Non-conforming Metrics: Development of a Macroinvertebrate Index for the New Jersey Pinelands

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ALK1

Summary

- Description of unique NJ Pinelands ecosystem
- Development of a macroinvertebrate index specific to Pinelands and unexpected responses of some metrics
  - Pinelands Macroinvertebrate Index (PMI)
- Application of PMI
  - Case studies

Slide 2

ALK1 Suggest adding this slide to beginning. Feel free to modify it as you see fit.
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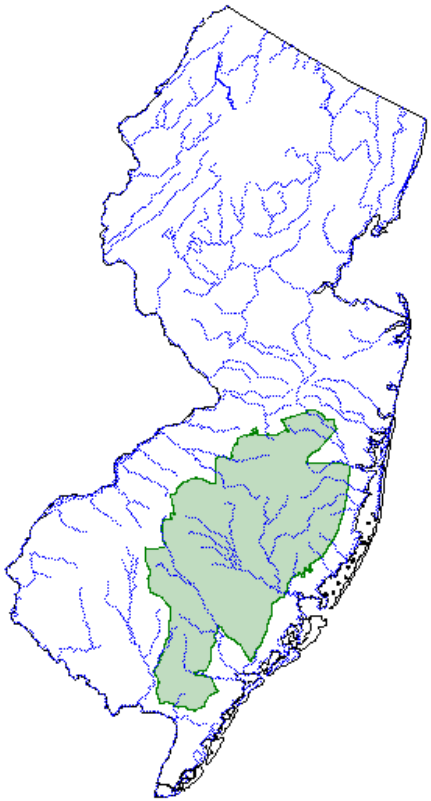
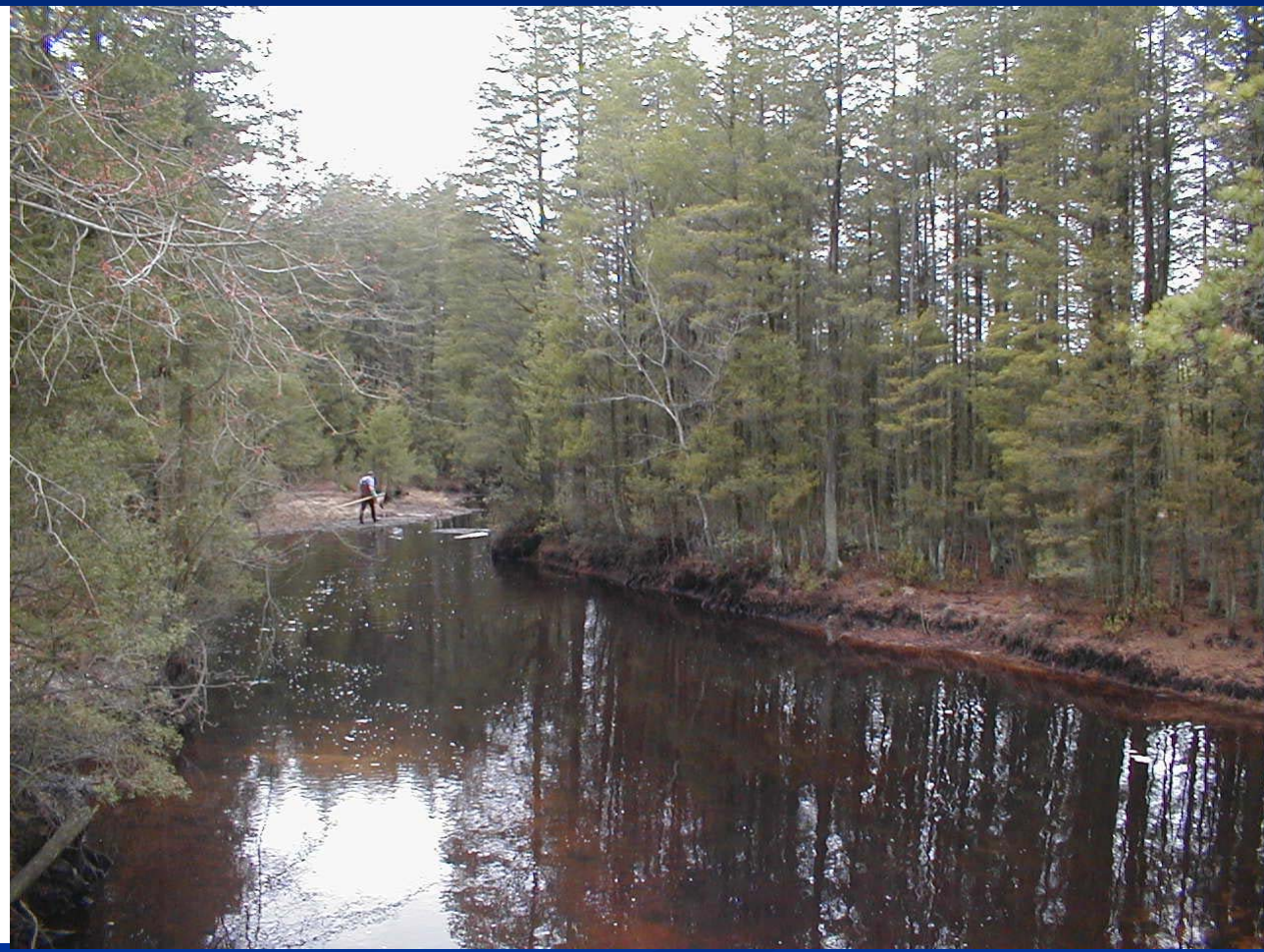
NJ Pinelands





Cranberry Bogs, Burlington Co.

New Jersey's Macroinvertebrate Monitoring Network

- Current network, known as AMNET, started in the early 90's and now consists of 822 active sites statewide.
- Index originally used, called New Jersey Impairment Score (NJIS), was based on guidance in original USEPA's Rapid Bioassessment Protocols.
- NJIS was used statewide throughout the 1990's and into this decade.
- 5 metrics(measurable characteristics of the stream macroinvertebrate community) are used.
- Index calculated with 100-organism subsample with family-level taxonomy

ALK2

NJIS

- Metrics: #Total Taxa(families), %EPT, #EPT Taxa, Family Biotic Index, and %Contribution of Dominant Taxa.
- Each metric scored a 6, 3, or 0 and totaled for index score.
- 0-30 scale with **Non-impaired 24-30**; **Moderately impaired 9-21**; **Severely impaired 0-6.**

ALK2 Stay away from using green or red text as those in the audience who are red/green color blind will not be able to see the text!
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Problems with NJIS in Pinelands

- Moderately enriched streams (higher pH and SC) tended to score as non-impaired.
- Some reference sites, with little or no development and pH readings approaching 4.0, scored moderately impaired.
- Assessments differed at some sites from Pinelands Commission. (Water quality, stream vegetation, and fish and frog assemblages)

ALK3

Seeking a Solution for Pinelands

- Funding obtained from USEPA-Region 2 for index development.
- Contracted Tetra Tech to develop a Pinelands-specific macroinvertebrate index.

Slide 13

ALK3 Suggest adding this slide so that logic of identifying a problem is followed by a solution. Leaving this in one slide fails to highlight this fact. Again, feel free to add some additional narrative here.

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Index Development Steps

- Collect and organize the data, separating calibration and verification data;
- Define reference and degraded sites;
- Stratify natural biological conditions;
- Calculate biological metrics and determine sensitivity of each metric;
- Combine appropriate metrics into index alternatives;
- Select the most appropriate index for application in the Pinelands based on sensitivity and variability, and;
- Assess performance of the index.

ALK4

Reference and Degraded Site Criteria

Environmental Parameter	Reference Criterion	Degraded Criterion
Predicted intensive land use (PLU%)	< 10%	>25%
Percent agricultural land cover	< 10%	>25%
Percent urban land cover	< 10%	>50%
Below Dam	No	No criterion

$$PLU\,\% = 12\,pH + 61\log(spec.cond.) - 148$$

Dow and Zampella (2000):

ALK4 Note that I added white background to equation so it can be seen.
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ALK5

Metric Responses to > Stress

Metric	DE	Expected	Observed
Insect taxa	66.7	-	-
Non-insect taxa	83.3	+	+
EPT taxa	61.1	-	-
Diptera taxa	33.3	-	-
Chironomidae taxa	<25	-	NR
Orthocladiinae taxa	38.9	-	-
Tanytarsini taxa	44.4	-	+
Tanypodinae taxa	<25	-	NR
%Diptera	61.1	+	-
%Diptera w/o Tanytarsini	72.2	+	-
%Orthocladiinae	38.9	+	-
%Tanytarsini	55.6	-	+
%Crustacea & Mollusca	77.8	+	+
%Mollusca & Amphipoda	77.8	+	+
%Plecoptera & Trichoptera	66.7	+	+
Beck's Biotic Index	55.6	+	+

Slide 16

ALK5 No one is going to be able to read this slide. Can it be divided into two slides?
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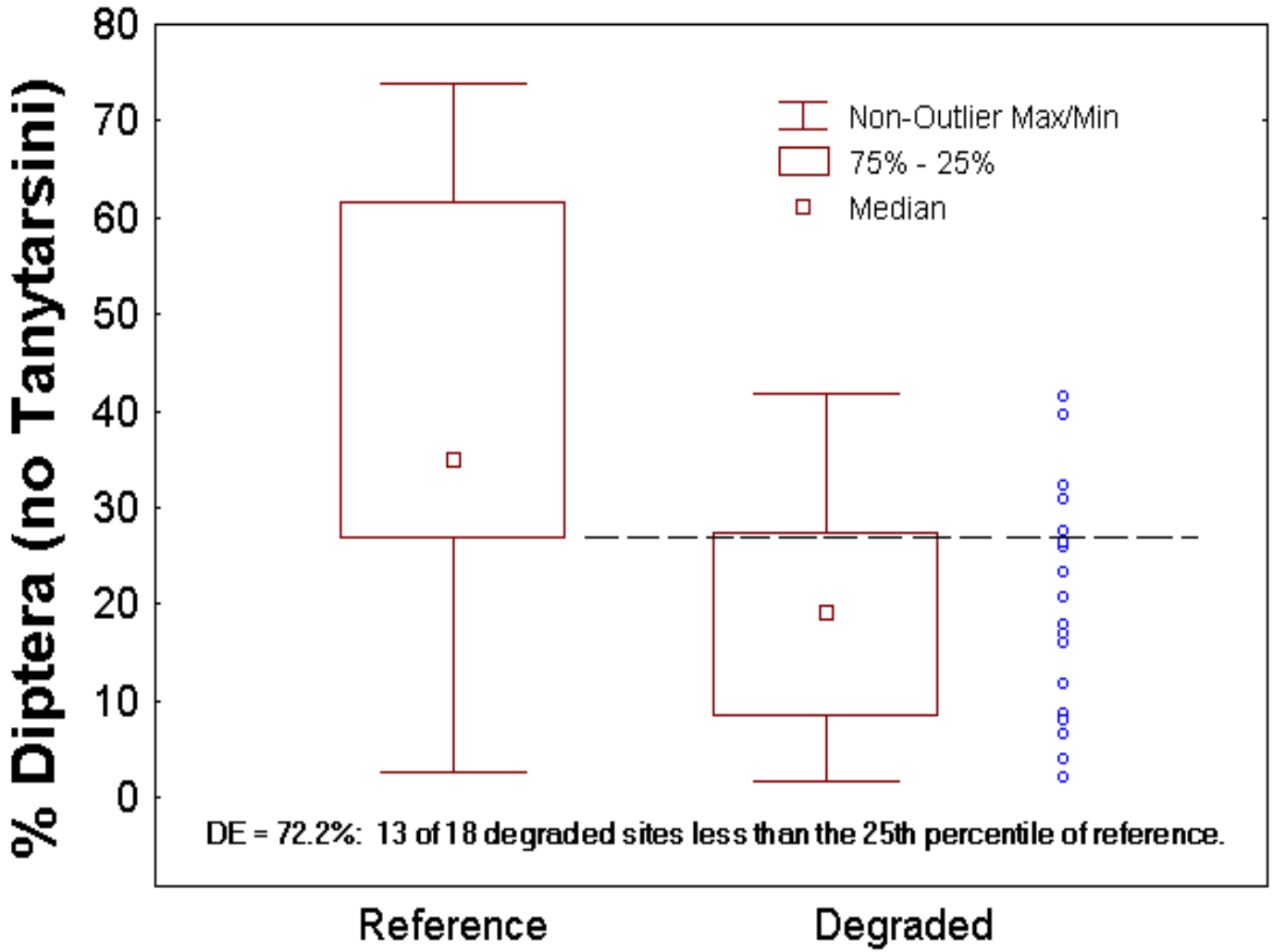
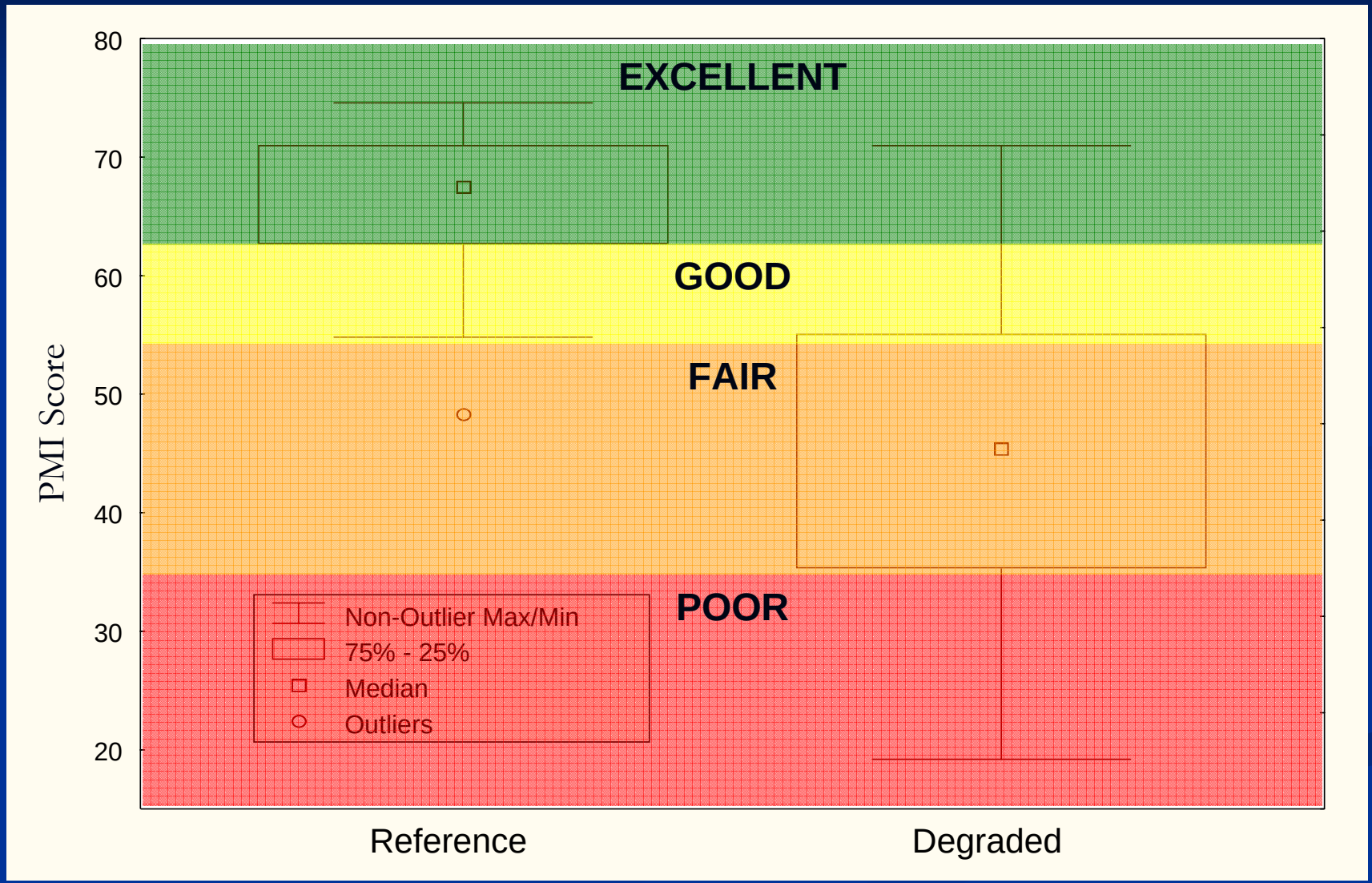
Metric Performance



Pinelands Macroinvertebrate Index (PMI)

1. # of Insect Taxa (-)
2. # of Non-insect Taxa (+)
3. % Plecoptera and Trichoptera (-)
4. % Diptera excluding Tanytarsini (-)
5. % Mollusca and Amphipoda (+)
6. Beck's Biotic Index (-)
7. % Filterers (+)

Index Performance



Index Performance

- Using calibration data set, PMI's DE was 94.4%
- With same data set, NJIS had a DE of 44.4%
- May be more sensitive to severe stresses than moderate stresses. Future refinements may be necessary to better assess slight to moderately enriched conditions.

ALK8

ALK8 Define what "DE" means.

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ALK10

Case Studies

- The following monitoring sites have been assessed using both the NJIS and the new PMI metrics.

ALK10 Need an intro slide

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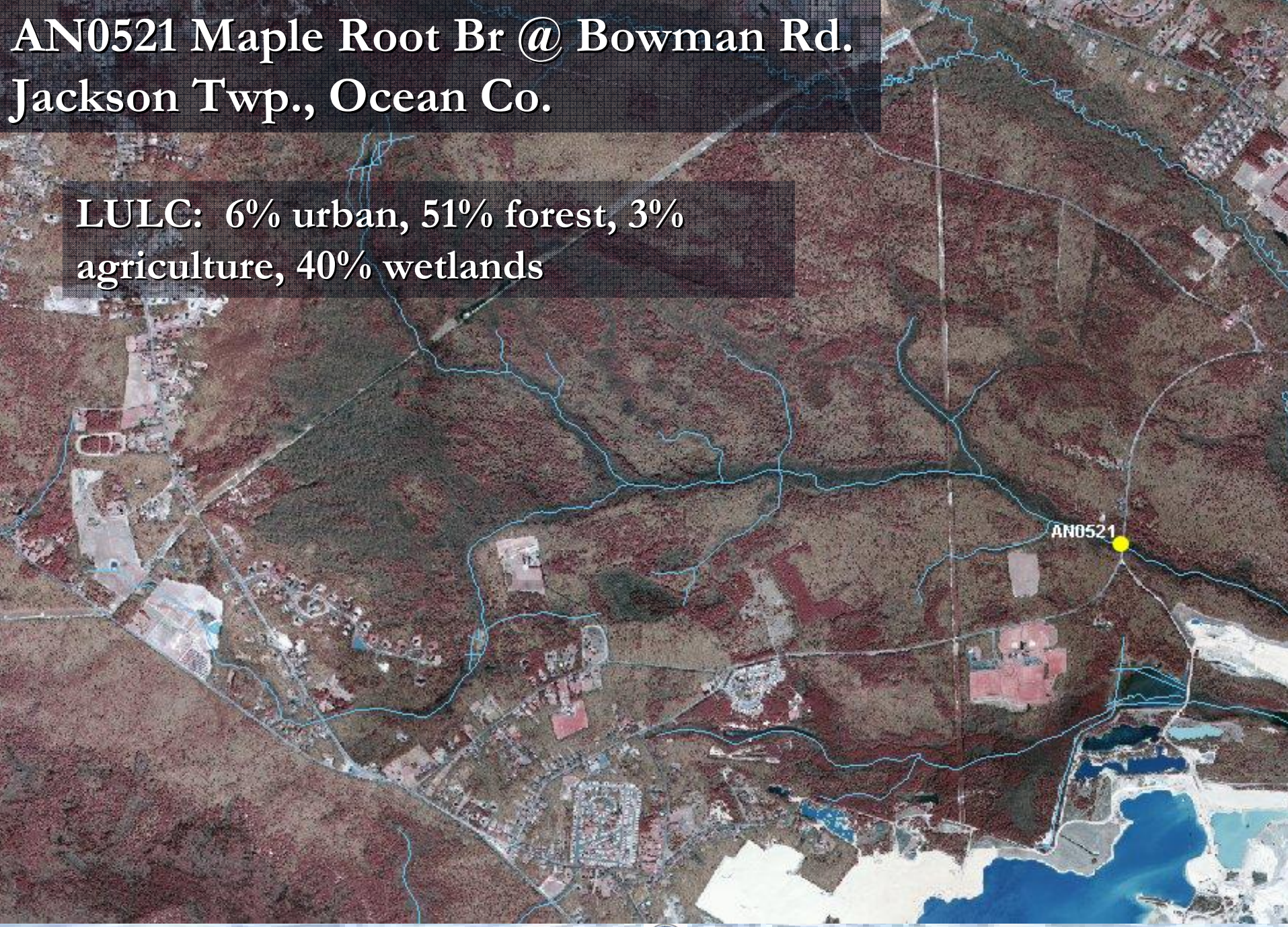
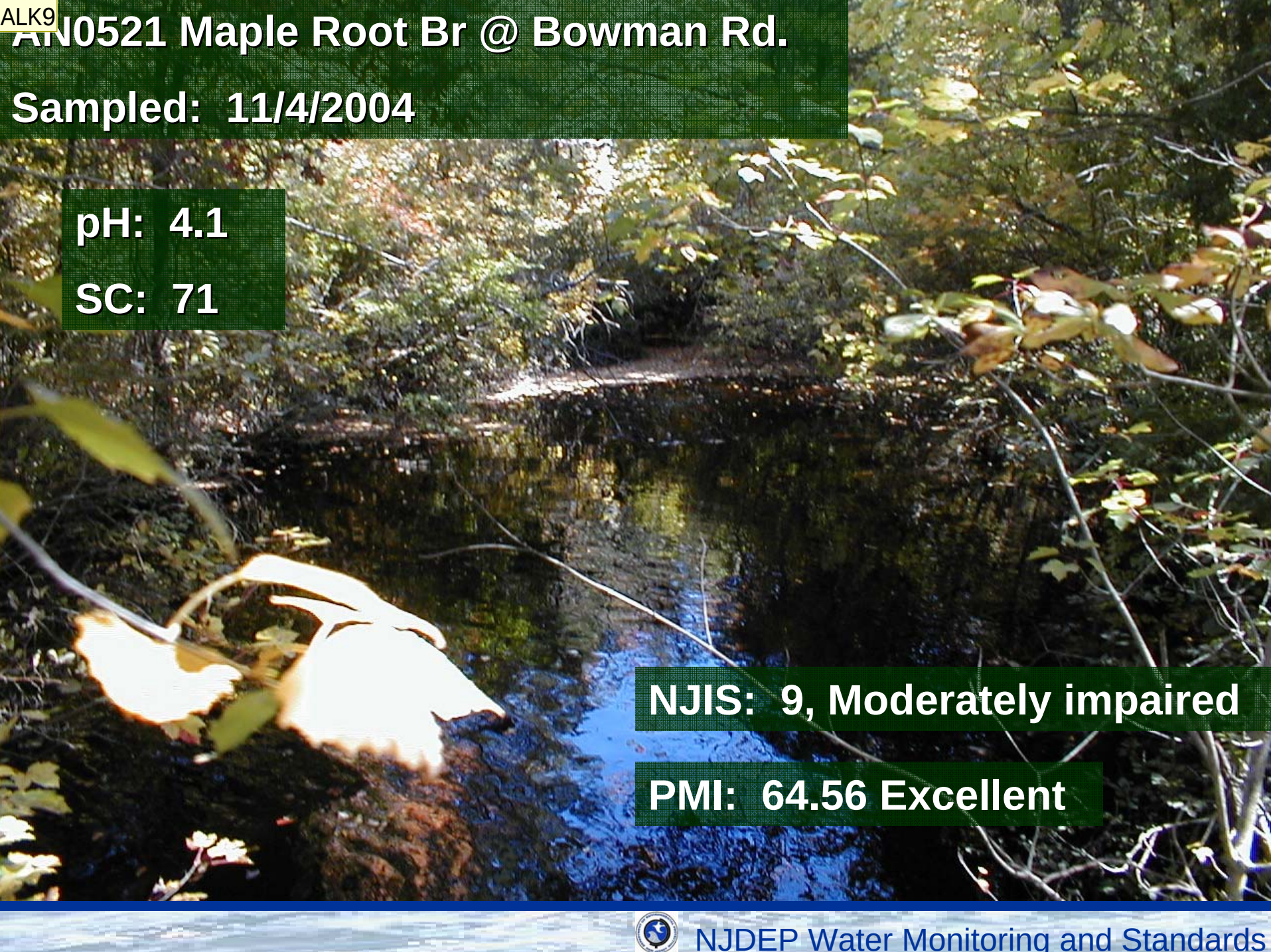
AN0521 Maple Root Br @ Bowman Rd. Jackson Twp., Ocean Co.

LULC: 6% urban, 51% forest, 3% agriculture, 40% wetlands




ALK9
AN0521 Maple Root Br @ Bowman Rd.
Sampled: 11/4/2004
pH: 4.1
SC: 71
NJIS: 9, Moderately impaired
PMI: 64.56 Excellent
NJDEP Water Monitoring and Standards

ALK9 Same problem, don't use green or red colored text

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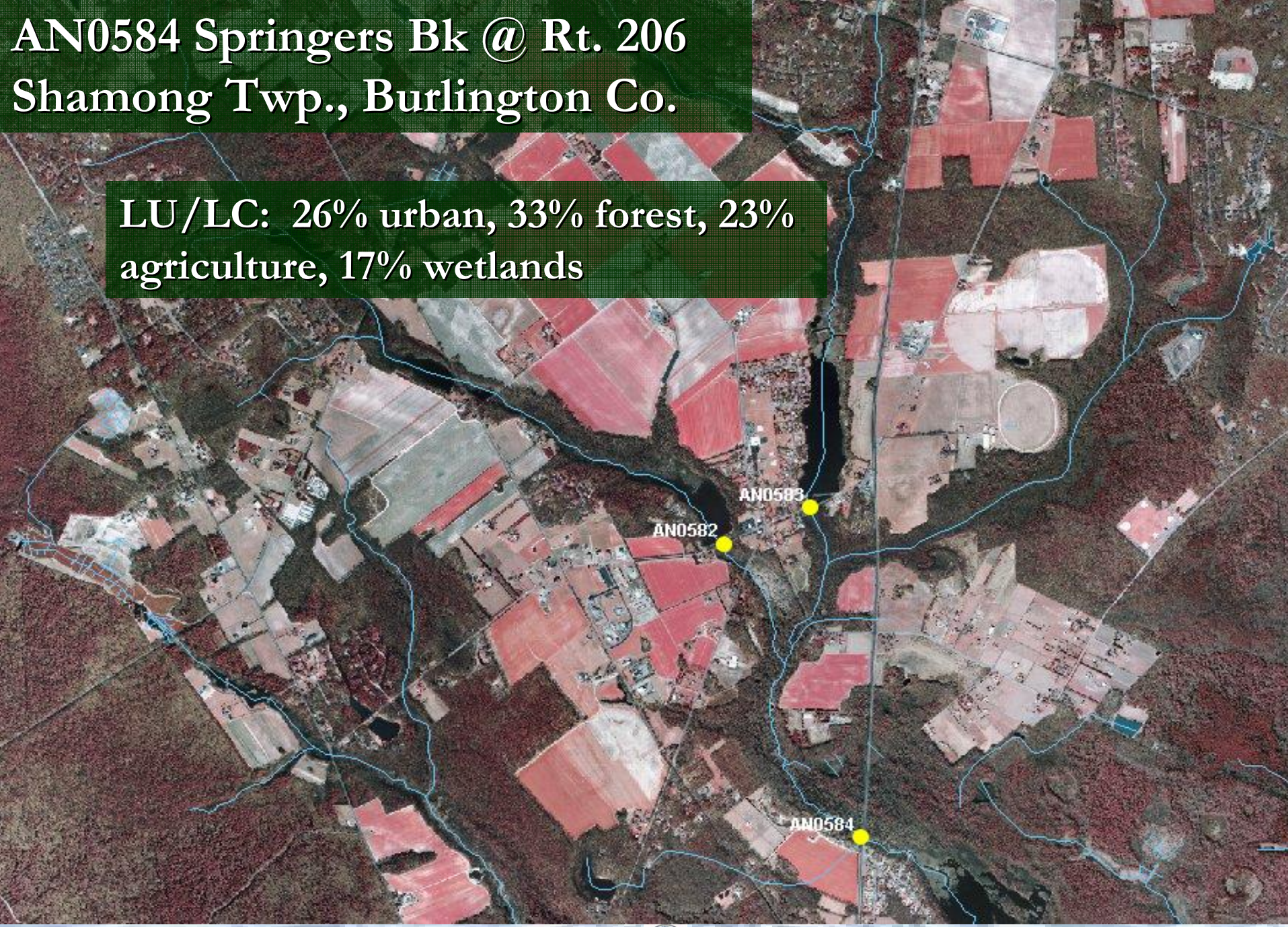
AN0584 Springers Bk @ Rt. 206 Shamong Twp., Burlington Co.

LU/LC: 26% urban, 33% forest, 23% agriculture, 17% wetlands



AN0584 Springers Bk @ Rt. 206
Sampled: 7/27/05
pH: 6.0
SC: 188
NJIS: 24, Non-impaired
PMI: 45.92, Fair

Application of PMI

- To be used for all sites within the boundary of the Pinelands Reserve and sites within a 5 kilometer buffer of the Reserve
- Currently, PMI is being used to assess about 200 of the active network sites in Coastal Plain of southern New Jersey
- Along with other Pinelands monitoring data, assessments using PMI are being used in development of the New Jersey's biennial Integrated Water Quality Monitoring and Assessment Report (303d/305b)

Questions?
www.state.nj.us/dep/wms/bfbm