

# Effectiveness of BMPs for Reducing Nitrogen to the Black Hawk Lake Watershed, Iowa

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## INTRODUCTION

- Black Hawk Lake (BHL) watershed is 5,324 hectares of tile drained, intensively managed agricultural landscape (Fig. 2).
- BHL is designated for primary contact recreation (Fig. 1).
- In 2015, BHL watershed became the focus of a 5-year monitoring project.
- Three sub watersheds are being monitored: 87.5%, 30%, and 22.5% best management practice (BMP) implementation.
- Water samples are collected and analyzed for nutrients in both surface and tile flows.
- The goal of this study is to identify the effectiveness of BMPs in reducing nitrogen export.
- BMPs considered include reduced tillage, cover crops, filter strips, terraces, grassed waterways (GWWs) and nutrient management plans (NMPs).

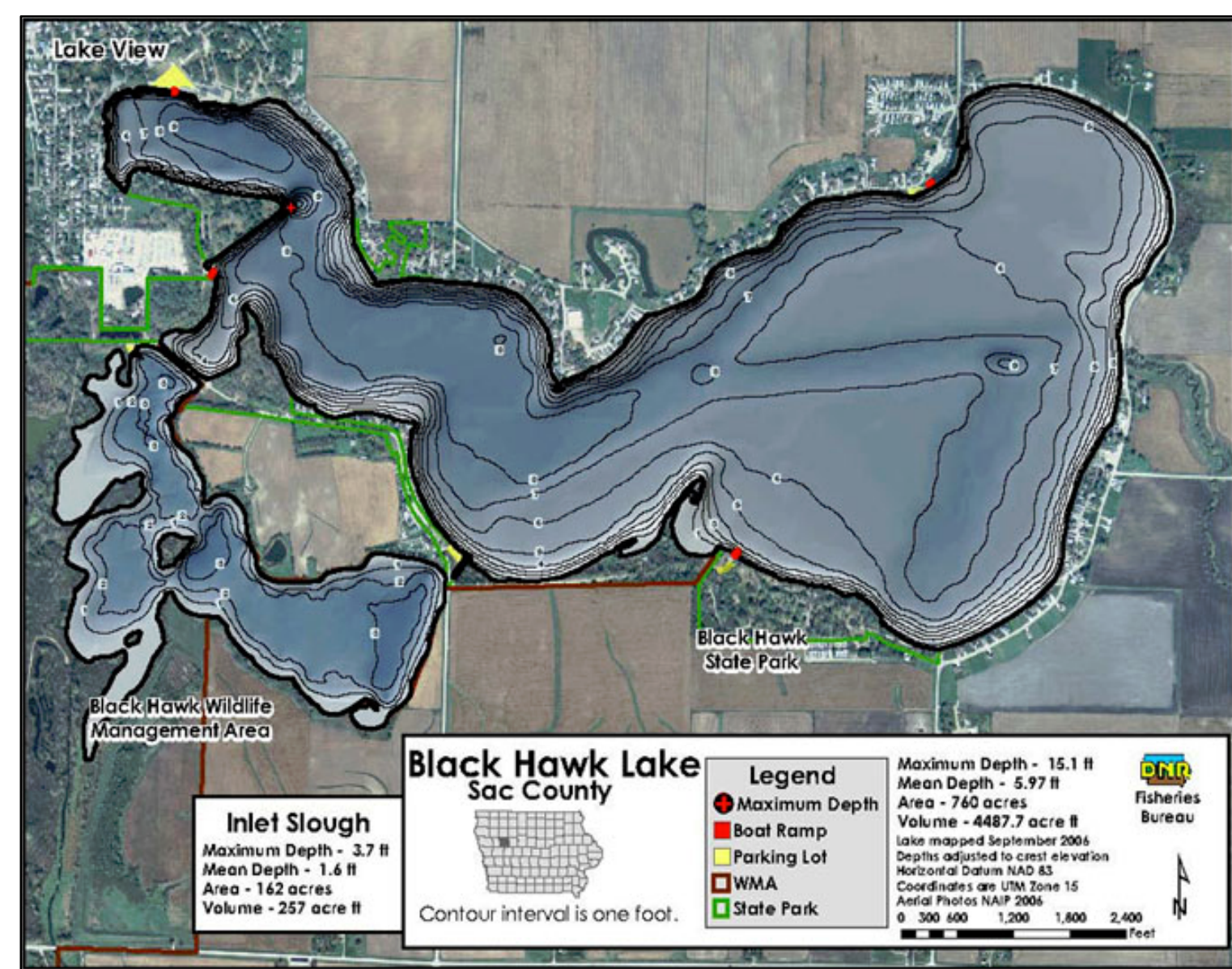


Figure 1: Black Hawk Lake Morphometry

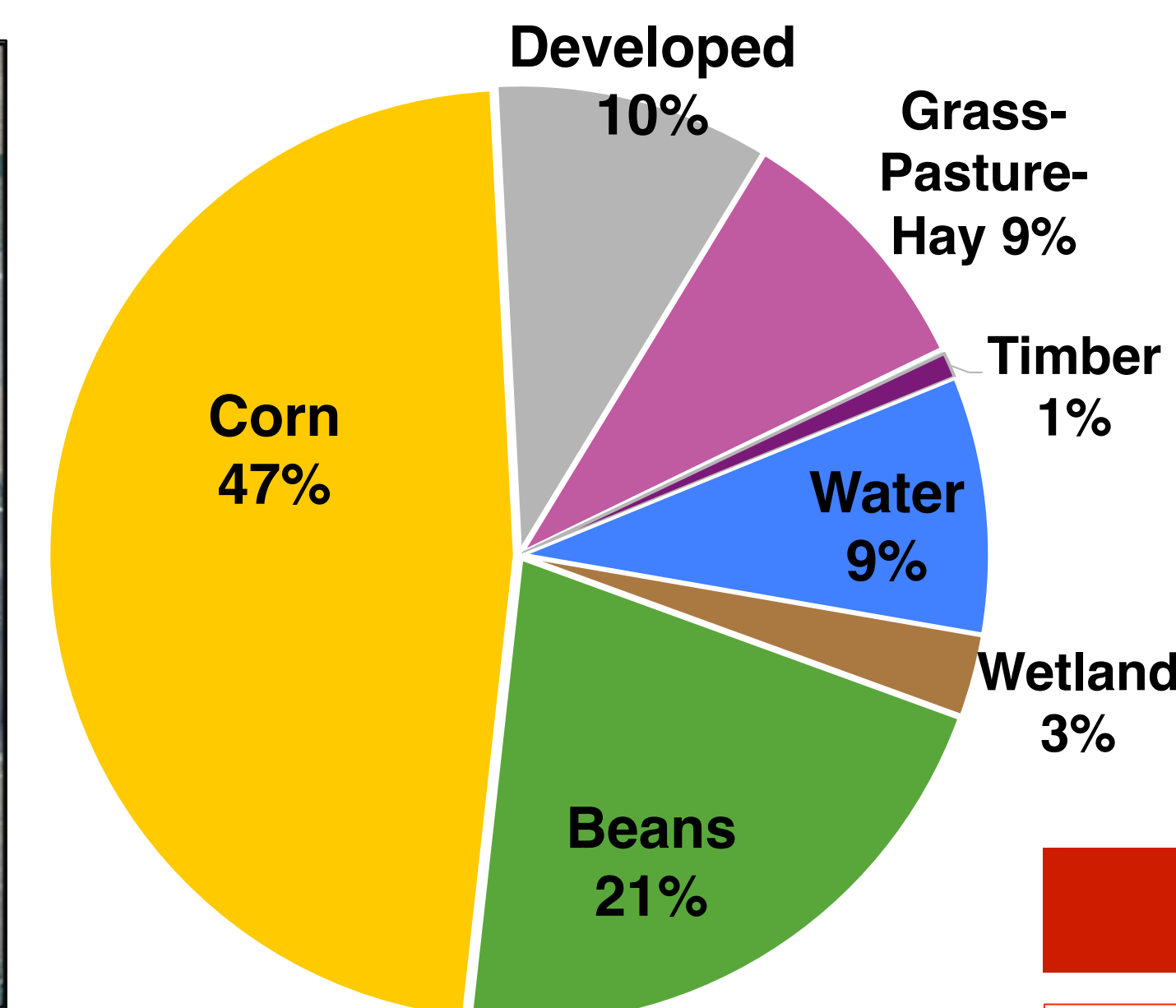


Figure 2: BHL Watershed 2016 Land Distribution

## ANALYSIS

**Sample Collection:**  
 Weekly and Event flow-weighted samples collected with ISCO 6700-Series Automated Sampler + Manual Grab samples

Flow, Level, Velocity, & Precipitation data measured

**Samples Analyzed For:**  
 Nitrate  
 Ammonia  
 Total Nitrogen (TN)



Figure 3: ISCO 6700 Series Sampler

### Study Area Cumulative Precipitation

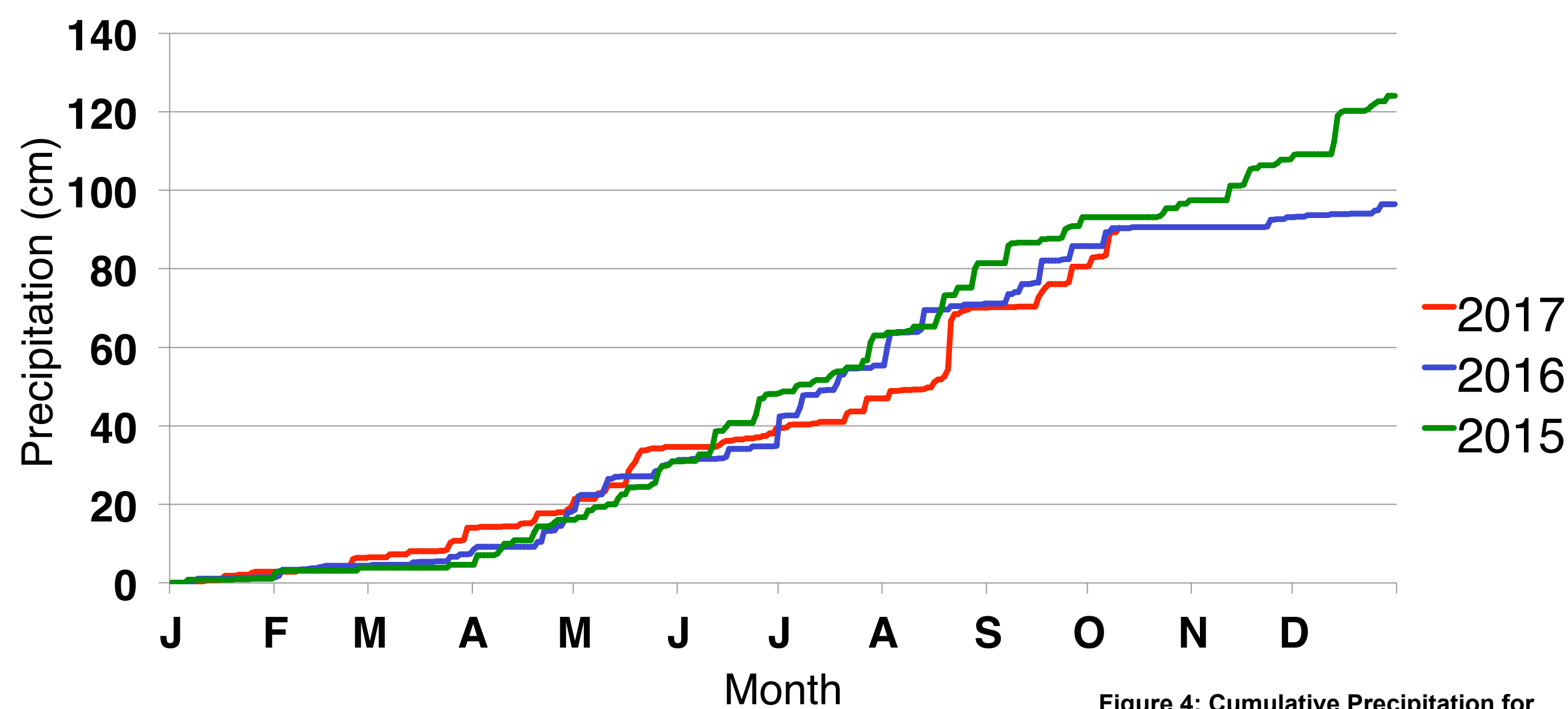


Figure 4: Cumulative Precipitation for BHL Watershed 2015 - 10/10/17

## MONITORING LOCATIONS

### Sub watershed 8

- Area: 804.5 ha
- Samples collected from end of grass waterway (S8) and large tile outlet (T8)
- Low BMP implementation 22.5% of area
- Some terraces, GWWs, and NMPs

### Sub watershed 11

- Area: 229.5 ha
- Samples collected from stream (S11)
- Low BMP implementation 30% of area
- Some terracing, no-till and NMPs

### Sub watershed 12

- Area: 221.4 ha
- Samples collected from stream (S12) and small tile outlet (T12)
- High BMP implementation 87.5% of area
- Extensive terrace work, NMPs and filter strips

### Black Hawk Lake Watershed

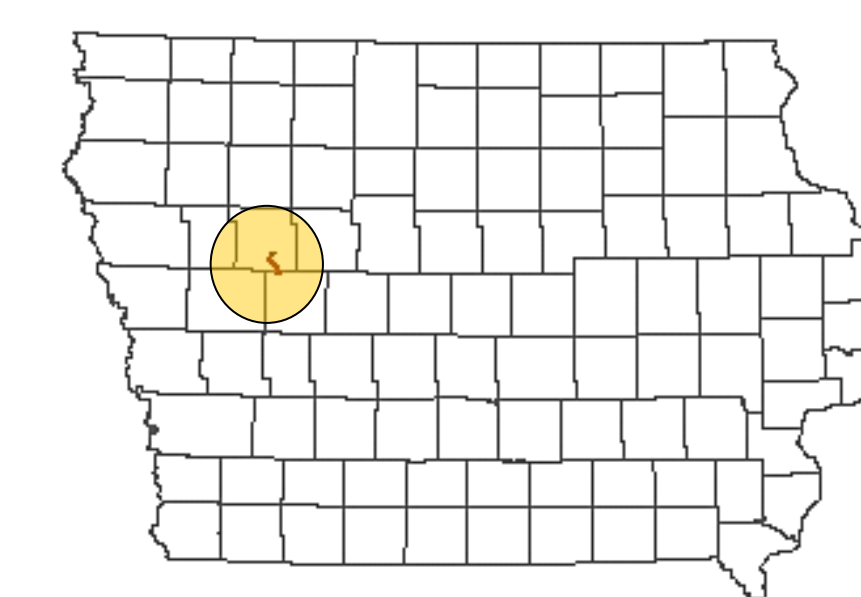
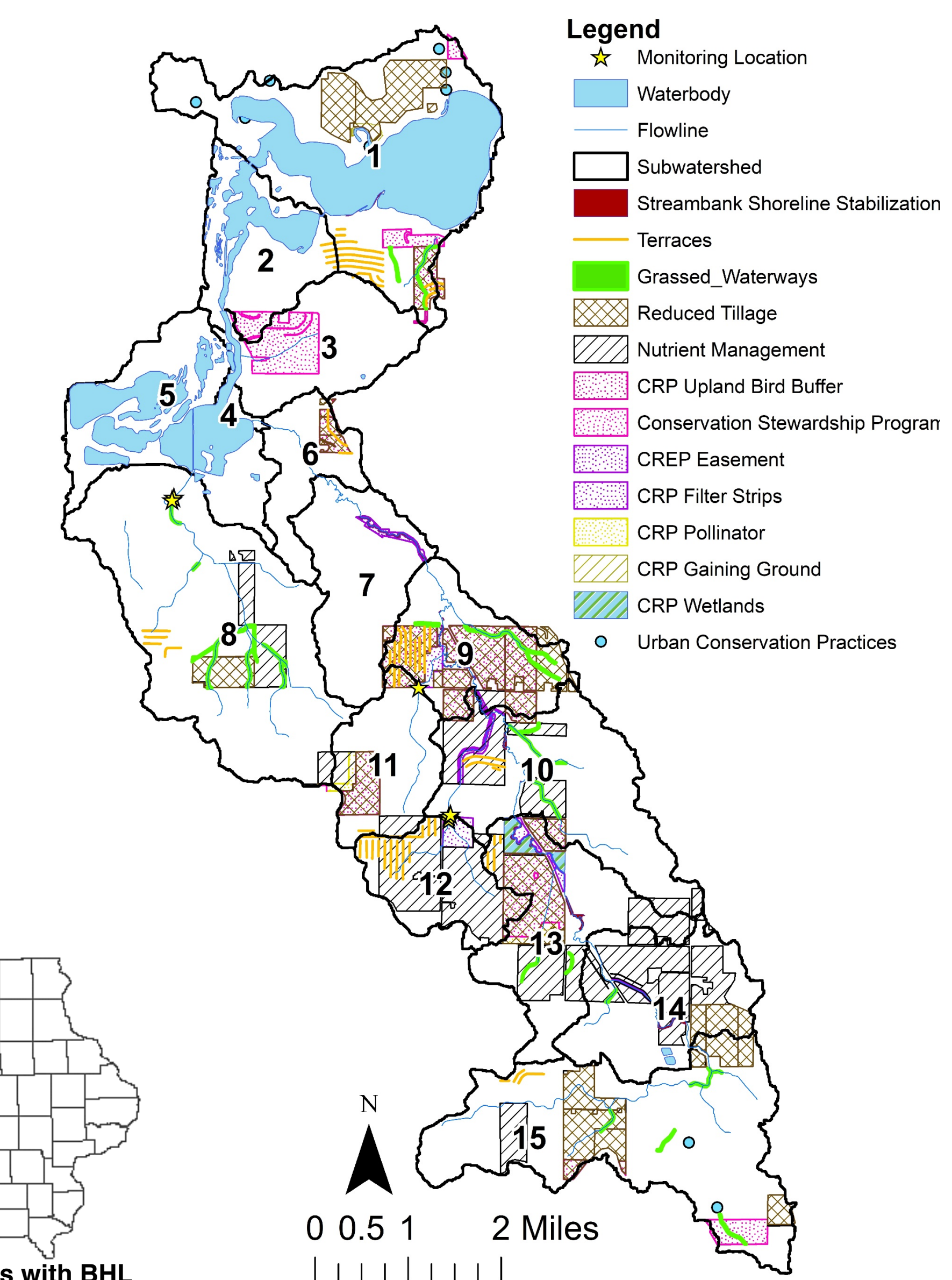


Figure 5: Iowa Counties with BHL Watershed Highlighted

Figure 6: Black Hawk Lake Watershed Monitoring Locations and BMPs



Sampling Location S8 & T8



Sampling Location S12



Sampling Location T12

## FLOW EXCEEDENCE CURVES

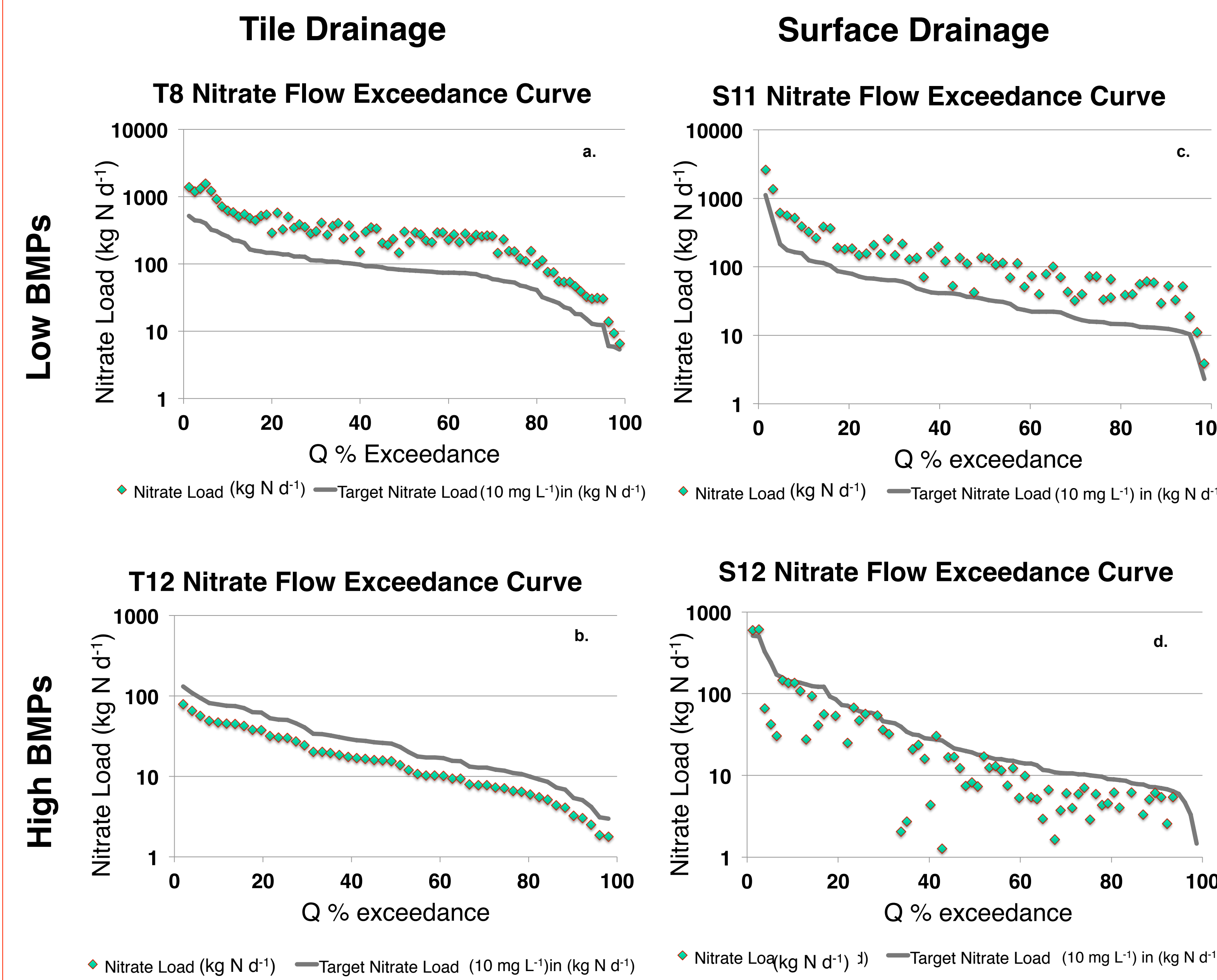
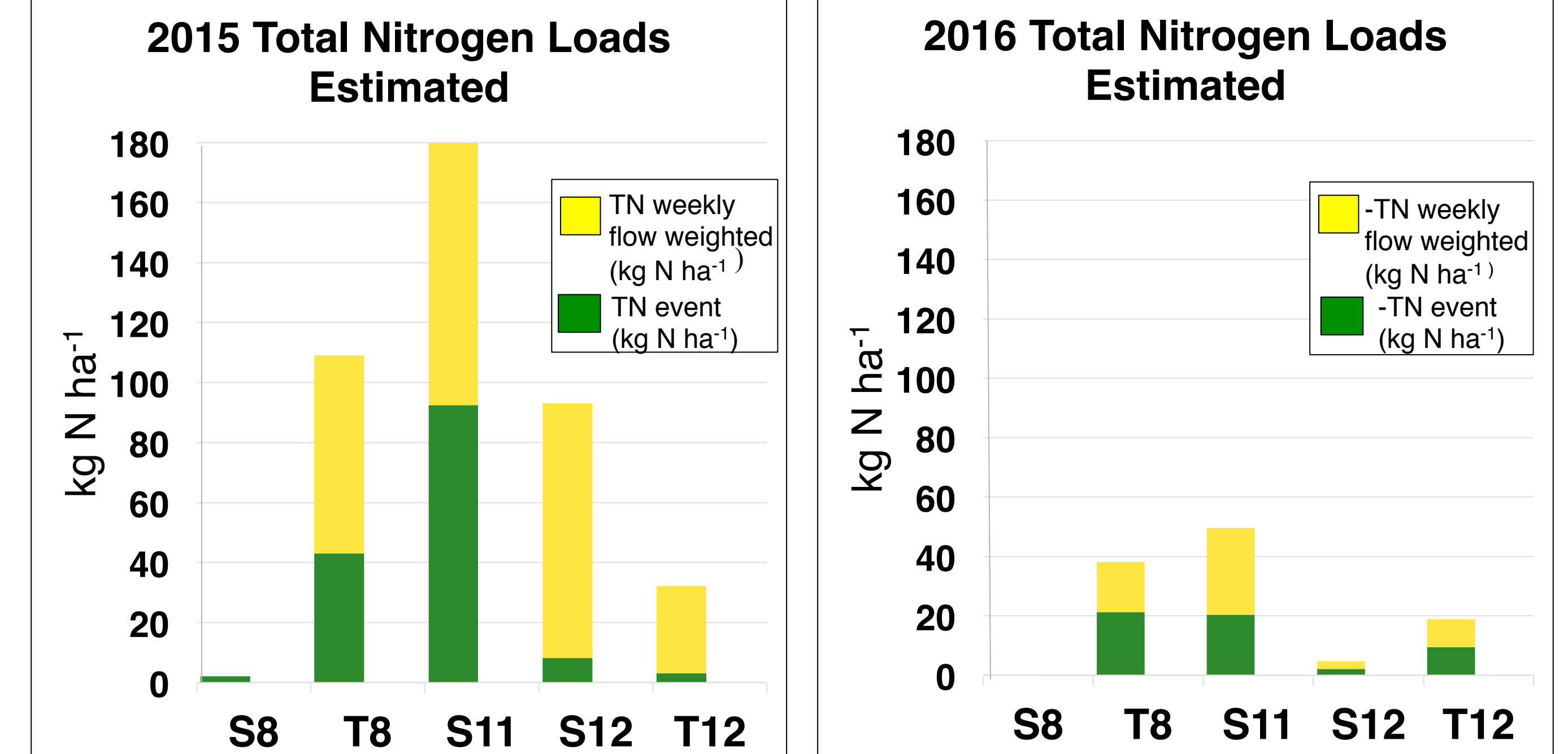


Figure 7 a, b, c, & d: BHL mean flow exceedence curve and nitrate loads by subwatershed

## RESULTS



## CONCLUSIONS

- 2015 was the wettest year in over 50 years.
- BMPs (S12) reduced TN by 30 - 50% when compared to low BMP implementation (S11).
- Nitrate levels exceed the drinking water standard, 10 mg L<sup>-1</sup> nitrate-N, over all flows in low BMP sub watersheds.
- Long-term studies provide important information on level of BMP implementation needed to reduce nitrate loads under a variety of weather conditions.

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References: 1) Samplers, Flow Meters, Syringe Pumps, and Liquid Chromatography Products. Teledyne ISCO, n.d. Web. 09 Mar. 2016. 2) Iowa Department of Natural Resources. Water Quality Improvement Plan for Black Hawk Lake. By Charles D. Ikenberry. N.p.:Iowa Department of Natural Resources Watershed Improvement Section, 2011. Web.

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