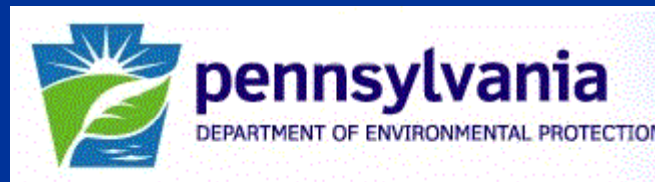# How is the Watershed?

An update on the most recent Aquatic Life Use assessment survey in the Christina Basin

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pennsylvania
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5/20/2010

What is an Aquatic Life Use survey?

- A stream can be assessed for 4 different uses:
  - Aquatic Life → the use we are focusing on.
  - Fish Consumption
  - Potable Water Supply
  - Recreation

- Aquatic life Use is the ability of stream to support aquatic organisms such as fish and macroinvertebrates.

- Is a particular stream meeting its Designated Use for Aquatic Life?
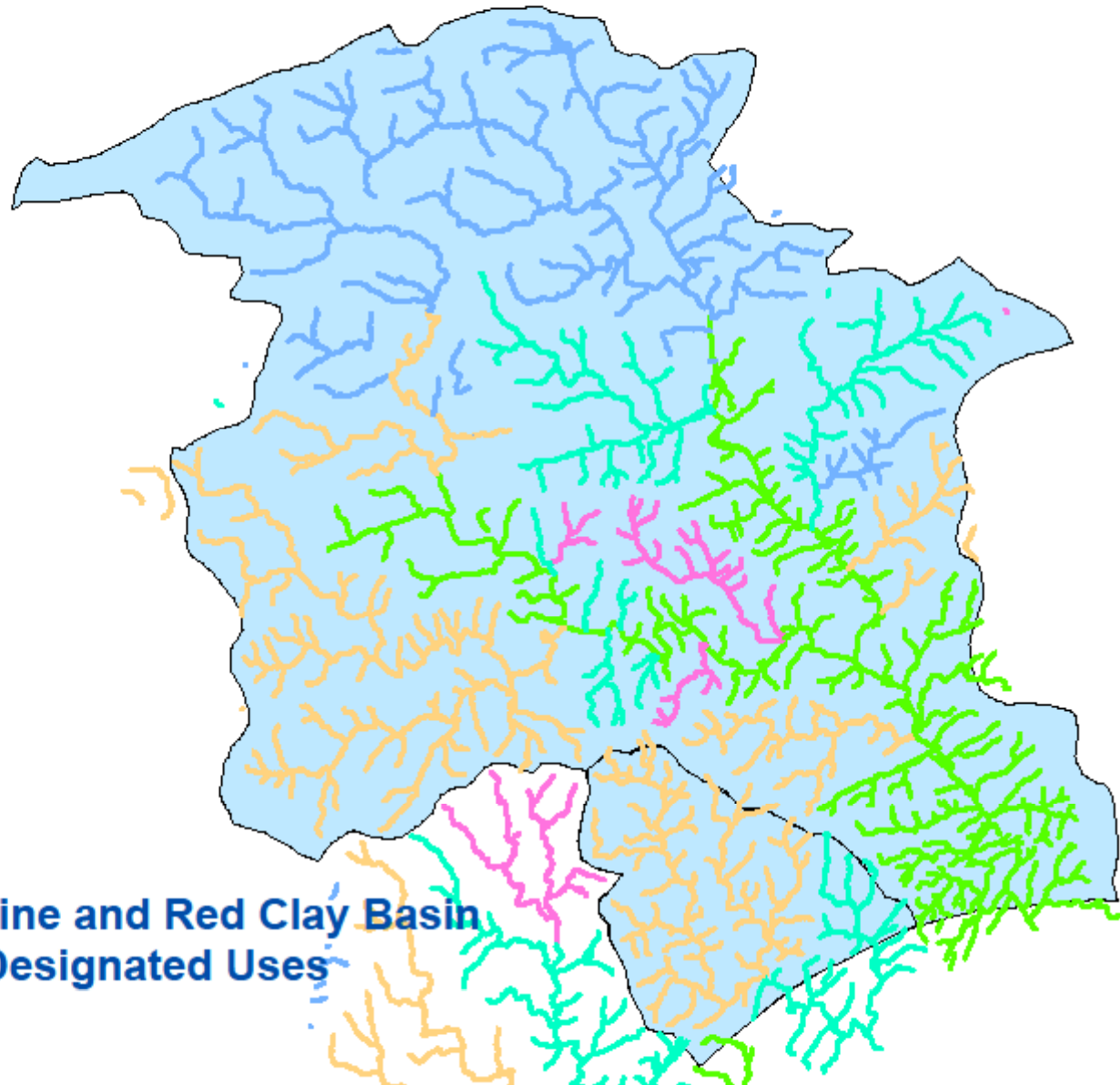
Designated Uses

- Each stream has a Designated Use for aquatic life assigned to it.
    - Assigned in the 80s. Not usually changed.
    - A stream is either attaining or impaired for its Designated Use.
- A stream can be:
    - Exceptional Value
    - High Quality } Special Protection Status
    - Trout Stocked Fishery
    - Cold Water Fishery } Regular status
    - Warm Water Fishery
- Special Protection streams are held to a higher standard.

Brandywine and Red Clay Basin Designated Uses

How do we determine the stream status?

- The establishment of standards

- ICE sampling

- Habitat assessment

- Macroinvertebrate identification

- Station IBI score and assessment

- Stream segment assessment

- (If impaired) Source/Cause determination

** You only see the last two steps in eMAP **

The establishment of standards

- Metrics and IBI (Index of Biotic Integrity) scores.
  - Benthic macroinvertebrates are given values, which in turn help us evaluate a particular stream.
  - Methods and analysis, while based on the EPA RBP III manual (Rapid Bioassessment Protocol), are state specific. Streams are compared to the best in Pennsylvania.
  - Statistical analysis methods developed by Bureau of Water Quality Standards folks in Harrisburg, approved by EPA.
- Goal is to make our findings scientifically defensible.
  - Needed to stand up in a court of law.
- Current standards are tougher to achieve than the less technical analysis methods of the past.
  - More streams are impaired as a result.

ICE sampling

- Instream Comprehensive Evaluation. Methods also established by Harrisburg and approved by EPA.

- Probabilistic and Targeted sampling.

- Water properties and field chemistry.
  - pH, temperature, alkalinity, conductivity, and dissolved oxygen.

- Macroinvertebrate collection.
  - 100 meter reach with riffles selected.
  - 6 "kicks" in different locations with a D-frame net.
  - 1 square meter each for about 1 minute.
  - Net and sieve with 500 micron mesh.
  - Samples preserved and returned to lab for processing.

Sampling is a "kick"

Sometimes we have help

Habitat assessment

- Visual field assessment of various parameters:
  - Instream Fish Cover
  - Epifaunal Substrate
  - Embeddedness
  - Velocity/Depth Regimes
  - Channel Alteration
  - Sediment Deposition
  - Frequency of Riffles
  - Channel Flow Status
  - Condition of Banks
  - Bank Vegetative Protection
  - Grazing or Other Disruptive Pressure
  - Riparian Vegetative Zone Width.

Macroinvertebrate identification

- 200 count subsample for each station, +/- 20%
  - Selection process eliminates bias and excessive work.
- Identification to the genus level for most macroinvertebrates.
  - Notable exceptions being Chironomidae (family) and Oligochaeta (class).
  - Previous assessments only required identification down to the family level.

Station IBI score and assessment

- The collected macroinvertebrates and their attributed values are used to determine various metric scores.
  - Hilsenhoff, Becks, Shannon Diversity, % Intolerance, various taxa richness.
- The metric scores are used to determine the IBI score.
  - Different metrics are used based on season (summer vs winter) and stream type (freestone, limestone, low grade).
- The IBI score is compared to a criteria for biological assessment.
  - There is some room for best professional judgment in "grey" area scores.
  - Special protection streams are held to a higher threshold level.
- The Habitat score is evaluated for habitat assessment.

IBI assessment criteria

2008 winter method

> 80	Attaining HQ and EV
> 63	Attaining
50 < x < 63	Gray zone
< 50	Impaired

2008 summer method

> 80	Attaining HQ and EV
> 50	Attaining
40 < x < 50	Gray zone
< 40	Impaired

Grey zone considerations:
- Dominance of tolerant taxa?
- Absence of EPT taxa?
  If so, then impaired.

Stream segment assessment

- Streams are assessed as being attaining or impaired for a designated use.

- Things to consider:
  - Assessment of sampled stations and their spatial relationship to the watershed.
  - Major changes in habitat across the landscape such as WWTP outfalls, point sources, urban areas, reservoirs, etc.
  - Previous assessment status (Delisting an impaired stream requires ample proof).
  - Manner in which special protection status was attained (survey vs conservation).
  - Similarity of streams without stations.

(If impaired) Source/Cause determination

- Sources can include: Urban Runoff, Agriculture, Habitat Modification, etc.
- Causes can include: Siltation, Water/Flow Variability, Organic Enrichment, etc.
- Determined by Biologist's best professional judgment. Things to consider include:
  - Field observations of land use in the watershed.
  - Habitat scores.
  - Macroinvertebrate composition.
  - Changes in watershed since last survey (New development, new farm, new point source).
  - Previous Source/Cause listing.
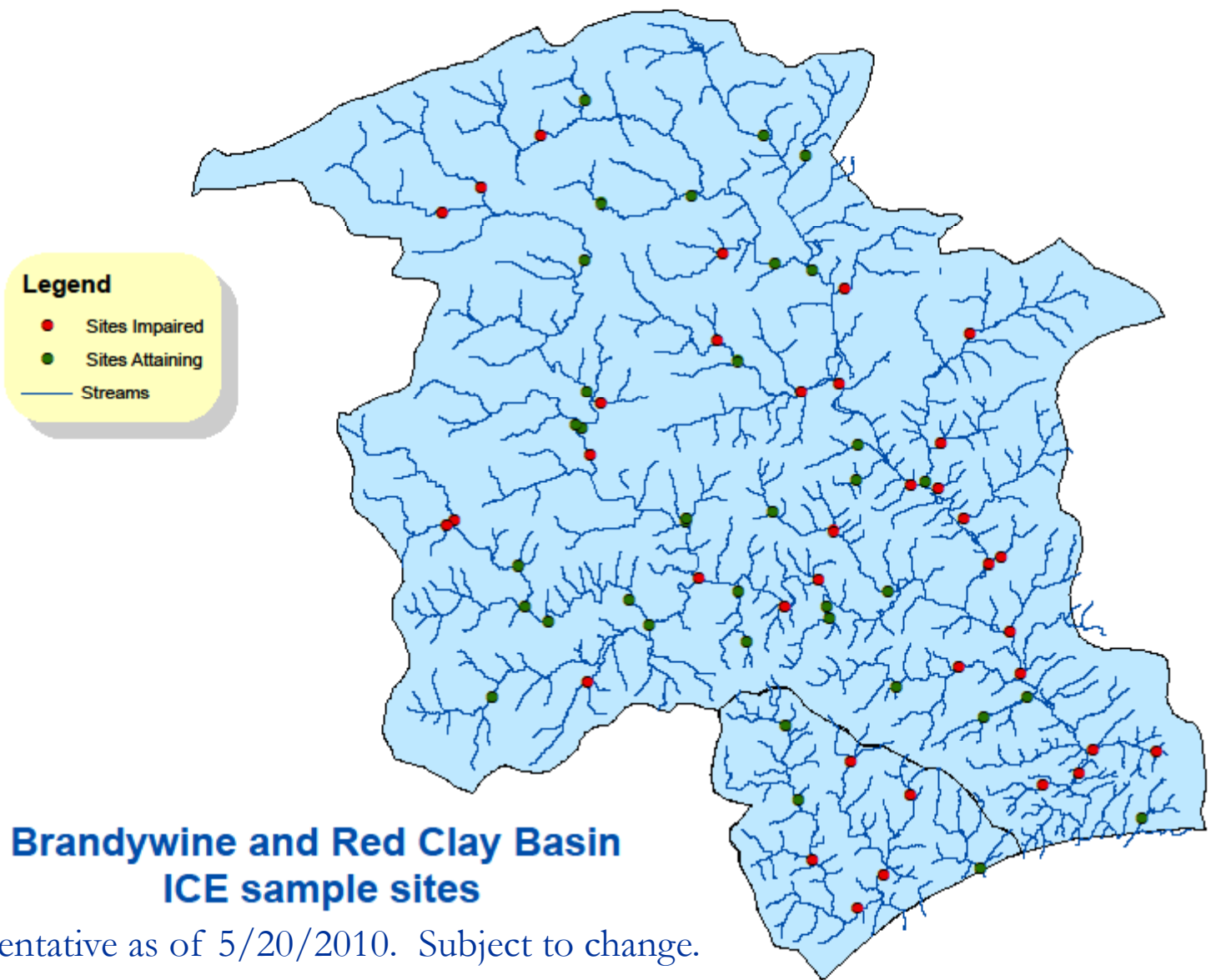
**Brandywine and Red Clay Basin
ICE sample sites**

Tentative as of 5/20/2010. Subject to change.
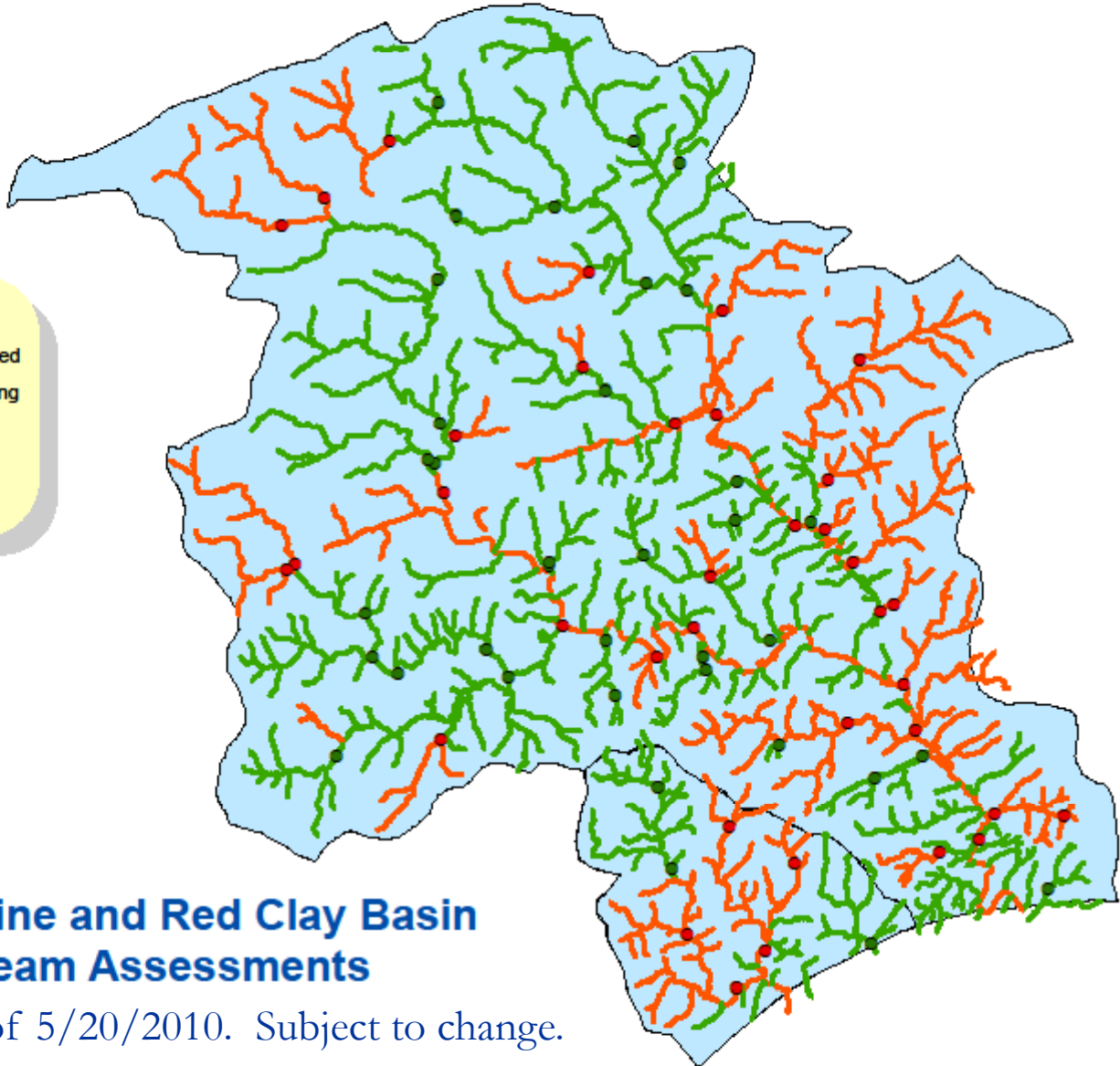
Brandywine and Red Clay Basin Stream Assessments

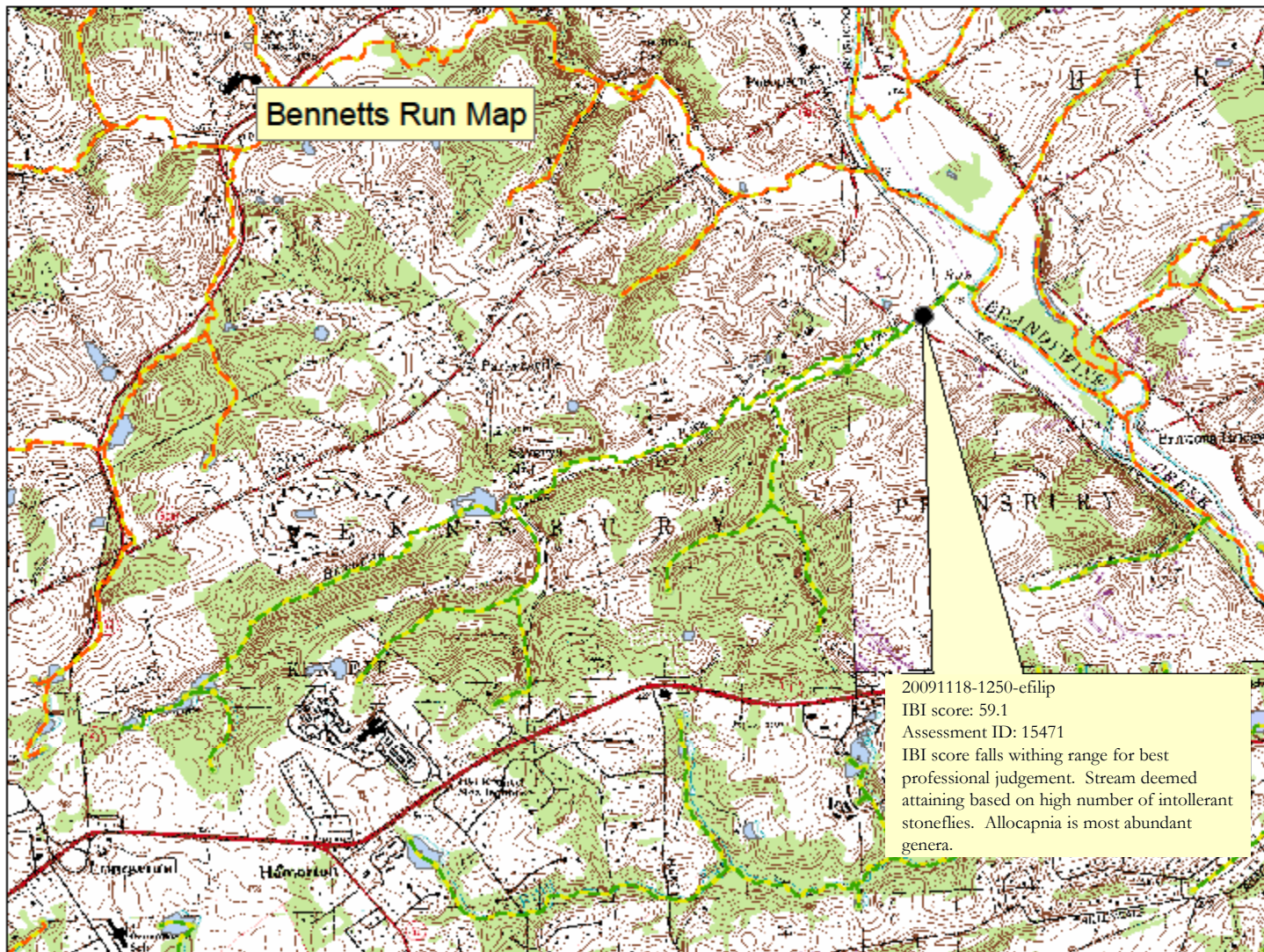Tentative as of 5/20/2010. Subject to change.
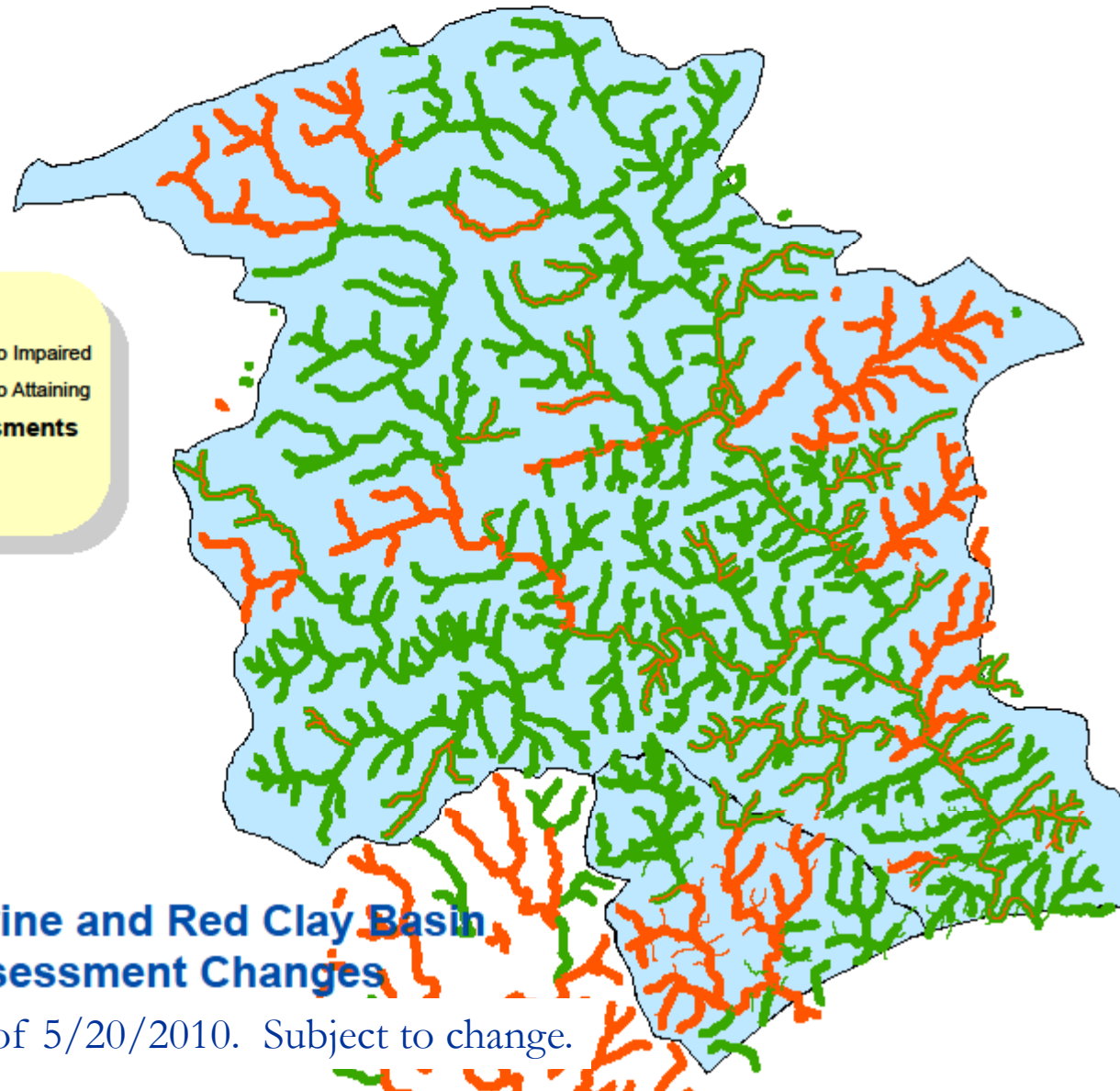
Brandywine and Red Clay Basin Assessment Changes

Tentative as of 5/20/2010. Subject to change.

Assessment changes

- Biggest changes include:
  - Impairment of long stretches of the Main Stem, East Branch, and West Branches of the Brandywine Creek.
  - Impairment of Brandywine tributaries such as Shamona Creek, Pocopson Creek, Culbertson Run, Broad Run, Harvey Run, and sections of the headwaters of Buck Run and Doe Run.
  - Impairment of the head waters of the East Branch of the Red Clay Creek
  - Attainment of Bennetts Run (Not depicted on previous map. See following detailed map) and segments of Indian Run and Beaver Run.

Bennetts Run Map

20091118-1250-efilip
IBI score: 59.1
Assessment ID: 15471
IBI score falls withing range for best
professional judgement. Stream deemed
attaining based on high number of intollerant
stoneflies. Allocapnia is most abundant
genera.

Legend
— Attaining
— Agricultural
— Agricultural/Urban
— Urban
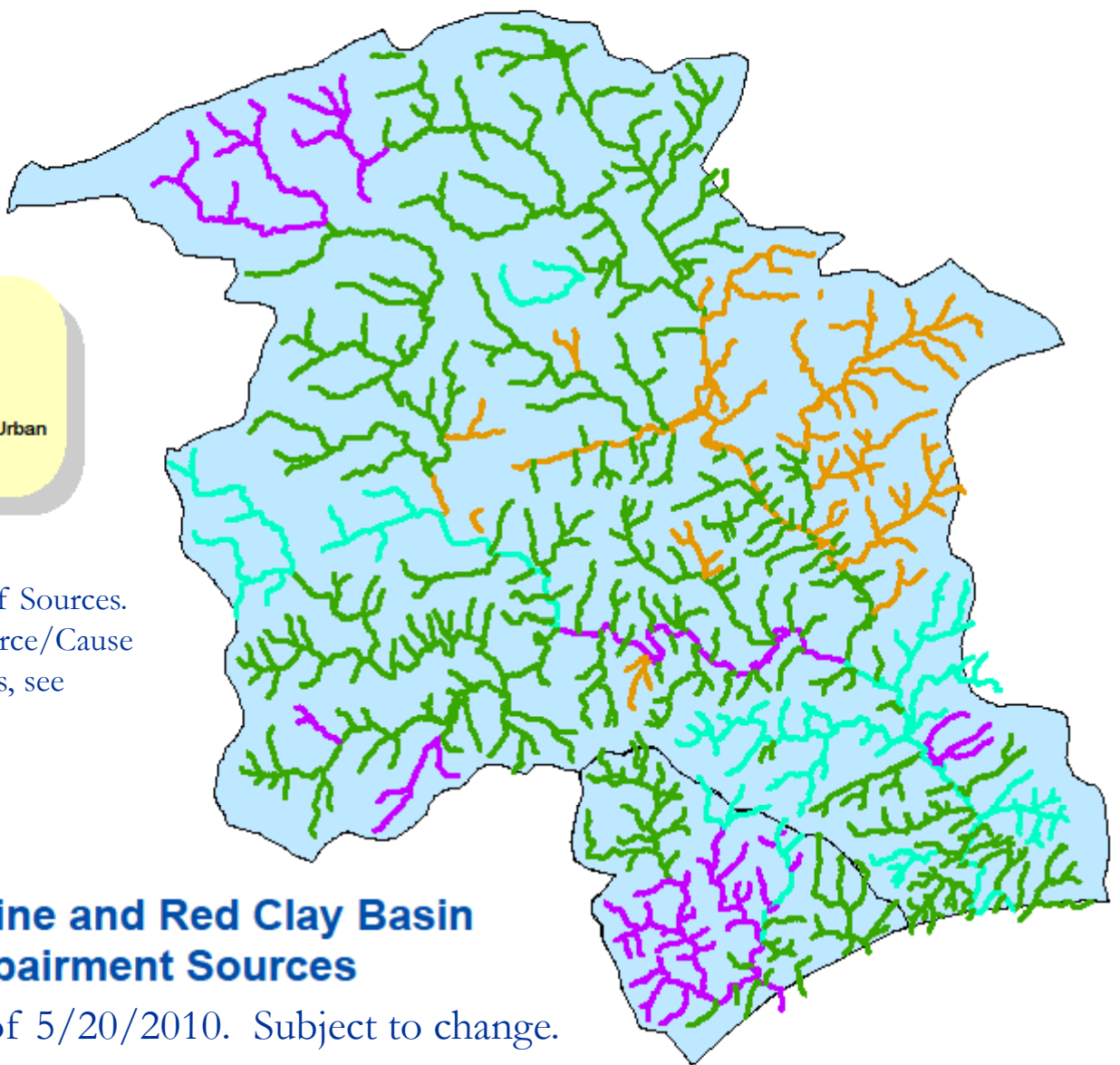
Rough grouping of Sources.
For individual Source/Cause
impairment listings, see
eMAP PA

**Brandywine and Red Clay Basin
Impairment Sources**

Tentative as of 5/20/2010. Subject to change.

In closing

- As the science behind stream assessment becomes more precise, our collection and data analysis methods change.

- This data is a summary of our most recent "Tentative" Assessments. Still subject to change.

- Currently the comment period is closed and EPA is considering our assessments for approval.

- The assessment changes have been mostly an increase in impairments. This is reflective of both tougher attainment standards and an increase in water quality stressors.

Any questions?

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