Southeastern Wisconsin

Regional Planning Commission

Big Cedar Lake Comprehensive Plan Update

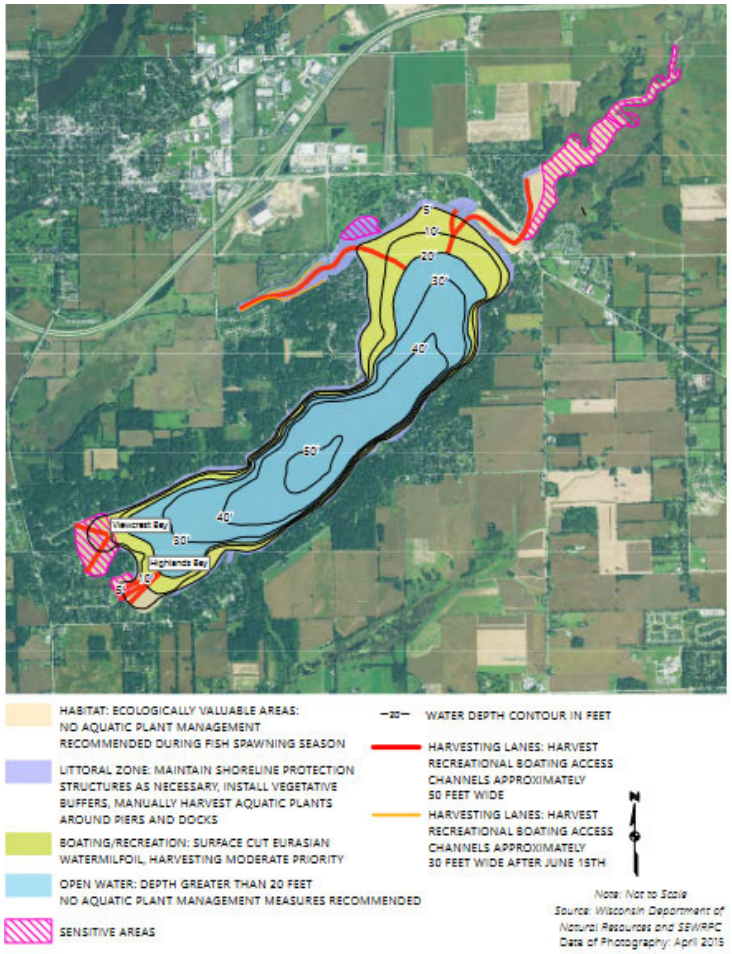
BCLPRD Meeting

November 19, 2024

Outline

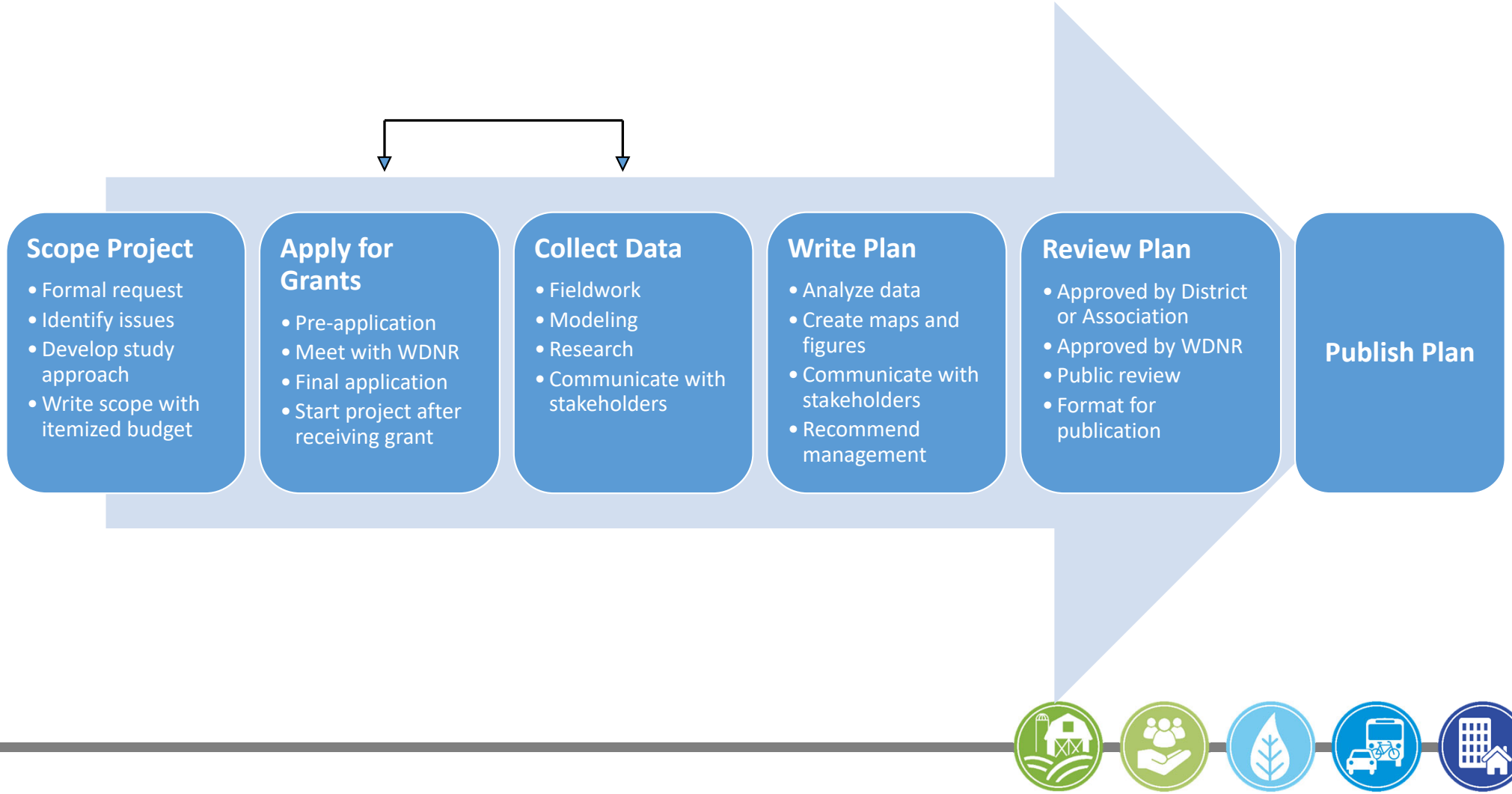
- Comprehensive plan background
  - Lake planning
  - Phase 1 vs. Phase 2
- Phase 1 Findings
  - Water quality impacts from boating
  - Recreational use surveys via drone
  - Shoreline survey
- Phase 2 Update
  - WDNR grant application
  - Additional plan elements

Lake Planning



- Establish community vision and goals for the lake
- Assess current lake condition and historical trends
- Model conditions using projected land use, management practice, and climate information
- Recommend programs and practices to maintain or enhance lake condition
- Identify grant programs to fund recommendations

Timeline for Developing Comprehensive Plan



Background

- District originally requested help preparing comprehensive plan in early 2023
- Decided on list of elements to be included in plan
  - Water quality, watershed characteristics, aquatic plants, septic systems, stormwater system, pollutant load modeling, shoreline conditions, fisheries, and recreational use
- Applied for WDNR grant in 2023 but were unsuccessful
- Split comprehensive plan work into phases
  - Phase 1: completed this year, paid entirely by District
  - Phase 2: to be completed, applying for grant

Phase 1 Overview

- Data-gathering tasks for water quality, shoreline conditions, and recreational use
- Impacts to water quality from recreational use
- Survey each parcel on shoreline and assess conditions
- Survey lake recreational use and evaluate whether lake exceeds “carrying capacity”

Phase 1: Water Quality Impacts

Background

- Sodium arsenite heavily applied to Big Cedar Lake in 1950s as herbicide
- Arsenic concentrations observed in lake sediment in previous studies
- Boating activity can resuspend lake sediment

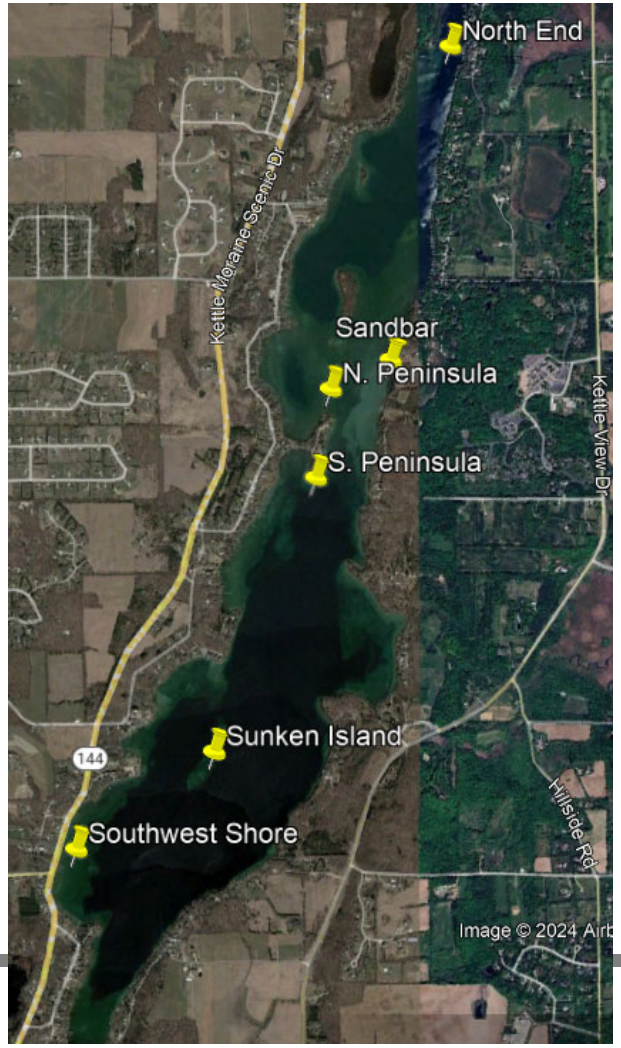
Questions

- Can we still detect arsenic in lake sediment?
- Does boating activity cause detectable concentrations of arsenic in water column?

Approach

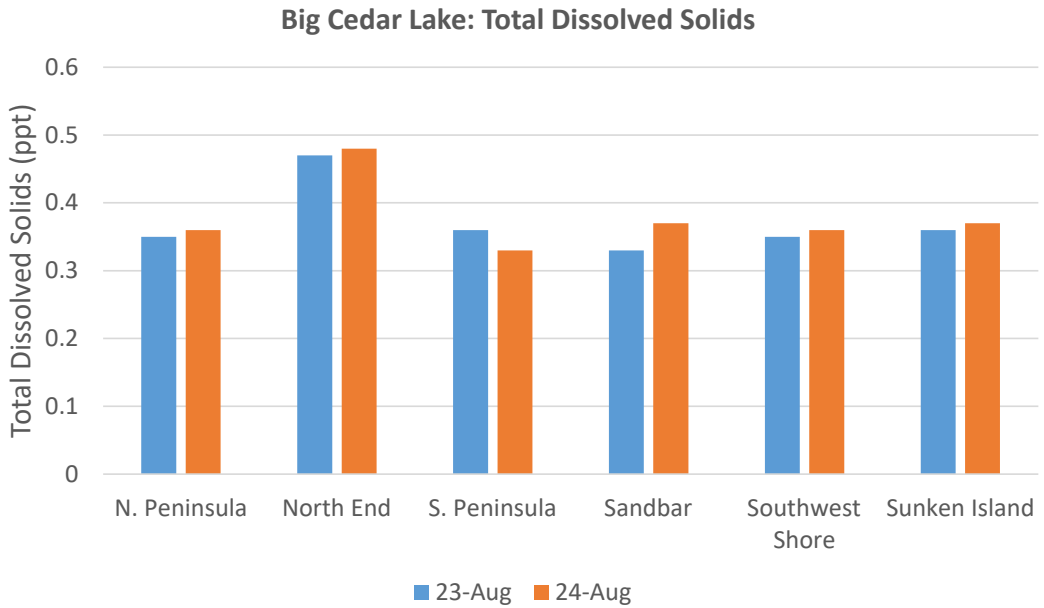
- Test shallow sediment samples for arsenic
- Measure arsenic in water on quiet day and on busy day
- Evaluate changes in nitrogen from human traffic

Phase 1: Water Quality Impacts



- Six sampling locations: fairly shallow and with high boat traffic or other interest
  - North End
  - Sandbar
  - North of Peninsula Drive
  - South of Peninsula Drive
  - Sunken Island
  - Along Southwest Shore
- Two sampling dates
  - "Quiet": morning of Friday, August 23rd
  - "Busy": afternoon of Saturday, August 24th
- Measurements
  - 23rd only: Arsenic in sediment
  - 23rd and 24th: Arsenic in water, specific conductance, total dissolved solids, total nitrogen and ammonia (at Sandbar only)

Phase 1: Water Quality Impacts

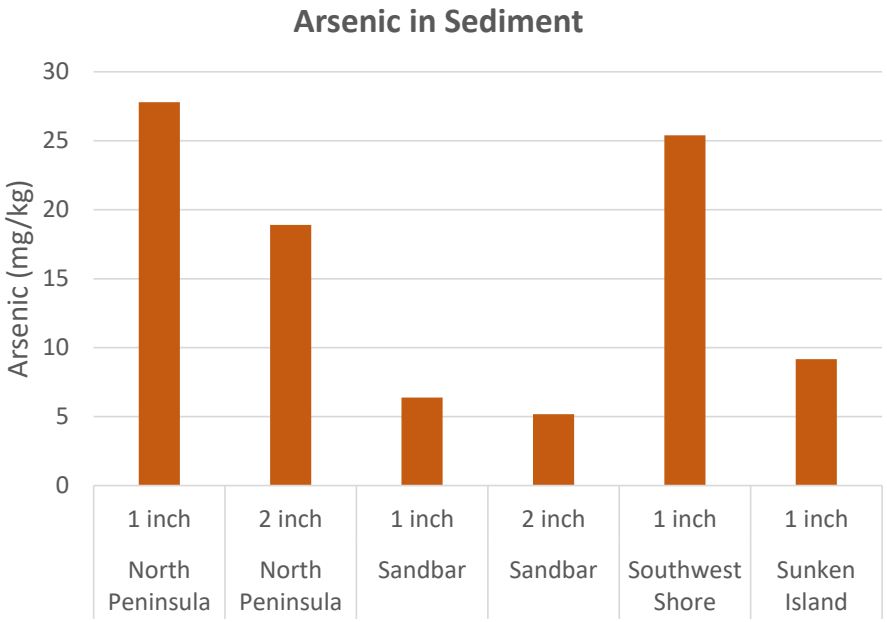


- Visual observations
  - Much more boat traffic on afternoon of 24th than morning of 23rd
  - Water clarity notably lower with suspended sediment visible
  - Higher TDS at most sites on 24th vs. 23rd

Phase 1: Water Quality

Arsenic

- Arsenic in sediment: 5.2 to 27.8 mg/kg
  - Natural concentrations between 5 to 10 mg/kg
- No detectable arsenic in water column on either date
  - Detection limit of 7 µg/L
- Boats are suspending sediment, but not suspending enough arsenic to detect in water



Nitrogen

- Slight increase in ammonia and total nitrogen on 24th
  - Very low concentrations overall
    - Likely within natural range
- More data needed to confirm results

Phase 1: Water Quality Impacts

Phase 1: Shoreline Conditions

Background

- SE WI lakes, including Big Cedar, have highly developed shorelines
- Leads to loss of habitat, shoreline erosion, and poor water quality

Questions

- What are the current conditions of the Big Cedar shoreline?
- What areas are most impacted and how can we improve them?

Approach

- Utilize 2020 WDNR shoreline survey protocol (Hein et al., 2020)
- Assess natural features and human impact on every parcel
  - Riparian zone, bank zone, littoral zone
- Conducted between 8/27 and 9/16 – most boats/docks still in water

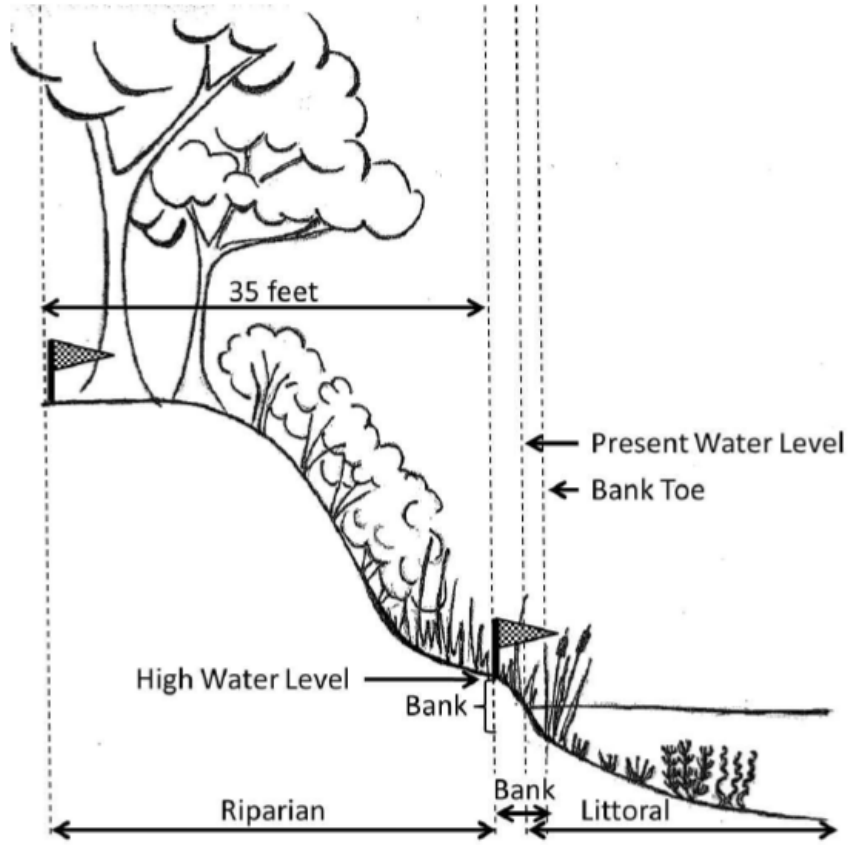
Phase 1: Shoreline Conditions

- Evaluate natural features and human impacts in three zones along lake shore

- Riparian zone
  - 35 feet back from lake

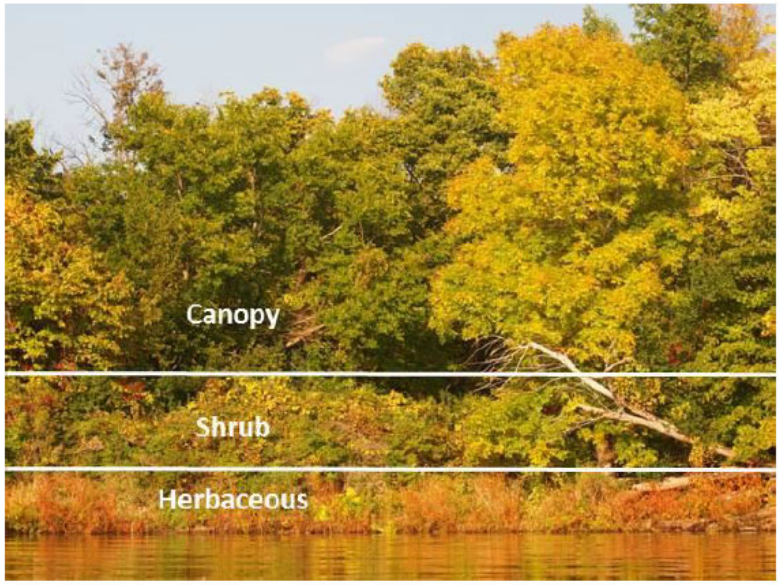
- Bank zone
  - Between high water level and bank toe

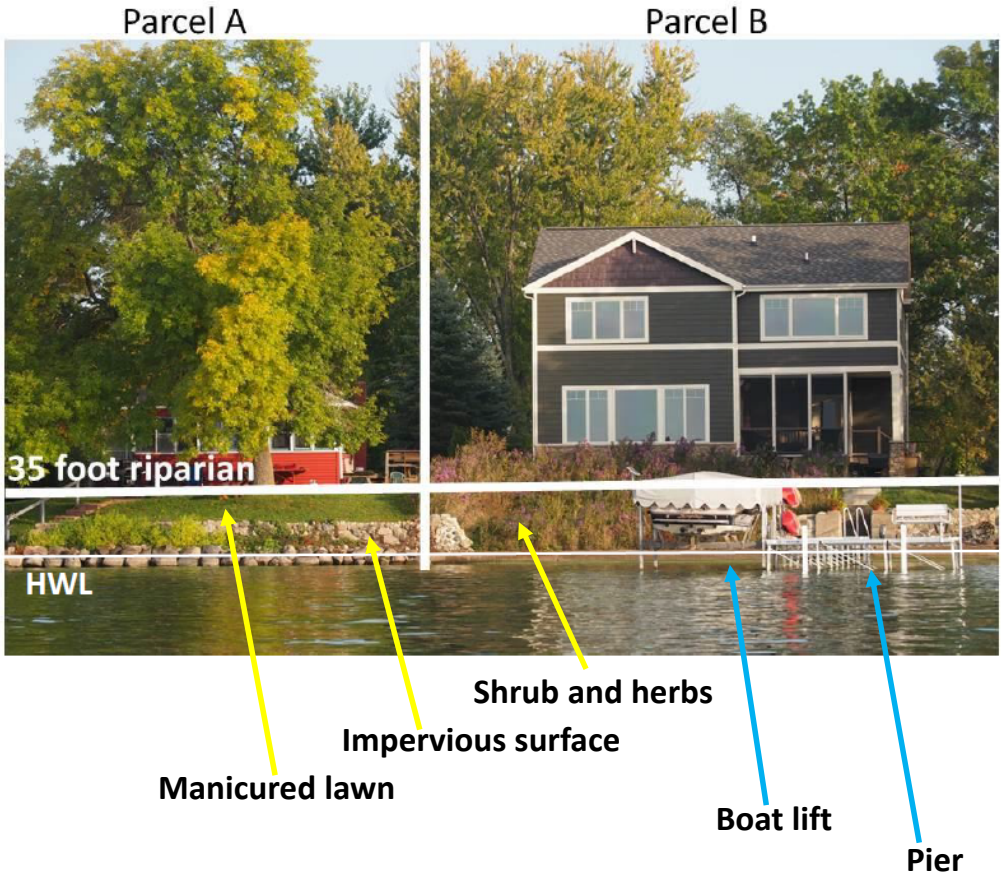
- Littoral zone
  - Nearshore lake area



Phase 1: Shoreline Conditions

- Riparian zone (35 feet back from lake)
  - Assess canopy cover
  - Estimate percent ground cover (lawn, impervious surface, shrubs, beach, etc.)
  - Count human structures (buildings, boats, etc.)
  - Identify runoff concerns (lawn, drain, etc.)





Phase 1: Shoreline Conditions

- Bank zone
  - Assess type of shoreline protection
    - Seawall, riprap, vegetation, other
  - Looks for signs of erosion

Phase 1: Shoreline Conditions

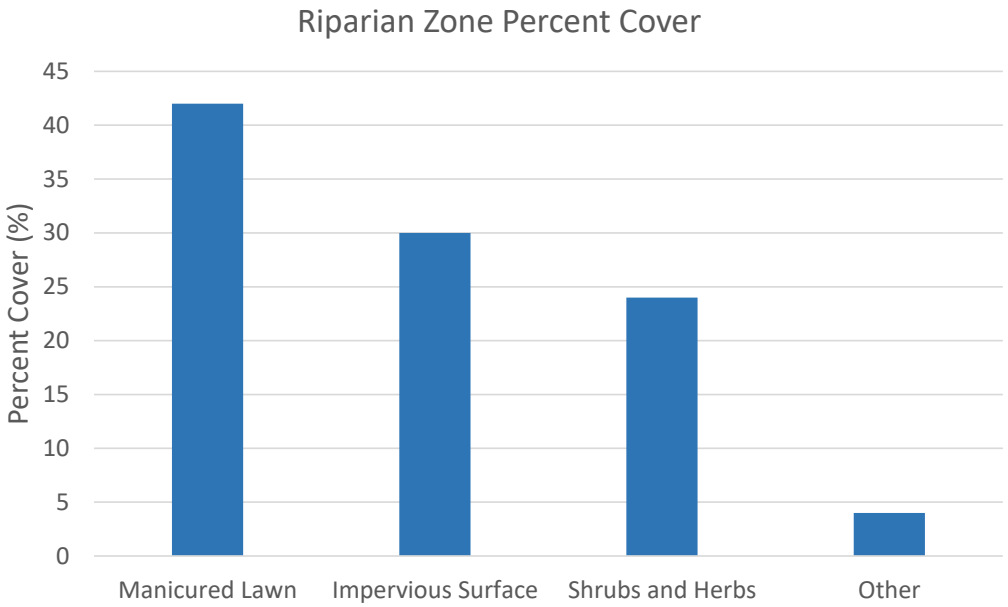
- Littoral zone
  - Number of human structures
    - Piers, boats, boat lifts, etc.
  - Presence of aquatic vegetation
  - Coarse woody habitat

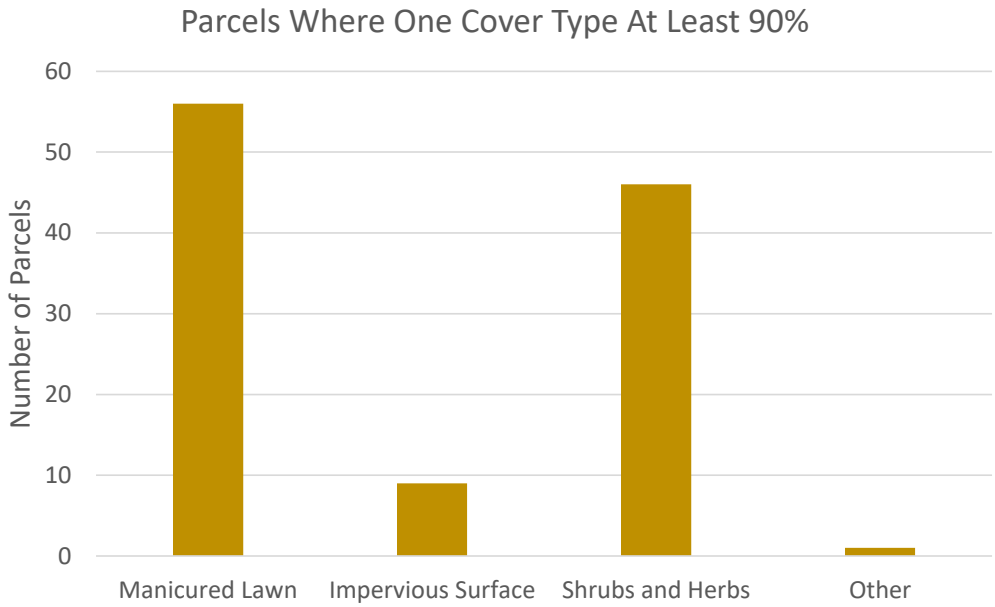

Coarse Woody Habitat


Floating-leaf Plants


Boat Lift with Boat

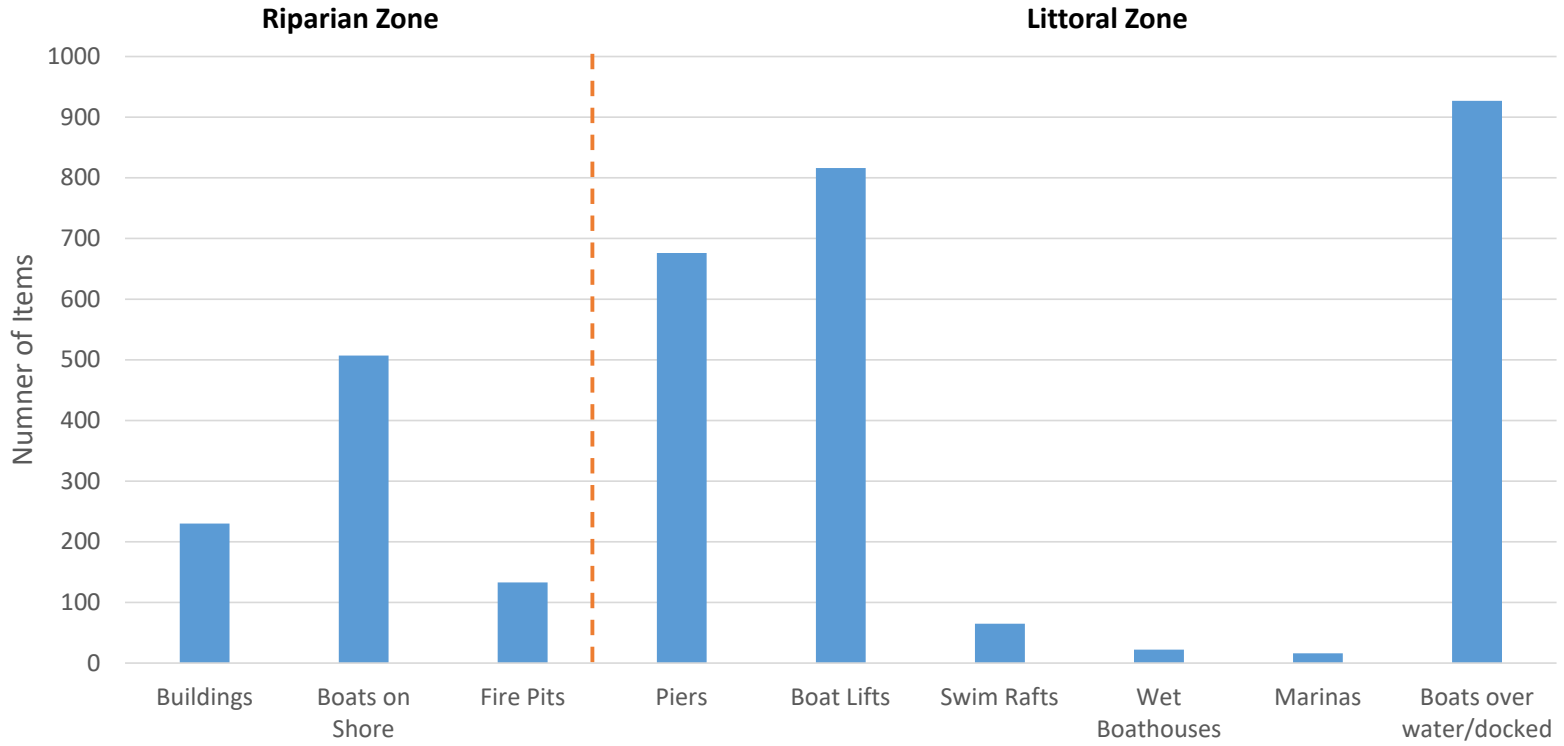
Phase 1: Shoreline Conditions





- Manicured lawn and impervious surfaces most common
- 35% of parcel riparian zones are at least 90% lawn and impervious surface
- 46 parcels have at least 90% natural vegetation in riparian zone

Phase 1: Shoreline Conditions



- Shoreline heavily developed with many structures and boats
  - 1,449 boats counted in total (includes kayaks, canoes, etc.)
  - Average of 1.2 piers and 2.6 boats per parcel

Phase 1: Shoreline Conditions

- Most parcels had at least one runoff concern
  - 429 parcels (78%) with lawn sloping to lake
  - 342 parcels (62%) with trail or stair to lake
  - 41 parcels (7.5%) with bare soil near lake
- Majority of bank zone is heavily armored
  - 6.65 miles of shoreline (60%) with riprap
  - 0.95 miles (8.6%) with sea wall
- 28 parcels had notable erosion along shoreline

Phase 1: Shoreline Conditions

- Limited areas of aquatic habitat
  - 79 parcels (14%) with floating-leaf vegetation
  - 20 parcels with emergent vegetation
  - 17 pieces of coarse woody habitat
- Largest areas on islands and in north basin

Phase 1: Shoreline Conditions

Phase 1: Recreational Use

Background

- Increasing and more intensive recreational uses on lakes
- Concerns regarding safety and ecological impacts

Questions

- What are the recreational uses of the lake?
- What is the “carrying capacity” for the lake?
- Is the lake exceeding that carrying capacity?

Approach

- Survey recreational use via drone on weekdays and weekends
- Use survey data to inform carrying capacity models
- Evaluate if/when carrying capacity is exceeded

Phase 1: Recreational Use

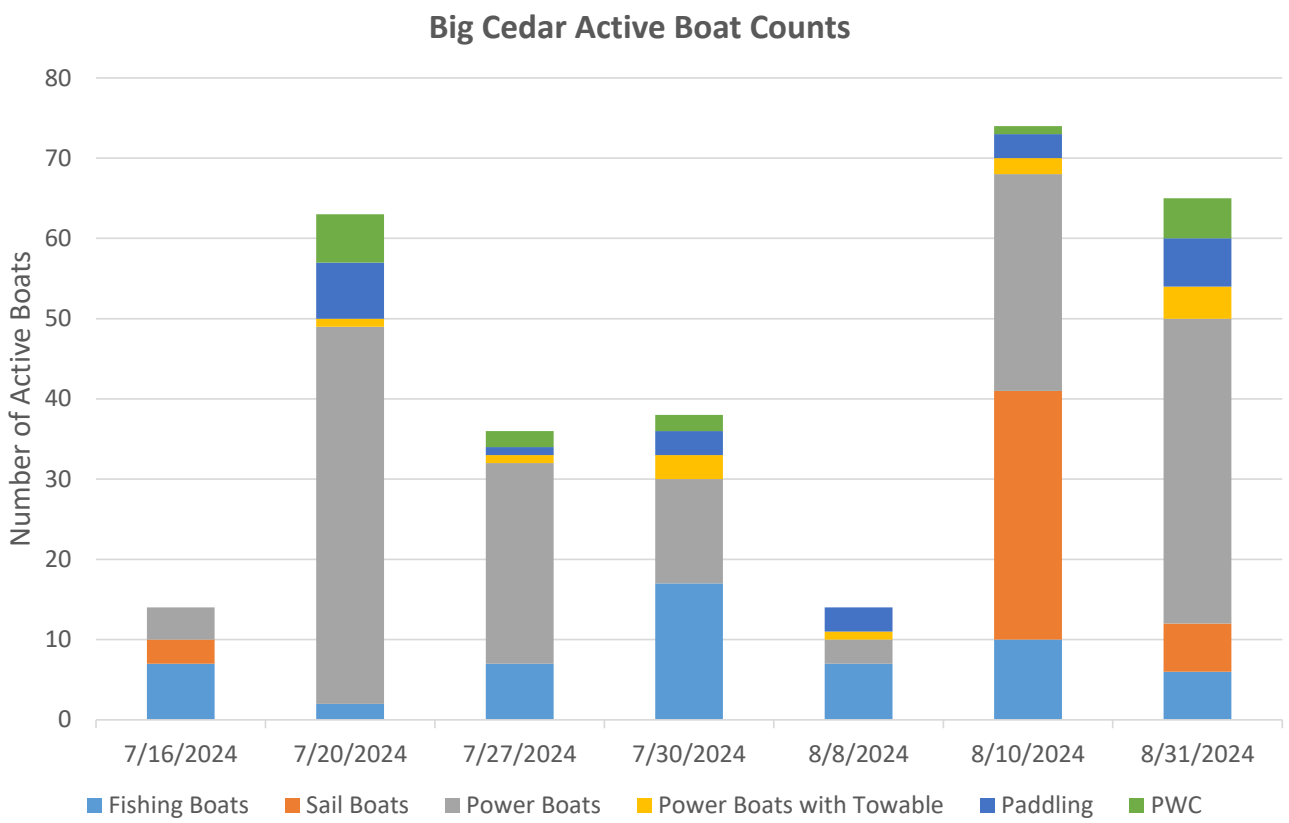
Drone-based recreational surveys

- Drone flights and boat tallies conducted by separate contractor
- Seven flights between 7/16 and 8/31
  - Tuesdays, Thursday, and Saturdays; all warm and sunny days
  - Provide “snapshot” of recreational use during low and high activity
- Data and videos provided to District and SEWRPC

Active boat counts

- Counted and categorized observed boats
  - Fishing boats
  - Sail boats
  - Powerboats
  - Powerboats with towable
  - Paddling
  - Personal watercraft

Phase 1: Recreational Use



- Powerboating most common in most surveys
  - Fishing boats more common on Tuesdays (7/16 and 7/30)
  - More sailing boats on 8/10
- More activity on Saturdays than Tuesday or Thursday

Phase 1: Recreational Use

- Sandbar boat counts:
  - July 20th: 126 boats
  - August 31st: 69 boats
- Moored boat count: August 8th
  - 956 total boats
    - 786 powerboats
    - 50 sail boats
    - 120 personal watercraft
- Photos of cars parked along County Hwy K

Phase 1: Recreational Use

- Lake "carrying capacity"
  - How much use can a lake support and still meet expected standards?
    - What are the ecological impacts from lake use?
    - Are there enough facilities to support use?
    - Is the lake perceived as too crowded?
    - Is there enough space on lake to support use?

- How to determine if capacity exceeded?
  - Ecological: water quality, aquatic biota, etc.
  - Facilities: wait times, parking space vacancies
  - Social: lake user survey
  - Spatial: boat density equations

Phase 1: Recreational Use

- Calculating spatial carrying capacity
  - Count number of boats and their activities
    - Recreational use survey
  - Measure number of useable lake acres
    - At least 200’ from shore
    - Exclude shallow bars
    - Exclude WDNR-designated Sensitive Areas
  - Determine how many acres each boat needs
    - Higher intensity activities need more space
      - Least space: paddling
      - Moderate space: fishing, sailing
      - Most space: water-skiing, jet skis, etc.

Phase 1: Recreational Use

				Carrying Capacity Exceeded?		
Date	*Day of Week*	*Total Boats*	*Boats in Intensive Operation*	*Warren and Rea (1989)*	*Progressive AE (2001)*	*US Bureau of Rec (2011)*
7/16/2024	Tuesday	14	4	No	No	No
7/20/2024	Saturday	63	54	No	**Yes**	**Yes**
7/27/2024	Saturday	36	28	No	No	No
7/30/2024	Tuesday	38	18	No	No	No
8/8/2024	Thursday	14	4	No	No	No
8/10/2024	Saturday	74	30	No	**Yes**	**Yes**
8/31/2024	Saturday	65	47	No	**Yes**	**Yes**

- Carrying capacity exceeded on 3 of 7 surveys in 2 of 3 published models
  - Does not include boats parked at sandbar
  - 3 out of 4 Saturday surveys
- Periods when lake use exceeds recommended boat densities

Phase 1: Recreational Use

Phase 2: Overview

- District applied for WDNR grant this fall to complete phase 2
- Comprehensive plan will incorporate all of phase 1 and phase 2
- Additional elements in phase 2
  - Watershed characteristics
  - Water quality and pollutant loads
  - Septic systems and stormwater management
  - Aquatic plants
  - Fish and wildlife

Phase 2: Additional Elements

- Watershed characteristics
  - Map soils, topography, land use, environmental corridors, and other features within watershed
- Groundwater
  - Delineate area contributing groundwater to lake
- Septic systems
  - Examine septic system records and model potential pollutant loading to lake
- Stormwater management
  - Evaluate stormwater management practices and model potential pollutant loading to lake
  - Recommend locations and types of new stormwater practices and provide estimated design costs
- Pollutant loading
  - Identify highest loading sources and areas
  - Recommend practices and programs to mitigate pollutants

Phase 2: Additional Elements

- Water quality
  - Compile and interpret water quality data to evaluate trends in lake health
- Aquatic plant management
  - Summarize recent APM plan and provide context for holistic lake management
- Fish and wildlife
  - Provide information regarding species and habitats in watershed, particularly for species of concern
    - Recommend how to protect, expand, and enhance these habitats
  - Summarize fish survey and fishery management goals, with focus on two-story fishery

Thank You

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