Score the Shore Metadata

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This document serves to explain and help others navigate the Score the Shore data document, which can be found here. Each column will be defined and an explanation of the type of data provided. Additionally, this field guide can provide additional context to how shorelines were evaluated in the field at the time of surveys being conducted. For visual references on each of the categories and examples of what this process looked like in the field, please refer to the Clear Lake 'Score the Shore' Field Data Collection Drive. It may also be helpful to reference the hard copy of the data form developed by the Michigan Clean Water Corps that we adapted to be used on Clear Lake.

All STS Data Page

Site information

- **Region**
    - On the data sheet, the data is ordered by region alphabetically. To see where the regions correlate on a map, refer to the image on the "Regional Data" tab or the maps on the Score the Shore StoryMap, specifically the one located under the header "Taking a Closer Look"
    - The lake was broken up into regions to help organize the data and to be able to compare distinct areas to one another. Although this is not something that was part of the procedure developed by Michigan nor used in Minnesota, it was done here because of the large size of Clear Lake
- **Site ID**

    - Site ID numbers were used to identify and name transects in the field. The numbers were arbitrarily given, but generally go up numerically clockwise.
    - A map with transects labeled can be found under the header "Taking a Closer Look" on the Score the Shore StoryMap
- **Rumsey Level at Time of Survey**
    - Lake levels can make a big difference in how the shoreline looks at the time of surveying. For Clear Lake, zero Rumsey is equivalent to 1318.25 feet above sea level (1929 NGVD) and full lake is established as 7.56 feet on the Rumsey gage.
    - This data set's maximum Rumsey level was 1.2, and the minimum was -1.4
- **Date of Survey**
    - Date that the field survey was completed
    - Surveying began on April 2nd, 2021 and was completed on April 4th, 2022; performed sporadically throughout the period

<u>Development *(this category does not get included in the Scoring process, but is used to determine developmental density)</u>

- **Number of Homes/Major Buildings**
    - The number of homes/buildings was counted after the beginning and end of the transect had been identified by the surveyors. In order to count, a home or major building had to be within the Upland Zone, or about 100 feet from the shoreline. When there were homes/buildings with docks on the shoreline but were further back from the shore, and especially if there was a road in between the home and shoreland, the home/building was not counted. In cases where there was a high density of smaller

structures, such as if a permanent caravan park was located on the shore, each structure was counted separately.

- **Number of Docks/Boatlifts**
    - The number of docks/boatlifts was counted after the beginning and end of the transect had been identified by the surveyors. Docks/boatlifts were only counted separately if they did not connect in any way. If there was a gangway between a boatlift and a dock, it was counted as one structure.

<u>Littoral Zone (Area right along shoreline, including characteristics in the water)</u>

- **Percent Emergent/Floating Vegetation or Natural Rocky Shoreline**
    - Tules are the primary species that qualified as Emergent/Floating vegetation. As native shoreline plants, tules provide ecosystem services, are habitat for fish and wildlife, reduce shoreline erosion, and can improve water quality. Throughout the year, tules change appearance and can appear brown and "dead" during the winter, but tules were still counted regardless of appearance. During the winter, it's normal for tules to turn brown, but the tubers (the underground root systems) are very much alive and will sprout green tules in the spring.
    - Natural Rocky Shoreline is shoreline in which vegetation does not naturally grow in the littoral zone because of rocky lakebed. Not to be confused with shorelines where vegetation was removed and rocky substrates were brought in, a Natural Rocky Shoreline should be reasonably unchanged by human presence. This was somewhat rare around the lake and most likely to be found in undeveloped areas.

    - For this category, Surveyors would do their best to accurately portray what percent of the shoreline's littoral zone had either Emergent/Floating Vegetation or a Natural Rocky Shoreline. This was performed most easily by surveying from about 100 feet from shore in order to see the whole transect at one time and make a judgment. There were 5 possible scorings, depicted in the spreadsheet by only the single digit that corresponds to a percentage range:
        - **0** - None
        - **1** - Less than 10%
        - **2** - 10 to 25%
        - **3** - 26 to 75%
        - **4** - Greater than 75%
- **Visibility of Submerged Vegetation**
    - Visibility of submerged vegetation in Clear Lake is very dependent on the time of year. In the winter, general visibility is low and submerged vegetation is out of season, and in the summer, submerged vegetation flourishes and may be easier to see.
    - "**Yes**" was selected when submerged vegetation was able to be seen, and "**No**" was selected when the surveyors could not say for certainty if submerged vegetation was present.
- **Percent Submerged**
    - If "Yes" was selected for the above question, surveyors were presented with the question of what percent of the littoral zone had submerged vegetation. The scoring was decided based on the density of submerged vegetation that was visible 20-30 yards from shore. There were 5 possible scorings, depicted in the spreadsheet by only the single digit that corresponds to a percentage range:

        - **0** - None
        - **1** - Less than 10%
        - **2** - 10 to 25%
        - **3** - 26 to 75%
        - **4** - Greater than 75%
    - If "No" was selected, this question was not answered
- **Is Aquatic Plant Management Evident or Known?**
    - This question refers to any obvious signs of vegetation removal or treatment. Sometimes, the lack of tules on one property contrasted with their presence on a neighboring property would indicate to the surveyors that tules had been removed. In some cases, tule removal was obvious due to their lack of presence in swim areas or boat ramps, or occasionally, tules appeared to be artificially sprayed with a herbicide and were discolored and damaged. In rare instances, property owners were also seen using solarization sheets on lakebed vegetation. Alternatively, plant management may have been known through permitting or if there were specialized treatments on record.
    - Surveyors used their best judgment to score this question, which had 3 possible scorings, depicted in the spreadsheet by only the single digit that corresponds to a percentage range:
        - **0** - No
        - **-1** - Minor (at docks or swim areas)
        - **-2** - Major
- **Amount of Downed Trees/Woody Debris**
    - Downed trees and woody debris is of importance because it provides littoral habitat for fish and wildlife, especially fish

    - Surveyors counted, to the best of their ability, the amount of downed trees and woody debris. There were 4 scoring options, depicted in the spreadsheet by only the single digit that corresponds to the number of downed trees:
        - **0** - None
        - **1** - Few, 1-5
        - **2** - Several, 6-15
        - **3** - Many 16+
- **Is There Erosion Along the Shoreline?**
    - If any erosion was visible to the surveyors, it was noted in this category. It could be severe and obvious, with large rocks or sediment portions slumping into the water, or more subtle, with the shoreline shape suggesting that erosion has been taking place through wave action.
    - Surveyors determined the amount of erosion to the best of their ability and categorized it into one of 4 scoring options, depicted in the spreadsheet by only the single digit that corresponds to the severity of erosion:
        - **0** - None Observed
        - **1** - Minor
        - **-2** - Moderate
        - **-3** - Severe
- **Littoral Zone Raw Score (If Sub Veg Present)**
    - The raw score of the littoral zone was calculated by adding together the single digit numbers of each category within this section, taking into account negative numbers. If submerged vegetation was present, the raw score undergoes a different

equation than raw scores that include scoring on submerged vegetation.
    - For example, looking at the Littoral Zone data for Site ID BIGV1, the raw score was calculated as such: (emergent/floating veg/rocky shoreline score) + (submerged veg score) + (aquatic plant management score) + (woody debris score) + (erosion score) = 4 + 4 + 0 + 1 + 0 = **9**
- **Littoral Zone Raw Score (If NO Sub Veg)**
    - The raw score of the littoral zone was calculated by adding together the single digit numbers of each category within this section, taking into account negative numbers. If submerged vegetation was NOT present, the raw score will not include the submerged vegetation category score, and the raw score undergoes a different equation than raw scores that include scoring on submerged vegetation.
    - For example, looking at the Littoral Zone data for the Site ID BUCK1, the raw score was calculated as such: (emergent/floating veg/rocky shoreline score) + (aquatic plant management score) + (woody debris score) + (erosion score) = 3 + 0 + 3 + 0 = **6**
- **Littoral Zone Final Score**
    - This calculation system was created by the Michigan Clear Water Corps in order to weigh different factors to different amounts. The Littoral Zone final score will be used to determine the overall Final Score of the entire transect with other section scores. In the spreadsheet, the Littoral Zone final score is rounded to the nearest whole number.
    - If Sub Veg was present, the calculation from the Littoral Zone raw score to final score was as follows:

        - (Raw Score) * 6.2 + 31.3 = Final Score
        - Example using **BIGV1**: (9) * 6.2 + 31.3 = **87.1**
    - If Sub Veg was NOT present, the calculation from the Littoral Zone raw score to final score was as follows:
        - (Raw Score) * 8.3 + 41.5 = Final Score
        - Example using **BUCK1**: (6) * 8.3 + 41.5 = **91.3**

<u>Riparian Zone (Area of land along the shoreline, going back about 100 ft)</u>

- **Percent Maintained Lawn, Maintained/Artificial Beach or Impervious**
    - This question addresses the near-shore land characteristics that may contribute negatively to shoreline health.
    - Maintained lawn was fairly rare on Clear Lake, but was sometimes apparent when there was grass on the landward side of the shoreline.
    - Maintained/artificial beaches would be places where it appears that sand or other beach-suitable substrate was brought in in order to have a beach along the shoreline. Again, beaches like this are fairly rare on Clear Lake, but still important to note.
    - Impervious surfaces included anything that would produce run-off to not be filtered into the group directly. Examples include patios, decks, sideways, or roads that run along the shoreline, as is common along Clear Lake's shore.
    - Within the 1000 ft section, the percent of near-shore land with any of the above characteristics was noted by surveyors to the best of their ability. The surveyors categorized this percent into one of 5 scoring options, depicted in the spreadsheet by only the single digit that corresponds to the amount of Maintained Lawn/Maintained/Artificial Beach/Impervious Surfaces:

        - **0** - None
        - **-1** - Less than 10%
        - **-2** - 10 to25%
        - **-3** - 25 to 75%
        - **-4** - Greater than 75%
- **Percent Unmowed Vegetation Belt**
    - Unmowed vegetation is classified as any plants on the land against the shoreline that are not maintained by mowing. These would often include trees and shrubs, and species of interest due to their habitat and ecological benefits were noted. Having unmowed vegetation helps to create a vibrant and healthy shoreline that is resistant to erosion and can act as a natural buffer system for run-off before it enters the lake.
    - Surveyors categorized the amount of unmowed vegetation by selecting one of 5 categories that depicted the percent of the 1000 ft transect which had an unmowed vegetation belt. These are reflected in the spreadsheet by only the single digit representing the percent of the shoreline with an unmowed vegetation belt:
        - **0** - None
        - 1 - Less than 10%
        - **2** - 10 to 25%
        - **3** - 26-75%
        - **4** - Greater than 75%
- **Average Unmowed Vegetation Belt**
    - The greater depth of the unmowed vegetation belt, as described above, contributes to a greater ability of the vegetation belt to provide habitat and ecosystem services. Depth was described as

the distance between the start of the vegetation from the shoreline back to where it ended on the land.

- Surveyors noted the average depth of the unmowed vegetation belt by selecting an option from the 4 categorical ranges, depicted in the spreadsheet by just the single digit corresponding to the depth in feet:
  - **0** - None
  - **1** - Less than 10 feet
  - **2** - 10 to 40 feet
  - **3** - Greater than 40 feet

- **Vegetation Present**
  - The surveyors were given the option to note any important vegetation seen within the transect. The surveyors could select as many or as little of the options as needed, in any combination. This information was not used in the score calculation but was important to collect for data analysis purposes and making future decisions about preservation and restoration along the shoreline.
    - **Tules** - Tules are a common and important ecological and cultural resource. They are a reedy plant found in the water and along the land of the shoreline and are easily identifiable in both their winter and summer phenotypes. Tules provide habitat for fish and wildlife, reduce shoreline erosion and protect structures from wave damage, improve water quality, and are used by the local Pomo tribes around the lake in clothing, to make boats, and can be eaten.
    - **Willows** - Willows are an important riparian tree species that provide habitat and resources for the ecological communities of the lake. There are several species of

willows, and surveyors studied the different types and what they looked like in different seasons in order to identify them during the time of survey. They are also important in lakebed habitat evaluations done by the Department.

        - **Cottonwoods** - Cottonwoods are also important habitat and provide resources to the ecological community. Surveyors studied what cottonwoods look like in different seasons in order to be able to identify them at the time of survey. They are also important in lakebed habitat evaluations done by the Department.

- **Riparian Zone Raw Score**
    - The raw score of the Riparian Zone was calculated by adding together the single digit numbers of each category within this section, taking into account negative numbers.
    - For example, looking at the Riparian Zone data for the Site ID **BIGV13**, the raw score was calculated as such: (percent maintained lawn, maintained/artificial beach, or impervious) + (percent unmowed vegetation belt) + (average unmowed vegetation belt depth) = (-3) + (3) + (1) = **1**
- **Riparian Zone Final Score**
    - This calculation system was created by the Michigan Clear Water Corps in order to weigh different factors to different amounts. The Riparian Zone final score will be used to determine the overall Final Score of the entire transect with other section scores. In the spreadsheet, the Riparian Zone final score is rounded to the nearest tenth.
    - The equation used to calculate the Final Score is:
        - (Raw Score) * 9.1 +36.4 = Riparian Zone Final Score

        - For example, looking at the Riparian Zone Raw Score for the Site ID **BIGV13,** the final score is calculated:
            - (1) * 9.1 + 36.4 = **45.5**

<u>Erosion Control</u>

- **Percent of Shoreline with Vertical Artificial**
    - Vertical artificial structures are those that are generally perpendicular to the lakebed and are made with impervious materials. The scope of this question is only considering structures that are man-made, or artificial. Examples of vertical artificial structures include seawalls or boulder walls. In general, vertical artificial structures contribute negatively to the health of the shoreline as they can create more erosion of the lakebed on the lake side of the seawall due to wave energy being displaced and removing sediment from the base of the seawall/structure.
    - Surveyors selected one of 5 options based on the amount of the 1000 ft section that had vertical artificial structures along the shoreline. In the spreadsheet, only the single digit that corresponds to a percentage of the shoreline with vertical artificial is found in this column, and the options are as follow:
        - **0** - None
        - **-1** - Less than 10%
        - **-2** - 10 to 25%
        - **-3** - 26 to 75%
        - **-4** - Greater than 75%
- **Types of Vertical Artificial Structures**
    - The surveyors were given the option to note which structures were present. The surveyors could select as many or as little of the

options as needed, in any combination. This information was not used in the score calculation but was important to collect for data analysis purposes and making future decisions about preservation and restoration along the shoreline.

    - **Seawall** - Seawalls are extremely common around Clear Lake. In Michigan, where this survey originated, seawalls are being removed from the lake management system through policies and remediation efforts. However, the Clear Lake communities do not have the resources nor capacity to remove or prevent seawalls from being built. Regardless, they do tend to have a negative impact by hardening the shoreline, so they are important to note.
    - **Boulders/Rock Wall** - When rocks or boulders are used to create a vertical wall, this was noted in the vertical artificial section. These are not to be confused with riprap, which is counted in the sloped artificial category.
    - **Other** - If any other types of vertical artificial structures were seen in a transect, they could be noted here.

- **Percent of Shoreline with Sloped Artificial**
    - Sloped artificial features are those that separate the land from the shore with materials that are usually impervious and on a slant. As a rule of thumb, structures were considered sloped, and not vertical, if it would be feasible for a turtle to climb up it with ease. Examples of sloped artificial structures include concrete (especially as a boat ramp) or rocks/riprap. Because sloped artificial structures are typically used instead of vegetation and therefore reduces the amount of habitat and ecosystem services a

shoreline can provide, they negatively affect the health of the shoreline.

- Surveyors selected one of 5 options based on the amount of the 1000 ft section that had sloped artificial structures along the shoreline. In the spreadsheet, only the single digit that corresponds to a percentage of the shoreline with vertical artificial is found in this column, and the options are as follow:
  - **0** - None
  - **-1** - Less than 10%
  - **-2** - 10 to 25%
  - **-3** - 26 to 75%
  - **-4** - Greater than 75%

- **Types of Sloped Artificial**
  - The surveyors were given the option to note which structures were present. The surveyors could select as many or as little of the options as needed, in any combination. This information was not used in the score calculation but was important to collect for data analysis purposes and making future decisions about preservation and restoration along the shoreline.
    - **Concrete** - Concrete sloped artificial was commonly boat ramps or other types of structures leading directly into the water. In addition to being impervious and therefore may contribute to worse water quality, lakebed and land that is paved over cannot hold vegetation.
    - **Rock/Riprap** - Riprap is loose stone placed on the shoreline in a sloping structure. Typically used as erosion control for the land, it also removes the shoreline's ability to contribute to the ecology of the lake.

        - **Other** - If any other types of vertical artificial structures were seen in a transect, they could be noted here.
- **Percent of Shoreline with Bioengineering**
    - Bioengineering features are those made from natural materials with the intention of reducing erosion of the land. For reasons mentioned above in the other categories, these types of structures can negatively impact the health of the shoreline, even though they are generally a better option than typical hard shorelines, as reflected in their reduced effect on the scores. Examples of bioengineering are coir logs or branch bundles, but these were not common on Clear Lake.
    - Surveyors selected one of 5 options based on the amount of the 1000 ft section that had bioengineering structures along the shoreline. In the spreadsheet, only the single digit that corresponds to a percentage of the shoreline with vertical artificial is found in this column, and the options are as follow:
        - **0** - None
        - **-0.5** - Less than 10%
        - **-1** - 10 to 25%
        - **-1.5** - 26 to 75%
        - **-2** - Greater than 75%
- **Erosion Control Raw Score**
    - The raw score of the Erosion Control section was calculated by adding together the single digit numbers of each category within this section, taking into account negative numbers.
    - For example, looking at the Riparian Zone data for the Site ID **BIGV13**, the raw score was calculated as such: (percent of shoreline with vertical artificial) + (percent of shoreline with sloped

artificial) + (percent of shoreline with bioengineering) = (-3) + (-3) + (0) = **-6**

- **Erosion Control Final Score**
    - This calculation system was created by the Michigan Clear Water Corps in order to weigh different factors to different amounts. The Erosion Control final score will be used to determine the overall Final Score of the entire transect with other section scores. In the spreadsheet, the Erosion Control final score is rounded to the nearest tenth.
    - The equation used to calculate the Final Score is:
        - (Raw Score) * 11.1 + 100 = Erosion Control Final Score
        - For example, looking at the Erosion Control Raw Score for the Site ID **BIGV13,** the final score is calculated:
            - (-6) * 11.1 + 100 = **33.4**

<u>Transect Score</u>

- **Final Transect Sum**
    - The Raw Transect Score was calculated by adding together the three final section scores. This is not the final score. The equation used was: (Littoral Zone Final Score) + (Riparian Zone Final Score) + (Erosion Control Final Score) = Final Transect Sum
        - An example of this calculation using the data from SiteID **BIGV1** = 87 + 100.1 + 88.9 = **276**
- **Final Score of Transect**
    - The final score of the transect is the metric used to give an overall snapshot of the transect. It shows how healthy the shoreline is of the transect broadly by taking into account all of the important features. It should be noted that the range of scores for all

transects is 9.23 to 99.7. It is not feasible nor of interest to have all transects or even any transects get 100, but scores can be used to highlight specific areas of concerns and areas to be targeted by restoration efforts.

- To calculate the Final Score, the Final Transect Sum was divided by 3 to give the average of the three section scores.
  - An example of the calculation using the data from SiteID **BIGV1** = 276 / 3 = **92**

Comments

- Notes on anything of particular interest or importance

Regional Data Page

Region

Although the Michigan procedure does not specify breaking up shoreline areas into regions, the size of Clear Lake necessitated that we do in order to better analyze data of sections of shoreline with vastly different features. Because the Clear Lake shoreline has areas that are densely populated and areas that are preserved natural areas, we wanted to have specific regions we could compare. Additionally, it was helpful in terms of staying organized during the process and identifying transects in the field. Refer to the map on this page or on the StoryMap to visualize the start and end of regions and what transects fall where.

Developmental Density

As you may have noticed, we obtained the number of houses and docks per transect, but it was not included on any of the calculations. Instead, Developmental Density is a separate metric that looks specifically at those numbers.

- Developmental Density = ((number of houses) + (number of docks)) / 3
- Then, we can calculate the average transect score by adding together the scores from each transect in the region and dividing the sum by the total number of transects.
- Having these metrics is especially useful to compare different regions against each other to see how development affects the Score the Shore scores.