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science for a changing world

SARASOTA bay
National Estuary Program
Protecting Our Water Heritage

SBNEP-USGS Hydrology Project

Objectives

- Review existing and ongoing investigations
- Summarize the availability of existing hydrologic data
- Identify data gaps and data collection needs for successfully determining recharge, water quality, and constituent loads within the Sarasota Bay watershed

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Management Questions

- How do natural versus urbanized hydrologic regimes compare? What are the predevelopment and present hydrologic regimes?
- Are changes in imperviousness impacting runoff volumes to the Bay?

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Hypothesis

- As urbanization continues in Florida, does surface runoff increase and recharge to the aquifer decrease because of increases in impervious surfaces caused by the compaction and modification of the natural soils.

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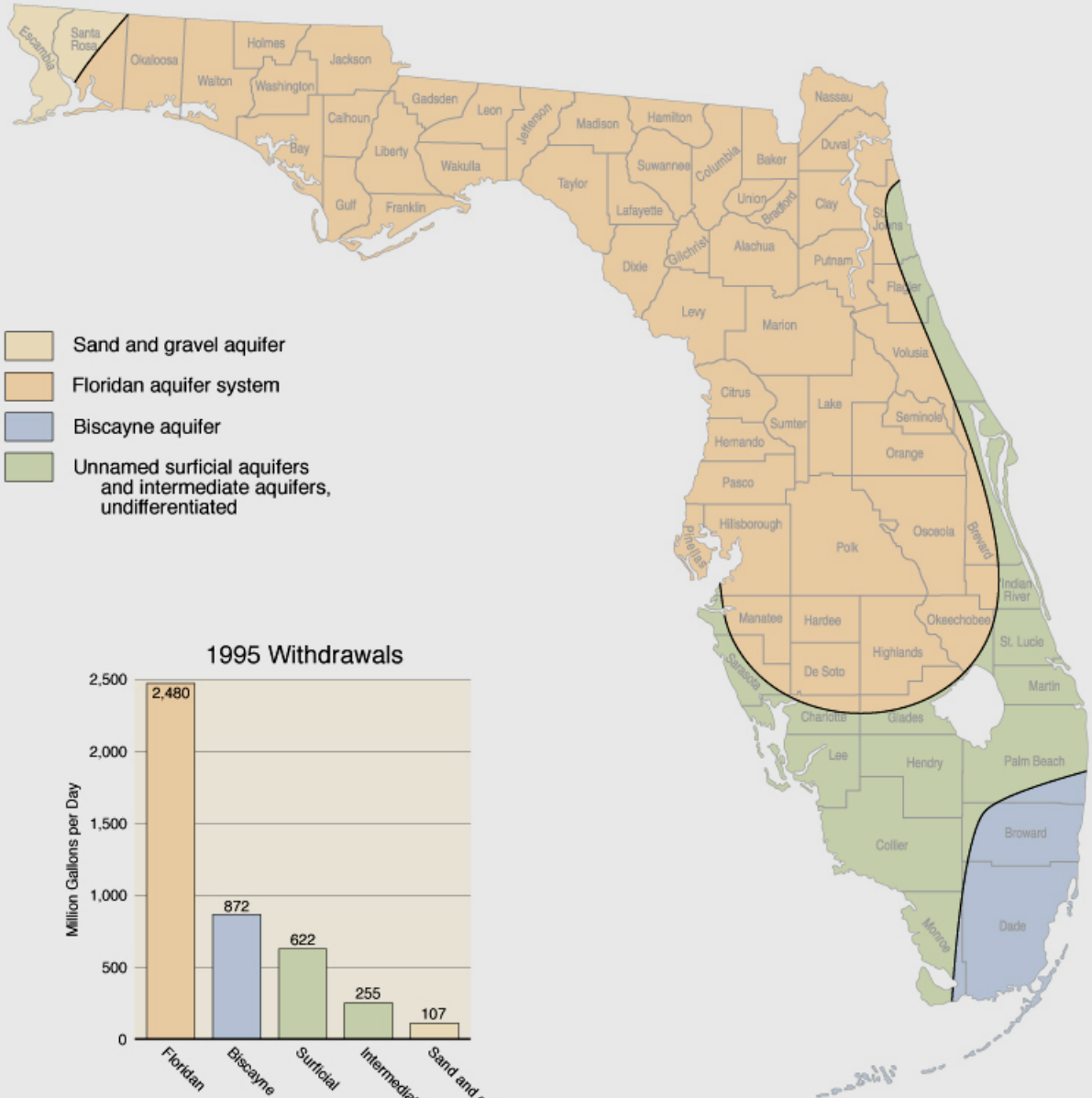
Principal Aquifer of Use



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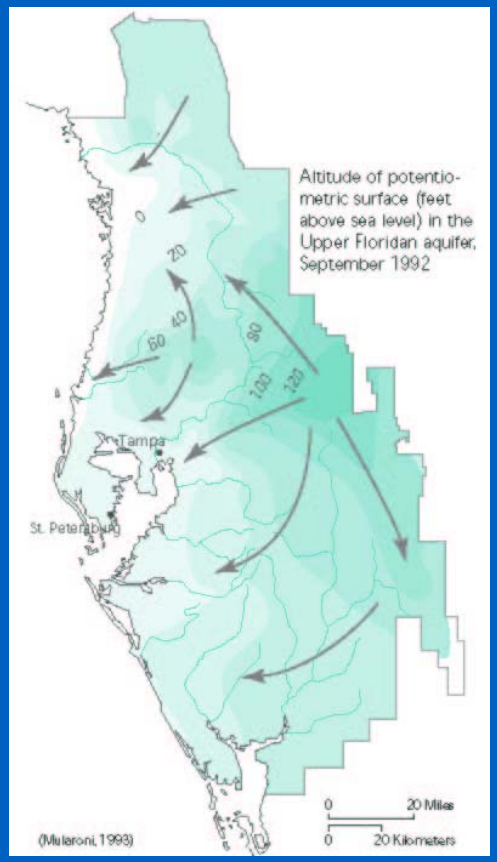
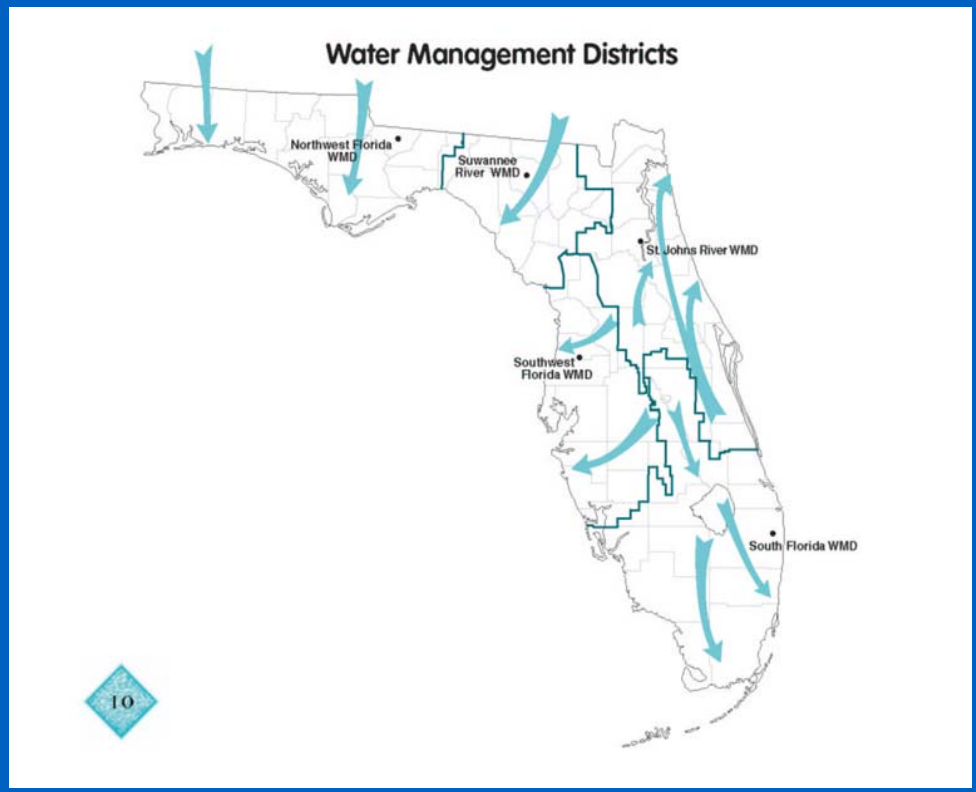
General Direction of Flow





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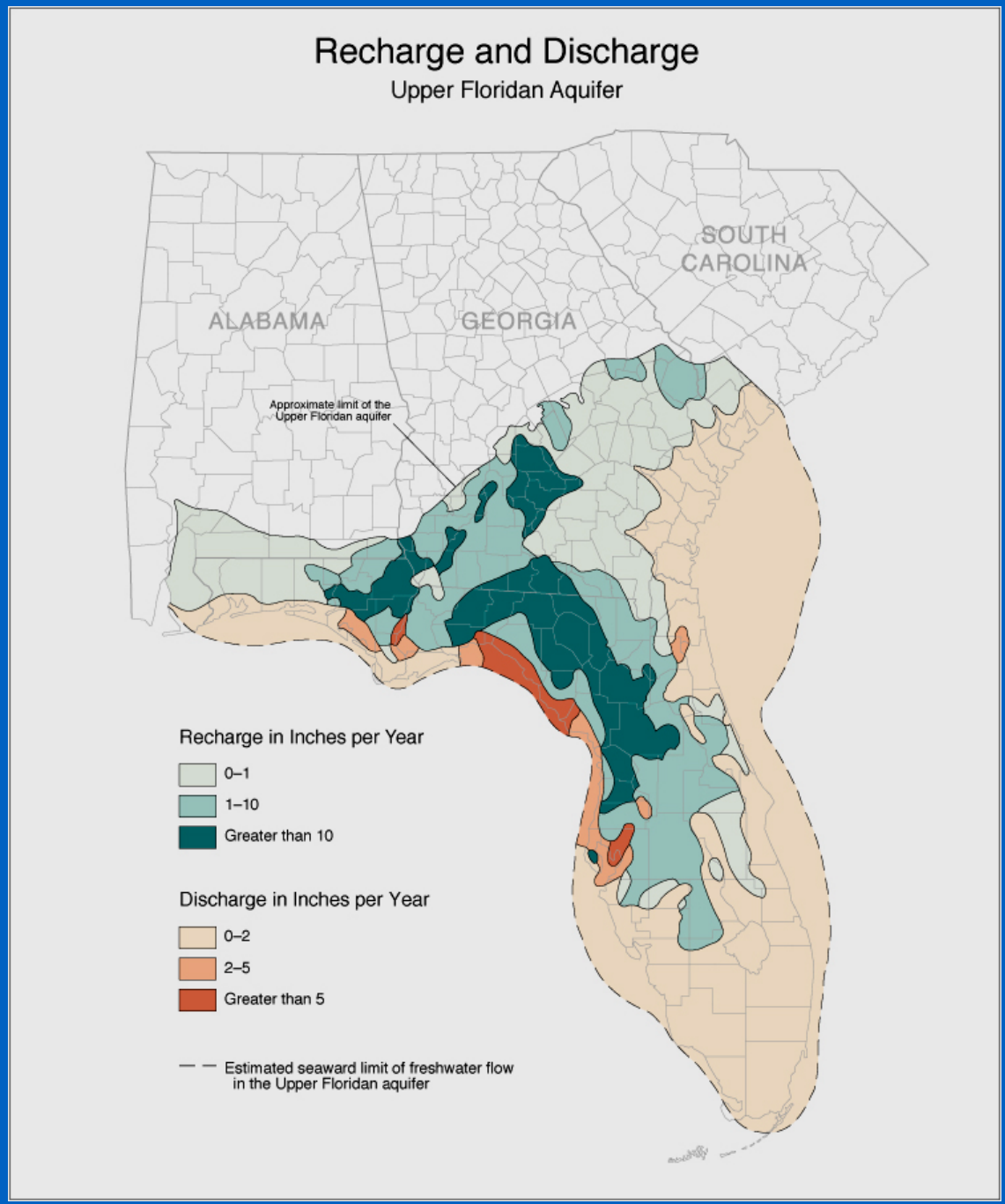
Recharge
Discharge



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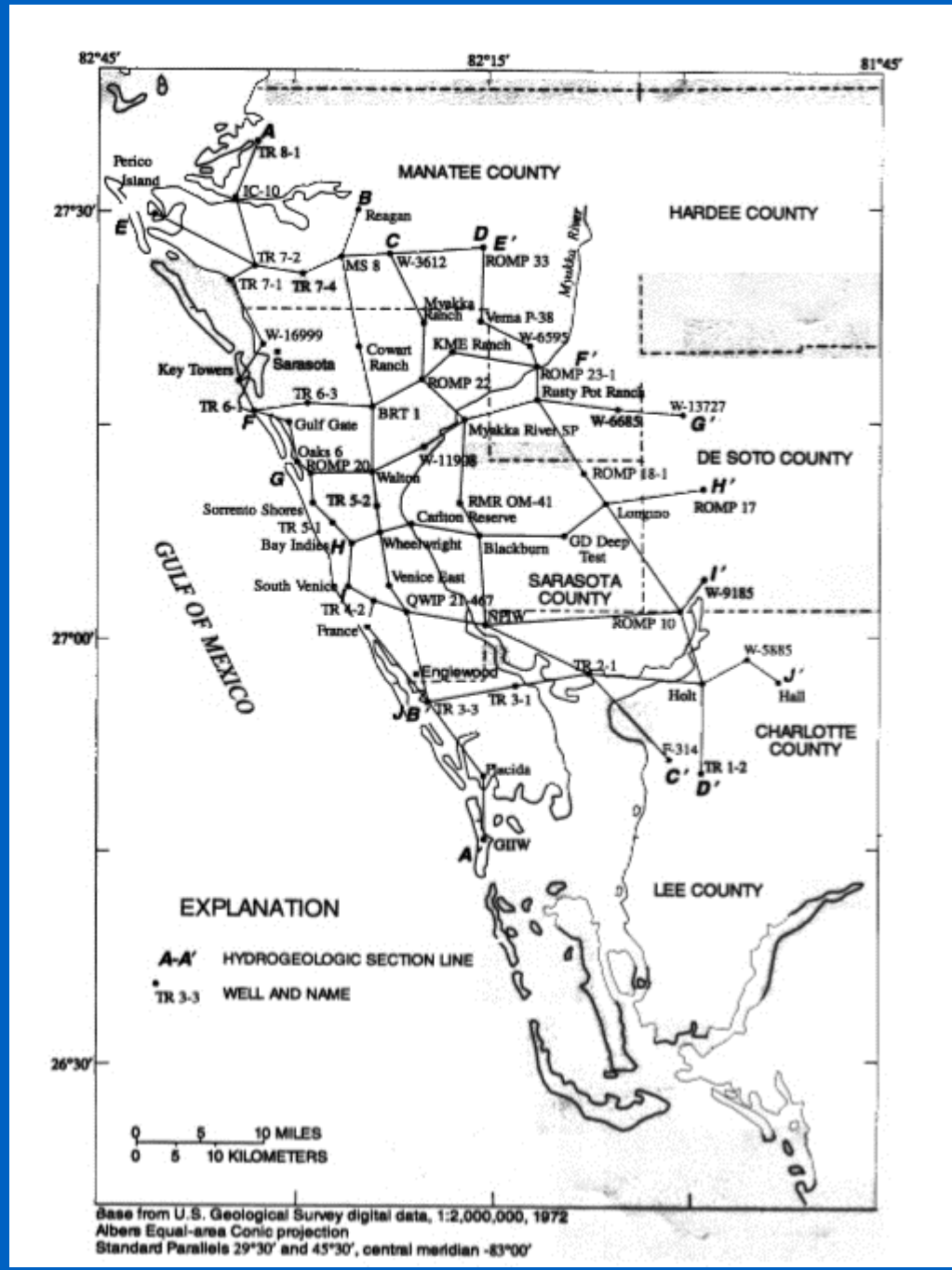
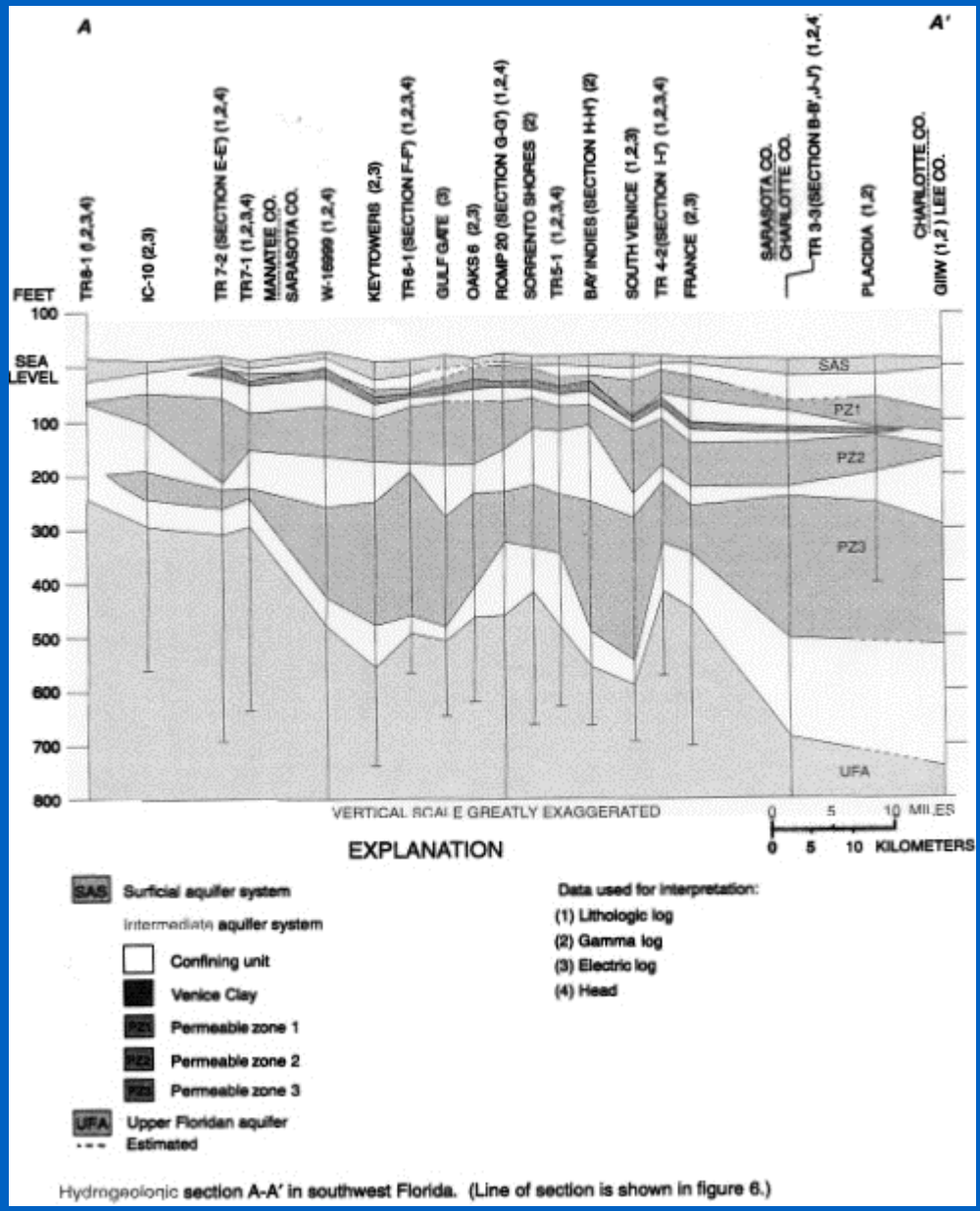
Locations of Hydrogeologic Sections



Section A – A’



Hydrogeologic section A-A' in southwest Florida. (Line of section is shown in figure 6.)

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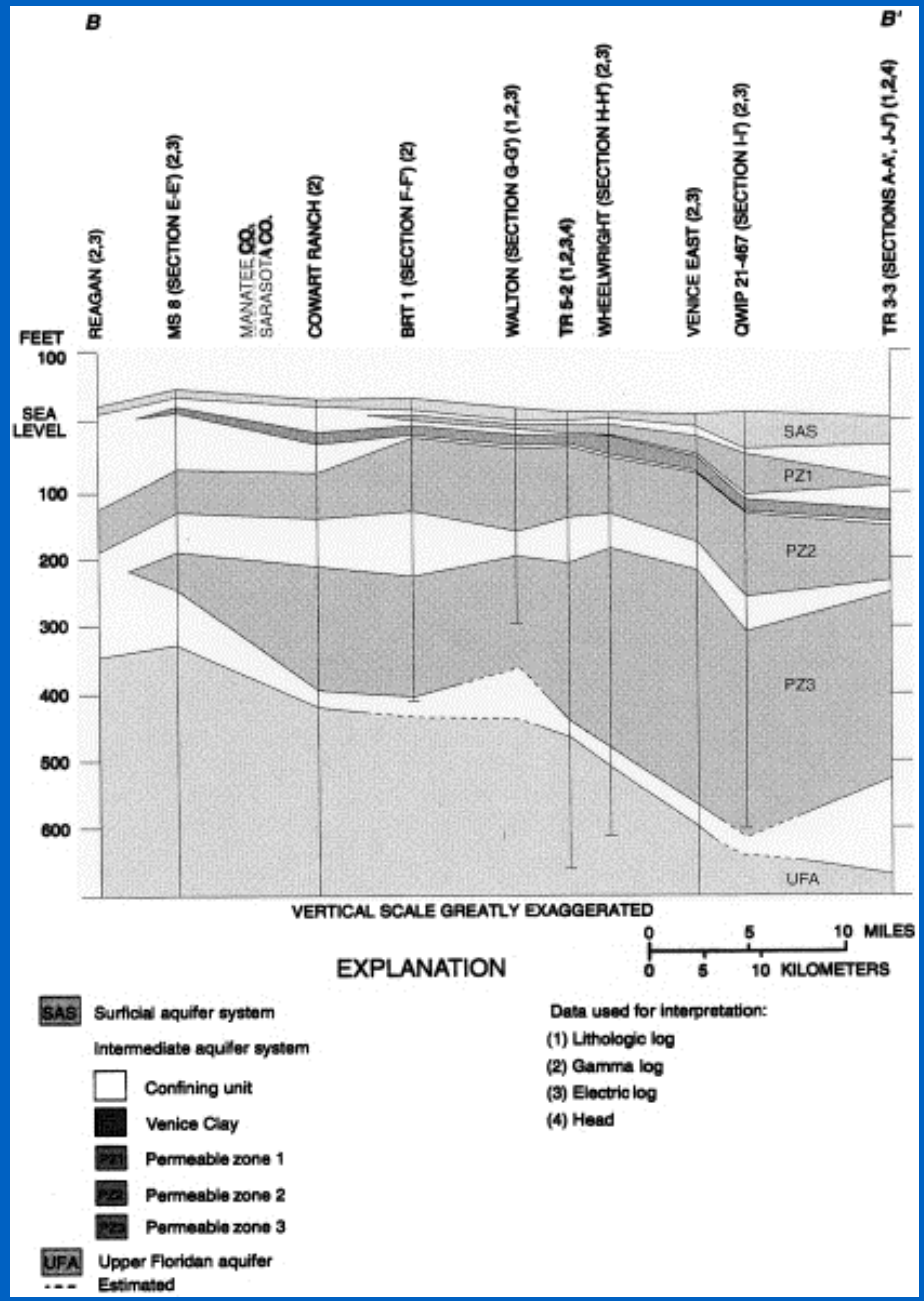
Section B – B’



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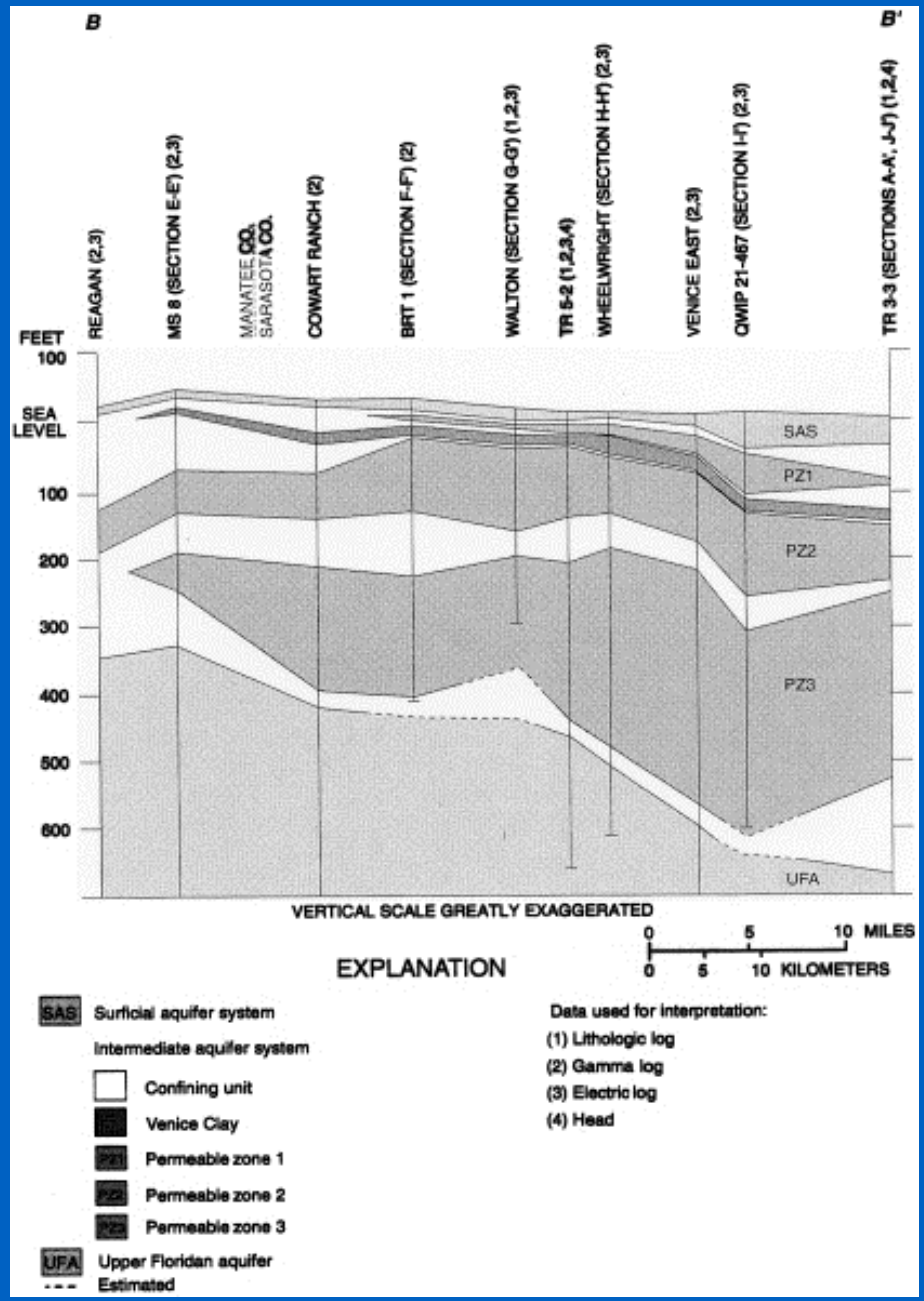
Section B – B’



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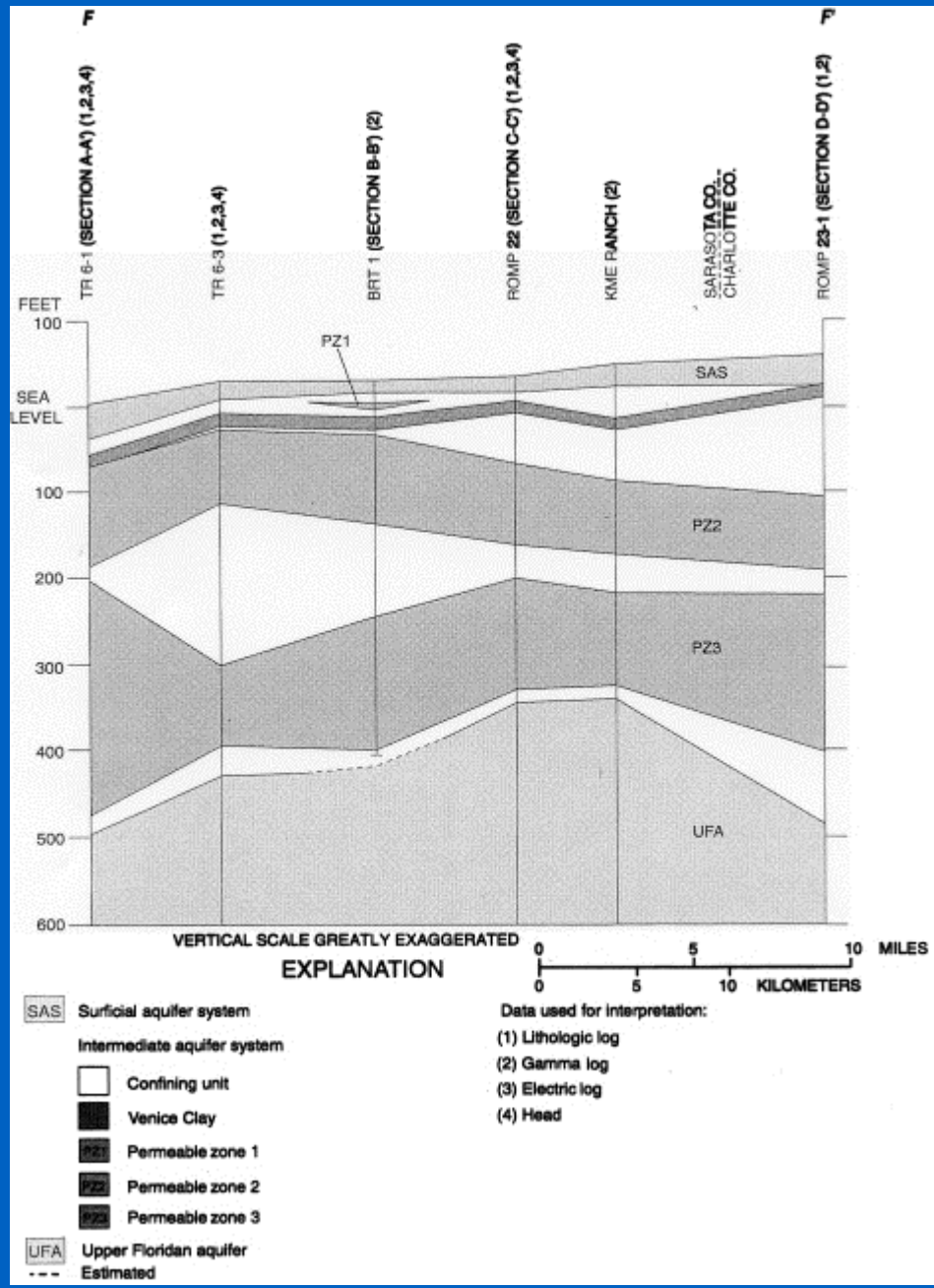
Section F – F’



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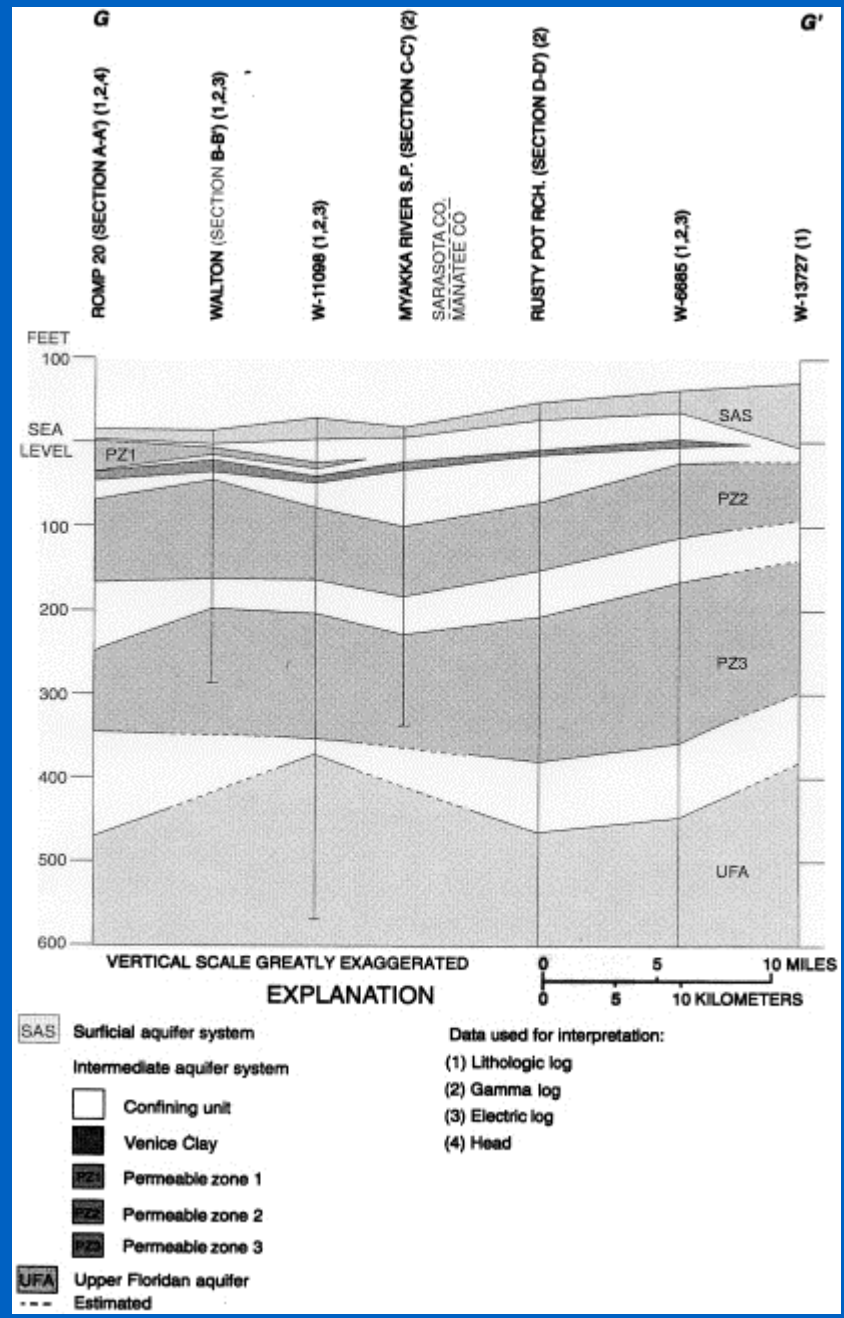
Section G – G’



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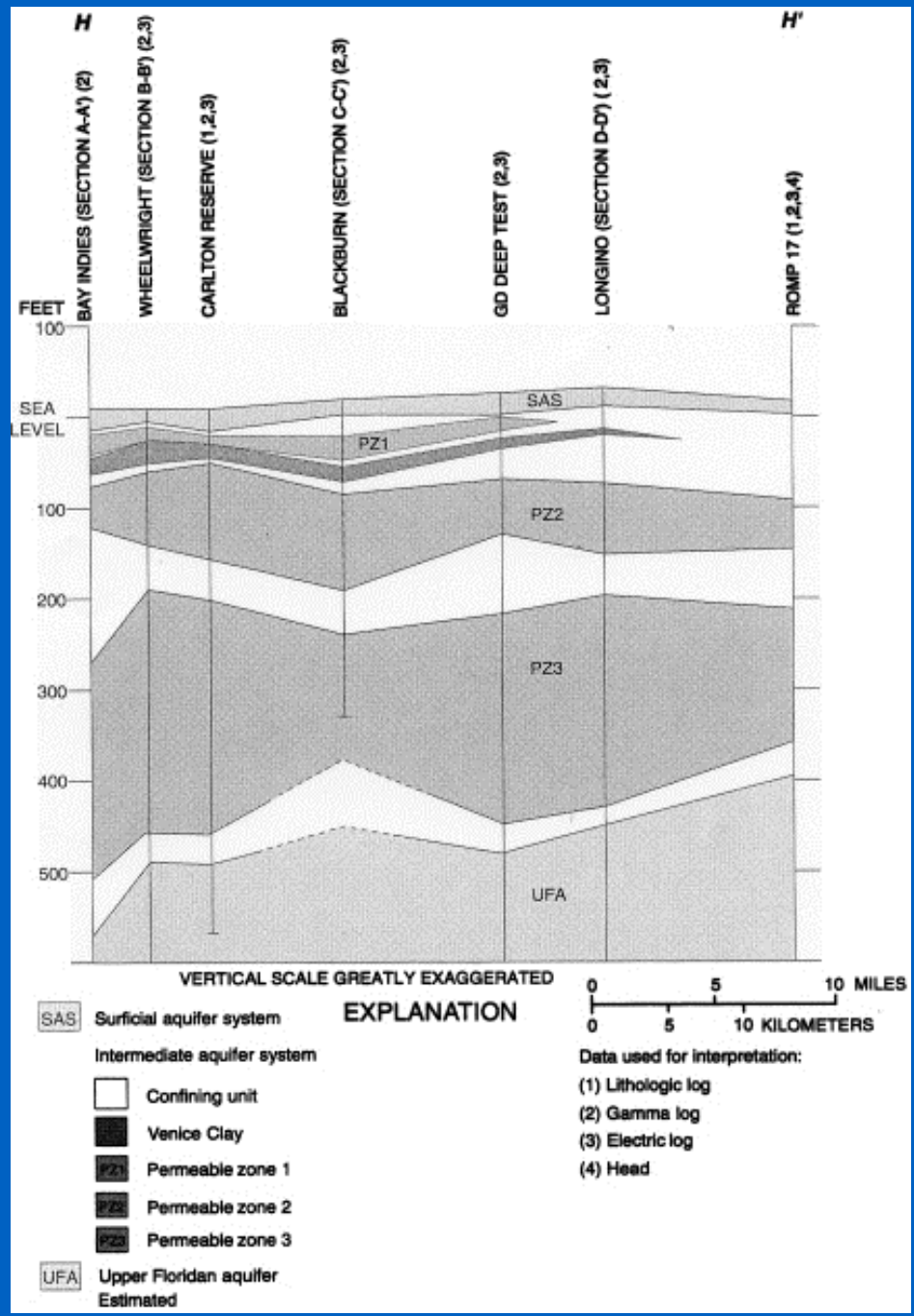
Section H – H’



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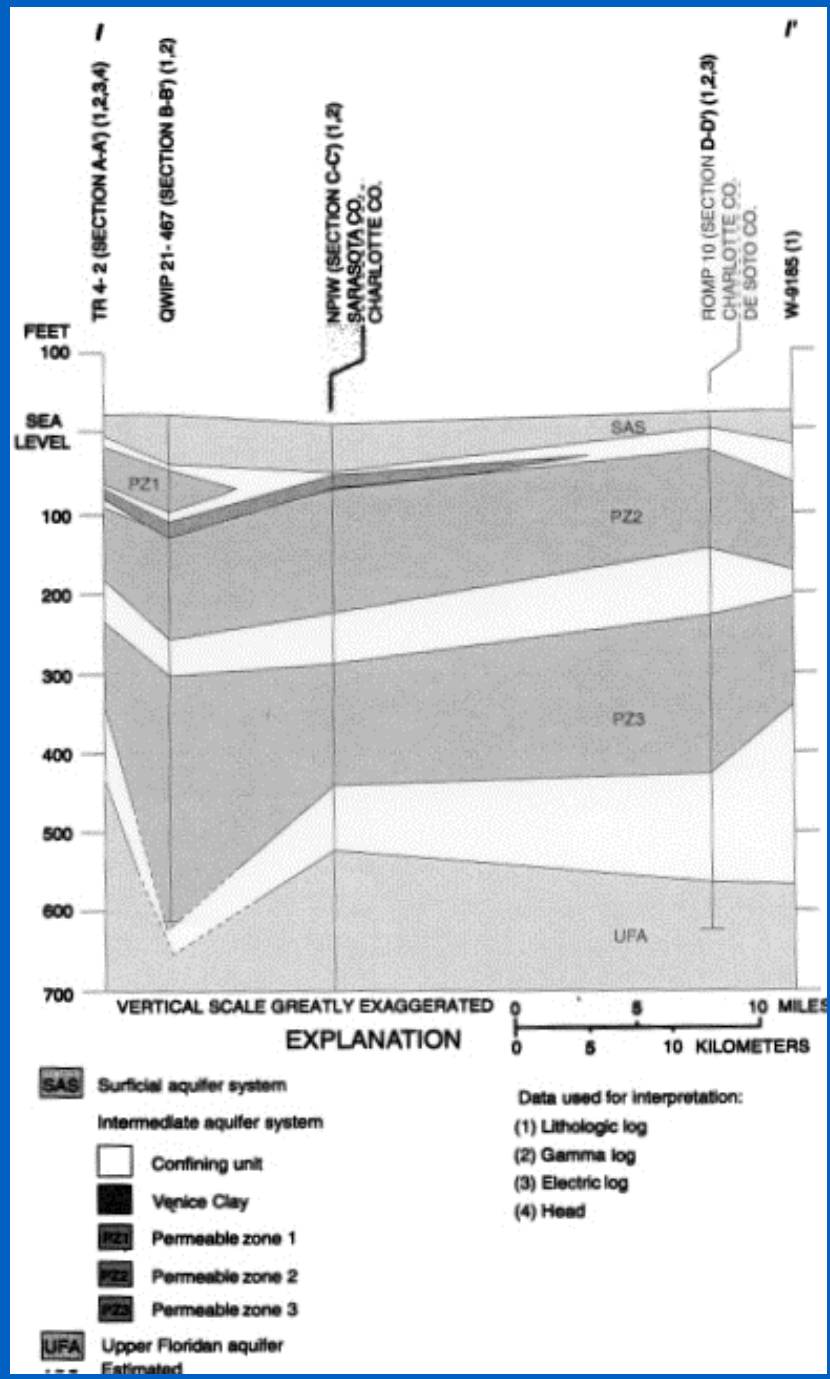
Section I – I’



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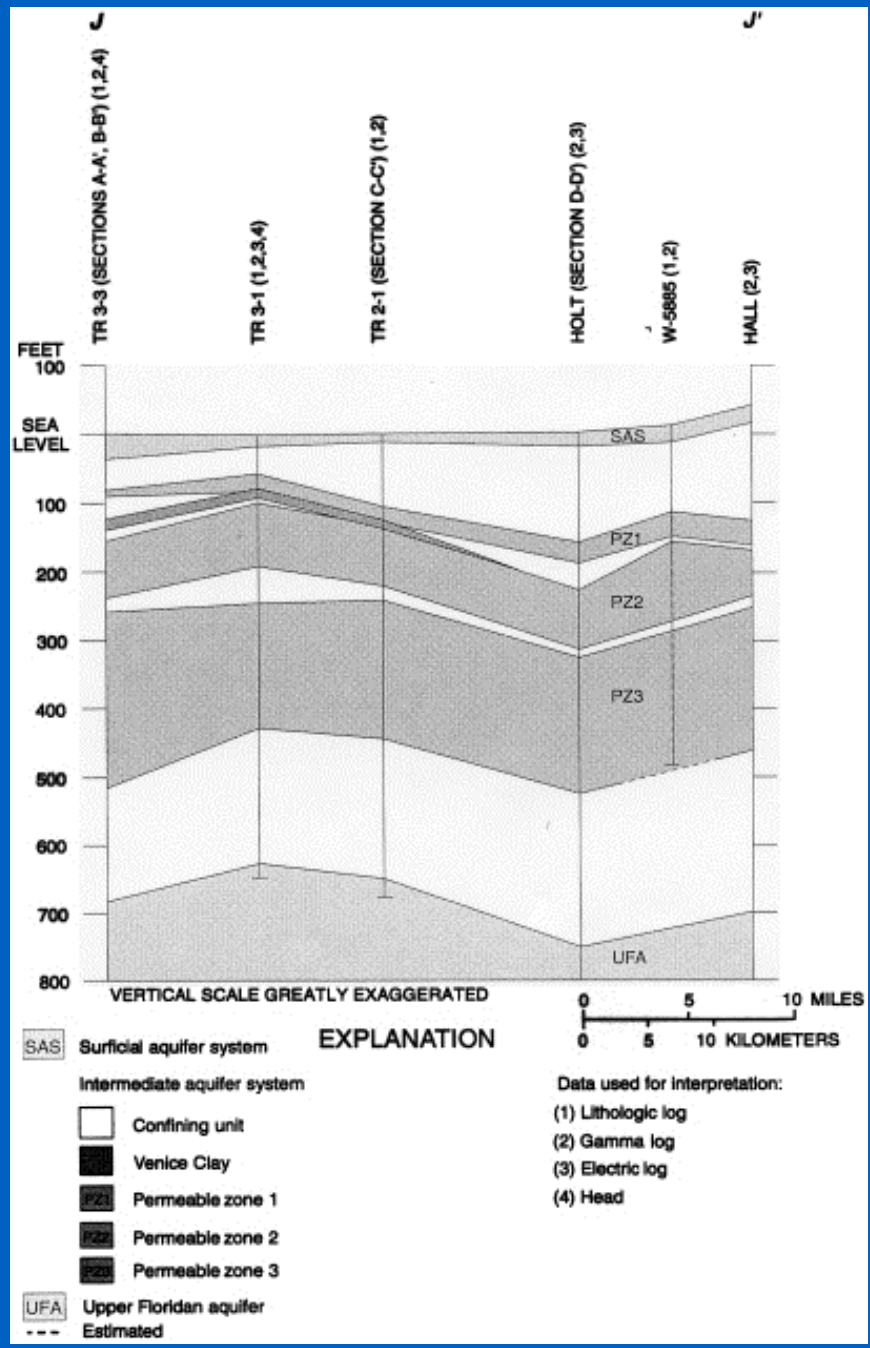
Section J – J’



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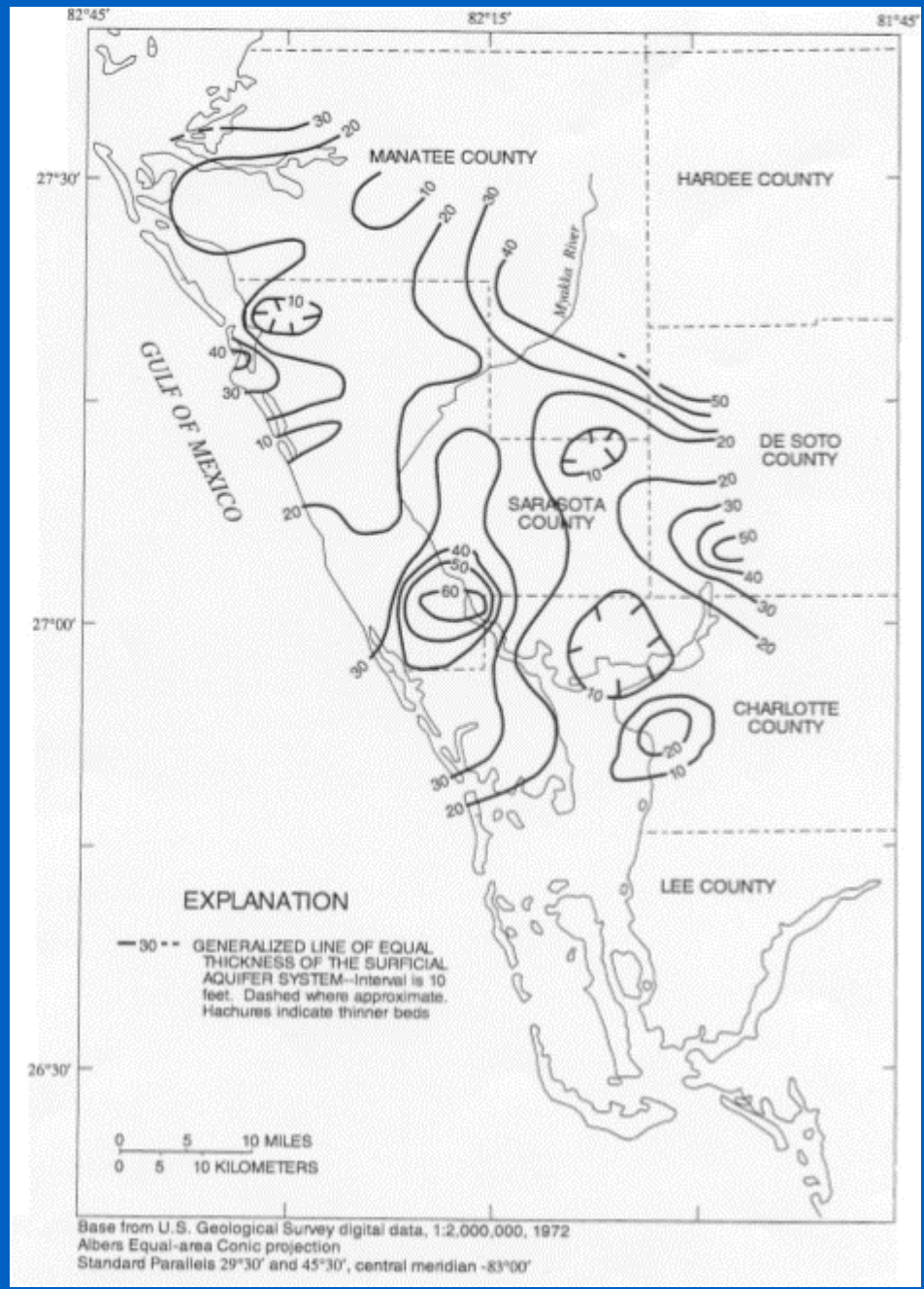
Thickness of the Surficial Aquifer System



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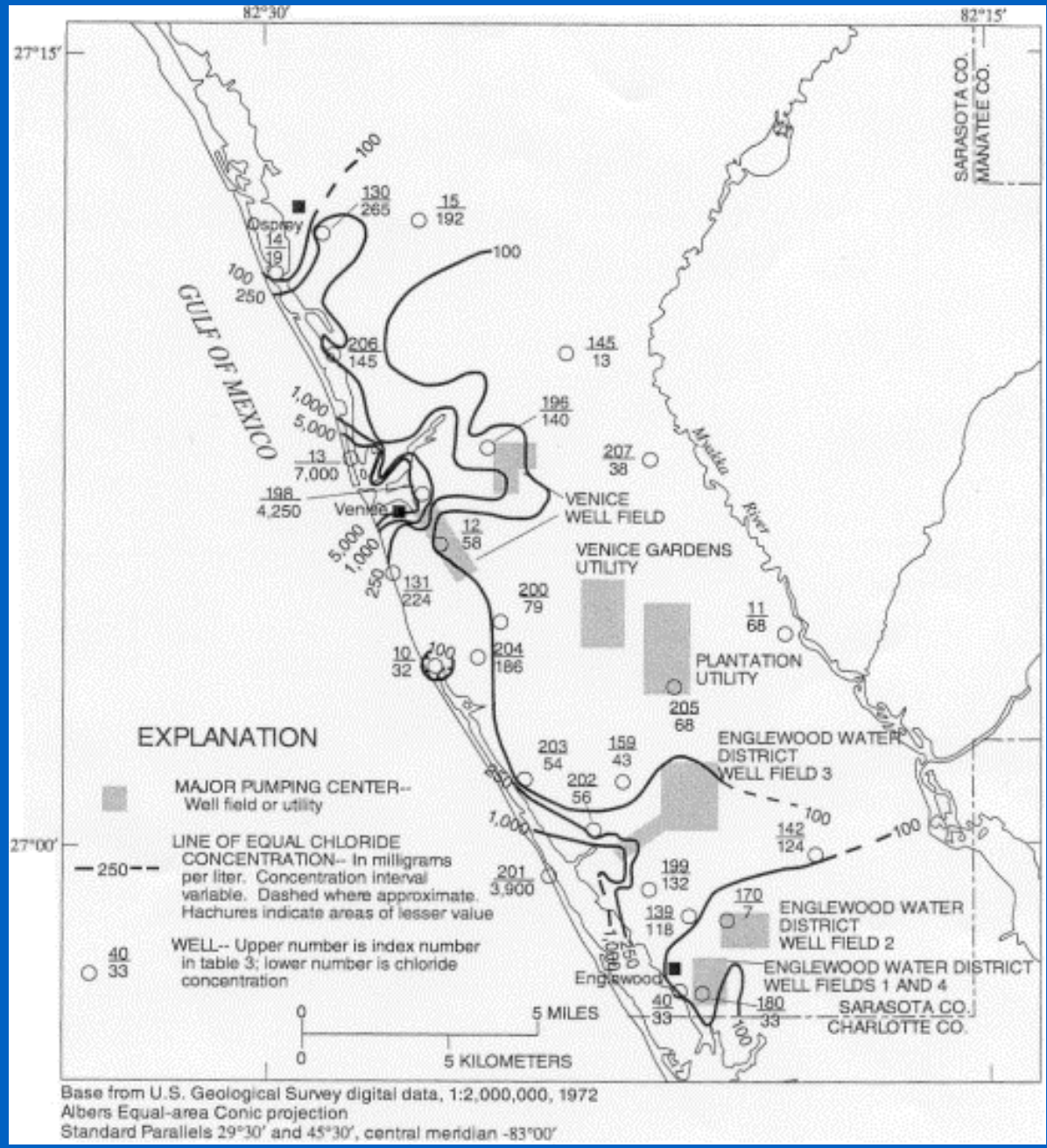
Chlorides in the Surficial Aquifer System



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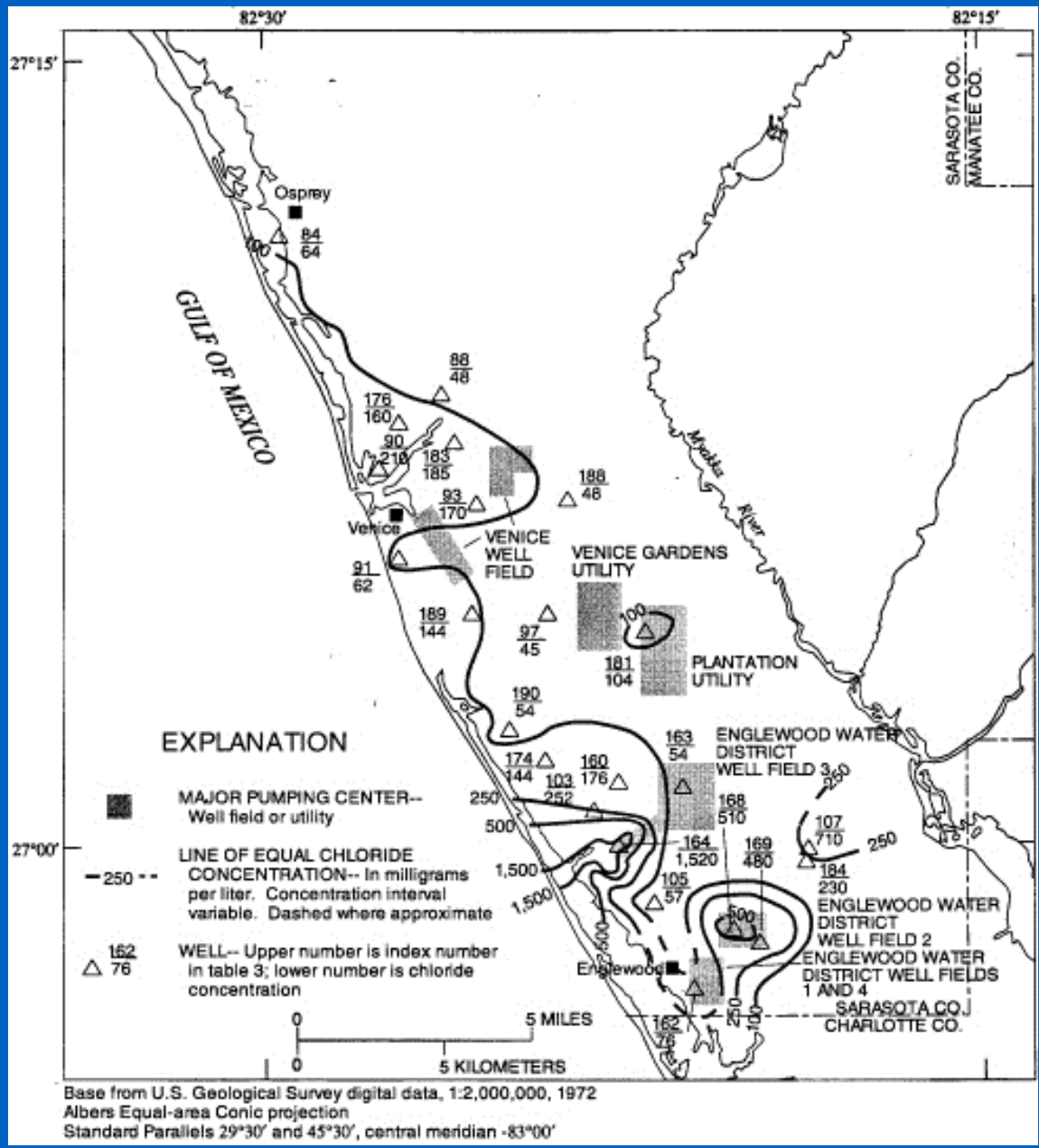
Chlorides in the Intermediate Aquifer System



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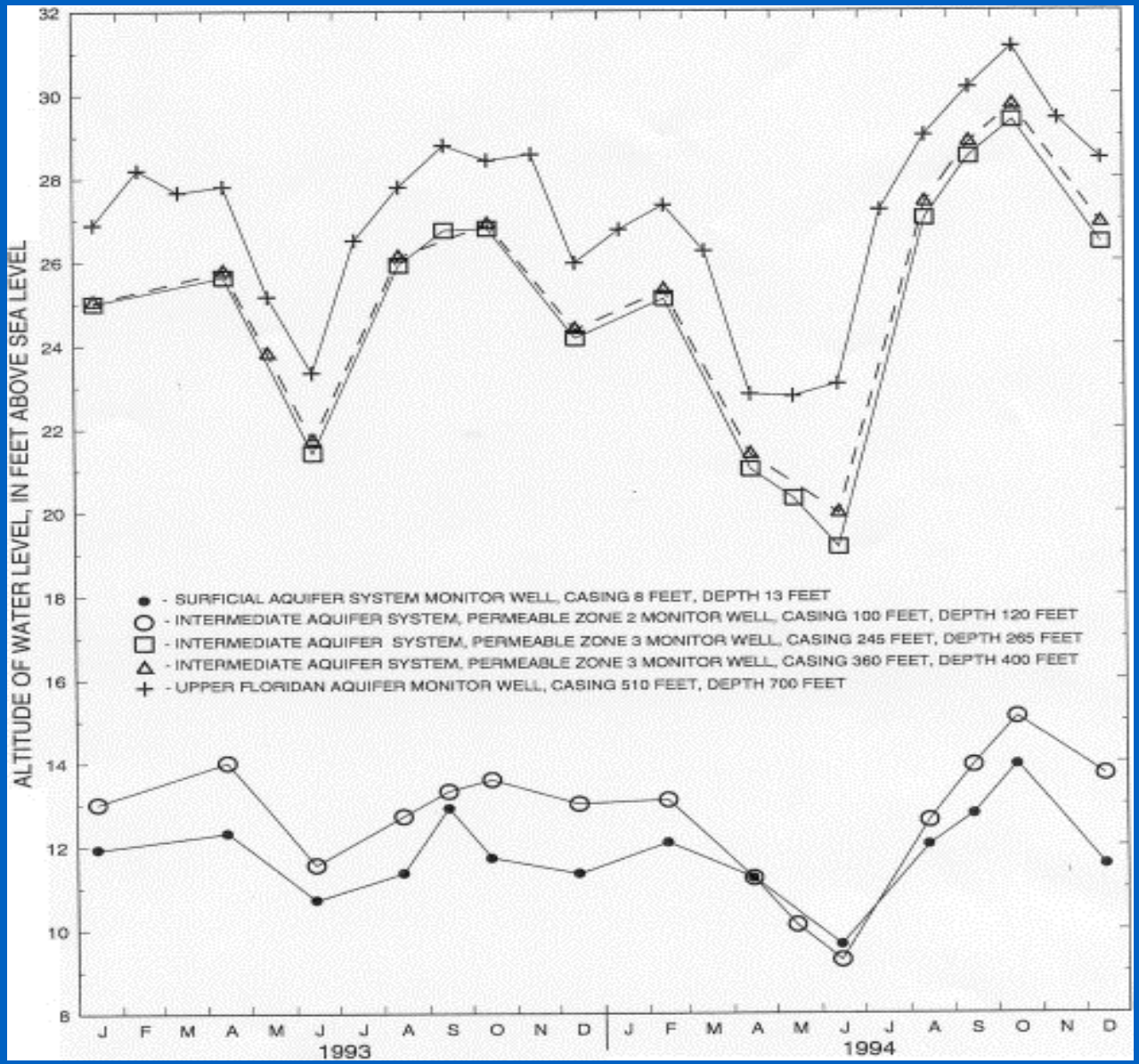
Potentiometric Heads



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Soil Characteristics Affecting the Infiltration of Water

- Porosity or bulk density
- Texture
- Water saturation
- Cultural practices – compaction, imperviousness, etc.

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Porosity and Bulk Density

$$\text{Porosity (n)} = V_{total} - V_{solids} / V_{total} \times 100$$

(ratio of voids to total volume of soil, as percent)

$$\text{Bulk density } D_d = \frac{\text{Weight of oven dried soil sample}}{V_{total}}$$

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Relation Between Porosity and Bulk Density

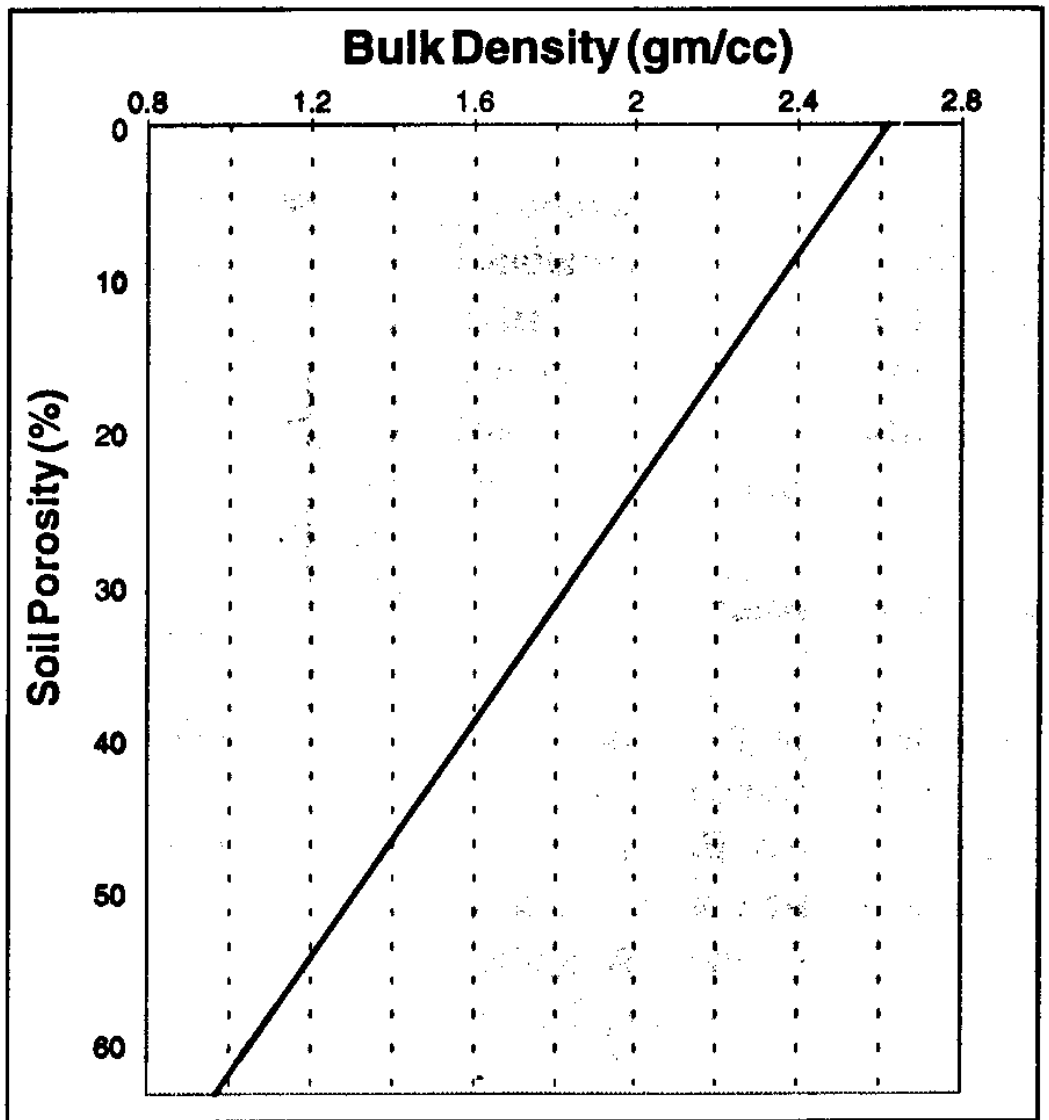

Figure 2: Relationship Between Soil Bulk Density and Soil Porosity

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Eau Gallie Soils

- **Hydrologic group B/D – poorly drained**
- **Depth to high water table: 6 – 18 inches**
- **Bulk density (g/cc)**
  - 0 to 22 in: 1.25 – 1.50
  - 22 to 48 in: 1.45 – 1.60
  - 48 to 66 in: 1.55 – 1.70 (clay content 13-31%)
  - 66 to 80 in: 1.45 – 1.55
- **Sandy, siliceous, acidic, spodic horizon, nearly level**

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Myakka Soils

- **Hydrologic group D – very poorly drained**
- **Depth to high water table: 0 – 12 inches**
- **Bulk density**
  - 0 to 24 in: 1.25 – 1.45
  - 24 to 42 in: 1.45 – 1.60
  - 42 to 80 in: 1.48 – 1.70
- **Sandy, siliceous, acidic, spodic horizon, nearly level on broad flatwoods**

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Hopopaw Soils

- **Hydrologic group D – very poorly drained**
- **Depth to high water table: +24 – 12 inches**
- **Bulk density**
  - 0 to 50 in: 1.35 – 1.60
  - 50 to 66 in: 1.60 – 1.70 (clay content 13-28%)
  - 66 to 80 in: 1.50 – 1.60
- **Loamy, siliceous, acidic, spodic horizon, nearly level**

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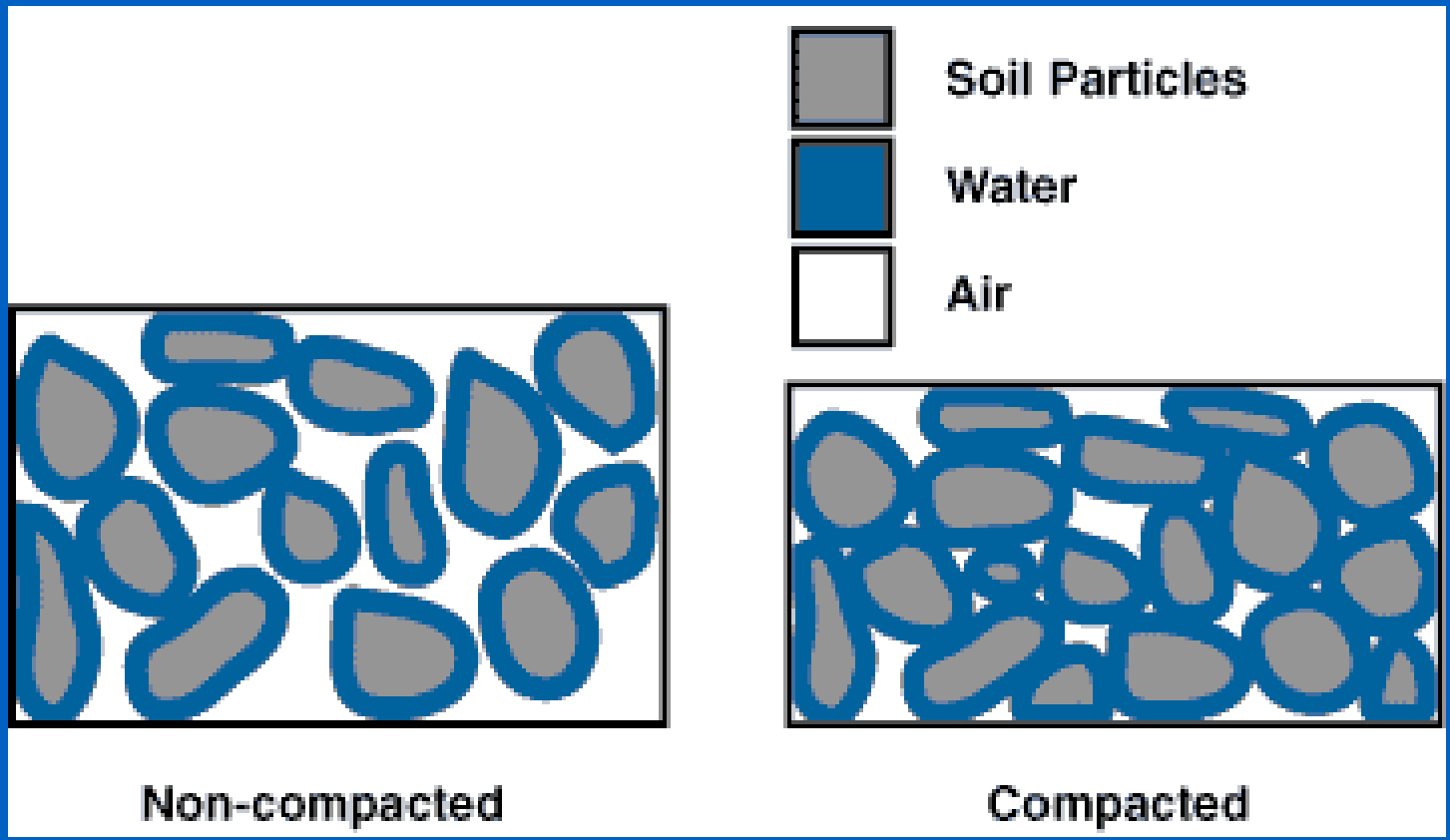
Compaction – soil particles pressed together, reducing pore spaces



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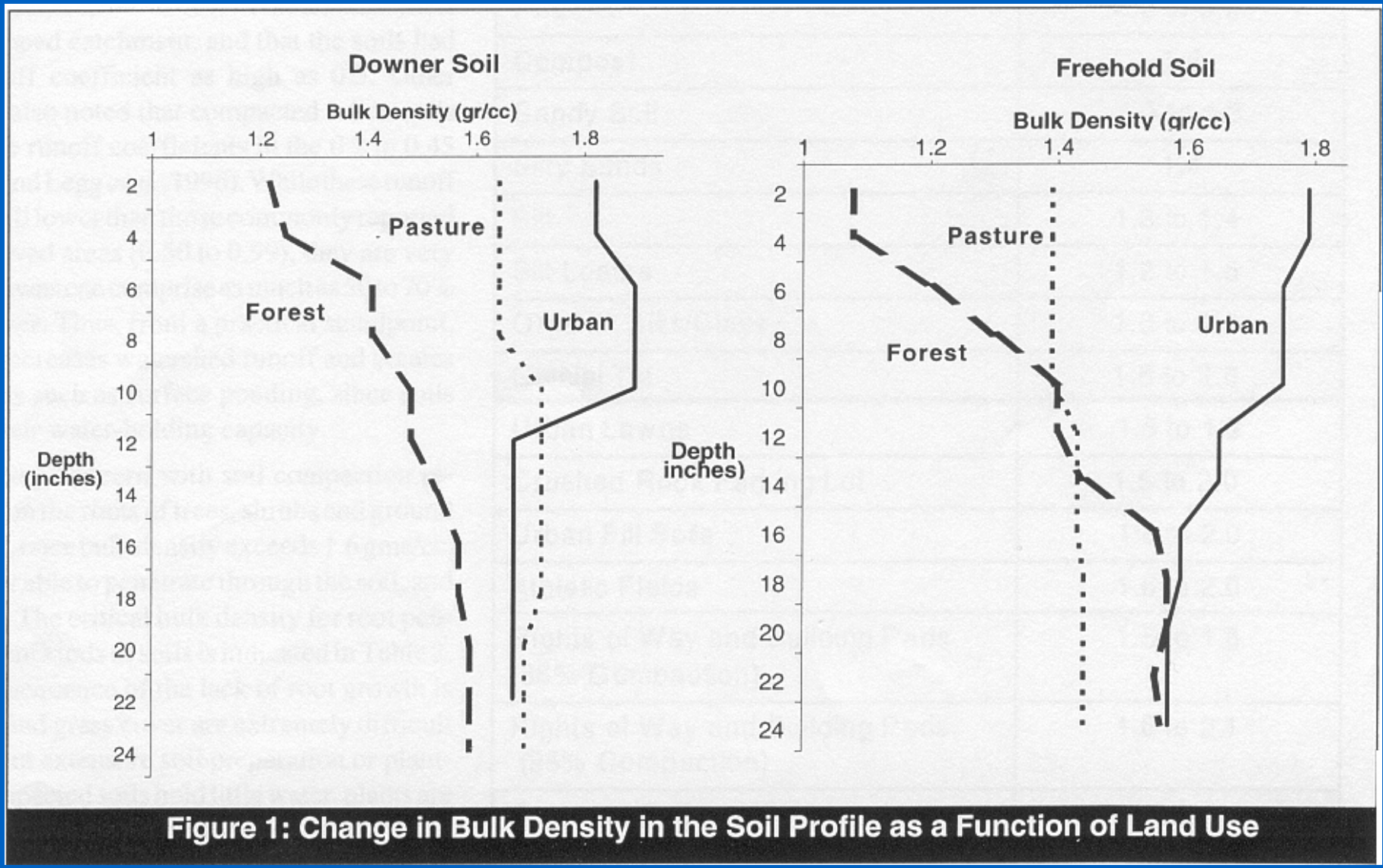

Figure 1: Change in Bulk Density in the Soil Profile as a Function of Land Use

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Soil texture	Ideal bulk density	Root growth affected	Root growth restricted
Sands, loamy sands	<1.60	1.69	>1.80
Sandy loam	<1.40	1.63	>1.80
Silty loam	<1.30	1.60	>1.75
Silty clay loam	<1.10	1.55	>1.65
Sandy clay	<1.10	1.39	>1.47

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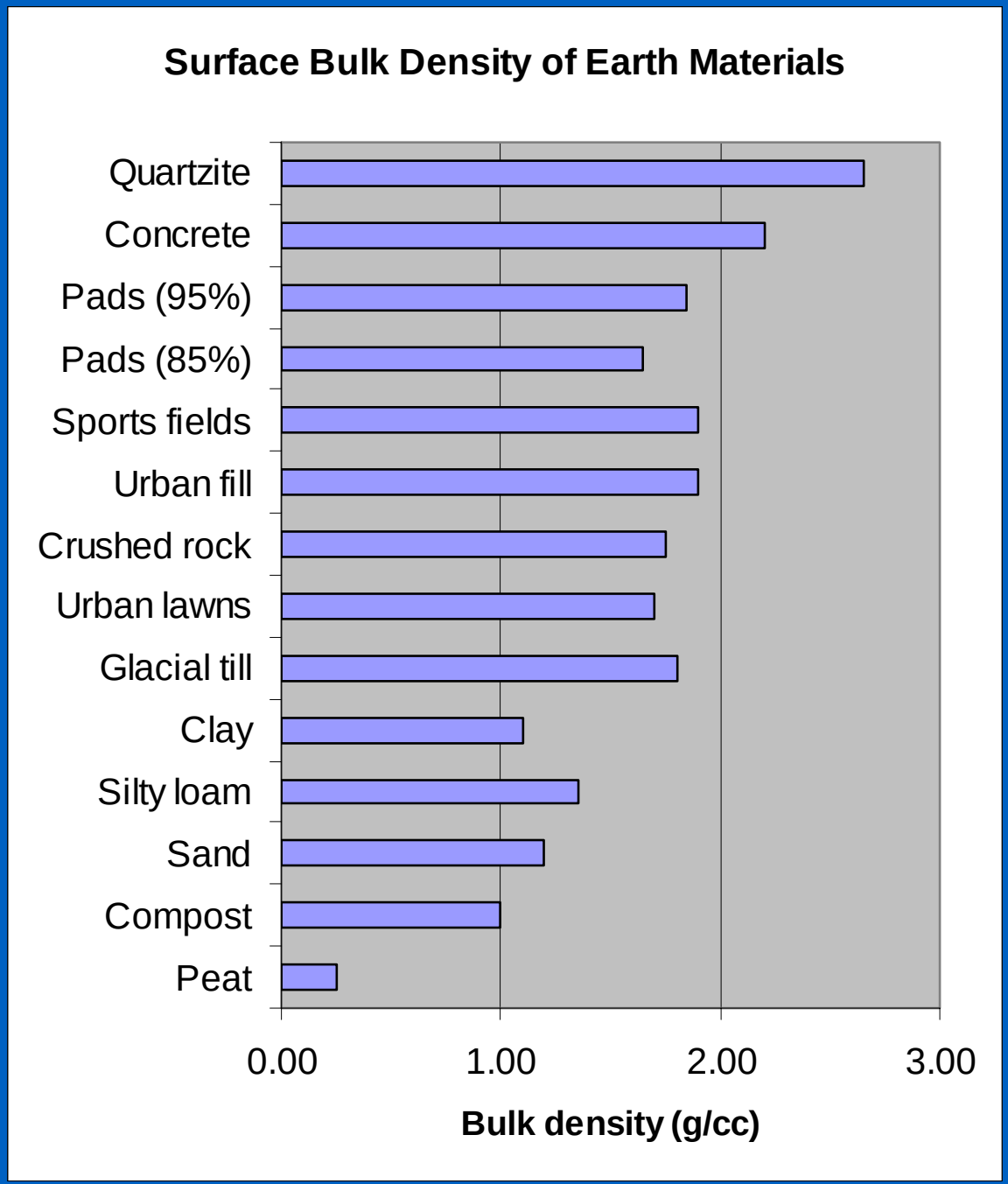
Surface Bulk Density of Earth Materials
Quartzite
Concrete
Pads (95%)
Pads (85%)
Sports fields
Urban fill
Crushed rock
Urban lawns
Glacial till
Clay
Silty loam
Sand
Compost
Peat
0.00
1.00
2.00
3.00
Bulk density (g/cc)

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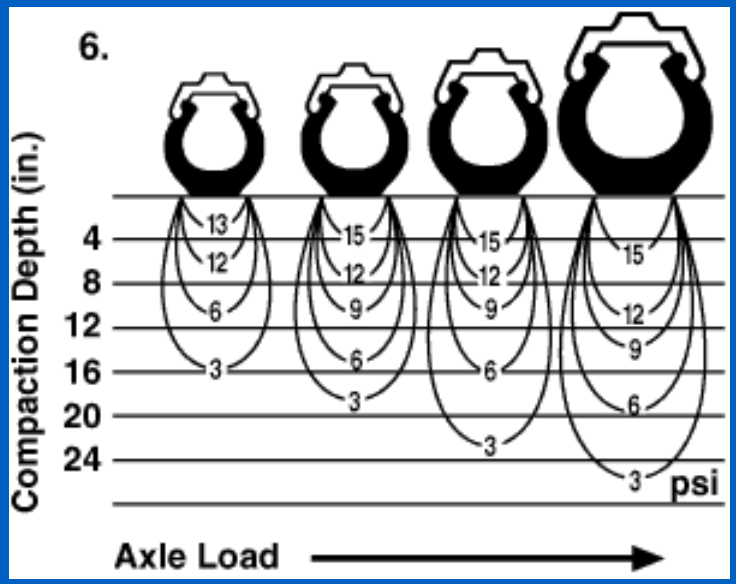
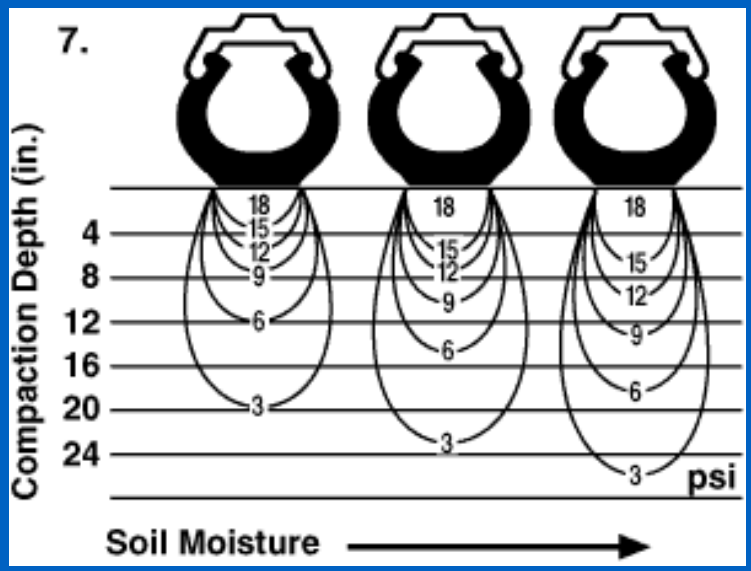
Subsurface Compaction from Wheel Traffic





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Compaction from Wheel Traffic

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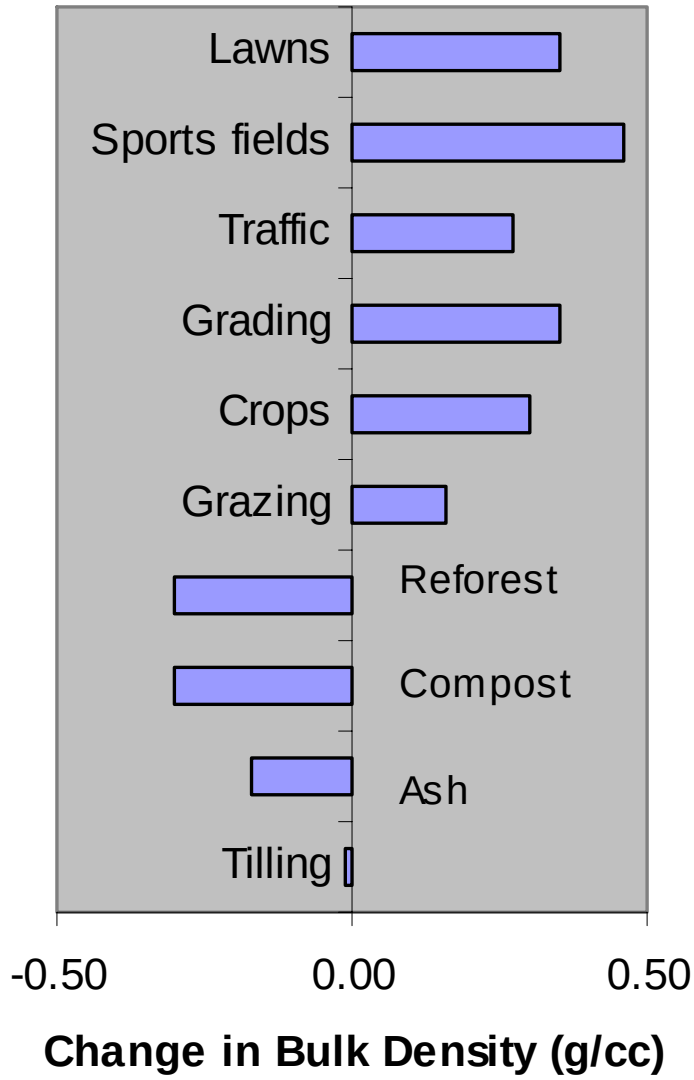
Activities That Increase or Decrease Bulk Density



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Hypothesis

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