**DEPARTMENT OF
NATURAL RESOURCES**

Watershed Health Assessment Framework (WHAF): Lakes

Use Guide

Open the WHAF for Lakes Application

Option 1: Launch the WHAF for Lakes application through the main WHAF map.

- Click on the map to set your location.
- Open 'Charts and Reports'.
- Select the scale you want to use to investigate a list of lakes.
- Click the **WHAF for Lakes** button.

Option 2: Launch the WHAF for Lakes application directly in your browser.

- The default map displays the major watershed boundaries.
- Select a major watershed from the map or select from the **Major Watershed** dropdown list.
- Or select a different exploration boundary from the scale dropdown list.

Option 3: Select a Specific Lake

- Launch the WHAF for Lakes application.
- Open Menu (Upper right corner).
- Select **Lake Details.**
- **Lake Search** is now active in the upper left.
- Enter a lake name or lake ID number and select your lake from the list.

Select an Area

- Select a new area to refresh your list of lakes.
- Use **Scale** to select a new exploration boundary (Catchment, Upstream, Major Watershed, Basin, County).
- Use the map or the second dropdown list to select a location at that scale.
- At the catchment or upstream scale, you can also enter a catchment number to zoom to that location.
- Depending on your screen width, your search results may appear to the right of the map or below the map.

Map Tool Set

Map tools with scale boundary selected:

Scored Lakes within Area

The table lists all the lakes with a health score that fall within your selected boundary. The table includes the overall Health Score and the three Component Scores that are averaged to create that value. A Lake Health Grade and other basic lake characteristics are also included in the table. The table can be sorted on any header field. The table can also be downloaded as an Excel or comma-delimited text (CSV) file.

Select a lake from the list

- Use the magnifier icon to **zoom the map** to that lake.
- Click a lake name in the table to open **Lake Health Details** for that lake.

After selecting a lake, the map will zoom to that lake and the Lakeshed Tool will appear:
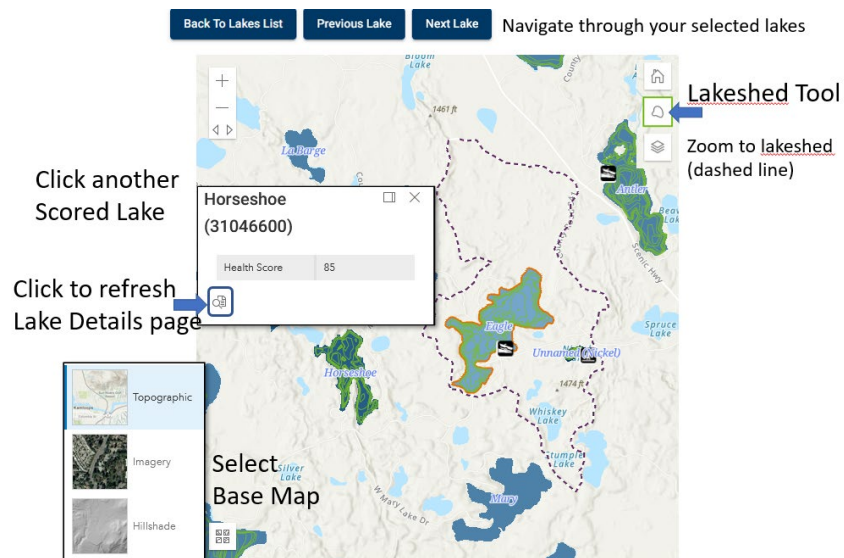
Select a new lake from the map.

- Use the map to zoom or pan to select another scored lake.
- Click the button in the popup (bottom left) to select a new lake.
- This will recenter the map and refresh the lake details page.

Lake Health Summary Page

Explore the Health Summary for your selected lake. There is an overall Lake Health Score along with sub-scores for each component. The summary page also displays the mean (average), minimum, and maximum health scores for all the lakes found within your major watershed. Those values can help you compare your lake to the other lakes in the same major watershed. Scroll down the summary page for tables that hold additional basic information about your lake.

SUMMARY   WATER QUALITY   BIOLOGY   HYDROLOGY   STEWARDSHIP

Component Pages

Use the tabs (top-right or below the map) to navigate to each Lake Health component page and to a Stewardship page for your lake.

- For example, click 'Water Quality' to open a new page that shows how your lake scored for different aspects of water quality.
- Use the **Learn More** buttons to understand each health concern and how the data was used.
- Click Stewardship for information on risks and opportunities to improve and protect lake health.

Creating a Lake Health Score

The diagram (next page) shows of the hierarchy of inputs into each Lake Health Score. The arrows show how scoring metrics are used to calculate each of the index scores; and how index scores are then combined into one score for each component. The mean of the three component scores becomes the overall Lake Health Score.
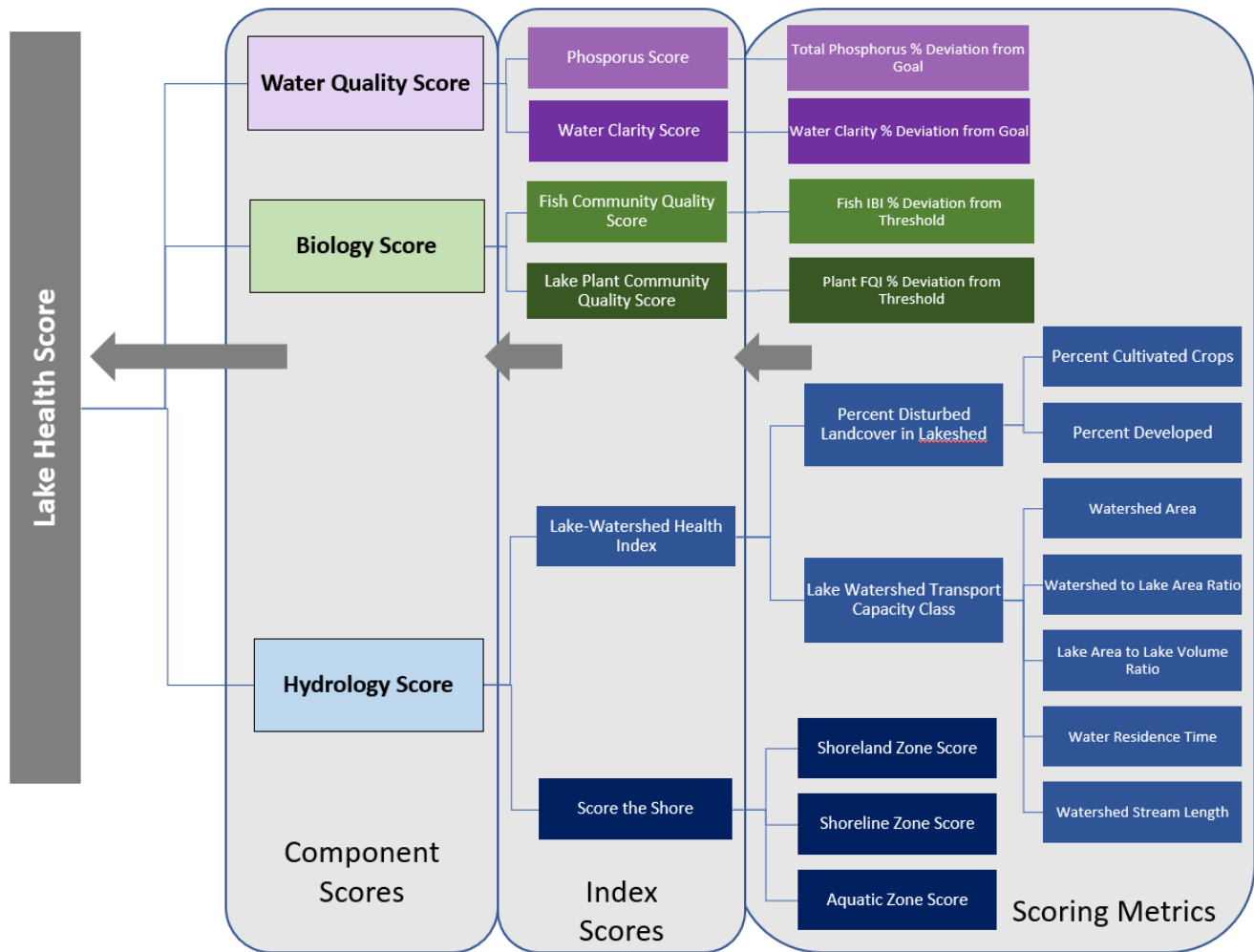
Diagram showing hierarchy of data values used to create the Lake Health Score

List of Lake Health Score Data Inputs:

- **Lake Health Score**
  - **Water Quality Score**
    - Phosphorus Score (WQ Score input #1)
      - Total Phosphorus % Deviation from Goal
    - Water Clarity Score (WQ Score input #2)
      - Water Clarity % Deviation from Goal
  - **Biology Score**
    - Fish Community Quality Score (Biology Score input #1)
      - Fish IBI % Deviation from Threshold
    - Lake Plant Community Quality Score (Biology Score input #2)
      - Plant FQI % Deviation from Threshold
  - **Hydrology Score**
    - Lake-Watershed Health Index (Hydrology Score input #1)

- Percent Disturbed Landcover in Lakeshed
  - Percent Cultivated Crops
  - Percent Developed
- Lake Watershed Transport Capacity Class
  - Watershed Area
  - Watershed to Lake Area Ratio
  - Lake Area to Lake Volume Ratio
  - Water Residence Time
  - Watershed Stream Length
- Score the Shore (Hydrology Score input #2)
  - Shoreland Zone Score
  - Shoreline Zone Score
  - Aquatic Zone Score

Lake Health Scores and Grades

There are almost 3000 lakes in Minnesota that have been given an overall Lake Health Score using the data described above. The overall scores can range from 0 to 100.

The figure shows of the distribution of scores for the 2939 lakes evaluated for lake health across Minnesota. The figure shows overall Lake Health as well as each contributing component (Water Quality, Biology, and Hydrology). The 'box and whisker' plot is included to compare lake scores. The center black line within each box depicts the median score. Black box extends from the 25th percentile at the bottom to the 75th at the top (i.e., the interquartile range). The black 'whiskers' help identify outliers (whiskers end at 1.5x the interquartile range). Each individual-colored circle in the box plot below represents the score of a single lake.
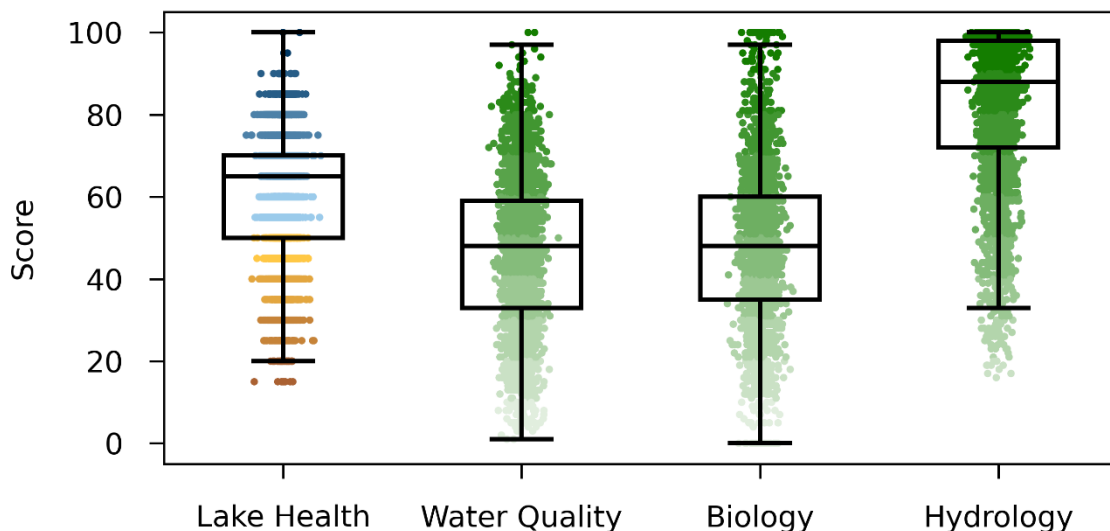

Figure showing distribution of lake health and component scores across Minnesota

Overall health scores converted to grades:

The overall Lake Health Score is then converted to a health grade to help compare your lake to others nearby or across all of Minnesota. This grade is designed to represent lake health for a single snapshot in time and to be a starting point to learning about the different components and conditions that are influencing the health of Minnesota lakes.

Grade	Range	
A+	91-100	An A+ grade is only obtained by 4 lakes in Minnesota. This indicates the highest health condition considering available data and that the lake should be valued and protected with strong stewardship actions.
A	81-90	
B+	71-80	The majority of Minnesota lakes fall within the A-B range (51%). These lakes should be monitored and protected so that risks in their shoreland and lakeshed areas are minimized to keep this healthy condition into the future.
B	61-70	
C+	51-60	
C	41-50	Many lakes are graded between a C+ and D+ (44%). This overall grade results from a wide range of input scores. It is particularly important to explore details about each input to understand which conditions are creating risk or health impacts as well as finding opportunities to protect good conditions.
D+	31-40	
D	21-30	
F+	11-20	D-F lakes make up about 6% of the scored lakes. This grade indicates the need to take action to improve the health condition. It may also indicate a high level of risk that may further degrade a lake if not addressed or mitigated for.
F	0-10	

What action should be taken to support lake health?

No matter what grade a lake currently receives, all of Minnesota's lakes require stewardship actions to keep them as healthy as possible, improve lake health when there are challenges, and address risks that may already exist or are expected to emerge.

It is important to remember that lake health is influenced by conditions in and near the lake as well as conditions and activities across the broader landscape or 'lakeshed'.

Suggestions for Action:

- Lakeshore owners can take action on your own property to provide benefits for fish, wildlife, habitat and water quality.
    - Learn more about why maintaining and restoring natural shorelines is beneficial.
    - Apply best management practices on shoreland properties to support lake health.
    - Participate in the Score your Shore survey for lakeshore property owners to self-assess lakeshore habitat and find suggestions for lakeshore friendly actions.
    - Join forces with your neighbors or lake association to make a bigger impact.

- Natural resource professionals can compare lake health and prioritize actions for different management objectives.
    - Identify and protect high quality resources, take action on public lands to build resilience to future risks.
    - Educate others on actions that have the greatest impact on lake health.
    - Form partnerships to restore lake health to lower quality systems, address existing risks and impairments.
- For local officials and decision makers
    - Consider mitigation measures for projects that directly increase risk to a lake.
    - Identify high value lake resource and protect conditions that are contributing to lake health.
    - There are many programs and initiatives that seek to restore conservation lands.
    - Use lakeshed boundaries when considering an increase in impervious surface, contaminant sources, or vegetation removal; which lakes could potentially be impacted by the increased risk?

Questions and comments can be sent to WHAF.DNR@state.mn.us.