009)



Keys to Success

- COMUNICATION
- Read the SWPPP!!
- Try to get out and see existing conditions, if not get soil survey map or see if test pits were conducted onsite prior to construction.
- Try to be present during construction to observe traffic patterns, note areas that will need treatment.
- Be present when tillage is occurring to confirm soil moisture and appropriate equipment is being used.
- Measure depths of tillage equipment.
- Get penetrometer, soil probe or 3/8” bar and poke around in the soil.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Maintenance of Restored Areas

- Grow vegetation (grass) and maintain
- Reseed bare areas
- Keep traffic off areas

References

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Questions?