2023 Aquatics Ecology Resources

Tips for studying for the aquatics test questions:

- ❖ Our resources provide the information needed to answer the learning objectives of the NCF curriculum guidelines: https://envirothon.org/the-competition/areas-of-study/aquatic-ecology/. Download this document and use it as a study guide. Although there are 61 items on the list, some overlap. If you answer just 3 or 4 questions per week, you will complete the study guide and be well prepared for the aquatic test.
- ❖ Our aquatics test aligns with the National Envirothon objectives and test guidelines. For better understanding of the aquatics test format and test writing go to https://envirothon.org/educational resources/test-writing/

New additions to 2022/23 in red - Updated 12/1/22

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- Contact Tina Harding for free curriculum resources with lesson plans to aid in teaching these concepts to you students.

Aquatics Resources – resources available for FREE upon request from **Tina Harding** (tinamharding@nd.gov)

1. Streamkeepers Field Guide-- Contact Tina Harding, ND Project WET Coordinator for hard copy: tinamharding@nd.gov

2. Healthy Water, Healthy People Water Quality Educators Guide—Contact Tina Harding, ND Project WET Coordinator for hard copy: tinamharding@nd.gov

3. Healthy Water, Healthy People Field Monitoring Guide Contact Tina Harding, ND Project WET Coordinator for hard copy: tinamharding@nd.gov

4. EPA Volunteer Stream Monitoring Manual: https://www.epa.gov/sites/production/files/2015-06/documents/stream.pdf

5. USGS Water Science School: https://www.usgs.gov/special-topic/water-science-school

Here are some additional resources that will relate to North Dakota

- North Dakota Department of Water Resources: http://swc.nd.gov
  - A reference Guide to North Dakota Waters: http://www.swc.nd.gov/pdfs/water_reference_guide.pdf
  - Prairie Waters Education and Research Center: https://www.vcsu.edu/academics/academic-centers/prairie-waters-education-research-center/

- Living with a River Handbook: https://deq.nd.gov/publications/WQ/3_WM/NPS/SWCBinder/Riparian/Living%20With%20A%20River%20Handbook%20(FINAL).pdf

National Envirothon Aquatics Resources:

Abiotic Factors:

1. USGS Water Science Basics: What is the Water Cycle? :
   - https://water.usgs.gov/edu/watercycle.html

2. Basic concepts on Watersheds:
   - https://www.epa.gov/hwp/basic-information-and-answers-frequent-questions#what
   - ND Watershed Basics Fact Sheet: https://deq.nd.gov/publications/WQ/3_WM/NPS/InfoEd/1_WatershedBasics_FactSheetFinal.pdf

3. How to Read a Topographic Map and Delineate a Watershed
   - https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_014819.pdf

4. Water Quality
   - https://nepis.epa.gov/Exe/ZyPDF.cgi/P100MRC3.PDF?Dockey=P100MRC3.PDF
     - Chapter 5: Stream Flow, Dissolved Oxygen and Biochemical Oxygen Demand, Temperature, pH, Turbidity, Phosphorous, Nitrated, Total Solids, Conductivity, Alkalinity, Fecal Bacteria. **Only the information under the "What is it and why is it important" section for each parameter**

Biotic Factors:

- Introduction to Watershed Ecology: Watershed Academy Web
  - https://cfpub.epa.gov/watertrain/pdf/modules/WatershedEcology.pdf

- Aquatic Macroinvertebrates
  - Understand how and why we use aquatic macroinvertebrates to determine water quality. Chapter 4: https://www.epa.gov/sites/default/files/2015-06/documents/stream.pdf
  - Below are links to aquatic macroinvertebrate websites. You will be given a dichotomous key to identify macroinvertebrates, so know how to use it!
    - http://www.waterbugkey.vcsu.edu/
    - http://www.ndfreshwaterinverts.vcsu.edu/
    - https://stroudcenter.org/wp-content/uploads/StroudWebsiteMacroKeyFNL.pdf

- Introduction to Freshwater Fish as Biological Indicators: Pages 3-12

- https://nepis.epa.gov/Exe/ZyPDF.cgi/P1002J1W.PDF?Dockey=P1002J1W.PDf

Aquatic Environments

- USGS Groundwater
  - What is groundwater (simplified)? https://pubs.usgs.gov/of/1993/ofr93-643/pdf/ofr93-643.pdf
  - Groundwater (more in-depth): https://pubs.usgs.gov/gip/gw/gwgip.pdf

- Types of Wetlands—4 main types. Which does ND have?
  - https://www.epa.gov/wetlands/wetlands-classification-and-types#marshes

- Wetland Functions and Values
  - https://cfpub.epa.gov/watertrain/pdf/modules/WetlandsFunctions.pdf
    Read to know how wetlands function for: habitat, water quality, flood storage, shoreline and erosion protection, economic and recreation, and climate change.

- Benefits and Definition of Riparian Zones (Riparian Buffer)
  - Understand riparian functions for: Habitat, aquatic ecosystem (influence water temperature and aquatic habitat), water quality (turbidity, sedimentation, eutrophication)
  - What is a Riparian Buffer?
    https://www.fs.usda.gov/nac/assets/documents/workingtrees/infosheets/rb_info_050712v3.pdf
  - Riparian Zones: Managing Early-Successional Habitats near the Water's Edge (more in-depth) ▪
    http://www.state.nj.us/dep/fgw/pdf/mgtguide/ch09_riparian_zones.pdf

Aquatics and Society

- Point source vs. non-point source.: https://en.wikipedia.org/wiki/Nonpoint_source_pollution
- Aquatic Nuisance Species: Know and identify invasive species in ND and how to prevent the spread.
  - North Dakota Aquatic Nuisance Species: https://gf.nd.gov/ans
  - Stop Aquatic Hitchhikers:
    https://stopaquatichitchhikers.org/hitchhikers/mollusks-zebra-mussel/

- Aquatic Endangered species in ND: What are the aquatic endangered species in ND and what agency is responsible in ND
  - https://www.fws.gov/office/north-dakota-ecological-services

- Summary of the Federal Clean Water Act: (SDWA)
  - https://www.epa.gov/sites/production/files/2015-04/documents/epa816f04030.pdf

- The Quality of Our Nation's Water
  - https://pubs.usgs.gov/fs/FS-116-99/pdf/fs-116-99.pdf

- GIS and Hydrology:
  - https://en.wikipedia.org/wiki/GIS_and_hydrology

- Water Resources:
  - https://en.wikipedia.org/wiki/Water_resources

- Water Conservation:
  - https://en.wikipedia.org/wiki/Water_resources

Current Issue: ADAPTING TO A CHANGING CLIMATE

- Refer to the ND and NCF current issue sources.