Developing a Wetland Condition Monitoring Network for NJ:

Application of New Assessment Methods

EPA R2 WPDG Grant – NJDEP

May 19, 2010

NJ Water Monitoring Council Meeting

National Aquatic Resource Survey (NARS) Field & Report Schedule

RESOURCE	FIELD	REPORT
• Lakes	FY07	FY09
• Rivers	FY08	FY10
• Streams	FY09	FY11
• Coastal	FY10	FY12
• Wetlands	FY11	FY13

EPA's "Three-Tier Framework" for Wetland Monitoring and Assessment

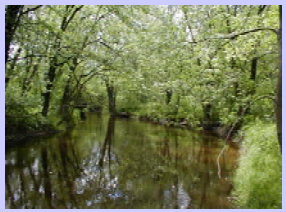
- Tier I: Landscape (Broad Landscape-Scale RAM)
- Tier II: Site (Field RAM)
- Tier III: Intensive Biological & Physical-Chemical Survey
  - Vegetation
  - Soils
  - Hydrology
  - WQ
  - Stressors
  - National Vegetation Classification (NVC)
- Tier IV: Intensive +
  - Fixed Monitoring Stations (e.g. SET)

Rare Wetland Research & Monitoring (Tier 3) in NJ 1997-2009

Calcareous Sinkhole Ponds of the Kittatinny Valley

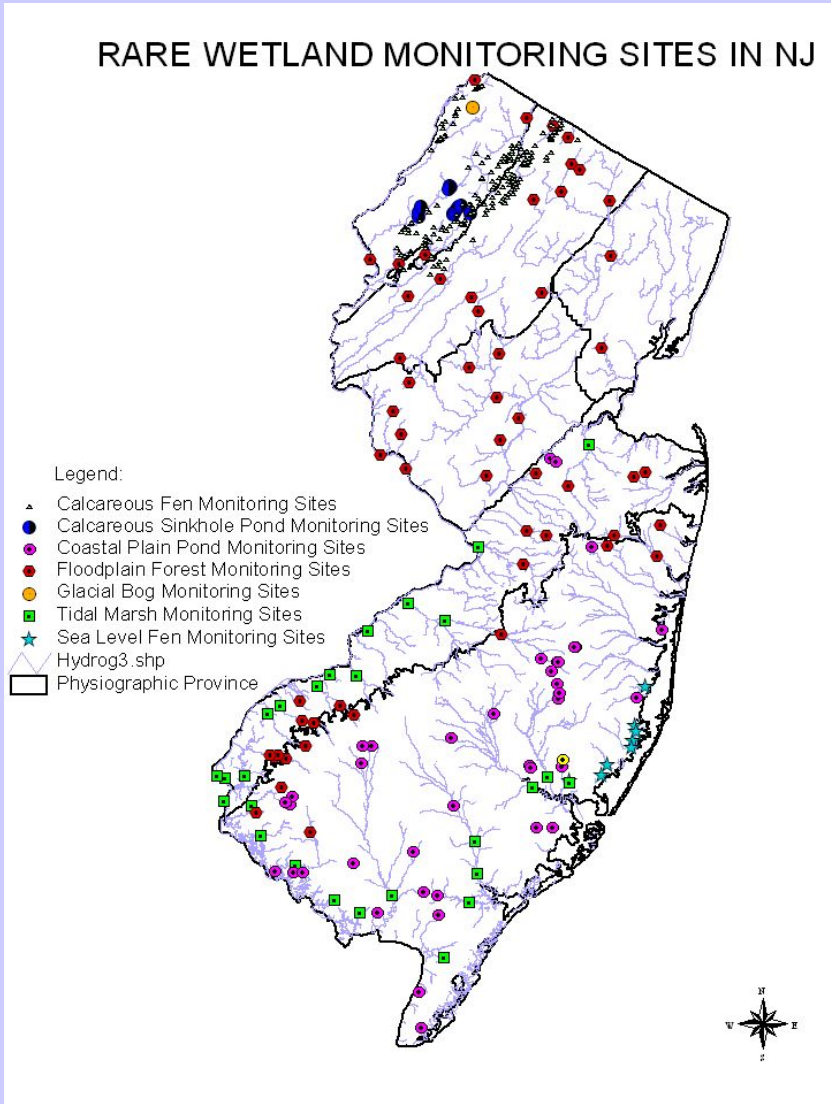
Pine Barren Riverside Savannas

Non-tidal Floodplain Forest Communities



Coastal Plain Intermittent Pond Communities

Sea-level Fen, Tidal Freshwater and Brackish Marsh Communities



RARE WETLAND RESEARCH AND MONITORING IN NEW JERSEY (1997-2009)

MONITORING PARAMETER	Calcareous Sinkhole Ponds	Pine Barren Riverside Savannas	Non-Tidal Floodplain Forests	Coastal Plain Intermittent Pondshores	Sea Level Fens	Tidal Freshwater Marsh	Tidal Brackish Marsh	SUM
Rare Ecological Communities	12	6	5	15	1	13	6	**58**
Plant Diversity (spp)	254	177	407	241	189	83	38	1389
Rare Plants	28	33	57	41	19	24	26	**228**
Rare Animals	7	4	1	2		1		**15**
SITES								
Number of Inventory Sites	85	34	150	60	58	40	41	468
Number of Monitoring Sites	**22**	**14**	**60**	**27**	**38**	**31**	**28**	**220**
VEGETATION								
Reconnaissance Points	253	250	92	188	22	31	40	876
Transects/Releve Monitoring Plots	**97**	**30**	**32**	**56**	**38**	**31**	**28**	**312**

What can we say?

- NJ supports and extraordinarily high diversity of wetland types, many of which are globally rare
- Missing data on wetland condition for common wetland types
- Previous rare wetland sites were not randomly selected – difficult to establish disturbance gradient (except for floodplain forests)
- No way to report on the overall condition of wetlands statewide, by region, or by watershed

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2. Map and classify the springs of New Jersey and establish long-term monitoring at characteristic springs statewide.
3. Augment the existing Floristic Quality Assessment Index with bryophytes and rare plants and use to evaluate and track vegetation at mitigation sites.
4. Outreach to federal, state, local, private and watershed conservation groups.

TASK 1. Establish statewide network of wetland condition assessment monitoring sites.

- Level 2 Wetland Condition Assessment Intensification Study Statewide Probabilistic Survey
  - 300 palustrine & estuarine wetland sites using LULC2007 data stratified by HUC, Phys Prov, Cowardin, HGM
- Level 3 Wetland Condition Assessment Intensification Study
  - 60 wetland monitoring sites using Ecological Integrity Assessment in conjunction with EPA NWCA sampling methods and protocols
    - » Establish long-term hydrological monitoring
    - » Freshwater Algae Study
    - » Sediment Carbon Sequestration Study
    - » Riparian Overbank Flow Study
  - 6 wetland experimental & monitoring sites established to inform water allocation permitting decisions

Probabilistic Stratified Random Sampling Framework (Tier 2)

Geographic Framework (TBD):

- HUC8 (12)* or HUC11 Watershed (152) * NJWMC recommendation 5/19/10
- Physiographic Provinces (5-6)
- Omernik Ecoregions EPA (5-17)
- Watershed Management Areas (20)
- Climate Regions (5)

Cowardin Wetland Class 6 (7)

- Estuarine Intertidal Forested/Scrub-Shrub
- Estuarine Intertidal Emergent
- Palustrine Forested
- Palustrine Scrub-Shrub
- Palustrine Emergent
- Palustrine Aquatic Bed
- Palustrine Farmed (in NWCA but not to be included in NJWCA)

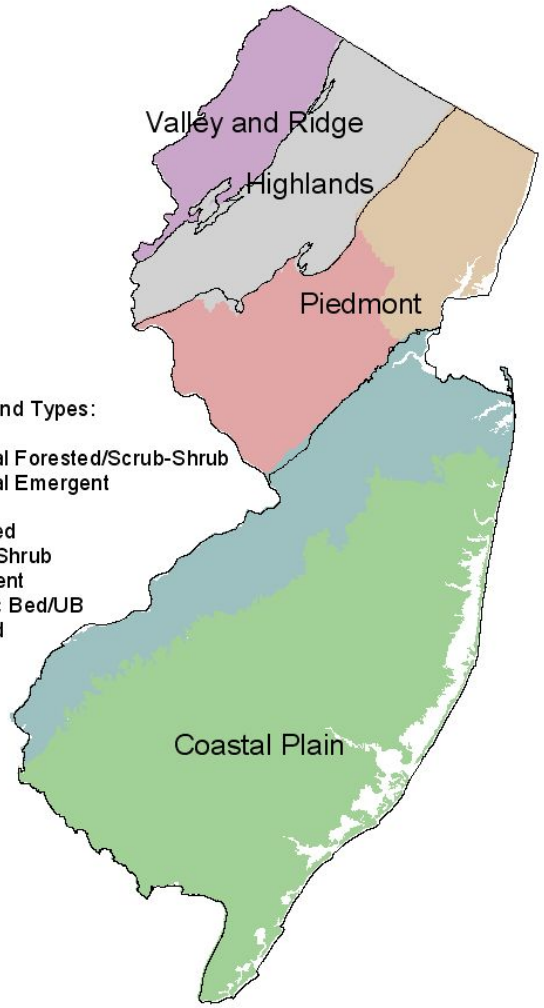
NWI 2010 HGM Class (7) - Ralph Tiner, USFWS

- Riverine, Depressional, Slope, Mineral Soil Flats, Organic Soil Flats, Estuarine Fringe, Lacustrine Fringe

Framework to be determined by 2013 NARS Wetlands REPORT FORMAT

300 RAM Level 2 sampling sites = 12HUC x 6NWI = 72 x 4-5 reps = 288-360 sites

Rapid Assessment Method (RAM) Framework
Physiographic Provinces & Cowardin Wetland Type



7 Cowardin Wetland Types:

Estuarine Intertidal Forested/Scrub-Shrub
Estuarine Intertidal Emergent

Palustrine Forested
Palustrine Scrub-Shrub
Palustrine Emergent
Palustrine Aquatic Bed/UB
Palustrine Farmed

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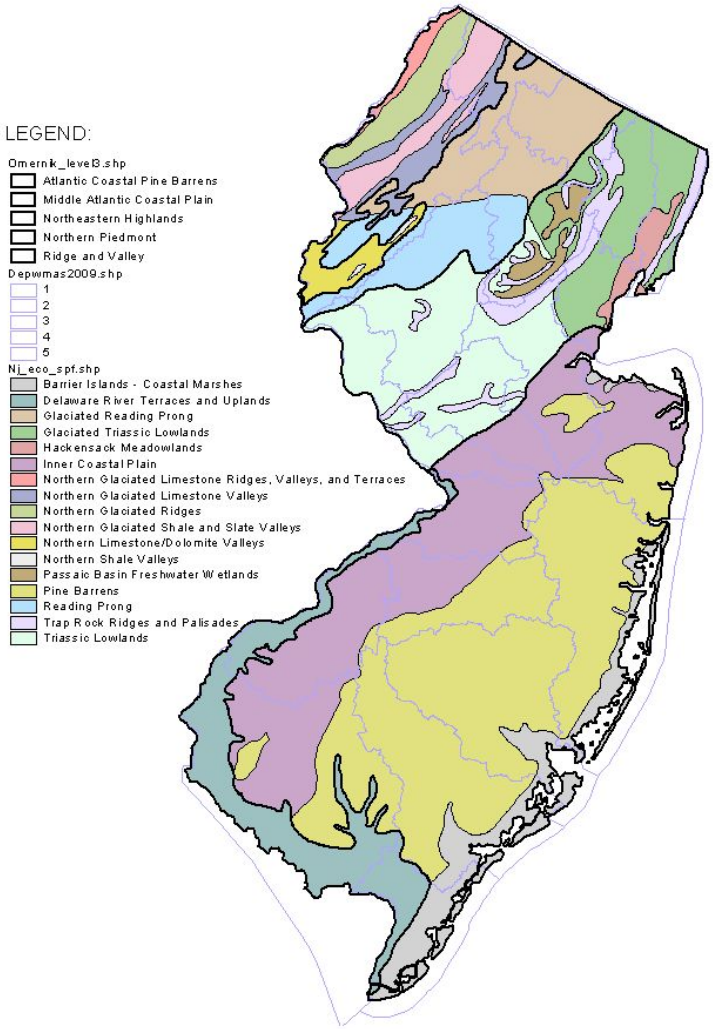
Draft Level III and IV Ecoregions of New Jersey
EPA Omernik



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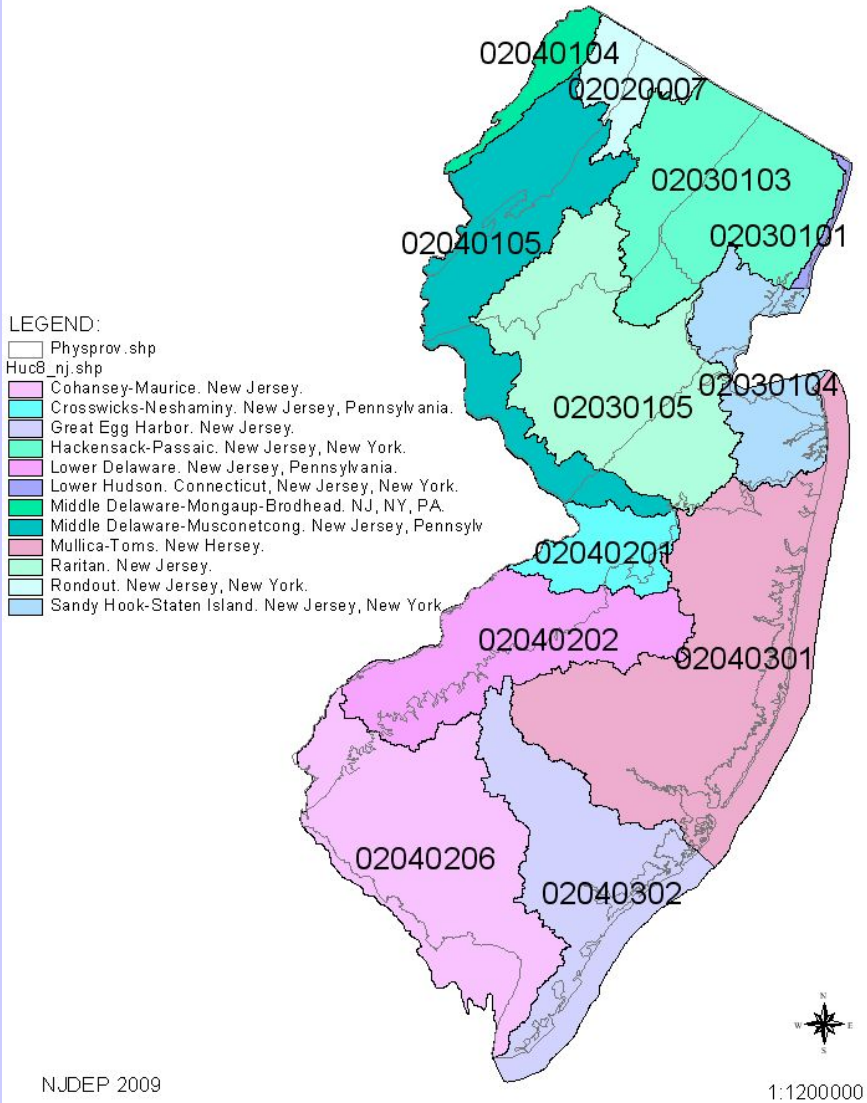
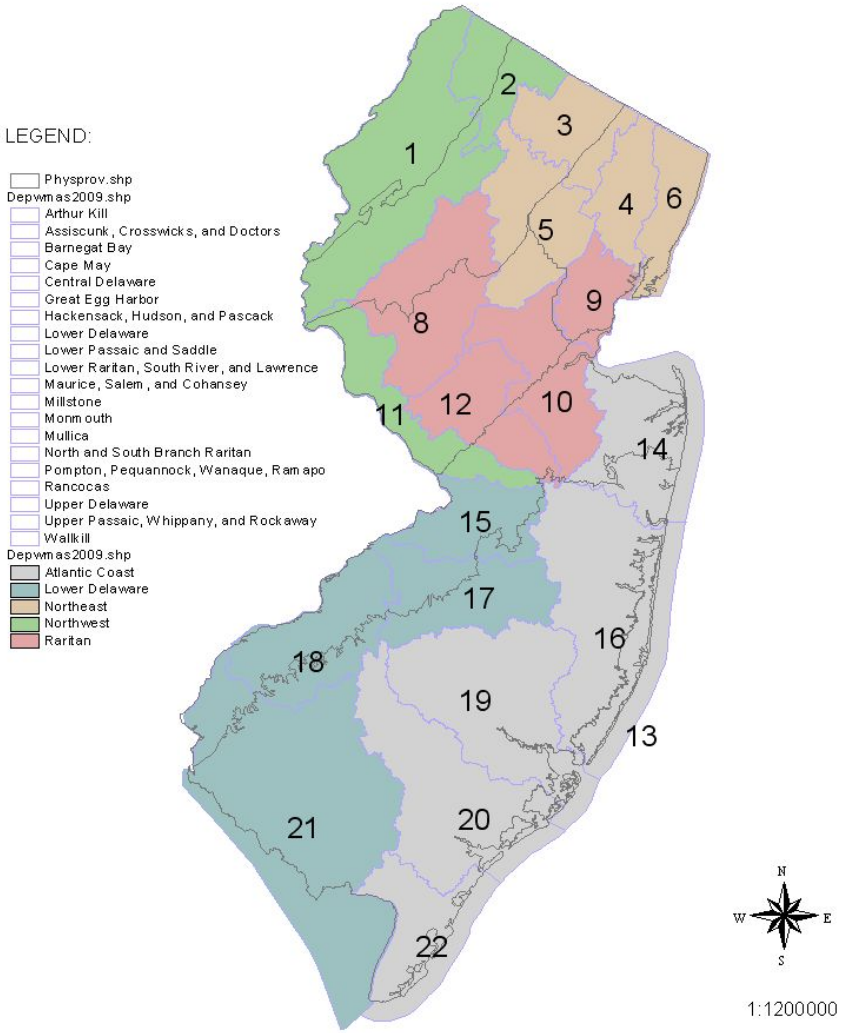
HUC8 Watersheds in New Jersey



Watershed Management Areas of NJ by Physiographic Province



EIA & NWCA Level 1 & 2 Assessment Metrics

Rank Factor	Major Ecological Attribute	Indicator
LANDSCAPE CONTEXT	**Landscape Structure**	Landscape Connectivity
		Buffer Index
		Surrounding Land Use Index
	Landscape Stressors	*Landscape Stressors Checklist*
SIZE	**Size**	Patch Size Condition
		Patch Size
CONDITION	**Vegetation**	Vegetation Structure
		Organic Matter Accumulation
		Vegetation Composition
		Relative Total Cover of Native Plant Species (FQAI)
	Vegetation Stressors	*Vegetation Stressors Checklist*
	Soils (including physico-chemical)	Physical Patch Types
		Water Quality
		Soil Surface Condition
	Soil Stressors	*Soils Stressors Checklist*
	Hydrology	Water Source
		Hydroperiod
		Hydrologic Connectivity (HGM)
	Hydrology Stressors	*Hydrology Stressors Checklist*

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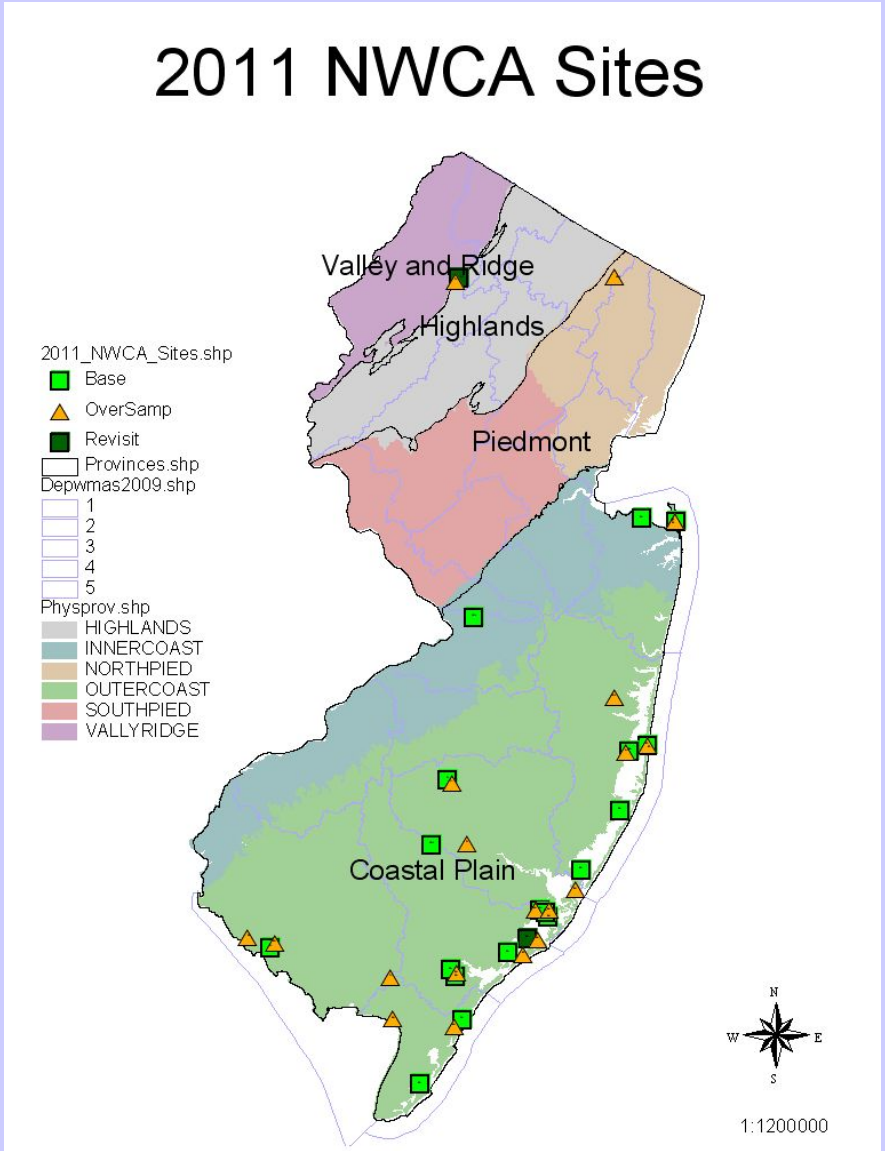
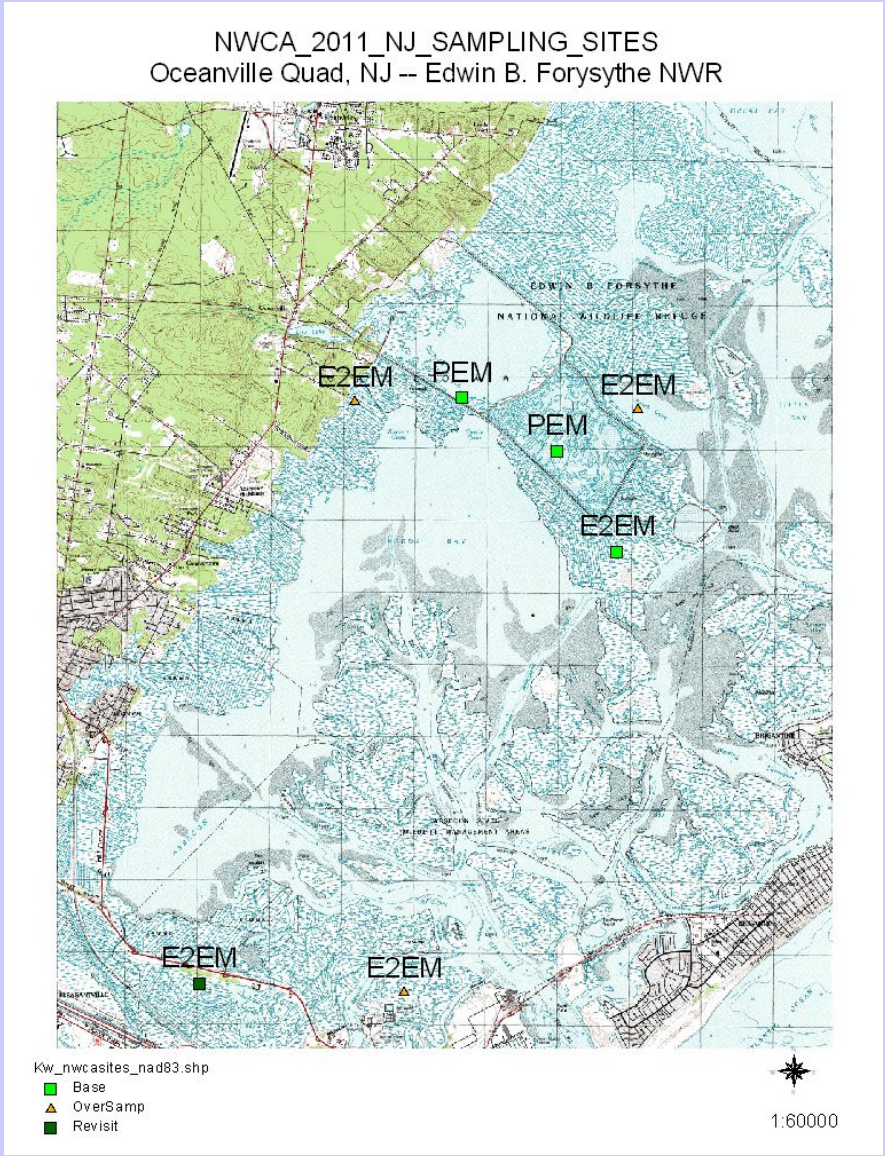
Level 3: Intensive Assessment

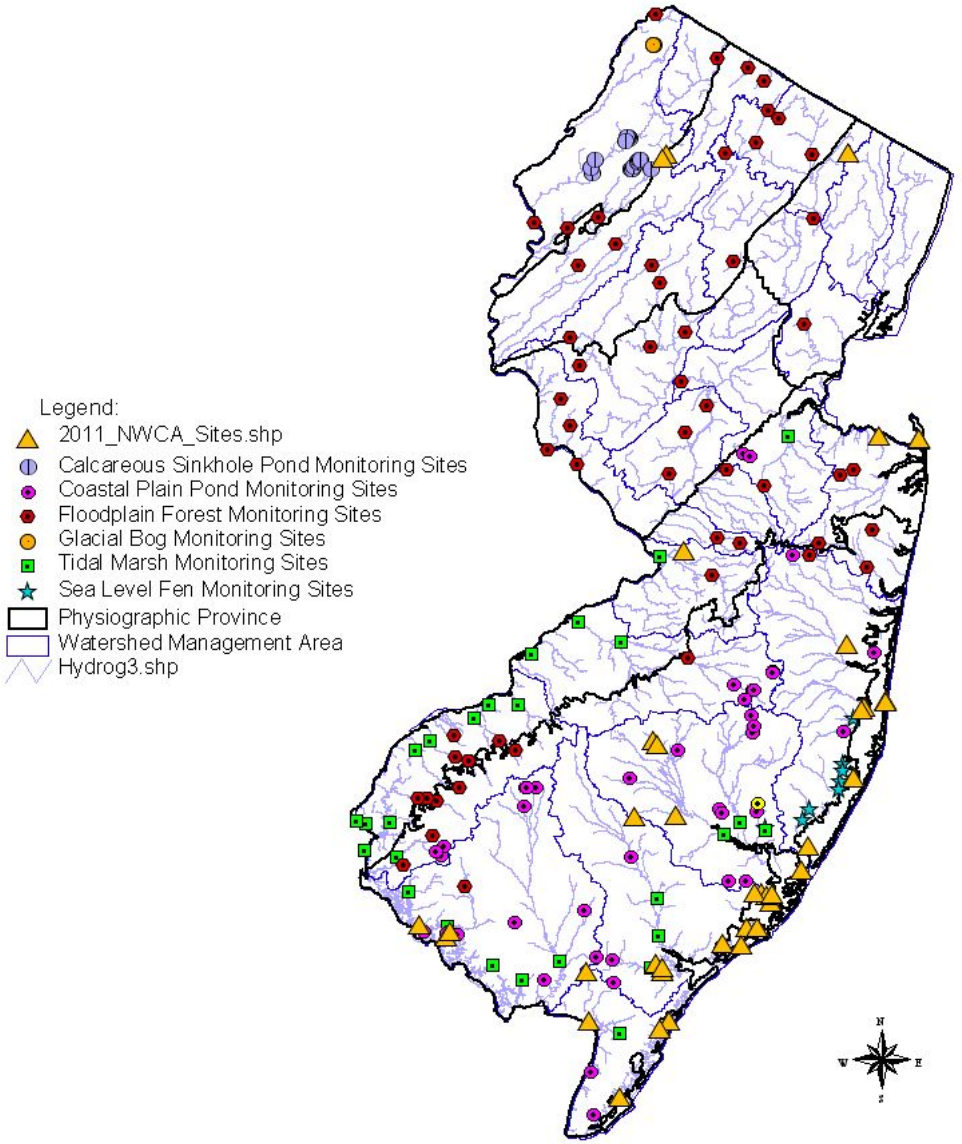
METRIC TYPE	EIA	NWCA (draft)
VEGETATION	20m x 50m plot (Peet)	20m x 50m plot (Peet)
	8 nested plots	10 nested plots
	11 veg strata classes	7 veg strata classes
	unvegetated surface	unvegetated surface
SOILS	2 soil pits (1m)	4 soil pits (3-60m+1-125cm)
	Soil drainage	Soil drainage
	Soil texture	Soil texture
	Matrix Soil Hue/Chroma	Matrix Soil Hue/Chroma
	Mottle Hue/Chroma	Redoximorphic Features
	Soil Organic Carbon	Soil Chemistry (C,N,P)
	Soil Bulk Density	Soil Bulk Density
WATER QUALITY	N/A	Porewater Chemistry
	N/A	Surface Water Chemistry
HYDROLOGY	Cowardin hydrologic regime	Cowardin hydrologic regime
	Evidence of flooding	Evidence of flooding
	Water source	Water source
	Standing water depth	Standing water depth
	Groundwater depth	Groundwater depth
	N/A	Surface water flow rate
OTHER BIOTIC FACTORS	Algae	Algae

National Wetland Condition Assessment 2011





RARE WETLAND MONITORING SITES 1997-2009 AND 2011 NWCA SITES



Collaboration ~ Monitoring

- Mid-Atlantic Coastal Wetland Assessment workgroup (MACWA)
  - Barnegat Bay & Delaware Bay Tidal Marsh Research
- Barnegat Bay National Estuarine Program
- Partnership for the Delaware Estuary
- USFWS Forsythe Refuge
- Academy of Natural Sciences
- Rutgers University
- DEP – CZM, DSRT, WMS, NJGS
- NJWMC

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EPA-R2-WPDG (2009-2013)

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Task 3. Floristic Quality Assessment Index for Bryophytes and Rare Flora

- Develop FQA Coefficients of Conservatism for bryophytes (mosses, liverworts) and rare plants of New Jersey.
- Use FQAI as a vegetation condition metric in Level 3 Wetland Condition Assessments
- Use FQAI as a metric to evaluate and track wetland mitigation site vegetation data (restoration and enhancement sites)

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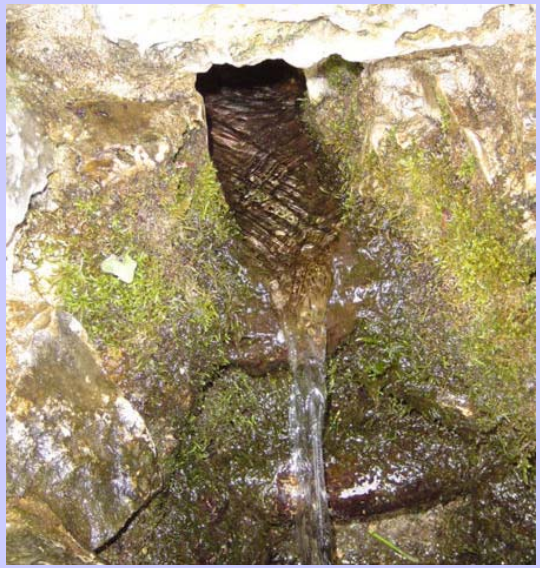
Identification and Classification of Springs in New Jersey



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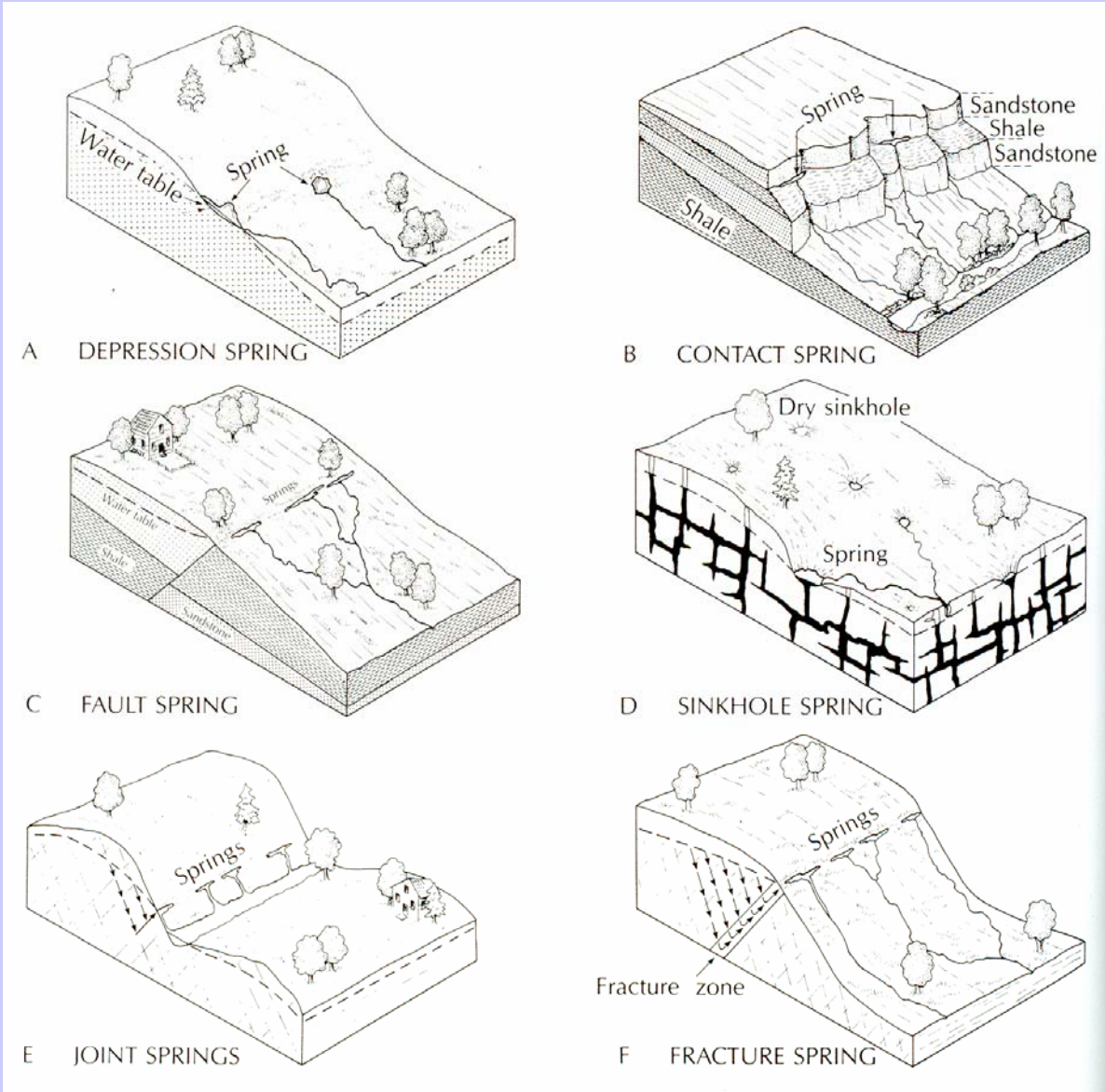
What is a spring?

- Areas of **focused** ground-water discharge
  - Perennial or ephemeral
  - Large or small volumes
  - Can be located on slopes, in wetlands and riparian areas, or under water
  - Can be specific point locations or distributed across a specific area (e.g. headwater wetlands/seeps)
  - Water temperatures and flow variability vary depending on length of flow path
  - Related spring terms include: mineral, soda, thermal, karst, boiling, sulfur, etc

Where do springs form?



From C.W. Fetter, Applied Hydrogeology, 1988

Why study springs in NJ?

- Hydro-ecological importance
  - Can provide relatively constant volume and temperature of water to nearby surface waters or wetlands
  - Thermal and ecological refuges
  - Unique flora and fauna; other studies have suggested they are significant sources of biological diversity
  - Smaller seasonal springs can provide breading areas (e.g. vernal pools)
  - Can be the primary source of water high up in the watershed

Why study springs in NJ? con't

- Socio-cultural importance
  - Native American and European settlement often associated with springs (drinking water, game animals and refrigeration)
  - Township of Boiling Springs – now East Rutherford
  - Laurel Springs Borough in Camden County
  - Historic markers
  - Schooley's Mountain Resort (late 1800s)

Why study springs in NJ? con't

- Regulatory Requirements
  - Drinking water:
    - Public Water: Washington Twp, Mine Hill Boro
    - Spring water bottling: Spring Meadow Farm, Mountain Wood Spring Water Company, Crystal Valley Spring, numerous historic bottlers
  - Water Allocation Permit requirements
    - Hydrologic impacts
  - Watershed Management
  - Land Use Regulation (wetland permitting)

What does this tell us?

- Springs have hydro-ecologic, socio-cultural, water supply importance.
- However, unlike lakes and wetlands comprehensive assessments of springs have not typically been conducted. This is true in NJ and elsewhere.
- Bits and pieces on the identification of and classification systems and assessments have been developed but they are far from comprehensive…

Meinzer's 1927 Spring Discharge Classification System

Still commonly used today, but only considers flow…

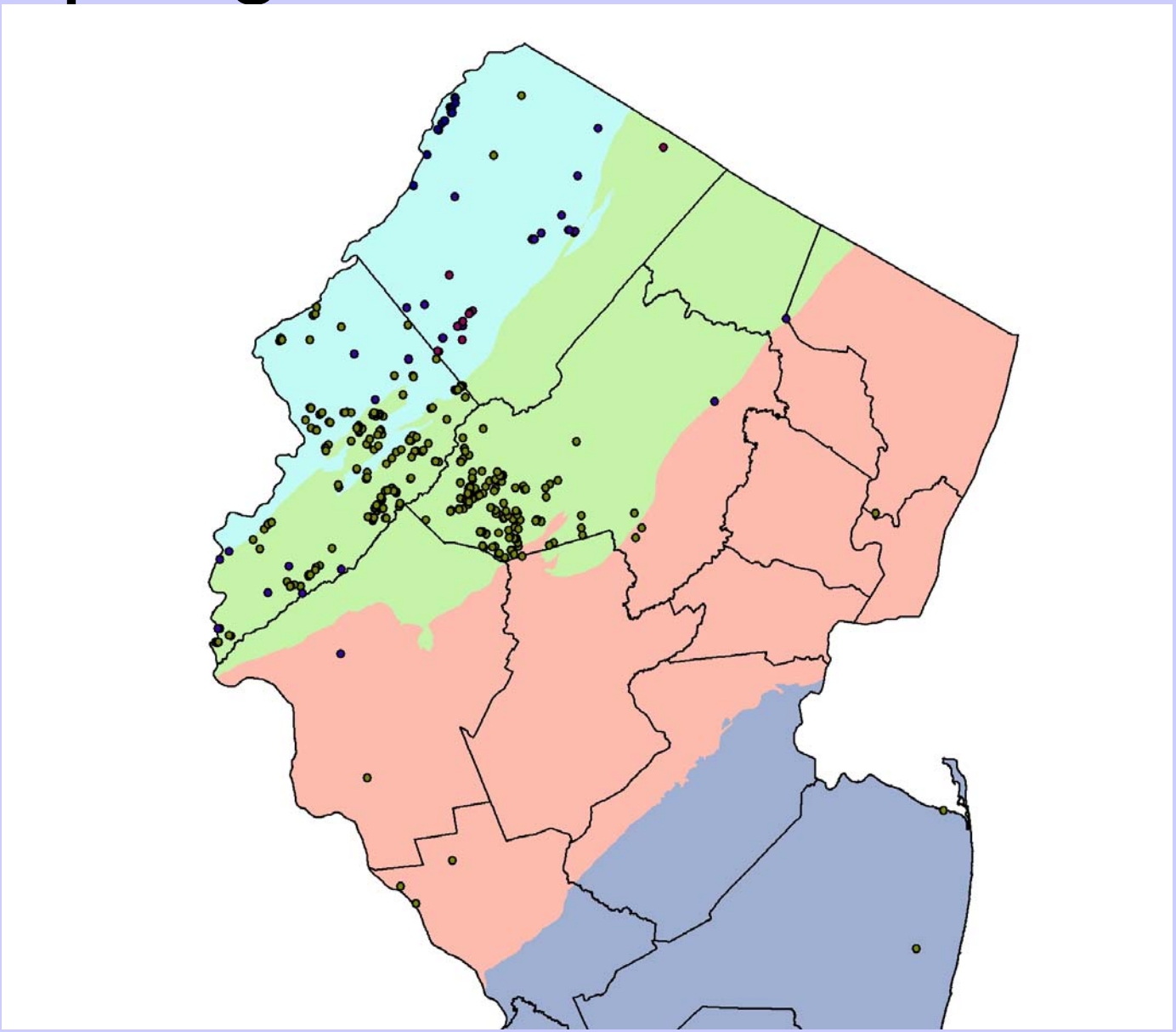
Magnitude	Avg. Annual Flow
First Order	>100 cfs
Second Order	10 to 100 cfs
Third Order	1 to 10 cfs
Fourth Order	100 gpm to 1 cfs
Fifth Order	10 to 100 gpm
Six Order	1 to 10 gpm
Seventh Order	1 pint to 1 gpm
Eighth Order	<1 pint pm
Zero Order	no longer flowing

- “What are the largest springs in the United States, how much water do they discharge and what geologic conditions produce them are questions of much popular interest and considerable scientific and economic importance. Yet the information in regard to large springs has been so widely scattered and so difficult to interpret that most people have only very vague notions on the subject.”

  From O.E. Meinzer, Large Springs in the United States, 1927

- Same could be said today

Springs Identified to date



Proposed Approach

- Phase 1: Statewide Spring Survey
  - Identify locations of major springs in NJ
    - Review/consolidate existing resources
    - As discovered during other field work
  - Develop a statewide GIS database locating and characterizing springs using a consistent methodology
    - GPS locations
    - Pictures
    - Approximate flow rates
    - Where readily available
      - Hydrogeologic setting
      - Water chemistry field parameters

- Phase II: more detailed research
  - Using data collected in Phase 1:
    - Identify regions/geologic settings where springs are prevalent
    - Or vice versa, locations where springs have been located but are not common (and therefore potentially unique/significant)
  - Identify subset of springs for more detailed analysis and monitoring
    - Characterize geologic, hydrologic, and ecologic settings
    - Monitor water quality, quantity, and temperature over time

- Phase II con't:
  - Using survey and detailed data collected develop a spring classification system for NJ
    - Possibly base NJ's classification system on one developed by Springer, et al.
      - Relational database design using relevant physical, chemical, biological, and socio-cultural variables
      - Includes geomorphic considerations, flow forcing mechanisms, flow characteristics, water quality, habitat characteristics, springs biota, and land management
  - Identify vulnerable springs and headwater seepage wetlands
  - Develop database and field worksheets to manage future data collection

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Task 4. Outreach

- Post final wetland condition assessment and spring mapping products on DEP website(s).
- Provide Floristic Quality Assessment Index (FQAI) bryophyte and rare plant information to Bowman's Hill Wildflower Preserve for posting on their FQAI/Plant Stewardship Index (PSI) website.
- Provide summary information on condition of palustrine and estuarine wetlands and headwater springs of NJ for land use planning, protection and restoration of vulnerable wetland and aquatic resources to federal, state, local, private and watershed conservation groups.
- Provide site information and monitoring data to the NJDEP Water Monitoring Council, Volunteer Monitoring Program and Watershed Watch Network.

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