# CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: 12/11/2024 FILE REF: NA

TO: Sarah Luck, Limit Calculator; Jordan Main, Compliance Engineer

FROM: Kimberly Kuber, Stream Biologist; Kristi Minahan, Water Quality Standards; Diane Figiel, Limit Calculator Coordinator

SUBJECT: Roxbury Sanitary District #1, Roxbury Creek (WBIC 1259900), Dane County

**Overview of issue**

In preparation for reissuance of the Roxbury Sanitary District #1 permit, staff were requested to do a site visit to determine the appropriate stream classifications for the receiving waters. Roxbury is a continuous discharger, with an annual average design flow of 0.025 MGD (0.039 cfs).

The immediate receiving water is Roxbury Creek (Segment 3, WBIC 1259900). This flows into an unnamed side channel of the Wisconsin River (Segment 4, WBIC 1259800), which rejoins the Wisconsin River after ~1.25 miles. Both Roxbury Creek and the side channel are modelled as cool-cold headwater, which would be in the coldwater designated use category. The 2018 permit limits were based on Limited Forage Fish for ~1/3 mile. They have phosphorus limits for Limited Forage Fish. None of these segments are in code as Limited Aquatic Life or Limited Forage Fish (LAL/LFF), but in 2003 there was a recommendation to add a short extent of Roxbury Creek from the outfall to ~0.6 mile as LFF based on a classification report by Roger Schlesser in 1991 that recommended LFF for that stretch.

A site visit including fish and qualitative habitat surveys was conducted by Kimberly Kuber (Water Quality Biologist), Camille Bruhn (Water Quality Biologist), Marco Scarasso (Water Resource Management Specialist), and Emma Bailie (Water Quality Intern) on Wednesday, June 12th, 2024. Additional surveys including a fish and quantitative habitat survey were conducted by Kimberly Kuber, Camille Bruhn, Marco Scarasso, and Jonah Hoeper (Water Quality Intern) on Thursday, June 13th, 2024. The main objective of these site visits was to determine the appropriate stream classification for Roxbury Creek and to evaluate if Roxbury Creek falls under the Coldwater or Warmwater designated use.

**Note:** There is potential for confusion regarding which stream thread is Roxbury Creek proper. For the purposes of this memo, the upstream thread (Segment 2) that has the same Waterbody Identification Code as the lower portion of Roxbury Creek (WBIC 1259900) has been deemed to be the upstream segment of Roxbury Creek. However, Unnamed Tributary (Segment 1; WBIC 1260000) is locally named Roxbury Creek, carries a majority of the stream flow prior to the confluence with Roxbury Creek, and its flows are augmented by the addition of water pumped from the Fish, Crystal, and Mud Lake Rehabilitation District.

**Summary of previous and proposed stream class recommendations**

- **Segment 1: Unnamed tributary (WBIC 1260000) to Roxbury Creek**
  - *Currently codified designated use:* Not previously in NR 104 as LAL or LFF. Not a trout water.
  - *Classification used for previous permit issuance:* NA
  - *Previous stream class recommendations:* None.
  - *Modeled Natural Community:* Coldwater
  - ***New recommended Natural Community (NC) & Designated Use (DU)**:* Cool-warm headwater or mainstem NC (see Discussion), Warmwater DU
- **Segment 2: Roxbury Creek (WBIC 1259900) above Roxbury Sanitary District Outfall**
  - *Currently codified designated use:* Not previously in NR 104 as LAL or LFF. Not a trout water.
  - *Classification used for previous permit issuance:* NA

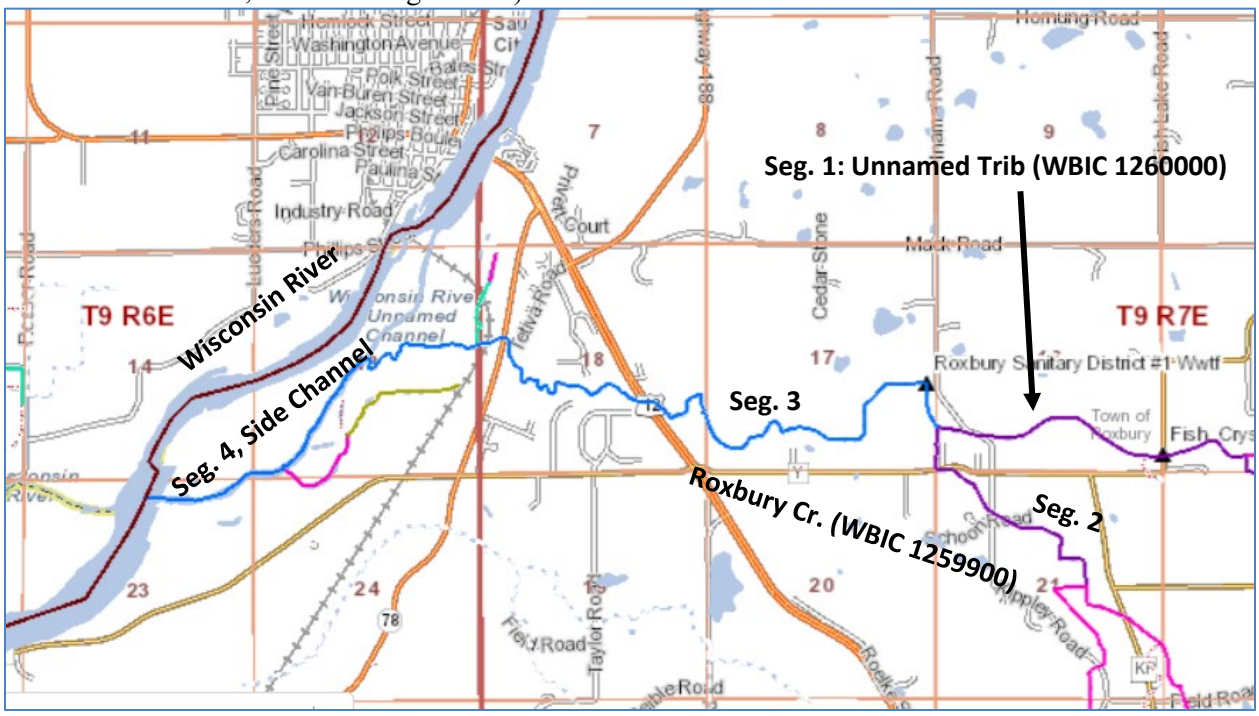
- *Previous stream class recommendations:* None.
- *Modeled Natural Community:* Cool-cold headwater and Coldwater
- ***New recommended NC & DU:*** Cool-warm headwater NC, Warmwater DU

- **Segment 3: Roxbury Creek (WBIC 1259900) below Roxbury Sanitary District Outfall**
  - *Currently codified designated use:* Not previously in NR 104 as LAL or LFF. Not a trout water.
  - *Classification used for previous permit issuance:* The 2018 permit limits were based on LFF for ~1/3 mile.
  - *Previous stream class recommendations:* The 2003 proposal recommended classifying a short extent, about 0.6 miles, of "Roxbury Creek (a.k.a. Blums Creek) as LFF from the WWTP outfall in the SW1/4 SW1/4 T9N R7E S16 to the SW1/4 SE1/4 T9N R7E S17". This was based on an extensive report by Roger Schlesser in 1991. There was also an initial report by Roger Schlesser in 1978 recommending "marginal"/LAL.
  - *Modeled Natural Community:* Cool-cold mainstem
  - ***New recommended NC & DU:*** Cool-warm headwater or mainstem NC (see Discussion), Warmwater DU
- **Segment 4: Unnamed side channel (WBIC 1259800) of the Wisconsin River**
  - *Currently codified designated use:* Not previously in NR 104 as LAL or LFF. Not a trout water.
  - *Classification used for previous permit issuance:* Warmwater
  - *Previous stream class recommendations:* NA
  - *Modeled Natural Community:* Cool-cold mainstem
  - ***New recommended NC & DU:*** Warmwater DU (Nonwadeable Warm River NC). No new fish surveys were completed at this time, but existing data supports that this is warmwater community that reflects the main channel of the Wisconsin River.

*(continued)*

**Site overview maps**

Map 1. Map from Water Condition Viewer showing Roxbury Creek and its connection to the side channel of the Wisconsin River. (Colors indicate modeled Natural Community from the Wisconsin Stream Model, not the final stream class recommendations: pink = Cool-Cold Headwater; purple = Coldwater; bright blue = Cool-cold Mainstem; brown = Large River.)




Map 2. Aerial photo (2022) from Water Condition Viewer. The short segment proposed as LFF in 2003 is shown in yellow.

Map 3. Map of the breakdown of the segments evaluated on June 12th and 13th, 2024 by water quality staff. The orange stream thread represents Segment 1, the blue stream thread represents Segment 2, and the yellow stream thread represents Segment 3. The locations where fish and habitat surveys were conducted are marked with green dots. Black triangles represent outfall locations.

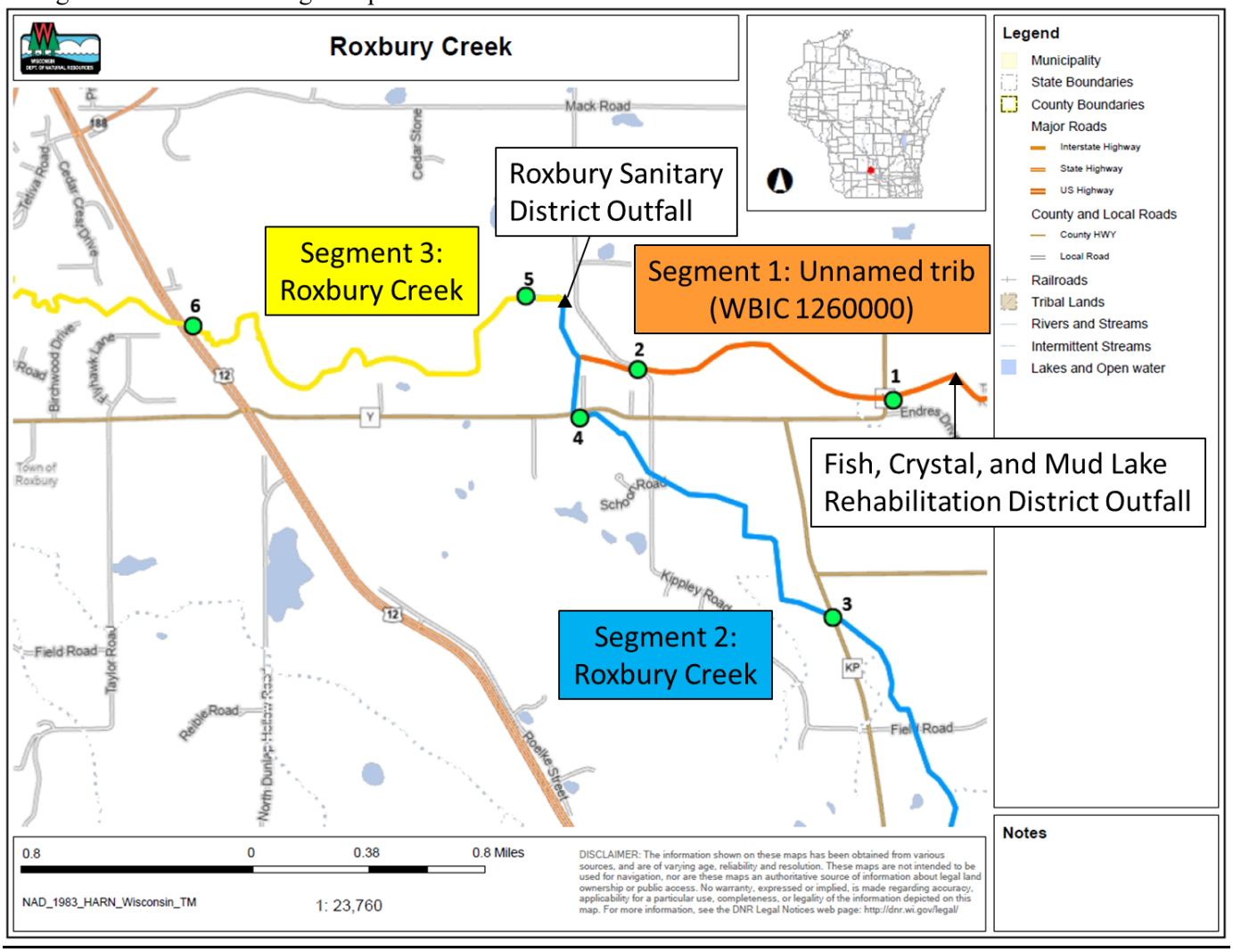



Table 1. Station locations and water quality parameters measured at each location. Map numbers correspond to dots on Map 3.

| Stream Name | WBIC | Station Description | Map # | Temperature (°C) | Dissolved Oxygen (mg/L) | Dissolved Oxygen (% Saturation) | Specific Conductivity (uS/cm) | pH (SU) | Flow (cfs) | Transparency (cm) |
|---|---|---|---|---|---|---|---|---|---|---|
| Unnamed Tributary to Roxbury | 1260000 | Upstream CTH Y | 1 | 15.1 | 12.99 | 133.9 | 613 | 7.88 | Not measured | >120 |
| Unnamed Tributary to Roxbury | 1260000 | Upstream Inama Road | 2 | 17.2 | 14.2 | 153.3 | 612 | 8.26 | 4.53 | >120 |
| Roxbury Creek | 1259900 | Upstream CTH KP | 3 | 14.1 | 7.27 | 73.1 | 707 | 7.54 | 0.83 | >120 |
| Roxbury Creek | 1259900 | Upstream CTH Y | 4 | 15.1 | 6.11 | 62.5 | 724 | 7.52 | 1.74 | 64 |
| Roxbury Creek | 1259900 | Downstream WWTP Outfall | 5 | 18.4 | 11.51 | 127.3 | 603 | 8.11 | Not measured | 62 |
| Roxbury Creek | 1259900 | Upstream STH 12 | 6 | 18.5 | 9.67 | 107.8 | 628 | 8.42 | 5.63 | 68 |

**Site observations and habitat survey results**

- **Segment 1: Unnamed tributary (WBIC 1260000) to Roxbury Creek**
  Two habitat surveys were completed on the Unnamed tributary (WBIC 1260000) to Roxbury Creek. This channelized stream flows to the west towards Roxbury Creek and exhibited monotonous habitat at both survey locations. The riparian corridor of this stream had narrow buffers and the stream flows through agricultural fields at both of the sites surveyed. Curly-leaf pondweed (*Potamogeton crispus*), an invasive aquatic plant species, was present at both sites and formed dense beds of aquatic vegetation in the stream. Sago pondweed (*Stukenia pectinata*) and Waterweed (*Elodea canadensis*) were also present at both sites, but far less abundant. The water quality parameters measured at both sites fall within normal ranges for this region (Table 1).
  - Flow in this Unnamed tributary is augmented by the Fish, Crystal, and Mud Lake Rehabilitation District. These nearby lakes are experiencing high water conditions and pump lake water as needed into the Unnamed Tributary to maintain lower lake water levels. The lake drawdown was permitted to discharge beginning December 1, 2013 and discharges intermittently until Crystal Lake reaches the Ordinary High Water Mark (Sarah Luck, personal communication). The outfall for this discharge into the Unnamed tributary is approximated 1200 feet east of the County Highway Y road crossing, so this additional discharge influenced both fish and habitat survey locations in this segment (Kenzie Ostien, personal communication; Outfall marked by black triangle upstream of dot 1 on Map 3).
  - A qualitative habitat survey was completed on Unnamed tributary (WBIC 1260000) to Roxbury Creek at County Highway Y and received a score of 45, rating Fair (Map 3, dot 1; Table 2; Photo 1). This stream reach consisted exclusively of run habitat with no bends or riffles, leading to Poor ratings for the riffle:riffle or bend:bend ratio and percent pool area metrics. Bottom substrate was primarily sand and silt, with some gravel patches, and received a Poor score. The stream was incised at this location; however, banks were well vegetated, and erosion was limited. There was a narrow buffer between the stream and the surrounding crop fields. The qualitative habitat score was boosted by Excellent ratings for width:depth ratio and fish cover, both of which are reflective of the agricultural influences of this site, where the creek is forced into a modified channel that is narrow and deep and excess nutrients are likely fueling the plant growth. The silty substrate observed at this site is also conducive for plant growth. Flow was not measured due to the dense aquatic vegetation found throughout this reach.
  - An additional survey was conducted on Unnamed tributary (WBIC 1260000) to Roxbury Creek at Inama Road, approximately 350 meters (0.22 miles) upstream of the confluence with mainstem Roxbury Creek (Map 3, dot 2; Photo 2). A qualitative habitat survey was conducted and received a score of 48, rating Fair (Table 3). This downstream site was slightly more diverse than the upstream survey reach, with a few riffles and an area with a plunge pool where water from a tile drain enters the stream. The riparian corridor had a narrow buffer and primarily flowed through agricultural fields and through a small residential area near Inama Road. Bottom substrate consisted mostly of sand and silt. Gravel, rubble/cobble, and boulders were also present, but limited. Banks were relatively steep and eroded, leading to a Fair rating for the bank erosion metric. Similar to the upstream reach, this portion of the Unnamed tributary received Excellent ratings for width:depth ratio and fish cover, due to the channelized condition of the stream and the abundance of instream vegetation. Despite being an "Unnamed tributary" to Roxbury, this stream appears to make up a majority of the flow once it meets Roxbury Creek (Table 1).
- **Segment 2: Roxbury Creek (WBIC 1259900) above Roxbury Sanitary District Outfall**
  Two habitat surveys were completed on Roxbury Creek upstream of the Roxbury Sanitary District Outfall. This stream is channelized and flows to the north and west through an agriculturally influenced landscape. Curly-leaf pondweed and filamentous algae were present but limited at both sites. The water quality parameters measured in this segment fall within normal ranges for this region (Table 1).

- A qualitative habitat survey was completed on Roxbury Creek upstream of County Highway KP (Map 3, dot 3; Photo 3). This stream reach received a score of 53, rating Good (Table 4). The riparian corridor had a narrow buffer and adjacent land use was pasture and row crops. Bank erosion was moderate, with a mix of steep, raw banks and some areas that were grassed and stable, rating Fair. The bottom substrate was mostly gravel, with sand and silt. Habitat diversity was low and pools were limited. This channelized reach received an Excellent width:depth ratio score, which is common for ditched systems. Fish cover also rated Excellent and included a substantial amount of overhanging vegetation and a few undercut banks.
- An additional qualitative habitat survey was conducted on Roxbury Creek upstream of County Highway Y (Map 3, dot 4; Photo 4). This survey was heavily impacted by an improperly set culvert at the County Highway Y road crossing, which is impounding water and also contributing to sedimentation upstream (Photo 4, left image). This stream reach received a qualitative habitat score of 50, rating Good (Table 5). The stream flows primarily through an agricultural area, with a moderate buffer width and limited bank erosion. This stream reach is channelized, and the monotonous habitat lacks riffles, pools, or bends. The bottom substrate was primarily silt. Clay and gravel were also present but were completely covered by a thick layer of silt. Fish cover rated Excellent and included some woody debris and abundant overhanging vegetation. The flow measurement (1.74 cfs) was lower than expected and may have been impacted by the improperly set culvert. Efforts were made to select a site to measure flow upstream of its influence; however, a suitable site was difficult to find. There are obvious differences in stream characteristics upstream and downstream of the culvert; where the stream is wider and more stagnant upstream, and narrower and swifter downstream (Photo 5).

- **Segment 3: Roxbury Creek (WBIC 1259900) below Roxbury Sanitary District Outfall**
  At the site of the Roxbury Sanitary District Outfall, Roxbury Creek is a ditched system. Two habitat surveys were completed in Segment 3.
  - A quantitative habitat survey was conducted and began approximately 180 meters downstream of the Roxbury Sanitary District Outfall, and ended at the outfall (Map 3, dot 5; Photos 6 and 7). This survey received a score of 40, rating Fair (Table 6). Bottom substrate consisted mostly of sand and silt, but also included clay and detritus to a lesser degree and sparse gravel that was completely embedded in the fine substrates. Fish cover was common throughout the reach, primarily in the form of submerged macrophytes, but overhanging vegetation was also common. The stream was heavily vegetated. The plant community was dominated by non-native Curly-leaf pondweed, but other native aquatic plants including Waterweed and Sago pondweed were present in low abundances. The stream corridor had a narrow buffer with a mowed path around the field edge, and was surrounded by agricultural fields. Habitat was monotonous and consisted of a run with no riffles or pools present.
  - A qualitative habitat survey was conducted on Roxbury Creek upstream of where it crosses STH 12, approximately 1.6 miles downstream from the Roxbury Sanitary District outfall (Map 3, dot 6; Photo 8). This qualitative habitat survey scored 78, rating Excellent (Table 7). At this location, the stream had a steeper gradient than the other sites and it flowed through a well-protected, forested riparian corridor with limited bank erosion. The stream exhibits a more natural, meandering channel and the bottom substrate was primarily gravel and rubble cobble with limited fine sediments. There were diverse habitats in this stream segment; riffles were common, some pools were present, and there was a good amount of fish habitat including woody debris, log jams, and root wads.

- **Segment 4: Unnamed side channel (WBIC 1259800) of the Wisconsin River**
  - This segment was not evaluated at this time and historical habitat data are not available.

Table 2. Qualitative habitat survey on Unnamed tributary (WBIC 1260000) at CTH Y.

| Metric | Score | Rating |
|---|---|---|
| Riparian Buffer Width | 5 | Fair |
| Bank Erosion | 10 | Good |
| Pool Area | 0 | Poor |
| Width:Depth Ratio | 15 | Excellent |
| Riffle:Riffle or Bend:Bend Ratio | 0 | Poor |
| Fine Sediments | 0 | Poor |
| Fish Cover | 15 | Excellent |
| **Total** | **45** | **Fair** |

Table 3. Qualitative habitat survey on Unnamed tributary (WBIC 1260000) at Inama Road.

| Metric | Score | Rating |
|---|---|---|
| Riparian Buffer Width | 5 | Fair |
| Bank Erosion | 5 | Fair |
| Pool Area | 3 | Fair |
| Width:Depth Ratio | 15 | Excellent |
| Riffle:Riffle or Bend:Bend Ratio | 0 | Poor |
| Fine Sediments | 5 | Fair |
| Fish Cover | 15 | Excellent |
| **Total** | **48** | **Fair** |

Table 4. Qualitative habitat survey on Roxbury Cr. at CTH KP.

| Metric | Score | Rating |
|---|---|---|
| Riparian Buffer Width | 5 | Fair |
| Bank Erosion | 5 | Fair |
| Pool Area | 3 | Fair |
| Width:Depth Ratio | 15 | Excellent |
| Riffle:Riffle or Bend:Bend Ratio | 5 | Fair |
| Fine Sediments | 5 | Fair |
| Fish Cover | 15 | Excellent |
| **Total** | **53** | **Good** |

Table 5. Qualitative habitat survey on Roxbury Cr. at CTH Y.

| Metric | Score | Rating |
|---|---|---|
| Riparian Buffer Width | 10 | Good |
| Bank Erosion | 10 | Good |
| Pool Area | 0 | Poor |
| Width:Depth Ratio | 15 | Excellent |
| Riffle:Riffle or Bend:Bend Ratio | 0 | Poor |
| Fine Sediments | 0 | Poor |
| Fish Cover | 15 | Excellent |
| **Total** | **50** | **Good** |

Table 6. Quantitative habitat survey on Roxbury Cr. downstream of the Roxbury WWTP outfall.

| METRIC | VALUE | SCORE |
|---|---|---|
| Mean Buffer Width (m) | 5 | 10 |
| Mean Bank Erosion (m) | 0.72 | 5 |
| % Pool | 0 | 0 |
| Width:Depth Ratio | 6.06 | 10 |
| Bend:Bend Ratio | 44.05 | 0 |
| % Fine Sediments | 92.81 | 0 |
| % Fish Cover | 74.89 | 15 |
| Stream (<10m wide) Habitat Score | | 40 |
| Stream (<10m wide) Habitat Rating | | **Fair** |

Table 7. Qualitative habitat survey on Roxbury Cr. at STH 12.

| Metric | Score | Rating |
|---|---|---|
| Riparian Buffer Width | 15 | Excellent |
| Bank Erosion | 10 | Good |
| Pool Area | 3 | Fair |
| Width:Depth Ratio | 10 | Good |
| Riffle:Riffle or Bend:Bend Ratio | 15 | Excellent |
| Fine Sediments | 15 | Excellent |
| Fish Cover | 10 | Good |
| **Total** | **78** | **Excellent** |

**Fish survey results**

- **Segment 1: Unnamed tributary (WBIC 1260000) to Roxbury Creek**
  - A fish survey was conducted on Unnamed tributary (WBIC 1260000) to Roxbury Creek using a stream tow barge on June 12, 2024 (Map 3, dot 1). The survey was approximately 130 meters long, capturing primarily Brook Stickleback, Creek Chub, and White Suckers; all are tolerant species (Table 8). Despite the coldwater modeled natural community for this stream segment, no coldwater species were captured in this reach. The fish community present fits best with a warm transition headwater natural community, however, there are too many tolerant species present and no intolerant species present, so it fails the tolerance tests (Figure 1). The small stream Index of Biotic Integrity (IBI) was applied to the fish data and received scores of 50, rating Fair (Table 9).
  - An additional fish survey was conducted farther downstream on Unnamed tributary (WBIC 1260000) to Roxbury Creek, prior to the confluence with Roxbury Creek (Map 3, dot 2). This 150 meter fish survey was also conducted using a stream tow barge and captured eight species of fish (Table 10). Creek Chub, Johnny Darter, and Western Blacknose Dace were most common at this survey location. A majority of the species captured fall into the transitional or warmwater thermal guild, except for the single coldwater species captured, an 8.9 inch Brown Trout. This segment of Unnamed tributary (WBIC 1260000) is modeled as a coldwater natural community, however, only one coldwater species was found. A natural community verification was completed and the warm transition headwater natural community fit best with the fish assemblage captured at this site. The warm transition headwater guild test fails one of the tolerance tests because no intolerant species were captured in this survey (Figure 2). The small stream IBI and warm-transitional IBI were applied to the fish data and received scores of 60 (Fair) and 40 (Fair), respectively (Table 11).

- **Segment 2: Roxbury Creek (WBIC 1259900) above Roxbury Sanitary District Outfall**
  - A fish survey was conducted using backpack electrofishing gear on Roxbury Creek upstream of County Highway KP (Map 3, dot 3). This survey was 120 meters long and captured six species. Brook Stickleback and Creek Chub were the most common species at this site. A majority of the fish captured fall within the small stream and transitional species guilds (Table 12). The stream is modeled as a cool-cold headwater, but no coldwater species were captured. The fish assemblage fits best as a warm-transitional headwater; however, both tolerance tests failed because all fish captured are tolerant species (Figure 3). The small stream IBI was applied to the data and received a score of 40, rating Fair (Table 13).
  - An additional 120 meter fish survey using a stream tow barge was conducted on Roxbury Creek at County Highway Y, upstream of the confluence with Unnamed tributary (WBIC 1260000) (Map 3, dot 4). This survey captured eight species, most of which fall within the small stream and transitional species guilds (Table 14). White Suckers were most abundant and Central Mudminnow and Creek Chub were also common, which are all tolerant species. Brassy Minnow, an intermediate tolerance species was present, but only two individuals were found, and they comprised a very small proportion of the fish assemblage. Roxbury Creek is modeled as a coldwater natural community, but no coldwater species were captured. The fish assemblage fits best as a warm-transitional headwater; however, both tolerance tests failed because all fish captured are tolerant species (Figure 4). The small stream IBI was applied to the data and received a score of 60, rating Fair (Table 15).
- **Segment 3: Roxbury Creek (WBIC 1259900) below Roxbury Sanitary District Outfall**
  - A fish survey was conducted using a stream tow barge shocker on Roxbury Creek approximately 180 meters downstream of the Roxbury Sanitary District outfall (Map 3, dot 5). This 166 meter survey captured four species of fish. Creek Chubs and White Suckers were most abundant; Western Blacknose Dace and Brook Stickleback were present in low numbers (Table 16). All of these species fit within the transitional thermal guild and all but White Suckers are typically associated with small streams. Roxbury Creek is modeled as a cool-cold mainstem at this location, but the warm transition headwater natural community fits the fish assemblage better. Similar to other locations in the watershed, both tolerance tests fail because all species captured are tolerant (Figure 5). The small stream IBI and warm-transitional IBI were applied to the fish data and received scores of 30 (Poor) and 10 (Poor), respectively (Table 17).
  - An additional 170 meter fish survey was conducted on Roxbury Creek upstream of the State Highway 12 crossing using stream tow barge electrofishing gear (Map 3, dot 6). This survey captured 8 fish species (Table 18). Warmwater species such as Central Stoneroller, Fathead Minnow, and Green Sunfish were captured, but at low abundances. Creek Chubs were most common followed by Western Blacknose Dace and White Suckers, all tolerant species that fall into the transitional thermal guild. Roxbury Creek is modeled as a cool-cold mainstem at this location, but the cool-warm headwater natural community fits the fish assemblage better. Similar to other locations in the watershed, both tolerance tests failed because a majority of fish species captured are considered tolerant (Figure 6). The small stream IBI and warm-transitional IBI were applied to the data and received scores of 50 (Fair) and 30 (Fair), respectively (Table 19).
- **Segment 4: Unnamed side channel (WBIC 1259800) of the Wisconsin River**
  - This segment was not evaluated; however, a survey was conducted on June 20th, 2009, by Dave Marshall. This survey used a stream tow barge to electrofish approximately 100 meters of the Unnamed side channel of the Wisconsin River. Survey results indicate that this side channel supports many of the warmwater and large river fishes associated with the mainstem of the Wisconsin River, including a state endangered species and a state species of special concern (Table 20).

- **Additional fish surveys conducted in the Roxbury Creek watershed**
  - There are three previous surveys conducted in the Roxbury Creek watershed that provide additional context to the data collected during this site visit.
  - Survey 1 is backpack electrofishing survey conducted on Roxbury Creek at Ballweg Road on May 27, 2003. This 150 meter survey captured five species (Table 21). Creek Chub and White Suckers were the most abundant. Brook Stickleback and a few Central Mudminnow and Southern Redbelly Dace were also present. The species captured in this survey were common throughout the watershed. This survey represents a reach of Roxbury Creek upstream of the County Highway KP survey (Map 3, dot 3).
  - Survey 2 is a 150 meter stream tow barge electrofishing survey that took place on Roxbury Creek at State Highway 12 on 6/2/2003. This survey was completed in a similar stream reach as the one sampled for the 2024 evaluation (Map 3, dot 6). This survey captured seven species; Creek Chubs were most abundant (Table 22). Other common species included White Sucker and Western Blacknose Dace.
  - Survey 3 is stream tow barge electrofishing survey that took place on Roxbury Creek at State Highway 78 on August 7, 2018. This survey captured eleven species of fish (Table 23). One coldwater species, a 7.2" Brown Trout, was captured. The remaining fish fall into transitional and warmwater thermal guilds. All fish captured were intermediate or tolerant species and represent a variety of stream size guilds. This survey is the farthest downstream survey conducted on Roxbury Creek itself and is starting to show the influence of the Wisconsin River with the presence of large river and warm water species.

Table 8. Guild assignments for fish captured during an electrofishing survey conducted on Unnamed tributary (WBIC 1260000) to Roxbury Creek at County Highway Y on June 12, 2024.

| Species | Count | Thermal Guild | Stream Size Guild | Tolerance Guild |
|---|---|---|---|---|
| BROOK STICKLEBACK | 15 | Transitional | Small | Tolerant |
| CENTRAL STONEROLLER | 2 | Warmwater | Small | Intermediate |
| CREEK CHUB | 14 | Transitional | Small | Tolerant |
| WHITE SUCKER | 12 | Transitional | Medium | Tolerant |

Table 9. IBI results for fish survey conducted on Unnamed tributary (WBIC 1260000) to Roxbury Creek at County Highway Y on June 12, 2024.

| Small Stream IBI | | |
|---|---|---|
| METRIC | VALUE | SCORE |
| Number Intolerant Species Score | 0 | 0 |
| Number Native Species | 4 | 10 |
| Number Headwater Species | 1 | 10 |
| Percent DELT | 0 | 0 |
| Number Minnow Species | 2 | 10 |
| Catch Per 100 m, exc. Tolerants | 1.54 | 0 |
| Catch Per 100 m Brook Stickleback | 11.54 | 20 |
| | TOTAL | 50 |
| | RATING | Fair |

Table 10. Guild assignments for fish captured during an electrofishing survey conducted on Unnamed tributary (WBIC 1260000) to Roxbury Creek at Inama Road on June 12, 2024.

| Species | Count | Thermal Guild | Stream Size Guild | Tolerance Guild |
|---|---|---|---|---|
| BROOK STICKLEBACK | 13 | Transitional | Small | Tolerant |
| BROWN TROUT | 1 | Coldwater | Medium | Intermediate |
| CREEK CHUB | 36 | Transitional | Small | Tolerant |
| FATHEAD MINNOW | 8 | Warmwater | Small | Tolerant |
| GREEN SUNFISH | 1 | Warmwater | Small | Tolerant |
| JOHNNY DARTER | 35 | Transitional | Medium | Intermediate |
| WESTERN BLACKNOSE DACE | 29 | Transitional | Small | Tolerant |
| WHITE SUCKER | 17 | Transitional | Medium | Tolerant |

Table 11. IBI results for fish survey conducted on Unnamed tributary (WBIC 1260000) to Roxbury Creek at Inama Road on June 12, 2024.

| Small Stream IBI | | |
|---|---|---|
| METRIC | VALUE | SCORE |
| Number Intolerant Species Score | 0 | 0 |
| Number Native Species | 7 | 20 |
| Number Headwater Species | 0 | 0 |
| Percent DELT | 0 | 0 |
| Number Minnow Species | 3 | 20 |
| Catch Per 100 m, exc. Tolerants | 24 | 10 |
| Catch Per 100 m Brook Stickleback | 8.67 | 10 |
| | TOTAL | 60 |
| | RATING | Fair |

| Cool-Warm Transition IBI | | |
|---|---|---|
| METRIC | VALUE | SCORE |
| Number of intolerant species | 0 | 0 |
| Number of native minnow species | 3 | 10 |
| Number of benthic invertivore species | 1 | 0 |
| % as tolerant individuals | 74 | 10 |
| % as omnivore individuals | 18 | 20 |
| | TOTAL | 40 |
| | RATING | Fair |

Table 12. Guild assignments for fish captured during an electrofishing survey conducted on Roxbury Creek at County Highway KP on June 12, 2024.

| Species | Count | Thermal Guild | Stream Size Guild | Tolerance Guild |
|---|---|---|---|---|
| BROOK STICKLEBACK | 12 | Transitional | Small | Tolerant |
| CENTRAL MUDMINNOW | 4 | Transitional | Small | Tolerant |
| CREEK CHUB | 9 | Transitional | Small | Tolerant |
| GREEN SUNFISH | 2 | Warmwater | Small | Tolerant |
| WESTERN BLACKNOSE DACE | 5 | Transitional | Small | Tolerant |
| WHITE SUCKER | 2 | Transitional | Medium | Tolerant |

Table 13. IBI results for fish survey conducted on Roxbury Creek at County Highway KP on June 12, 2024.

| Small Stream IBI | | |
|---|---|---|
| **METRIC** | **VALUE** | **SCORE** |
| Number Intolerant Species Score | 0 | 0 |
| Number Native Species | 6 | 20 |
| Number Headwater Species | 0 | 0 |
| Percent DELT | 0 | 0 |
| Number Minnow Species | 2 | 10 |
| Catch Per 100 m, exc. Tolerants | 0 | 0 |
| Catch Per 100 m Brook Stickleback | 10 | 10 |
| | TOTAL | 40 |
| | RATING | Fair |

Table 14. Guild assignments for fish captured during an electrofishing survey conducted on Roxbury Creek at County Highway Y on June 12, 2024.

| Species | Count | Thermal Guild | Stream Size Guild | Tolerance Guild |
|---|---|---|---|---|
| BLACK BULLHEAD | 4 | Warmwater | Medium | Tolerant |
| BRASSY MINNOW | 2 | Transitional | Small | Intermediate |
| BROOK STICKLEBACK | 6 | Transitional | Small | Tolerant |
| CENTRAL MUDMINNOW | 22 | Transitional | Small | Tolerant |
| CREEK CHUB | 23 | Transitional | Small | Tolerant |
| FATHEAD MINNOW | 8 | Warmwater | Small | Tolerant |
| GREEN SUNFISH | 9 | Warmwater | Small | Tolerant |
| WHITE SUCKER | 54 | Transitional | Medium | Tolerant |

Table 15. IBI results for fish survey conducted on Roxbury Creek at County Highway Y on June 12, 2024.

| Small Stream IBI | | |
|---|---|---|
| **METRIC** | **VALUE** | **SCORE** |
| Number Intolerant Species Score | 0 | 0 |
| Number Native Species | 8 | 20 |
| Number Headwater Species | 1 | 10 |
| Percent DELT | 0 | 0 |
| Number Minnow Species | 3 | 20 |
| Catch Per 100 m, exc. Tolerants | 1.67 | 0 |
| Catch Per 100 m Brook Stickleback | 5 | 10 |
| | TOTAL | 60 |
| | RATING | Fair |

Table 16. Guild assignments for fish captured during an electrofishing survey conducted on Roxbury Creek downstream of Roxbury WWTP outfall on June 13, 2024.

| Species | Count | Thermal Guild | Stream Size Guild | Tolerance Guild |
|---|---|---|---|---|
| BROOK STICKLEBACK | 2 | Transitional | Small | Tolerant |
| CREEK CHUB | 37 | Transitional | Small | Tolerant |
| WESTERN BLACKNOSE DACE | 10 | Transitional | Small | Tolerant |
| WHITE SUCKER | 29 | Transitional | Medium | Tolerant |

Table 17. IBI results for fish survey conducted on Roxbury Creek downstream of Roxbury WWTP outfall on June 13, 2024.

| Small Stream IBI | | |
|---|---|---|
| METRIC | VALUE | SCORE |
| Number Intolerant Species Score | 0 | 0 |
| Number Native Species | 4 | 10 |
| Number Headwater Species | 0 | 0 |
| Percent DELT | 0 | 0 |
| Number Minnow Species | 2 | 10 |
| Catch Per 100 m, exc. Tolerants | 0 | 0 |
| Catch Per 100 m Brook Stickleback | 1.2 | 10 |
| | TOTAL | 30 |
| | RATING | Poor |

| Cool-Warm Transition IBI | | |
|---|---|---|
| METRIC | VALUE | SCORE |
| Number of intolerant species | 0 | 0 |
| Number of native minnow species | 2 | 0 |
| Number of benthic invertivore species | 0 | 0 |
| % as tolerant individuals | 100 | 0 |
| % as omnivore individuals | 37 | 10 |
| | TOTAL | 10 |
| | RATING | Poor |

Table 18. Guild assignments for fish captured during an electrofishing survey conducted on Roxbury Creek upstream of State Highway 12 on June 12, 2024.

| Species | Count | Thermal Guild | Stream Size Guild | Tolerance Guild |
|---|---|---|---|---|
| BROOK STICKLEBACK | 1 | Transitional | Small | Tolerant |
| CENTRAL STONEROLLER | 1 | Warmwater | Small | Intermediate |
| CREEK CHUB | 89 | Transitional | Small | Tolerant |
| FATHEAD MINNOW | 1 | Warmwater | Small | Tolerant |
| GREEN SUNFISH | 3 | Warmwater | Small | Tolerant |
| JOHNNY DARTER | 2 | Transitional | Medium | Intermediate |
| WESTERN BLACKNOSE DACE | 30 | Transitional | Small | Tolerant |
| WHITE SUCKER | 20 | Transitional | Medium | Tolerant |

Table 19. IBI results for fish survey conducted on Roxbury Creek upstream of State Highway 12 on June 12, 2024.

| Small Stream IBI | | |
|---|---|---|
| METRIC | VALUE | SCORE |
| Number Intolerant Species Score | 0 | 0 |
| Number Native Species | 8 | 20 |
| Number Headwater Species | 1 | 10 |
| Percent DELT | 0 | 0 |
| Number Minnow Species | 4 | 20 |
| Catch Per 100 m, exc. Tolerants | 1.76 | 0 |
| Catch Per 100 m Brook Stickleback | 0.59 | 0 |
| | TOTAL | 50 |
| | RATING | Fair |

| Cool-Warm Transition IBI | | |
|---|---|---|
| METRIC | VALUE | SCORE |
| Number of intolerant species | 0 | 0 |
| Number of native minnow species | 4 | 10 |
| Number of benthic invertivore species | 1 | 0 |
| % as tolerant individuals | 98 | 0 |
| % as omnivore individuals | 14 | 20 |
| | TOTAL | 30 |
| | RATING | Fair |

Note: More data from earlier fish surveys (2003, 2009, 2018) are in the Attachments.

**Discussion and Designated Use Recommendations**

***Note: Recommendations from this site visit are shown at the top of this memo.***

- ***Determining the Designated Use:*** Under the Clean Water Act framework, a waterbody's Designated Use should be based on the use that is attainable within the waterbody under good land management practices, and the Designated Use can be set no lower than its existing use (the highest use that has been attained at any time since 1975).
  - ***Existing use:*** The existing fish community present throughout this system is a cool-warm headwater Natural Community (NC), which falls under the Warmwater Designated Use (DU). Therefore, the Designated Use can be no less stringent than a Warmwater DU.
  - ***Attainable use:*** The second step in determining the appropriate DU is to determine what would be attainable in this system under good land management practices (while maintaining similar land uses, such as percent agriculture/urban). Although the Wisconsin Stream Model predicted that these segments may be in a cool-cold thermal guild (which would fall under a Coldwater DU), none of the segments have the potential to be classified as cool-cold or cold given the existing land use, which is predominantly agriculture. Even if this were improved and best management practices were in place, the stream segments likely wouldn't be able to support a cool-cold or coldwater fish community. Therefore, the Warmwater Designated Use is appropriate.
- ***1991 LFF recommendation:*** Although the 1991 report from Schlesser recommends Limited Forage Fish (LFF) from the outfall approximately 560 meters (0.35 miles) downstream to the north line of the SW ¼ of the SE ¼, Section 17, T9N, R7E, this no longer appears to be appropriate. Stream flows have increased, more fish were caught in the 6 surveys conducted throughout the system for this evaluation, and qualitative and quantitative habitat surveys resulted in Fair to Good scores using the current techniques.
- ***Fish surveys:***
  - Similar species were captured at the six sites surveyed for this stream classification evaluation. Brook Stickleback, Creek Chub, and White Sucker were found at all sites. Species tolerant of environmental disturbance comprised a majority of the fish captured throughout Roxbury Creek and the Unnamed Tributary. No intolerant species were captured at any of the sites and only a few individuals of intermediate tolerance were captured.
  - Although Segment 3 below the outfall received poor scores for the fish survey and a fair score for the habitat, similarly ditched stream reaches upstream have a higher quality fish community demonstrating that this segment should be capable of supporting a more diverse and abundant fish community.
  - Previous fish surveys from 2003 captured similar species and abundances as those captured during the 2024 surveys. Surveys conducted in 2003 and 2024 on Roxbury Creek at State Highway 12 had similar results both reflect a warm-transitional fish species assemblage. Seven species were captured in 2003, while eight were captured in 2024. Five species, Brook Stickleback, Creek Chub, Fathead Minnow, Wester Blacknose, Dace, and White Suckers, were captured in both surveys and found in similar proportions of the overall assemblage. This provides some evidence that conditions in the streams at the time surveys were conducted are representative of this system, and relatively consistent over time.
- ***Tolerant species:*** Throughout the system, the segments had predominantly tolerant species, leading to "failed tolerance tests". This means that, as expected, the quality of the fish community is impacted by surrounding land use, and more sensitive species (intolerant of disturbance) are not present. In a more natural system, we would expect to see at least some intolerant or intermediately tolerant species. In some cases with failed tolerance tests, if the modeled NC is thought to be attainable under good land management, we would base the DU on the modeled NC instead of basing it on the existing fish community. However, here, the modeled NC of cool-cold headwater has been determined not to be

attainable given the predominance of agriculture, even under good management, so the DU is recommended to be set at Warmwater, reflecting the existing cool-warm headwater community.

- ***Stream flow: headwater vs. mainstem:*** At the time these surveys were conducted, Unnamed tributary to Roxbury at Inama Road (Map 3, dot 2), along with surveys conducted on Roxbury Creek downstream of the Roxbury Sanitary District Outfall (Map 3, dot 5) and upstream of STH 12 (Map 3, dot 6) all had flows greater than 3 cubic feet per second (cfs). Stream flow was not measured at two of the survey locations due to dense macrophytes throughout the stream reach. According to natural community verification guidance, a long-term average annual 90% exceedance flow of 3 cfs is considered the transition point from a headwater to a mainstem stream classification. Flows were likely elevated when sampling was conducted compared to typical flows due to the wet conditions in spring and early summer of 2024. All sites matched best with the cool-warm headwater natural community even though some sites on the lower end of the Unnamed tributary and Segment 3 of Roxbury Creek fell above the headwater and mainstem stream discharge. Flow has increased in this system since 2013, due to the inputs from Fish, Crystal, and Mud Lake Rehabilitation District. This input combined with the wet conditions in early 2024 may have boosted flows and helps explain why the fish assemblages at many of these sites reflected a headwater community while the stream flows at some of these sites on the date surveyed were more indicative of a mainstem. Thus, in the Recommendations section above, we indicated it could be considered either a cool-warm headwater or a cool-warm mainstem. Whether it is a classified as a headwater or mainstem does not affect permit limits.
- ***Downstream waters:*** The Wisconsin River and side channel were not re-evaluated with a fish survey at this time, but the existing data from Dave Marshall (2009), support that the side channel is a warmwater fish community reflecting that of the Wisconsin River (Nonwadeable Large River NC). Therefore, the permit limits established for warmwater in Roxbury Creek should be protective of downstream waters.

**Are code changes and/or a Use Attainability Analysis needed?**

No Administrative Code changes are needed. None of these segments is currently in the code as LAL or LFF, so they do not need to be removed from code, and they are not recommended for addition to the code as LAL or LFF. A Use Attainability Analysis is not needed since there is no LAL/LFF recommendation.

**Attachments**

Figure 1. Guild tests for survey conducted on Unnamed tributary (WBIC 1260000) to Roxbury Creek at County Highway Y. The guild test for the modeled Natural Community is on the left, the guild test that fits best is on the right.

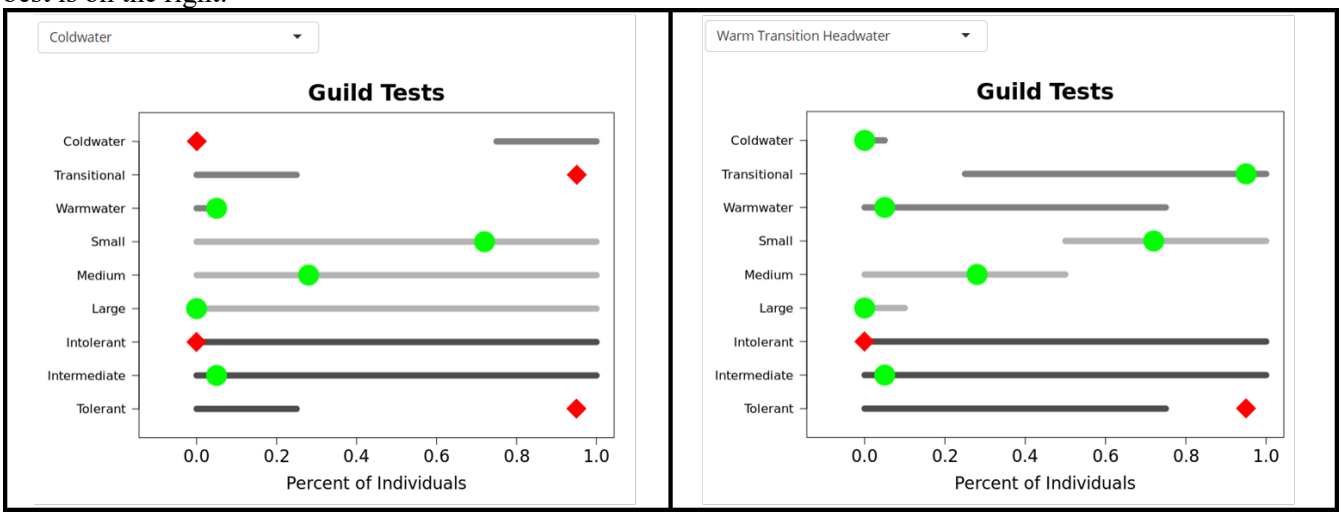


Figure 2. Guild tests for survey conducted on Unnamed tributary (WBIC 1260000) to Roxbury Creek at Inama Road. The guild test for the modeled Natural Community is on the left, the guild test that fits best is on the right.

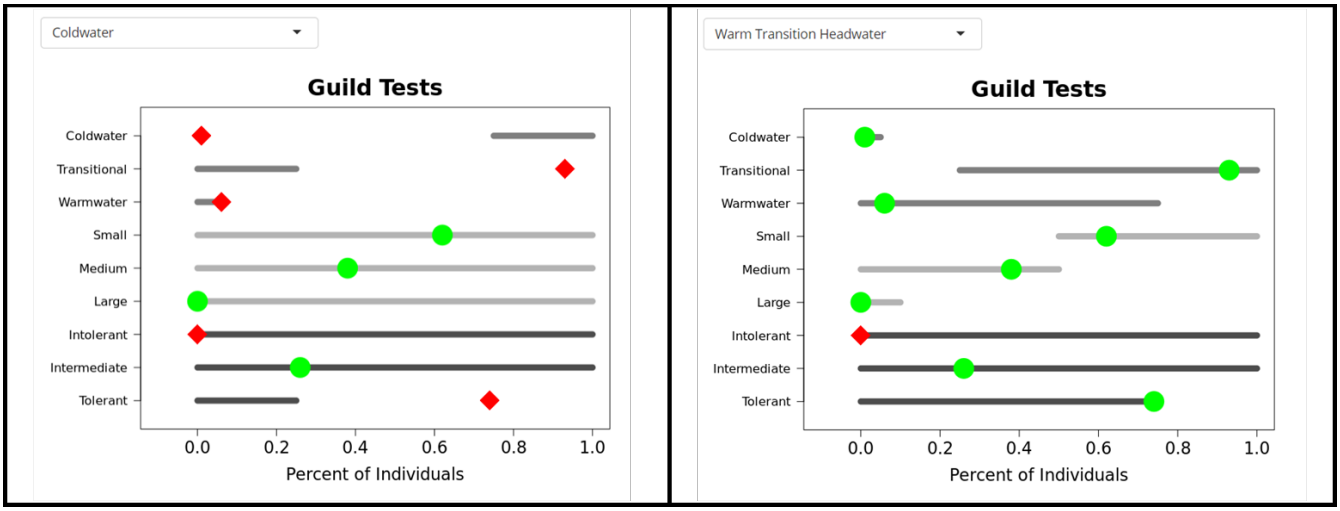



Figure 3. Guild tests for the survey conducted on Roxbury Creek at County Highway KP. The guild test for the modeled Natural Community is on the left, the guild test that fits best is on the right.

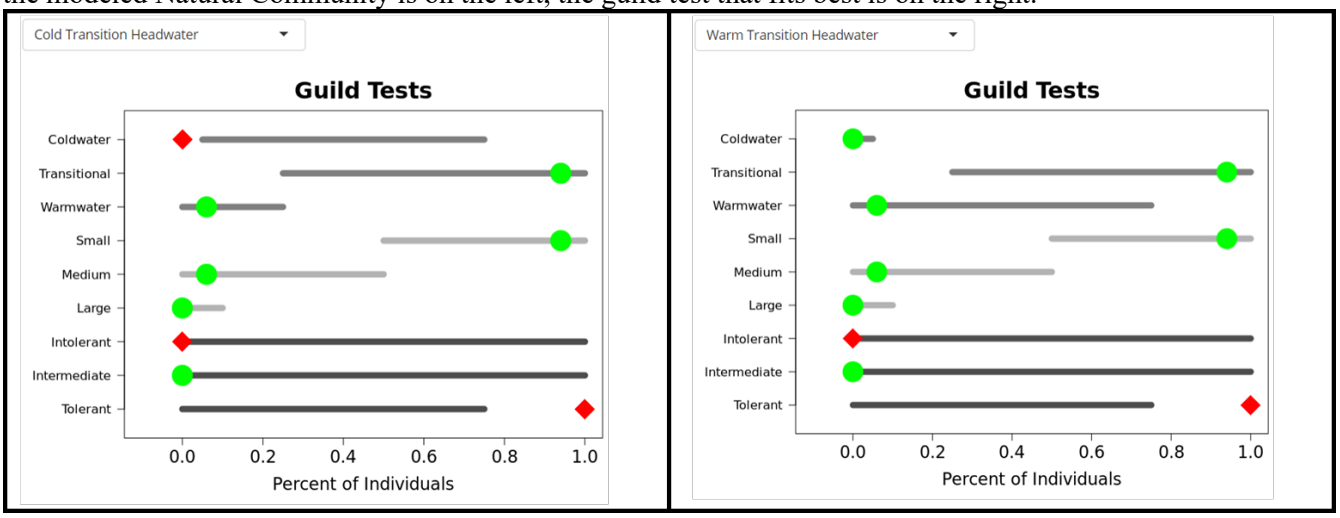


Figure 4. Guild tests for the survey conducted on Roxbury Creek at County Highway Y. The guild test for the modeled Natural Community is on the left, the guild test that fits best is on the right.

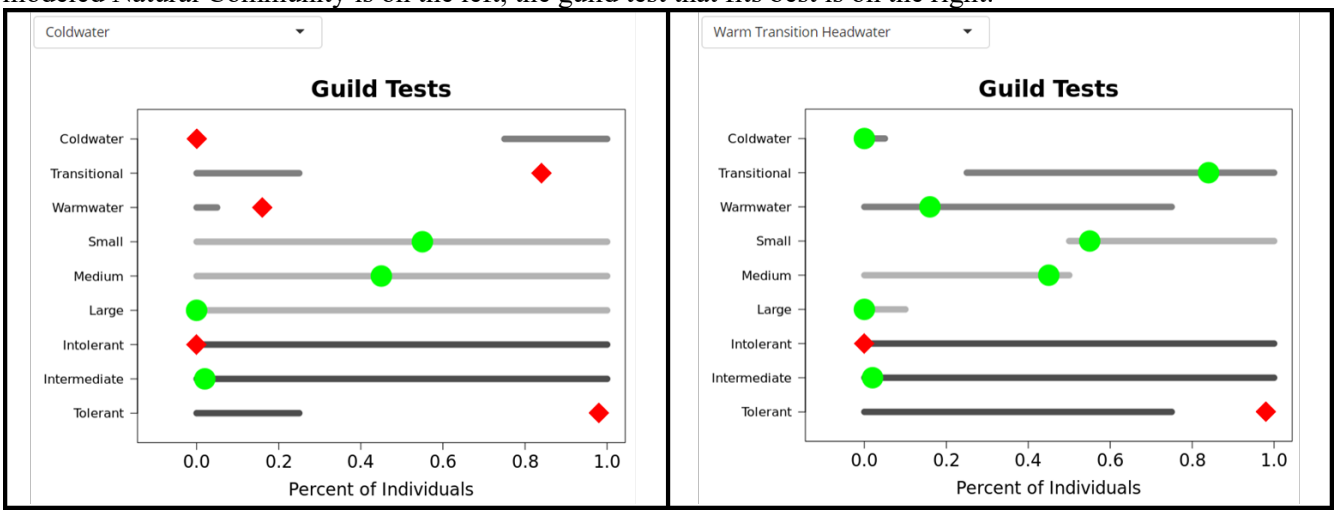



Figure 5. Guild tests for the survey conducted on Roxbury Creek downstream of the Roxbury Sanitary District Wastewater outfall. The guild test for the modeled Natural Community is on the left, the guild test that fits best is on the right.

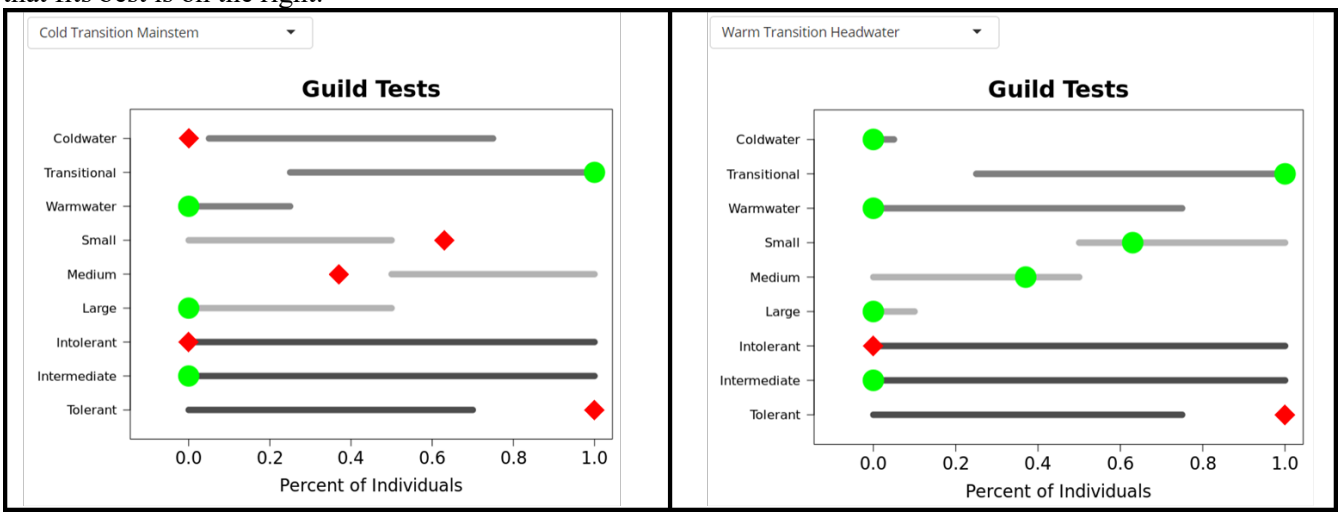


Figure 6. Guild tests for the survey conducted on Roxbury Creek upstream of State Highway 12. The guild test for the modeled Natural Community is on the left, the guild test that fits best is on the right.

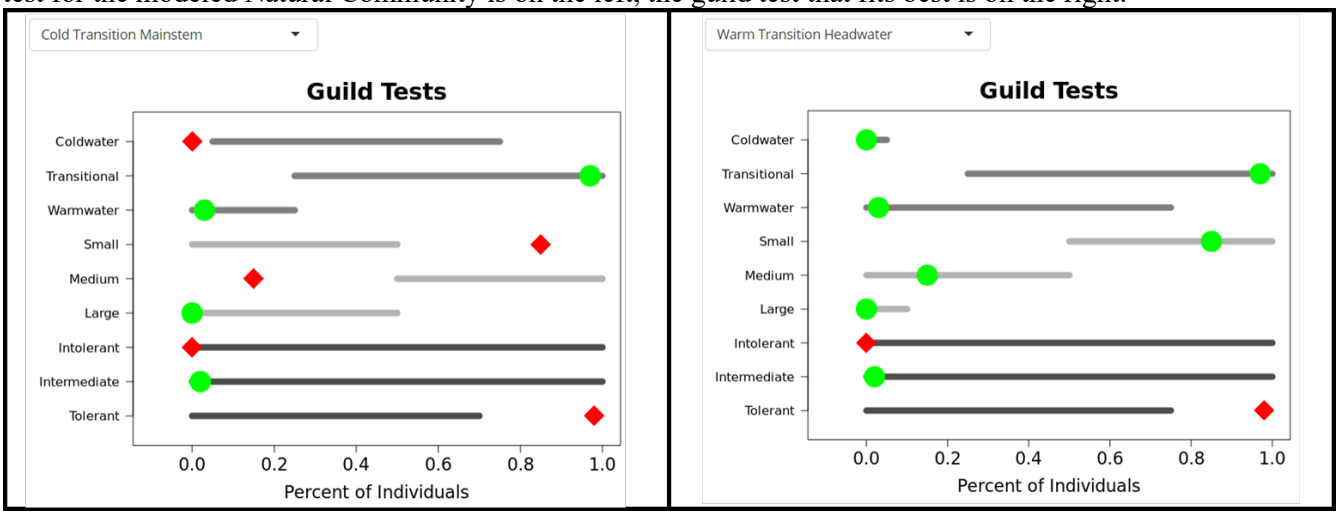



Table 20. Results from fish survey of an Unnamed side channel (WBIC 1259800) of the Wisconsin River conducted by Dave Marshall on June 20th, 2009.

| Common Name | Total Count | Thermal Guild | Stream Size Guild | Tolerance Guild |
|---|---|---|---|---|
| BLUEGILL | 311 | Warmwater | Large | Intermediate |
| BROOK STICKLEBACK | 112 | Transitional | Small | Tolerant |
| CENTRAL MUDMINNOW | 17 | Transitional | Small | Tolerant |
| COMMON CARP | 18 | Warmwater | Large | Tolerant |
| EMERALD SHINER | 49 | Warmwater | Large | Intermediate |
| GOLDEN SHINER | 4 | Warmwater | Medium | Tolerant |
| GRASS PICKEREL | 19 | Warmwater | Medium | Intermediate |
| GREEN SUNFISH | 7 | Warmwater | Small | Tolerant |
| JOHNNY DARTER | 61 | Transitional | Medium | Intermediate |
| LARGEMOUTH BASS | 34 | Warmwater | Large | Intermediate |
| MUD DARTER | 7 | Warmwater | Large | Intermediate |
| NORTHERN PIKE | 1 | Transitional | Small | Intermediate |
| SMALLMOUTH BASS | 10 | Warmwater | Large | Intolerant |
| STARHEAD TOPMINNOW | 26 | Warmwater | Large | Intermediate |
| WARMOUTH | 1 | Warmwater | Large | Intermediate |
| YELLOW PERCH | 3 | Transitional | Large | Intermediate |

Table 21. Results from fish survey of Roxbury Creek at Ballweg Road conducted by Dave Marshall on May 27, 2003.

| Species Name | Count | Thermal Guild | Stream Size Guild | Tolerance Guild |
|---|---|---|---|---|
| BROOK STICKLEBACK | 11 | Transitional | Small | Tolerant |
| CREEK CHUB | 49 | Transitional | Small | Tolerant |
| CENTRAL MUDMINNOW | 2 | Transitional | Small | Tolerant |
| SOUTHERN REDBELLY DACE | 1 | Warm | Small | Intermediate |
| WHITE SUCKER | 46 | Transitional | Medium | Tolerant |

Table 22. Results from fish survey of Roxbury Creek at State Highway 12 conducted by Dave Marshall on June 2, 2003.

| Species Name | Count | Thermal Guild | Stream Size Guild | Tolerance Guild |
|---|---|---|---|---|
| BLUNTNOSE MINNOW | 1 | Warmwater | Medium | Tolerant |
| BROOK STICKLEBACK | 5 | Transitional | Small | Tolerant |
| CREEK CHUB | 75 | Transitional | Small | Tolerant |
| FATHEAD MINNOW | 5 | Warmwater | Small | Tolerant |
| SPOTFIN SHINER | 5 | Warmwater | Large | Intermediate |
| WESTERN BLACKNOSE DACE | 11 | Transitional | Small | Tolerant |
| WHITE SUCKER | 14 | Transitional | Medium | Tolerant |

Table 23. Results from fish survey of Roxbury Creek at State Highway 78 conducted by Jean Unmuth (DNR Water Quality) on August 7, 2018.

| Species | Count | Thermal Guild | Stream Size Guild | Tolerance Guild |
|---|---|---|---|---|
| BROWN TROUT | 1 | Coldwater | Medium | Intermediate |
| COMMON SHINER | 391 | Warmwater | Medium | Intermediate |
| CREEK CHUB | 17 | Transitional | Small | Tolerant |
| EMERALD SHINER | 18 | Warmwater | Large | Intermediate |
| GRASS PICKEREL | 1 | Warmwater | Medium | Intermediate |
| JOHNNY DARTER | 4 | Transitional | Medium | Intermediate |
| SAND SHINER | 2 | Warmwater | Large | Intermediate |
| SPOTFIN SHINER | 15 | Warmwater | Large | Intermediate |
| WESTERN BLACKNOSE DACE | 1 | Transitional | Small | Tolerant |
| WHITE SUCKER | 33 | Transitional | Medium | Tolerant |
| YELLOW PERCH | 2 | Transitional | Large | Intermediate |

Photo 1. Beginning (left photo) and end (right photo) of fish and qualitative habitat survey on Unnamed tributary (WBIC 1260000) to Roxbury Creek at County Highway Y (Map 3, dot 1).

Photo 2. Beginning (left photo) and end (right photo) of fish and qualitative habitat survey conducted on Unnamed tributary (WBIC 1260000) to Roxbury Creek at Inama Road (Map 3, dot 2).

Photo 3. Beginning (left photo) and end (right photo) of fish and qualitative habitat surveys on Roxbury Creek at CTH KP (Map 3, dot 3).

Photo 4. Improperly set culvert upstream of County Highway Y road crossing on Roxbury Creek. Right photo taken near the beginning of the fish survey on Roxbury Creek upstream of CTH Y. Roxbury Creek upstream of CTH Y near the end of the fish survey (left photo) (Map 3, dot 4).

Photo 5. Roxbury Creek upstream of County Highway Y (left photo) and downstream of CTH Y (right photo). Note the difference in stream width and characteristics upstream versus downstream of CTH Y.

Photo 6. Beginning of fish and quantitative habitat survey (left photo) on Roxbury Creek below the Roxbury Sanitary district outfall and the outfall pipe at upstream end of fish and quantitative habitat survey (right photo) (Map 3, dot 5).

Photo 7. Roxbury Creek from wastewater treatment plant outfall and downstream. Overall view of survey reach.

Photo 8. Beginning (left photo) and end (right photo) of fish and qualitative habitat surveys conducted on Roxbury Creek upstream of State Highway 12 (Map 3, dot 6).