Protocols for Completing the Biological Monitoring Wetland Human Disturbance Assessment

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December 2013
DEP-LW1259

Bureau of Land and Water Quality
Division of Environmental Assessment
Biomonitoring Program

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TABLE OF CONTENTS

1. Applicability....3
2. Purpose....3
3. Definitions....3
4. Guidelines and Procedures....3
   A. Evaluating the Assessment Area and Watershed....3
   B. Scoring Procedure....4
   C. WHDA Section Descriptions and Scoring Specifications....6
      (1) Hydrologic Modifications to Wetland....6
      (2) Vegetative Modifications to Wetland....8
      (3) Evidence of Chemical Pollutants....12
      (4) Watershed Characterization and Potential NPS Pollution Impacts....14
5. Examples of Completed Wetland Human Disturbance Assessment Forms....21
   A. Example #1....22
   B. Example #2....28
   C. Example #3....34
6. References....40
7. Appendix 1: Wetland Human Disturbance Assessment form....41

Cover Photo: Lower Togus Pond (North End), station W-090, June 2012. MDEP

1. **Applicability.** This standard operating procedure (SOP) applies to the completion of the Wetland Human Disturbance Assessment as part of the Maine DEP's Biological Monitoring (Biomonitoring) Program wetland sampling protocol. It describes the scoring procedure and provides guidance for each section of the assessment. This SOP does not cover collection of biological samples, water samples, or physical/chemical field measurements; such protocols are described in *Protocols for Sampling Aquatic Macroinvertebrates in Freshwater Wetlands* (DiFranco 2014), *Protocols for Sampling Algae in Wadeable Rivers, Streams, and Freshwater Wetlands* (Danielson 2014), *Protocols for Collecting Water Grab Samples in Rivers, Streams, and Freshwater Wetlands* (Danielson 2014), and *Protocols for Using the Hanna Dissolved Oxygen and Specific Conductance/pH Meters in Rivers, Streams, and Freshwater Wetlands* (Danielson 2014).

2. **Purpose.** The purpose of the Wetland Human Disturbance Assessment (WHDA) is to characterize the degree of human disturbance at a given wetland monitoring location and to document environmental stressors. The WHDA is only one portion of the Biomonitoring Program's wetland sampling protocol and is not intended to serve as an impact assessment in the absence of biological data. Information on stressors is valuable for diagnosing the causes of impairment and for determining possible remediation measures. WHDA scores are used to categorize pristine reference sites, minimally impacted sites, and highly disturbed sites.

   This scoring manual provides guidance for completing the WHDA. Prior knowledge of human disturbance principles and associated terminology is assumed. This manual includes definitions of the Assessment Area and watershed, a description of the scoring scale, ways to prevent double-counting of the same impact, and descriptions of the form's four sections: Hydrologic Modifications to the Wetland, Vegetative Modifications to the Wetland, Evidence of Chemical Pollutants, and Watershed Characterization and Potential Non-point Source Pollution Impacts. The description of each section includes scoring examples of common human disturbances, which are based on impacts observed at existing Biomonitoring wetland stations. The manual concludes with three examples of completed WHDA forms.

3. **Definitions**
   A. **Assessment Area –**The Assessment Area for this assessment includes all sections of the waterbody observed by Biomonitoring staff while performing the standard sampling procedure. This includes the access point and the entire area seen while searching for biological sampling locations. During the sampling protocol, habitat characteristics and human activities within the Assessment Area are noted. The level of human disturbance is evaluated after all samples have been collected.

   B. **Buffer Area** – The Buffer Area for Biomonitoring wetland stations is the area that lies within a 100 foot distance of the wetland perimeter.

4. **Guidelines and Procedures**
   A. **Evaluating the Assessment Area and Watershed**
   The Assessment Area for this assessment, as defined above, includes all sections of the waterbody observed by Biomonitoring staff while performing the standard sampling procedure. This includes the access point and the entire area seen while searching for

biological sampling locations. During the sampling protocol, habitat characteristics and human activities within the Assessment Area are noted. The level of human disturbance is evaluated after all samples have been collected.

Watershed characteristics are evaluated by observing land features during the sampling procedure and by consulting the Maine Atlas and Gazetteer and a GIS aerial photograph of the wetland and its surrounding watershed. To better assess the degree of human disturbance, the Biomonitoring Unit utilizes several GIS data layers, including: dams, wetlands, licensed discharges, roads, EGAD Site Location points and watershed boundaries (see Section 5. below for examples of GIS aerial photographs with overlays). Potential impacts commonly assessed from the GIS aerial photograph include residential and commercial development, roads, agriculture, and forestry activity. All stressors within the watershed are considered and evaluated based on potential to negatively affect the wetland.

B. **Scoring Procedure**

(1) Scoring method

The Wetland Human Disturbance Assessment is scored using a 5-point scale (Table 1) and is divided into four sections: Hydrologic Modifications to Wetland, Vegetative Modifications to Wetland, Evidence of Chemical Pollutants, and Watershed Characterization and Potential NPS Pollution Impacts. Each section is divided into subsections. Under each subsection, all stressors present should be checked, and a score between 0 and 5 (whole numbers only; no decimals or fractions) should be determined for the entire subsection based on potential impact(s) to the wetland. Observed stressors not listed on the form may be written into the 'Other' line in each subsection. In most cases, the score should be at least 1 if any of the listed stressors are present. If the only stressor present is highly unlikely to impact wetland condition, a severity ranking of 0 is acceptable. Sections 1 and 2 have subsections listing natural modifications (i.e. beaver activity). These are meant for record-keeping purposes and are not scored because the disturbances are not anthropogenic. Empty line space next to each stressor can be used for comments, and the comment boxes at the end of each section can be used for notes pertaining to the entire section or when additional space is required. The human disturbance form includes 24 scored subsections (maximum score for each subsection is 5), making the maximum human disturbance ranking score 120. Because so many different types of stressors are captured in this assessment, it is unlikely a site would score near the maximum. All sites assessed to date have scores below 50.

Table 1. Description of stressor severity ranks.

Severity	Severity Description	Rank
Not Observed or Unknown	The stressor is not observed or has no detrimental impact on wetland condition.	**0**
Observed; Minimal Disturbance	The stressor is present and appears to have negligible impacts on wetland condition.	**1**
Low Disturbance	The stressor is present and appears to have minor impacts on wetland condition.	**2**
Moderate Disturbance	The stressor is present and appears to moderately impact wetland condition.	**3**

High Disturbance	The stressor is present and appears to significantly impact wetland condition.	**4**
Severe Disturbance	The stressor is present and appears to have major impacts on wetland condition.	**5**

(2) Scoring Considerations - Several factors are considered when deciding the stressor severity ranking for each subsection and all factors must be considered simultaneously for each stressor present.

(a) One factor is the number of stressors present. If several stressors are present from one subsection, a higher score will likely be given than if only one stressor were present. However, a high score may be given for one stressor that significantly impacts the wetland.

(b) Distance from the wetland is also considered, with disturbances in close proximity to the waterbody receiving higher scores than disturbances near the outer edge of the watershed.

(c) Age of the stressor is also a factor (i.e. recent/ongoing forestry activity would likely receive a higher score than old/recovering activity).

(d) Size of the stressor, proportion of the wetland impacted, and likelihood of a stressor affecting the wetland are all considered as well. For instance, if a logging operation is occurring on the outer edge of the watershed but there is clear evidence of sedimentation near the wetland caused by the activity, the "forestry activities in watershed" subsection (Section 4) would receive a high score.

(e) Wetlands with high WHDA scores are generally impacted by stressors from several categories, have a great deal of human development in their watersheds, and have greatly altered buffers. Wetlands with total WHDA scores of 10 or less and with no single section score greater than 5, are potential reference sites.

(3) Double-Counting

Double-counting the same impact should be minimized as much as possible. An impact should only be considered in multiple sections if it affects the wetland in more than one manner. A stormwater discharge could affect the wetland hydrologically with large inputs of water and also chemically if the water is polluted. The addition of a fire hydrant could affect the wetland hydrologically by removing large amounts of water and also by modifying the vegetated wetland buffer. A road built across a wetland will impede water flow and alter vegetation. In such cases, scoring the impact in multiple sections is acceptable. However, be careful not to double count a stressor in multiple subsections of the same section. A road created by fill could be modifying a wetland's hydrology due to the fill and by impeding the water flow. It should be noted in both subsections, but scored in only one. Double-counting the same effects of the same stressor should be prevented. In section 4, roads with residential housing are considered part of Residential Development and should not be counted again under the Additional Roads subsection. Only roads without residential or commercial development, such as highways, should be included in the Additional Roads subsection.

C. WHDA Section Descriptions and Scoring Specifications

(1) Hydrologic Modifications to Wetland (Section 1)

Hydrologic modifications include impoundment structures such as dams and man-made berms, unnatural draining sources or water inputs, filling and excavation, and any other structures that could impede water flow. A subsection for natural hydrologic modifications is also included but not scored. Hydrologic modifications can affect wetland vegetation composition and productivity, fish and amphibian spawning, waterfowl habitat, and biogeochemical processes.

(a) Scoring specifications for Section 1

1. This section includes hydrologic impacts **directly in the wetland**.
2. In this section, only impacts to water level and flow are considered. For instance, a stormwater discharge would be scored solely for water input. The impacts of possible pollutants, erosion, etc. will be covered in Sections 3 and 4.
3. Only count a structure as an impoundment structure if it is actually impeding the flow of water. If a bridge spans the entire width of the wetland and does not appear to affect water flow, note its presence but do not count it as a hydrologic modification.

(b) Section 1 subsections

1. Impoundment Structures (Table 2)
   i. Scoring is based on size, age, and management of the impoundment
   ii. Scoring example – Dams: Wetlands created by dams are generally given a severity ranking of 3, unless dam management is greatly affecting water quality. Several factors must be considered during the scoring process, including dam management, size, and water level fluctuations. Level of impact is also considered (i.e. old logging dam that is partially or mostly breached and no longer used would receive a low score). The dam's purpose will likely affect scoring, with waterfowl management dams typically receiving lower scores than hydropower dams.

Table 2. Impoundment structures stressor list

Impoundment structures	Check if present	Score 0 to 5
dams		
dikes		
man-made berms		
tide gates		
Other:		

2. Other structures that impede water flow (Table 3)
   i. Only structures that are actually impeding water should be counted in this subsection. If a bridge spans the entire width of the wetland and does not appear to affect water flow, note its presence but do not count it as a hydrologic modification.
   ii. Scoring example – roads: The only stressor present under this subsection is a major two-lane road with wide shoulders that crosses the entire width of the wetland. Water is still able to flow to the opposite side of the road, but movement is moderately obstructed because of the length and width of the road. It would be appropriate to give a severity score of 3 to a sampling station near this road.

Table 3. Additional structures that impede water flow stressor list

Other structures that impede water flow	Check if present	Score 0 to 5
causeways/roads		
railroad beds		
bridge abutments (and associated structures)		
inadequate, hanging or obstructed culverts (and associated structures)		
additional retaining walls/riprap (not included above)		
Other:		

3. Draining/Dewatering (Table 4)
   i. Water withdrawal stressors should only be scored if active water withdrawal is witnessed or if sampling personnel has prior knowledge of water withdrawal activity occurring at the site.
   ii. Scoring example – water withdrawal: A water withdrawal structure, such as a fire hydrant, is the only stressor present from this subsection. If water levels appear stable, the draining structure would receive a severity ranking of 1 for its hydrologic impacts. The draining structure has the potential to remove large quantities of water when needed, but stable water levels indicate that no draining activity occurred recently. However, if there is evidence of recent dewatering or active pumping is observed, a severity ranking of 3 -5 could be given based on level of impact.

Table 4. Draining/Dewatering stressor list

Draining/Dewatering	Check if present	Score 0 to 5
ditching		
drain tiles		
agricultural water withdrawal		
non-agricultural water withdrawal (fire hydrant, intake pipe)		
Other:		

4. Unnatural inputs of water (Table 5)
   i. Do not count impacts of pollutants associated with water inputs. These stressors will be scored in Sections 3 and 4.
   ii. Scoring example – stormwater discharge: A stormwater discharge is the only stressor present from this subsection. The wetland is receiving a direct discharge from a stormwater pond, and erosion and gullying surrounding the discharge indicates that a significant amount of water is entering the wetland from the discharge on a regular basis. This stressor received a severity ranking of 4. It did not receive the maximum score because the effects were localized near the discharge and did not disrupt the integrity of the entire wetland.

Table 5. Unnatural water input sources stressor list

Unnatural inputs of water	Check if present	Score 0 to 5
stormwater drain/discharge		
combined sewer overflow		
municipal/industrial point source discharge		
agricultural irrigation		
spray irrigation (non-agricultural, waste discharge, etc.)		

Other:		

5. Filling and excavation (Table 6)
   i. When assessing fill within the wetland, do not double-count fill associated with dams, roads, etc. Only score for additional filling.
   ii. Recent/ongoing fill is typically scored higher than older, stabilized fill.
   iii. The percentage of the original wetland affected is a major factor in scoring.
   iv. Scoring example – filling: The only stressor present from this subsection is filling. A wetland with minimal, stabilized fill along its edges would receive a severity ranking of 1. Recent or ongoing fill encompassing a large percentage of the original wetland area would receive a ranking of 4 or 5 depending on level of impact.

Table 6. Filling and excavation stressor list

Filling and excavation	Check if present	Score 0 to 5
fill – recent and/or ongoing		
fill – older, stabilized		
grading or bulldozing (elimination of micro-topography)		
plowing/tilling		
excavated farm pond		
other excavated pond		
excavated area associated with culvert or bridge		
channelization		
Other:		

6. Natural hydrologic modifications (Table 7)
   i. This subsection is not scored because the modifications are not anthropogenic.
   ii. Natural modifications are tracked for record-keeping purposes and may be useful when analyzing biological data (natural modifications can still negatively impact the wetland).

Table 7. Natural hydrologic modifications stressor list

Natural hydrologic modifications (specify but do not score)	Check if present	
beaver activity		
debris dams		
land slide		
major flooding/storm damage		
Other:		

(2) Vegetative Modifications to Wetland (Section 2)

Vegetative modifications include vegetation removal, forestry activities, agricultural activities, presence of invasive species, and other vegetation changes caused by human activity. A subsection for natural vegetative modifications is also included but not scored. Vegetation is easily observed and shifts predictably in response to stress. As vegetative communities change, important wetland services, such as biodiversity support and water quality improvement, may be affected.

(a) Scoring specifications for Section 2

1. This section includes vegetative modifications **directly in the wetland**. Vegetative modifications in the buffer and watershed are considered in Sections 3 and 4.
2. Only changes in vegetative composition should be considered in this section. Hydrologic impacts of structures crossing the wetland are considered in Section 1.
3. Recent/ongoing vegetation removal activity should be scored higher than old/recovering removals.

(b) Section 2 subsections

1. Clearing/removal of vegetation (Table 8)
   i. Only use the roads category in this subsection for roads unrelated to forestry and agriculture activities. Logging roads and farm roads are counted under the forestry activities and agricultural activities subsections, respectively.
   ii. Scoring example – Roads: Roads are the only stressor present from this subsection. If one road crosses through the wetland edge, a severity ranking of 1 or 2 would be given depending on the size and usage of the road. If several roads cross the entire width of the wetland, a severity ranking of 3 or 4 would be given depending on the size and usage of the roads. A major highway running through the wetland would be given a severity ranking of 5.

Table 8. Clearing/removal of vegetation stressor list

Clearing/removal of vegetation	Check if present	Score 0 to 5
roads		
recreation trails (atv, hiking, snowmobile, etc.)		
utility lines		
buildings, structures, parking lots, etc.		
mowing (in the wetland, not a lawn)		
brush hogging		
intentional/controlled burning		
human-caused accidental/arson fires		
chemical removal (herbicides, etc.)		
Other:		

2. Clearing/removal of wetland vegetation – forestry activities (Table 9)
   i. Clear cuts typically receive higher scores than selective cuts.
   ii. Recent and/or ongoing forestry activities would be scored higher than past/stable activities.

Table 9. Impacts on wetland vegetation from forestry activities stressor list

Clearing/removal of wetland vegetation – forestry activities	Check if present	Score 0 to 5
clear cut		
selective cut		
logging roads		
skidder trails/staging areas		
replacement of wetland vegetation by tree plantation		
Other:		

3. Clearing/removal of wetland vegetation – agricultural activities (Table 10)

i. Recent and/or ongoing activities would be scored higher than past/stable activities.

Table 10. Impacts on wetland vegetation from agricultural activities stressor list

Clearing/removal of wetland vegetation - agricultural activities	Check if present	Score 0 to 5
plowing/conversion to cropland		
pasture/grazing		
hayfield		
farm roads		
Other:		

4. Wetland vegetation changes due to other human activities (Table 11)
   i. Vegetation changes in the wetland (most likely) caused by toxic effects are scored in Section 3, "Evidence of toxic effects to vegetation, aquatic life or wildlife" subsection.
   ii. Vegetation changes in the wetland caused by nutrient enrichment are scored in Section 4, "Evidence of erosion, sedimentation, and nutrient enrichment" subsection.
   iii. Scoring example – replacement of natural plant community: An open-water marsh with sparse natural vegetation and cattails surrounding the entire perimeter would receive a severity ranking of 3.

Table 11. Wetland vegetation changes due to other human activities stressor list

Wetland vegetation changes due to other human activities (hydrological alterations, nutrient inputs, etc.)	Check if present	Score 0 to 5
dead or dying vegetation due to inundation or flooding		
dead or dying vegetation due to desiccation (draining, water withdrawal, water diversion, upstream dam, etc.)		
replacement of natural plant community (excessive Typha sp., etc.)		
change in historic wetland class (conversion from PFO to PEM, etc.)		
Other:		

5. Presence of non-aquatic invasive plants (Table 12)
   i. Consider all non-aquatic invasive plants species, as identified by the Maine Natural Areas Program (http://www.maine.gov/doc/nrimc/mnap/features/invsheets.htm).
   ii. The "unknown/not assessed" box in the percentage estimate category should be used when no invasive plants are observed or when an invasive plant assessment is not performed.
   iii. This subsection is scored based on the total percent cover of non-aquatic invasive species present. Write the score associated with the selected percentage range in the score box.

Table 12. Presence of non-aquatic invasive plant species

Presence of Non-aquatic Invasive Plants (total cover, all known species)		
Estimate total percent cover of non-aquatic invasive species in the assessment area using cover classes below and score accordingly. Check appropriate box if presence unknown and/or not assessed.		

1 < 5% ☐ 5-10% ☐	2 11-25% ☐	3 26-50% ☐	4 51-75% ☐	5 76-100% ☐	unknown/not assessed ☐		
purple loosestrife							
Phragmites							
Other(s):							

6. Presence of aquatic invasive plants (Table 13)
   i. Stressor list includes aquatic invasive plants species, as identified by the Maine DEP Invasive Aquatic Plant Program, (http://www.maine.gov/dep/water/invasives/).
   ii. Aquatic invasive plants should be indicated if observed or known to be present, but determining a percentage of cover is not practicable during this assessment.
   iii. Scoring should be based on the number of invasive species present, the extent of infestation (if known), potential effects to the wetland and any control measures that have been implemented.

Table 13. Presence of aquatic invasive plant species

Presence of Aquatic Invasive plants (check if present**):** ☐ unknown/not assessed		
For aquatic invasive plants (floating or submerged), indicate if observed (positive ID) or known to be present through signs or other means. Check appropriate box if presence unknown and/or not assessed.		
Eurasian water- milfoil		
Variable water-milfoil		
Hydrilla		
Other(s)		

7. Natural vegetative modifications (Table 14)
   i. This subsection is not scored because the modifications are not anthropogenic.
   ii. Natural modifications are tracked for record-keeping purposes and may be useful when analyzing biological data (natural modifications can still negatively impact the wetland).

Table 14. Natural vegetative modifications stressor list

Natural vegetative modifications (specify but do not score)	Check if present	
herbivory (insect damage, animal browsing, beavers, etc.)		
fires		
floods		
storm damage (blow downs, etc.)		
Other:		

(3) <u>Evidence of Chemical Pollutants (Section 3)</u>

Chemical pollutant sources include direct discharges, solid waste, chemical spills, and herbicide or pesticide applications. Evidence of chemical pollutants in a wetland includes dead or dying wildlife, unnatural sheens or water color, presence of sewage fungus or solid waste, and chemical odors. As chemical stressors accumulate in a wetland, the water quality purification function is typically reduced. Biodiversity support

and biogeochemical cycling are compromised, causing toxic effects to wildlife and loss of sensitive taxa.

(a) Scoring specifications for Section 3

1. Score based on observations in the wetland and adjacent/upstream sources that may impact the wetland.

(b) Section 3 subsections

1. Direct discharge present (Table 15)
   i. Stressors in this subsection are only scored for potential chemical impacts. Hydrologic impacts of direct discharges are considered in Section 1.
   ii. Scoring example: Three different stressors from this subsection are present: industrial, stormwater, and treatment plant discharges. A severity ranking of 3 was given because all of the discharges are located a fair distance upstream, with plenty of opportunity for dilution before reaching the wetland.

Table 15. Stressor list for the chemical impacts of direct discharges

Direct discharge present	Check if present	Score 0 to 5
stormwater		
industrial discharge		
treatment plant		
combined sewer overflow		
leachate plume		
fish hatchery		
Other:		

2. Other evidence of contaminants (Table 16)
   i. Oil sheen should not be confused with surface iron films, which is natural in some wetlands. To determine whether the sheen is natural or anthropogenic, poke the area with a stick. If the sheen swirls back together immediately, it is petroleum-based. If the sheen breaks apart, forms plates and does not flow back together, it is from bacteria or plant/animal decomposition.
   ii. Most foam in waterbodies is natural and does not indicate pollution. Biodegradable detergents and the reduction of pollution from wastewater treatment plants have reduced the occurrence of pollution-related foam. If the foam has a fragrant odor, it may be from a nearby spill or waste discharge pipe. Natural foam may smell fishy or earthy and breaks apart easily when disturbed.
   iii. Sewage fungus is a visible growth of filamentous bacteria that form in response to organic nutrients in the water. Sewage fungus builds up on almost any surface where there is a flow of water and the necessary nutrients, such as organic wastes and feces.
   iv. Scoring example: A severity ranking of 1 would be given for a mild sewage odor. A station located downstream of a remediated Superfund site would receive a severity ranking of 3.

Table 16. Other evidence of contaminants stressor list

Other evidence of contaminants	Check if present	Score 0 to 5
documented previous oil/chemical spill		
free oil, petroleum, chemicals observed on site		

unusual water color/turbidity		
sheen (not from natural causes)		
soil staining (not from natural causes)		
foam (not from natural causes)		
chemical odor present		
sewage odor present		
evidence of CSO discharge (solids)		
sewage fungus present		
Other:		

3. Herbicide, pesticide, and fertilizer application (Table 17)
   i. To avoid double-counting the effects of agriculture, only score the "agricultural application" stressor if application and/or spraying equipment is witnessed during sampling or if there is evidence or reliable knowledge of regular spraying. Otherwise, all agricultural effects, including potential pesticide use, will be considered in the "Agriculture in watershed" subcategory of Section 4.
   ii. Scoring example – agricultural application: The only stressor present is evidence of agricultural pesticide application. Patches of dead and dying vegetation are seen in potato fields adjacent to the wetland. Although the fields are close to the wetland, the area impacted is not very large. This stressor received a severity ranking of 3.

Table 17. Herbicide, pesticide, and fertilizer application stressor list

Herbicide, pesticide and fertilizer application	Check if present	Score 0 to 5
utility line maintenance		
agricultural application		
forestry application		
insect pest control (specify):		
invasive species management (plants, fish, etc.); Only score impacts to non-target species		
Other:		

4. Solid waste (Table 18)
   i. Scoring example: A small amount of litter at a fishing area would receive a severity ranking of 1, while a site directly adjacent to a landfill would receive a severity ranking of 5.

Table 18. Solid Waste stressor list

Solid Waste	Check if present	Score 0 to 5
municipal dump/landfill		
sludge spreading		
household trash/dumping		
petroleum, chemical containers, drums, etc.		
abandoned vehicles, tires, etc.		
demolition debris		
stump dump		
litter		
Other:		

5. Evidence of toxic effects to vegetation, aquatic life, or wildlife (Table 19)

i. In this subsection, only vegetation changes **directly in the wetland** should be counted. Vegetation changes in the buffer or watershed caused by chemical pollutants should be counted in one of the other Section 3 subsections as appropriate.
ii. Only vegetation changes (most likely) caused by chemical pollutants should be scored in this subsection. Vegetative modifications caused by flooding or desiccation are considered in Section 2, and vegetation changes caused by nutrient enrichment are considered in Section 4.
iii. Scoring example: A severity ranking of 3 was given at a site where dead fish and tadpoles were observed. Recent spraying had occurred near the wetland, and no apparent natural cause could be determined. This stressor was given a 3 because the fatalities were few in number but indicated that chemical pollutants had reached the waterbody.

Table 19: Evidence of toxic effects to vegetation, aquatic life, or wildlife in wetland stressor list

Evidence of toxic effects to vegetation, aquatic life or wildlife in wetland	Check if present	Score 0 to 5
dead, dying or stressed vegetation (no apparent natural causes)		
dead or dying fish, amphibians or other aquatic life/wildlife (no other apparent natural causes)		
Other:		

(4) Watershed Characterization and Potential NPS Pollution Impacts (Section 4)

Potential sources of non-point source pollution (NPS) include residential and commercial development, recreation facilities, roads, forestry activity, agriculture, and soil erosion. NPS pollution can severely degrade water quality and is difficult to control once surrounding land is developed.

(a) Scoring specifications for Section 4
1. Score based on potential for erosion and sedimentation, urban runoff, nutrient enrichment, etc. **in the watershed**.

(b) Section 4 subsections
1. Residential development in the watershed
i. This subsection is divided into low, medium, and high density categories (Table 20), see Figure 2 for examples.
ii. Scoring includes houses, lawns, and residential roads.
iii. Check all density categories that apply (different areas of the watershed may have different densities) and score based on average density. The score also depends on the total amount of residential development. Watersheds with low-density development scattered throughout may receive higher scores than watersheds with only one area of high-density development.
iv. This subsection is scored for residential development only. Commercial development is considered in the "Commercial/Industrial/Municipal development in watershed" subsection of Section 4.
v. Scoring example – using 5-point scale:
- 1 – One or two camps in the watershed, but there are good buffers between the camps and the waterbody
- 2 – A few camps closer to the water, but good buffers remain

- 3 – Several year-round houses with some lawns close to the water, but buffer is still good overall
- 4 – Significant residential development near waterbody with several buffer disturbances
- 5 – High density residential development with little buffer; lawns run to water's edge; possible wetland filling for residential development purposes

Table 20. Residential development in watershed stressor list

Residential Development in watershed (including homes, lawns, residential roads)	Check if present	Score 0 to 5
low density		
medium density		
high density		

Figure 2. Visual examples of residential development density categories: (A) low density; (B) medium density; (C) high density (Photo credit: Google Earth)

2. Commercial/Industrial/Municipal development in watershed (Table 21)
   i. Scoring includes associated roads, paved areas, and parking lots.
   ii. This subsection is scored for commercial/industrial/municipal development only. Residential development is considered in the "Residential development in watershed" subsection of Section 4.
   iii. Scoring example – using 5-point scale:
      - 1 – One or two businesses in the watershed, but there are good buffers between them and the waterbody
      - 2 – A few businesses and a school closer to the water, but good buffers remain
      - 3 – Several types of commercial/industrial/municipal development close to the water, but buffer is still good overall
      - 4 – Significant commercial/industrial/municipal development near waterbody with several buffer disturbances
      - 5 – High density commercial/industrial/municipal development with little buffer; parking lots run to water's edge; possible wetland filling for development purposes

Table 21. Commercial/Industrial/Municipal development in watershed stressor list

Commercial/Industrial/Municipal Development in watershed	Check if present	Score 0 to 5
stores/businesses/office buildings		
schools, universities		
landfills/transfer stations		
sewage treatment plants		
power generation facility		
composting facility		
manufacturing plants/factories		
gravel pits/mining		
airports		
railroads (tracks, rail yards, etc.)		
military facilities		
additional parking lots/ pavement (not associated with any of the above)		
Other:		

3. Recreation facilities in watershed (Table 22)
   i. Scoring includes associated parking lots and access roads.
   ii. Scoring example: A site that is a Wildlife Management Area, with a boat launch, fishing access and hiking trails along the water would receive received a severity ranking of 3.

Table 22. Recreation facilities in watershed stressor list

Recreation facilities in watershed	Check if present	Score 0 to 5
lawn/park/picnic areas		
ball fields, tennis courts, basketball courts, etc.		
campgrounds		
boat launches		
piers/docks		
golf course		
trails (atv, hiking, snowmobile, etc.)		
boardwalks		
Wildlife Management Area (ME IF&W, US F&WS)		
Other:		

4. Additional roads in watershed (Table 23)

i. To avoid double-counting, only roads without residential or commercial development, such as highways, should be included in the roads subsection.
ii. Scoring example: One old, gravel road a fair distance from the wetland would receive a severity ranking of 1. A major, heavily used highway (i.e. the Maine Turnpike) crossing the wetland next to the sampling location would receive a severity ranking of 4 or 5.

Table 23. Additional roads in watershed stressor list

Additional Roads in watershed (not associated with any of the above)	Check if present	Score 0 to 5
gravel, small, low usage		
gravel, large, more heavily used (the Golden Road)		
1 or 2 lane, paved		
>2 lane, paved		
Other:		

5. Forestry activities in watershed (Table 24)
   i. Scoring includes all associated roads and staging areas.
   ii. Specific forestry activity categories should only be used if forestry activity is witnessed during sampling or if sampling personnel has prior knowledge of the area's forestry operations. If forestry stressors are scored based solely on visual evidence in the GIS aerial photograph, select the "mixed or unknown type(s)" category.
   iii. Scoring example – See Figure 3, below. Forestry activity encompasses a large portion of the immediate watershed, but appears to be a selective cut so a severity rank of 3 is assigned.

Table 24. Forestry activities in watershed stressor list

Forestry activities in watershed	Check if present	Score 0 to 5
clear cut, recent/ongoing		
selective cut, recent/ongoing		
clear cut, older/recovering		
selective cut, older/recovering		
tree farm/plantation		
mixed or unknown type(s)		
Other:		

Figure 3. Aerial photograph of forestry activity in a Biomonitoring wetland station's watershed. (Photo credit: Google Earth)

6. Agriculture in watershed(Table 25)
   i. Scoring includes all associated roads
   ii. Specific agriculture categories should only be used if activity is witnessed during sampling or if sampling personnel has prior knowledge of the area's agricultural operations. If agriculture stressors are scored based solely on visual evidence in the GIS aerial photograph, select the "mixed or unknown type(s)" category.
   iii. Scoring example – see Figure 4, the example on the left received a severity rank of 3. There are several types of agriculture throughout the entire watershed, but an adequate buffer is maintained surrounding the wetland. The example on the right received a severity rank of 4 due to the large proportion of agriculture in the watershed and the lack of buffer surrounding the wetland. Without the few remnants of natural vegetation in the watershed, this stressor would have received a severity rank of 5.

Table 25. Agriculture in watershed stressor list

Agriculture in watershed	Check if present	Score 0 to 5
pasture		
livestock		
feedlots		
manure piles/spreading		
row crops		
hayfield		
fallow field		
commercial blueberry operations		

commercial cranberry operations		
commercial nursery		
commercial orchard		
sod farm		
mixed or unknown type(s)		
Other:		

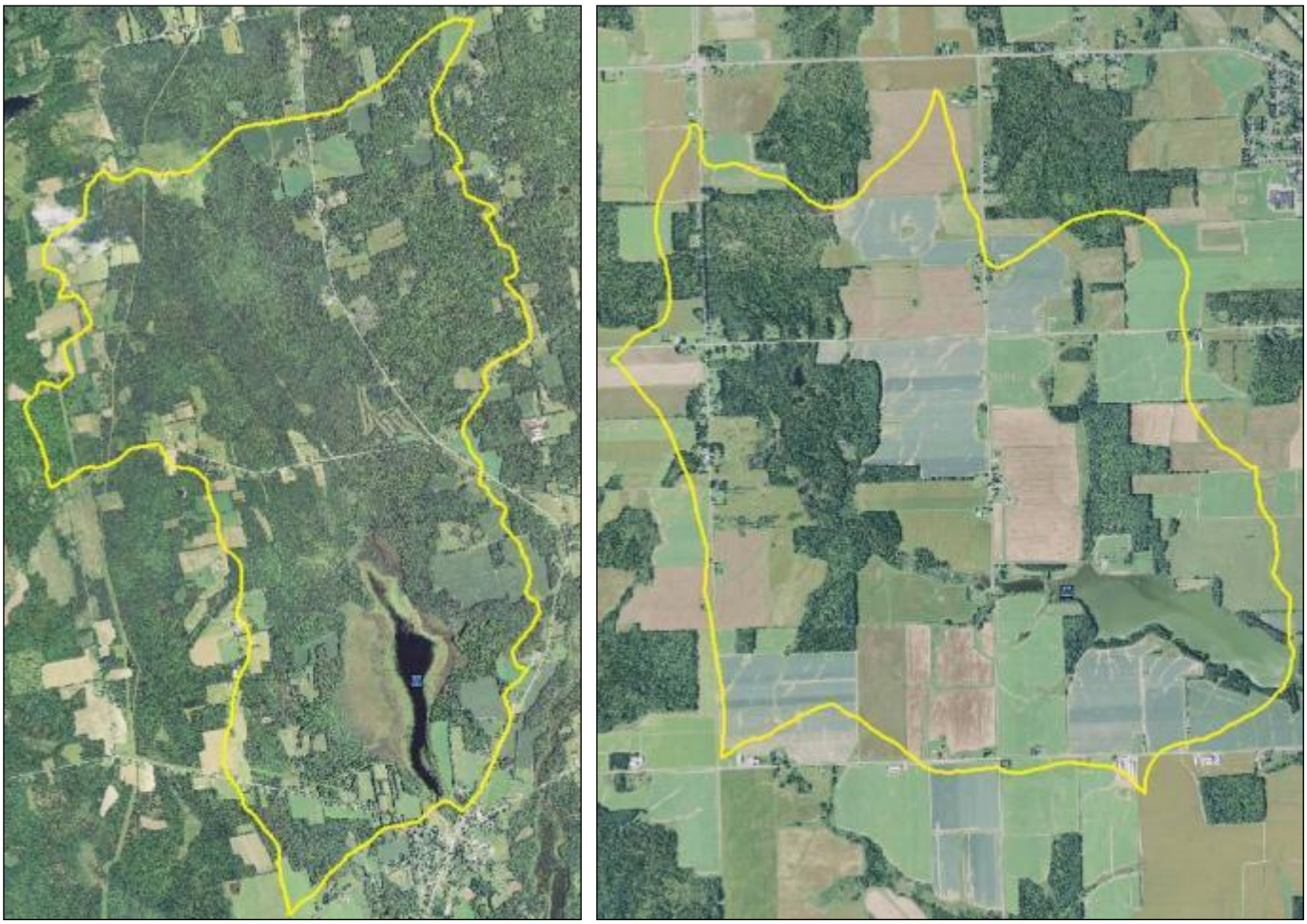

Figure 4. GIS aerial photographs of two watersheds located in agricultural areas of Maine. (Photo credit: ArcGIS 10)

7. Evidence of erosion, sedimentation, and nutrient enrichment (Table 26).
   i. Scoring example: The presence of excessive duckweed with no other stressor would get a severity ranking of 1. A small area of unstable soil on the bank of an open water wetland, with a visible path to the water and sediment in the water would receive a severity ranking of 4.

Table 26. Evidence of erosion, sedimentation, and nutrient enrichment stressor list

Evidence of erosion, sedimentation and nutrient enrichment	Check if present	Score 0 to 5
unstable soil in a position to wash into wetland or associated water body		
erosional gullies or washed out areas		
excess accumulated sediment		
sediment plume in water		
unnatural turbidity		

nuisance algae bloom		
presence of excessive duckweed (Lemna sp.)		
unusually heavy growth of epiphytic algae		
unusually dense or large growth habit of aquatic macrophytes or other vegetation		
Other:		

8. Alterations to wetland buffer (Table 27).
   i. The Buffer Area for Biomonitoring wetland stations is the area that lies within a 100 ft. distance of the wetland perimeter.
   ii. This subsection is scored based on the percentage of the buffer that has been altered by human activity. Write the score associated with the selected percentage range in the score box.

Table 27. Alterations to wetland buffer stressor list

Alterations to wetland buffer (within 100 feet of wetland edge)	Check if present	Score 0 to 5
Estimate total percent of buffer altered using cover classes below and score accordingly: **1** **2** **3** **4** **5** **< 5%** **5-10%** **11-25%** **26-50%** **51-75%** **76-100%** ☐ ☐ ☐ ☐ ☐ ☐		

5. Examples of Completed Wetland Human Disturbance Assessment Forms

The remaining pages of this manual include three completed Wetland Human Disturbance Assessment forms for three different Biomonitoring wetland sites. These examples are provided to demonstrate proper form completion procedures and to indicate realistic scores for sites with varying degrees of human disturbance. All site identifiers have been removed because site conditions may have changed since the form was completed. Example #1 only has a few anthropogenic disturbances, including hydrologic modifications and some development and agriculture in its watershed. Example #2 has a great deal of agriculture in its watershed and has direct discharges from potato processing plants. Example #3 has several hydrologic and vegetative modifications and a great deal of urban development in its watershed.

Wetland Human Disturbance Assessment (WHDA)
Maine Department of Environmental Protection Biomonitoring Program

Name of wetland and/or associated waterbodies: ____**Example #1** _____
Station #:__W-###__ Date: _6/14/XX____ Town: ____XX_____ Evaluator(s): __JD and BC_

The purpose of this assessment is to characterize the degree of human disturbance in and around a wetland Biomonitoring station, and to document environmental stressors. Note that this human disturbance assessment is a stressor identification tool and not a direct measure of biological condition. See *Protocols for Completing the Biological Monitoring Wetland Human Disturbance Assessment* for scoring procedures and guidance.

For each wetland station assessed, score all factors in each section below using the following scale:

Severity	Severity Description	Rank
Not Observed or Unknown	The stressor is not observed or has no detrimental impact on wetland condition.	**0**
Observed; Minimal Disturbance	The stressor is present and appears to have negligible impacts on wetland condition.	**1**
Low Disturbance	The stressor is present and appears to have minor impacts on wetland condition.	**2**
Moderate Disturbance	The stressor is present and appears to moderately impact wetland condition.	**3**
High Disturbance	The stressor is present and appears to significantly impact wetland condition.	**4**
Severe Disturbance	The stressor is present and appears to have major impacts on wetland condition.	**5**

Section 1. Hydrologic Modifications to Wetland	Check if present	Score 0 to 5
Impoundment structures		3
dams	X	
dikes		
man-made berms		
tide gates		
Other:		
Other structures that impede water flow		3
causeways/roads	X	
railroad beds		
bridge abutments (and associated structures)	X	
inadequate, hanging or obstructed culverts (and associated structures)		
additional retaining walls/riprap (not included above)		
Other:		
Draining/Dewatering		
ditching		
drain tiles		
agricultural water withdrawal		
non-agricultural water withdrawal (fire hydrant, intake pipe)		
Other:		
Unnatural inputs of water		
stormwater drain/discharge		
combined sewer overflow		
municipal/industrial point source discharge		
agricultural irrigation		
spray irrigation (non-agricultural, waste discharge, etc.)		
Other:		
Filling and excavation		
fill – recent and/or ongoing		
fill – older, stabilized		
grading or bulldozing (elimination of micro-topography)		
plowing/tilling		
excavated farm pond		

EXAMPLE

other excavated pond		
excavated area associated with culvert or bridge		
channelization		
Other:		
Natural hydrologic modifications (specify but do not score)		
beaver activity		
debris dams		
land slide		
major flooding/storm damage		
Other:		
Section 1 Comments:	**Section Score**	6

Section 2. Vegetative Modifications to Wetland Score based on vegetation impacts directly in the wetland, not in the buffer or watershed.	Check if present	Score 0 to 5
Clearing/removal of vegetation		
roads		
recreation trails (atv, hiking, snowmobile, etc.)		
utility lines		
buildings, structures, parking lots, etc.		
mowing (in the wetland, not a lawn)		
brush hogging		
intentional/controlled burning		
human-caused accidental/arson fires		
chemical removal (herbicides, etc.)		
Other:		
Clearing/removal of wetland vegetation – forestry activities		
clear cut		
selective cut		
logging roads		
skidder trails/staging areas		
replacement of wetland vegetation by tree plantation		
Other:		
Clearing/removal of wetland vegetation - agricultural activities		
plowing/conversion to cropland		
pasture/grazing		
hayfield		
farm roads		
Other:		
Wetland vegetation changes due to other human activities (hydrological alterations, nutrient inputs, etc.)		
dead or dying vegetation due to inundation or flooding		
dead or dying vegetation due to desiccation (draining, water withdrawal, water diversion, upstream dam, etc.)		
replacement of natural plant community (excessive Typha sp., etc.)		
change in historic wetland class (conversion from PFO to PEM, etc.)		
Other:		
Presence of Non-aquatic Invasive Plants (total cover, all known species)		
Estimate total percent cover of non-aquatic invasive species in the assessment area using cover classes below and score accordingly. Check appropriate box if presence unknown and/or not assessed.		
1 < 5% ☐ | **2** 5-10% ☐ | **3** 11-25% ☐ | **4** 26-50% ☐ | **5** 51-75% ☐ | 76-100% ☐ | **unknown/not assessed** ☐		

EXAMPLE

purple loosestrife		
Phragmites		
Other(s):		
Presence of Aquatic Invasive plants (check if present**):** ☐ unknown/not assessed		
For aquatic invasive plants (floating or submerged), indicate if observed (positive ID) or known to be present through signs or other means. Check appropriate box if presence unknown and/or not assessed.		
Eurasian water- milfoil		
Variable water-milfoil		
Hydrilla		
Other(s)		
Natural vegetative modifications (specify but do not score)		
herbivory (insect damage, animal browsing, beavers, etc.)		
fires		
floods		
storm damage (blow downs, etc.)		
Other:		
Section 2 Comments:	**Section Score**	0

Section 3. Evidence of Chemical Pollutants Score based on observations in the wetland and adjacent/upstream sources that may potentially impact the wetland.	Check if present	Score 0 to 5
Direct discharge present		
stormwater		
industrial discharge		
treatment plant		
combined sewer overflow		
leachate plume		
fish hatchery		
Other:		
Other evidence of contaminants		
documented previous oil/chemical spill		
free oil, petroleum, chemicals observed on site		
unusual water color/turbidity		
sheen (not from natural causes)		
soil staining (not from natural causes)		
foam (not from natural causes)		
chemical odor present		
sewage odor present		
evidence of CSO discharge (solids)		
sewage fungus present		
Other:		
Herbicide, pesticide and fertilizer application		
utility line maintenance		
agricultural application		
forestry application		
insect pest control (specify):		
invasive species management (plants, fish, etc.); Only score impacts to non-target species		
Other:		
Solid Waste		
municipal dump/landfill		
sludge spreading		
household trash/dumping		
petroleum, chemical containers, drums, etc.		

EXAMPLE

abandoned vehicles, tires, etc.		
demolition debris		
stump dump		
litter		
Other:		
Evidence of toxic effects to vegetation, aquatic life or wildlife in wetland		
dead, dying or stressed vegetation (no apparent natural causes)		
dead or dying fish, amphibians or other aquatic life/wildlife (no other apparent natural causes)		
Other:		
Section 3 Comments:	**Section Score**	0

Section 4. Watershed Characterization and Potential NPS Pollution Impacts Score based on potential for erosion and sedimentation, urban runoff, nutrient enrichment, etc. in the wetland watershed.	Check if present	Score 0 to 5
Residential Development in watershed (including homes, lawns, residential roads)		
low density	X	2
medium density		
high density		
Commercial/Industrial/Municipal Development in watershed (including associated roads, paved areas)		
stores/businesses/office buildings		
schools, universities		
landfills/transfer stations		
sewage treatment plants		
power generation facility		
composting facility		
manufacturing plants/factories		
gravel pits/mining		
airports		
railroads (tracks, rail yards, etc.)		
military facilities		
additional parking lots/ pavement (not associated with any of the above)		
Other:		
Recreation facilities in watershed		
lawn/park/picnic areas		
ball fields, tennis courts, basketball courts, etc.		
campgrounds		
boat launches	X	1
piers/docks		
golf course		
trails (atv, hiking, snowmobile, etc.)	X	
boardwalks		
Wildlife Management Area (ME IF&W, US F&WS)	X	
Other:		
Additional Roads in watershed (not associated with any of the above)		
gravel, small, low usage		
gravel, large, more heavily used (the Golden Road)		1
1 or 2 lane, paved	X	
>2 lane, paved		
Other:		
Forestry activities in watershed		
clear cut, recent/ongoing		
selective cut, recent/ongoing		
clear cut, older/recovering		
selective cut, older/recovering		
tree farm/plantation		

EXAMPLE

mixed or unknown type(s)		
Other:		
Agriculture in watershed		
pasture		
livestock		
feedlots		
manure piles/spreading		
row crops		
hayfield		
fallow field		
commercial blueberry operations		
commercial cranberry operations		
commercial nursery		3
commercial orchard		
sod farm		
mixed or unknown type(s) *Agriculture in watershed, but good buffers*	X	
Other:		
Evidence of erosion, sedimentation and nutrient enrichment		
unstable soil in a position to wash into wetland or associated water body		
erosional gullies or washed out areas		
excess accumulated sediment		
sediment plume in water		
unnatural turbidity		
nuisance algae bloom		
presence of excessive duckweed (Lemna sp.)		
unusually heavy growth of epiphytic algae		
unusually dense or large growth habit of aquatic macrophytes or other vegetation		
Other:		
Alterations to wetland buffer (within 100 feet of wetland edge)		
Estimate total percent of buffer altered using cover classes below and score accordingly: **1** | **2** | **3** | **4** | **5** **< 5%** ☐ **5-10%** ☐ | **11-25%** ☐ | **26-50%** ☐ | **51-75%** ☐ | **76-100%** ☐		
Section 4 Comments:	**Section Score**	7

WHDA Scores

Section 1 total: __6___ (Hydrological Modifications to Wetland)
Section 2 total: __0___ (Vegetative Modifications to Wetland)
Section 3 total: __0___ (Evidence of Chemical Pollutants)
Section 4 total: __7___ (Watershed Characterization and Potential NPS Pollution Impacts)

Total Wetland Human Disturbance Score (WHDS) _13_____

Additional Comments:

_____
_____
_____

EXAMPLE

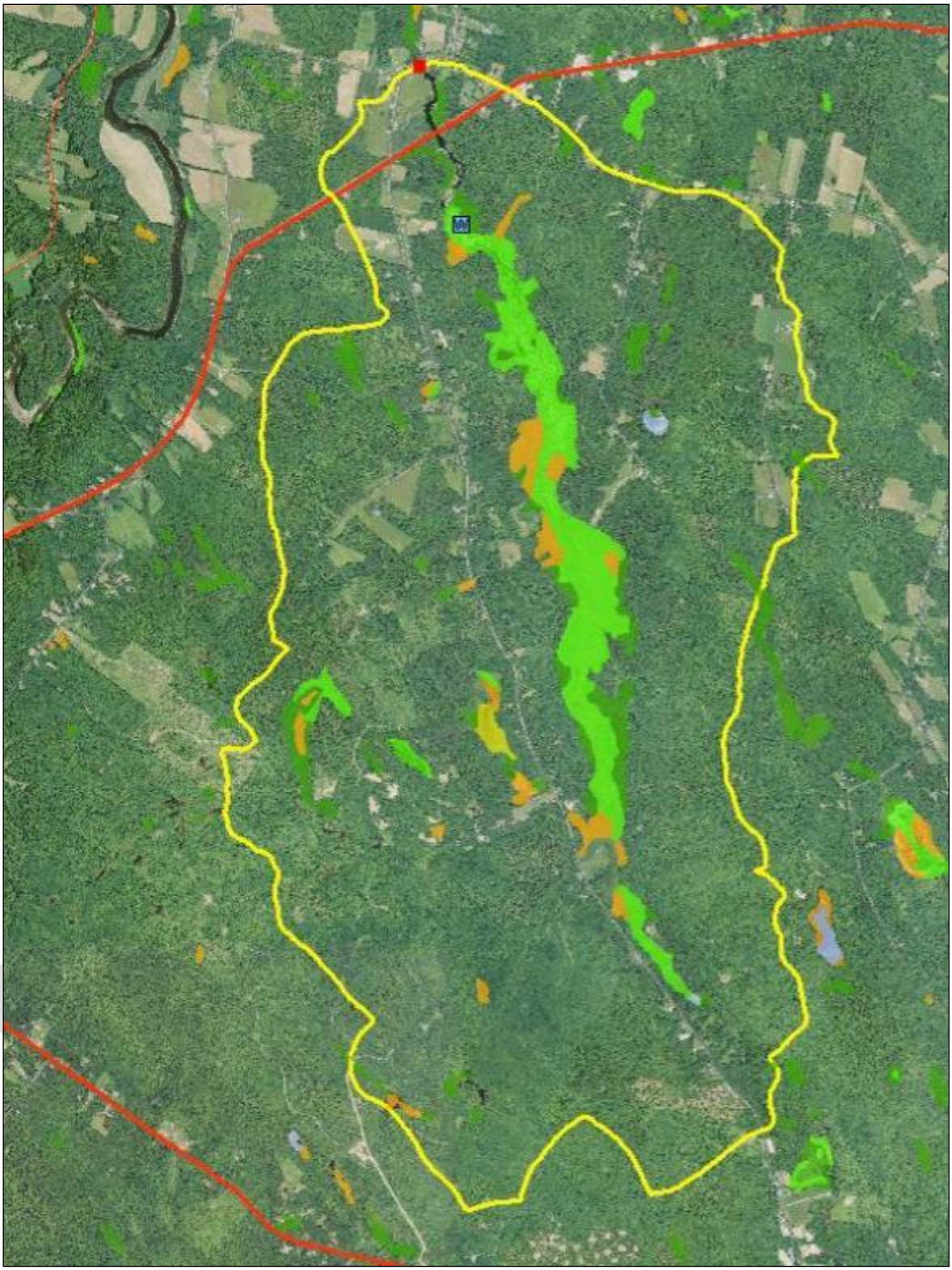

Figure 5. GIS aerial photograph of **Example #1**'s watershed. The watershed is delineated in yellow, major roads are drawn using red lines, and dams are represented with red squares. The blue "W" square marks the sampling location. Wetland habitat is delineated using the "NWI Palustrine Wetlands" layer. (Photo credit: ArcGIS 10)

Wetland Human Disturbance Assessment (WHDA)
Maine Department of Environmental Protection Biomonitoring Program

Name of wetland and/or associated waterbodies: __**Example #2**_____
Station #:_W-###__ Date: _06/30/XX__ Town: _____ Evaluator(s): _JD_____

The purpose of this assessment is to characterize the degree of human disturbance in and around a wetland Biomonitoring station, and to document environmental stressors. Note that this human disturbance assessment is a stressor identification tool and not a direct measure of biological condition. See *Protocols for Completing the Biological Monitoring Wetland Human Disturbance Assessment* for scoring procedures and guidance.

For each wetland station assessed, score all factors in each section below using the following scale:

Severity	Severity Description	Rank
Not Observed or Unknown	The stressor is not observed or has no detrimental impact on wetland condition.	**0**
Observed; Minimal Disturbance	The stressor is present and appears to have negligible impacts on wetland condition.	**1**
Low Disturbance	The stressor is present and appears to have minor impacts on wetland condition.	**2**
Moderate Disturbance	The stressor is present and appears to moderately impact wetland condition.	**3**
High Disturbance	The stressor is present and appears to significantly impact wetland condition.	**4**
Severe Disturbance	The stressor is present and appears to have major impacts on wetland condition.	**5**

Section 1. Hydrologic Modifications to Wetland	Check if present	Score 0 to 5
Impoundment structures		5
dams	X	
dikes		
man-made berms	X	
tide gates		
Other:		
Other structures that impede water flow		3
causeways/roads		
railroad beds	X	
bridge abutments (and associated structures)		
inadequate, hanging or obstructed culverts (and associated structures)		
additional retaining walls/riprap (not included above)		
Other:		
Draining/Dewatering		
ditching		
drain tiles		
agricultural water withdrawal		
non-agricultural water withdrawal (fire hydrant, intake pipe)		
Other:		
Unnatural inputs of water		
stormwater drain/discharge		
combined sewer overflow		
municipal/industrial point source discharge		
agricultural irrigation		
spray irrigation (non-agricultural, waste discharge, etc.)		
Other:		
Filling and excavation		
fill – recent and/or ongoing		
fill – older, stabilized		
grading or bulldozing (elimination of micro-topography)		
plowing/tilling		
excavated farm pond		

EXAMPLE

other excavated pond		
excavated area associated with culvert or bridge		
channelization		
Other:		
Natural hydrologic modifications (specify but do not score)		
beaver activity		
debris dams		
land slide		
major flooding/storm damage		
Other:		
Section 1 Comments:	**Section Score**	8

Section 2. Vegetative Modifications to Wetland Score based on vegetation impacts directly in the wetland, not in the buffer or watershed.	Check if present	Score 0 to 5
Clearing/removal of vegetation		
roads		
recreation trails (atv, hiking, snowmobile, etc.)		
utility lines		
buildings, structures, parking lots, etc.		
mowing (in the wetland, not a lawn)		
brush hogging		
intentional/controlled burning		
human-caused accidental/arson fires		
chemical removal (herbicides, etc.)		
Other:		
Clearing/removal of wetland vegetation – forestry activities		
clear cut		
selective cut		
logging roads		
skidder trails/staging areas		
replacement of wetland vegetation by tree plantation		
Other:		
Clearing/removal of wetland vegetation - agricultural activities		
plowing/conversion to cropland		
pasture/grazing		
hayfield		
farm roads		
Other:		
Wetland vegetation changes due to other human activities (hydrological alterations, nutrient inputs, etc.)		
dead or dying vegetation due to inundation or flooding		
dead or dying vegetation due to desiccation (draining, water withdrawal, water diversion, upstream dam, etc.)		
replacement of natural plant community (excessive Typha sp., etc.)		
change in historic wetland class (conversion from PFO to PEM, etc.)		
Other:		
Presence of Non-aquatic Invasive Plants (total cover, all known species)		
Estimate total percent cover of non-aquatic invasive species in the assessment area using cover classes below and score accordingly. Check appropriate box if presence unknown and/or not assessed.		
1 < 5% ☐ **2** 5-10% ☐ **3** 11-25% ☐ **4** 26-50% ☐ **5** 51-75% ☐ **6** 76-100% ☐ **unknown/not assessed** ☐		

EXAMPLE

purple loosestrife		
Phragmites		
Other(s):		
Presence of Aquatic Invasive plants (check if present**):** ☐ unknown/not assessed		
For aquatic invasive plants (floating or submerged), indicate if observed (positive ID) or known to be present through signs or other means. Check appropriate box if presence unknown and/or not assessed.		
Eurasian water- milfoil		
Variable water-milfoil		
Hydrilla		
Other(s)		
Natural vegetative modifications (specify but do not score)		
herbivory (insect damage, animal browsing, beavers, etc.)		
fires		
floods		
storm damage (blow downs, etc.)		
Other:		
Section 2 Comments:	**Section Score**	

Section 3. Evidence of Chemical Pollutants Score based on observations in the wetland and adjacent/upstream sources that may potentially impact the wetland.	Check if present	Score 0 to 5
Direct discharge present		
stormwater		
industrial discharge *potato plant discharge*	X	5
treatment plant		
combined sewer overflow		
leachate plume		
fish hatchery		
Other:		
Other evidence of contaminants		
documented previous oil/chemical spill		
free oil, petroleum, chemicals observed on site		
unusual water color/turbidity		
sheen (not from natural causes)		
soil staining (not from natural causes)		
foam (not from natural causes)		
chemical odor present		
sewage odor present		
evidence of CSO discharge (solids)		
sewage fungus present		
Other:		
Herbicide, pesticide and fertilizer application		
utility line maintenance		
agricultural application *dead and dying vegetation in agricultural fields adjacent to wetlands*	X	3
forestry application		
insect pest control (specify):		
invasive species management (plants, fish, etc.); Only score impacts to non-target species		
Other:		
Solid Waste		
municipal dump/landfill		
sludge spreading		
household trash/dumping		
petroleum, chemical containers, drums, etc.		

EXAMPLE

abandoned vehicles, tires, etc.		
demolition debris		
stump dump		
litter		
Other:		
Evidence of toxic effects to vegetation, aquatic life or wildlife in wetland		
dead, dying or stressed vegetation (no apparent natural causes)		
dead or dying fish, amphibians or other aquatic life/wildlife (no other apparent natural causes)		
Other:		
Section 3 Comments: ***Uncertain as to number and nature of discharges from potato processing plant, but GIS (EGAD) discharge coverage shows numerous discharge locations.***	**Section Score**	8

Section 4. Watershed Characterization and Potential NPS Pollution Impacts Score based on potential for erosion and sedimentation, urban runoff, nutrient enrichment, etc. in the wetland watershed.	Check if present	Score 0 to 5
Residential Development in watershed (including homes, lawns, residential roads)		
low density	X	1
medium density		
high density		
Commercial/Industrial/Municipal Development in watershed (including associated roads, paved areas)		
stores/businesses/office buildings		
schools, universities		
landfills/transfer stations		
sewage treatment plants		
power generation facility		
composting facility		
manufacturing plants/factories *potato processing plants*	X	5
gravel pits/mining		
airports		
railroads (tracks, rail yards, etc.)		
military facilities		
additional parking lots/ pavement (not associated with any of the above)		
Other:		
Recreation facilities in watershed		
lawn/park/picnic areas		
ball fields, tennis courts, basketball courts, etc.		
campgrounds		
boat launches		
piers/docks		1
golf course		
trails (atv, hiking, snowmobile, etc.)		
boardwalks		
Wildlife Management Area (ME IF&W, US F&WS)		
Other: *birding, hunting*	X	
Additional Roads in watershed (not associated with any of the above)		
gravel, small, low usage	X	
gravel, large, more heavily used (the Golden Road)		1
1 or 2 lane, paved		
>2 lane, paved		
Other:		
Forestry activities in watershed		
clear cut, recent/ongoing		
selective cut, recent/ongoing		
clear cut, older/recovering		
selective cut, older/recovering		
tree farm/plantation		

EXAMPLE

mixed or unknown type(s)		
Other:		
Agriculture in watershed		
pasture		
livestock		
feedlots		
manure piles/spreading		
row crops *potatoes, safflower*	X	
hayfield		
fallow field		
commercial blueberry operations		
commercial cranberry operations		
commercial nursery		5
commercial orchard		
sod farm		
mixed or unknown type(s)		
Other:		
Evidence of erosion, sedimentation and nutrient enrichment		
unstable soil in a position to wash into wetland or associated water body	X	
erosional gullies or washed out areas		
excess accumulated sediment		
sediment plume in water		
unnatural turbidity		4
nuisance algae bloom		
presence of excessive duckweed (Lemna sp.)		
unusually heavy growth of epiphytic algae		
unusually dense or large growth habit of aquatic macrophytes or other vegetation	X	
Other:		
Alterations to wetland buffer (within 100 feet of wetland edge)		
Estimate total percent of buffer altered using cover classes below and score accordingly: **1** **2** **3** **4** **5** **< 5%** **5-10%** **11-25%** **26-50%** **51-75%** **76-100%** ☐ ☐ ☐ ☐ ☐ ☐		4
Section 4 Comments:	**Section Score**	21

WHDA Scores

Section 1 total: __8___ (Hydrological Modifications to Wetland)
Section 2 total: __0___ (Vegetative Modifications to Wetland)
Section 3 total: __8___ (Evidence of Chemical Pollutants)
Section 4 total: __21___ (Watershed Characterization and Potential NPS Pollution Impacts)

Total Wetland Human Disturbance Score (WHDS) __37_____

Additional Comments:

_____
_____
_____

EXAMPLE

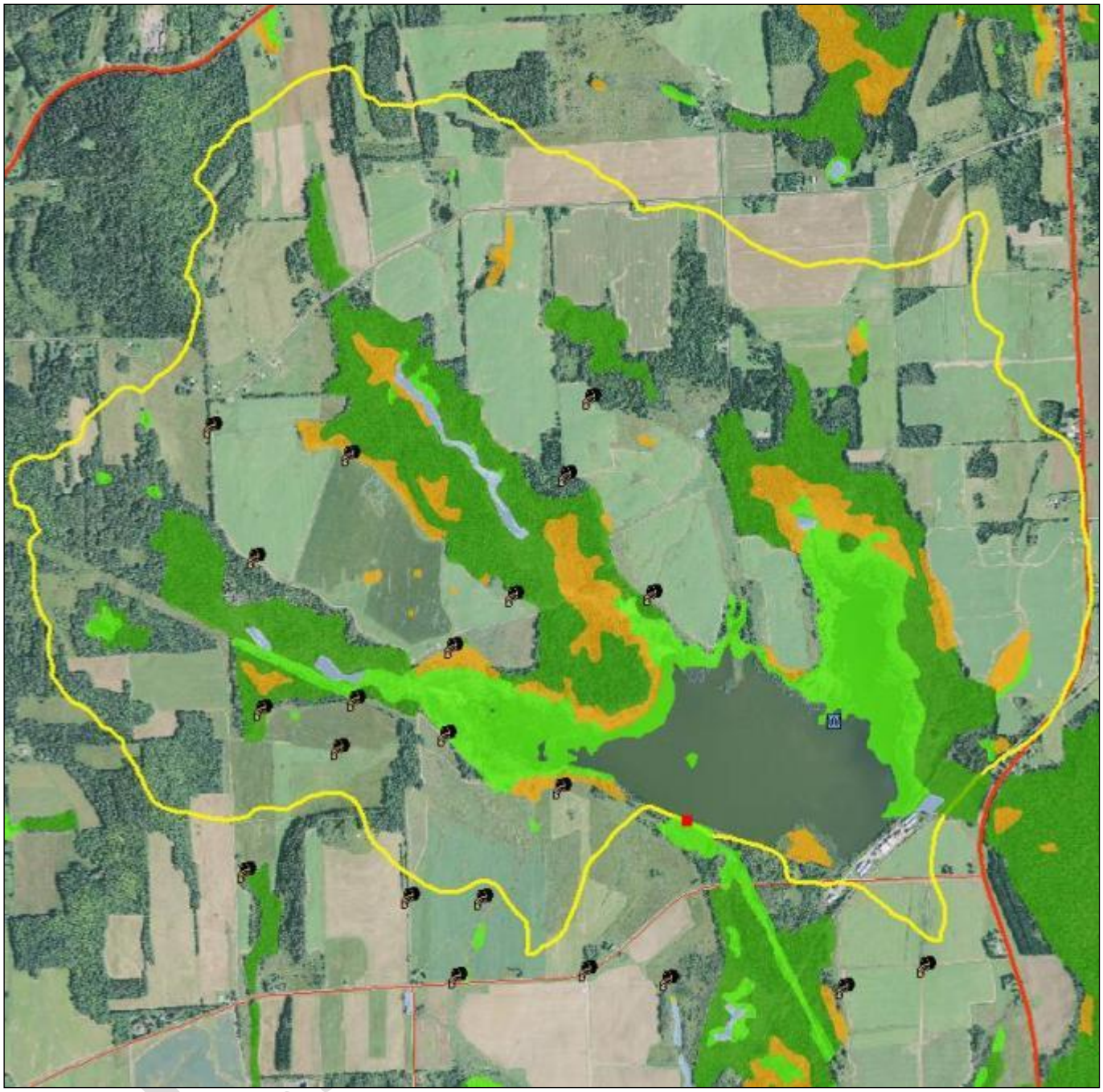

Figure 6. GIS aerial photograph of **Example #2**'s watershed. The watershed is delineated in yellow, major roads are drawn using red lines, dams are represented with red squares, and licensed discharges are symbolized with a drainage pipe icon. The blue "W" square marks the sampling location. Wetland habitat is delineated using the "NWI Palustrine Wetlands" layer. (Photo credit: ArcGIS 10)

Wetland Human Disturbance Assessment (WHDA)
Maine Department of Environmental Protection Biomonitoring Program

Name of wetland and/or associated waterbodies: __**Example 3**_____
Station #:_W-###__ Date: __06/07/XX__ Town: _____ Evaluator(s): _JD, BC, JP___

The purpose of this assessment is to characterize the degree of human disturbance in and around a wetland Biomonitoring station, and to document environmental stressors. Note that this human disturbance assessment is a stressor identification tool and not a direct measure of biological condition. See *Protocols for Completing the Biological Monitoring Wetland Human Disturbance Assessment* for scoring procedures and guidance.

For each wetland station assessed, score all factors in each section below using the following scale:

Severity	Severity Description	Rank
Not Observed or Unknown	The stressor is not observed or has no detrimental impact on wetland condition.	**0**
Observed; Minimal Disturbance	The stressor is present and appears to have negligible impacts on wetland condition.	**1**
Low Disturbance	The stressor is present and appears to have minor impacts on wetland condition.	**2**
Moderate Disturbance	The stressor is present and appears to moderately impact wetland condition.	**3**
High Disturbance	The stressor is present and appears to significantly impact wetland condition.	**4**
Severe Disturbance	The stressor is present and appears to have major impacts on wetland condition.	**5**

Section 1. Hydrologic Modifications to Wetland		Check if present	Score 0 to 5
Impoundment structures			4
dams	dam at outlet	X	
dikes			
man-made berms			
tide gates			
Other:			
Other structures that impede water flow			
causeways/roads			
railroad beds			
bridge abutments (and associated structures)			
inadequate, hanging or obstructed culverts (and associated structures)			
additional retaining walls/riprap (not included above)			
Other:			
Draining/Dewatering			
ditching			
drain tiles			
agricultural water withdrawal			
non-agricultural water withdrawal (fire hydrant, intake pipe)			
Other:			
Unnatural inputs of water			4
stormwater drain/discharge			
combined sewer overflow			
municipal/industrial point source discharge			
agricultural irrigation			
spray irrigation (non-agricultural, waste discharge, etc.)			
Other:	*evidence of flashy flow due to stormwater and CSO*	X	
Filling and excavation			
fill – recent and/or ongoing			
fill – older, stabilized			
grading or bulldozing (elimination of micro-topography)			
plowing/tilling			
excavated farm pond			

EXAMPLE

other excavated pond		
excavated area associated with culvert or bridge		
channelization		
Other:		
Natural hydrologic modifications (specify but do not score)		
beaver activity		
debris dams		
land slide		
major flooding/storm damage		
Other:		
Section 1 Comments:	**Section Score**	8

Section 2. Vegetative Modifications to Wetland Score based on vegetation impacts directly in the wetland, not in the buffer or watershed.	Check if present	Score 0 to 5
Clearing/removal of vegetation		
roads	X	
recreation trails (atv, hiking, snowmobile, etc.)	X	
utility lines		
buildings, structures, parking lots, etc.		
mowing (in the wetland, not a lawn)		2
brush hogging		
intentional/controlled burning		
human-caused accidental/arson fires		
chemical removal (herbicides, etc.)		
Other: *historical vegetative removal for dam, road and path*		
Clearing/removal of wetland vegetation – forestry activities		
clear cut		
selective cut		
logging roads		
skidder trails/staging areas		
replacement of wetland vegetation by tree plantation		
Other:		
Clearing/removal of wetland vegetation - agricultural activities		
plowing/conversion to cropland		
pasture/grazing		
hayfield		
farm roads		
Other:		
Wetland vegetation changes due to other human activities (hydrological alterations, nutrient inputs, etc.)		
dead or dying vegetation due to inundation or flooding		
dead or dying vegetation due to desiccation (draining, water withdrawal, water diversion, upstream dam, etc.)		2
replacement of natural plant community (excessive Typha sp., etc.) *heavy cattail growth in area*	X	
change in historic wetland class (conversion from PFO to PEM, etc.)		
Other:		
Presence of Non-aquatic Invasive Plants (total cover, all known species)		
Estimate total percent cover of non-aquatic invasive species in the assessment area using cover classes below and score accordingly. Check appropriate box if presence unknown and/or not assessed.		
1 < 5% ☐ **2** 5-10% ☐ **3** 11-25% ☐ **4** 26-50% ☐ **5** 51-75% ☐ **6** 76-100% ☐ **unknown/not assessed** ☐		

EXAMPLE

purple loosestrife		
Phragmites		
Other(s):		
Presence of Aquatic Invasive plants (check if present**):** ☐ unknown/not assessed		
For aquatic invasive plants (floating or submerged), indicate if observed (positive ID) or known to be present through signs or other means. Check appropriate box if presence unknown and/or not assessed.		
Eurasian water- milfoil		
Variable water-milfoil		
Hydrilla		
Other(s)		
Natural vegetative modifications (specify but do not score)		
herbivory (insect damage, animal browsing, beavers, etc.)		
fires		
floods		
storm damage (blow downs, etc.)		
Other:		
Section 2 Comments:	**Section Score**	4

Section 3. Evidence of Chemical Pollutants Score based on observations in the wetland and adjacent/upstream sources that may potentially impact the wetland.	Check if present	Score 0 to 5
Direct discharge present		
stormwater	X	
industrial discharge		
treatment plant		5
combined sewer overflow	X	
leachate plume		
fish hatchery		
Other:		
Other evidence of contaminants		
documented previous oil/chemical spill		
free oil, petroleum, chemicals observed on site		
unusual water color/turbidity		
sheen (not from natural causes)		
soil staining (not from natural causes)		
foam (not from natural causes)		
chemical odor present		
sewage odor present		
evidence of CSO discharge (solids)		
sewage fungus present		
Other:		
Herbicide, pesticide and fertilizer application		
utility line maintenance		
agricultural application		
forestry application		
insect pest control (specify):		
invasive species management (plants, fish, etc.); Only score impacts to non-target species		
Other:		
Solid Waste		
municipal dump/landfill		
sludge spreading		3
household trash/dumping		
petroleum, chemical containers, drums, etc.		

EXAMPLE

abandoned vehicles, tires, etc.		
demolition debris		
stump dump		
Litter *significant amount*	X	
Other:		
Evidence of toxic effects to vegetation, aquatic life or wildlife in wetland		
dead, dying or stressed vegetation (no apparent natural causes)		
dead or dying fish, amphibians or other aquatic life/wildlife (no other apparent natural causes)		
Other:		
Section 3 Comments:	**Section Score**	8

Section 4. Watershed Characterization and Potential NPS Pollution Impacts Score based on potential for erosion and sedimentation, urban runoff, nutrient enrichment, etc. in the wetland watershed.	Check if present	Score 0 to 5
Residential Development in watershed (including homes, lawns, residential roads)		
low density		3
medium density	X	
high density	X	
Commercial/Industrial/Municipal Development in watershed (including associated roads, paved areas)		
stores/businesses/office buildings	X	
schools, universities		
landfills/transfer stations		
sewage treatment plants		
power generation facility		
composting facility		3
manufacturing plants/factories		
gravel pits/mining		
airports		
railroads (tracks, rail yards, etc.)		
military facilities		
additional parking lots/ pavement (not associated with any of the above)		
Other:		
Recreation facilities in watershed		
lawn/park/picnic areas	X	
ball fields, tennis courts, basketball courts, etc.		
campgrounds		
boat launches		
piers/docks		3
golf course		
trails (atv, hiking, snowmobile, etc.)	X	
boardwalks		
Wildlife Management Area (ME IF&W, US F&WS)		
Other:		
Additional Roads in watershed (not associated with any of the above)		
gravel, small, low usage		
gravel, large, more heavily used (the Golden Road)		
1 or 2 lane, paved		
>2 lane, paved		
Other:		
Forestry activities in watershed		
clear cut, recent/ongoing		
selective cut, recent/ongoing		
clear cut, older/recovering		
selective cut, older/recovering		
tree farm/plantation		

EXAMPLE

mixed or unknown type(s)		
Other:		
Agriculture in watershed		
pasture		
livestock		
feedlots		
manure piles/spreading		
row crops		
hayfield		
fallow field		
commercial blueberry operations		
commercial cranberry operations		
commercial nursery		
commercial orchard		
sod farm		
mixed or unknown type(s)		
Other:		
Evidence of erosion, sedimentation and nutrient enrichment		
unstable soil in a position to wash into wetland or associated water body		
erosional gullies or washed out areas		
excess accumulated sediment *sediment deposits on leave, bottom sandy in spots*	X	
sediment plume in water		
unnatural turbidity		4
nuisance algae bloom		
presence of excessive duckweed (Lemna sp.)		
unusually heavy growth of epiphytic algae		
unusually dense or large growth habit of aquatic macrophytes or other vegetation *huge yellow water lily leaves*	X	
Other:		
Alterations to wetland buffer (within 100 feet of wetland edge)		
Estimate total percent of buffer altered using cover classes below and score accordingly: **1** **2** **3** **4** **5** **< 5%** **5-10%** **11-25%** **26-50%** **51-75%** **76-100%** ☐ ☐ ☐ ☐ ☐ ☐		3
Section 4 Comments:	**Section Score**	16

EXAMPLE

WHDA Scores

Section 1 total: _ 8___ (Hydrological Modifications to Wetland)
Section 2 total: _ 4___ (Vegetative Modifications to Wetland)
Section 3 total: _ 8___ (Evidence of Chemical Pollutants)
Section 4 total: _16___ (Watershed Characterization and Potential NPS Pollution Impacts)

Total Wetland Human Disturbance Score (WHDS) ___36_____

Additional Comments:

_____

_____

_____

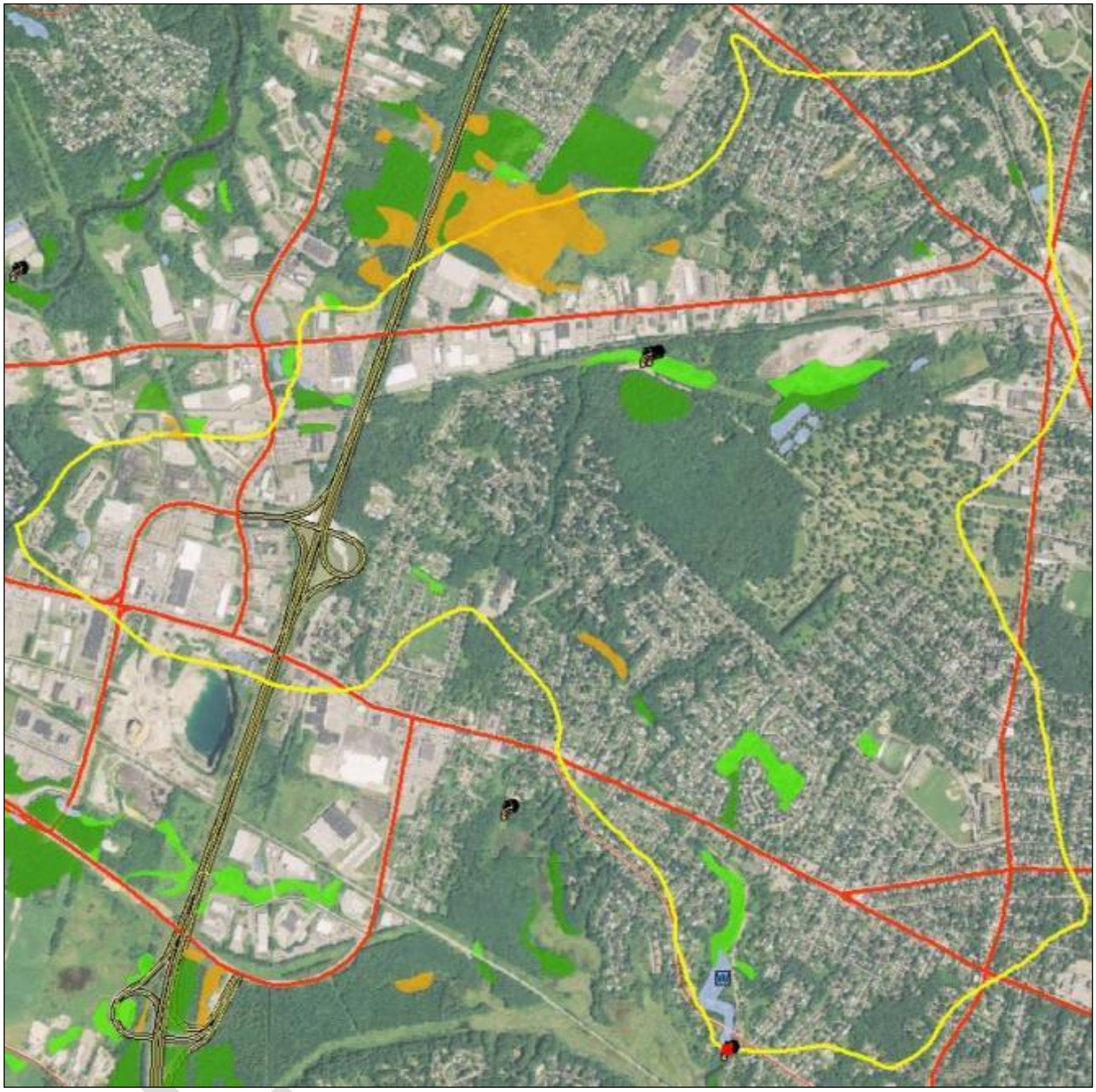

Figure 7. GIS aerial photograph of **Example #3**'s watershed. The watershed is delineated in yellow, roads are drawn using red lines (major routes) and yellow/black striped lines (highways), dams are represented with red squares, and licensed discharges are symbolized with a drainage pipe icon. The blue "W" square marks the sampling location. Wetland habitat is delineated using the "NWI Palustrine Wetlands" layer. (Photo credit: ArcGIS 10)

6. **References**

Danielson, T. J. 2014. *Protocols for Sampling Algae in Wadeable Rivers, Streams, and Freshwater Wetlands.* DEPLW-0634B-2014. Maine Department of Environmental Protection, Augusta, ME.

Danielson, T. J. 2014. *Protocols for Using the Hanna Dissolved Oxygen and Specific Conductance/pH Meters in Rivers, Streams, and Freshwater Wetlands*. Department of Environmental Protection, Augusta, ME. DEPLW-0636A-2014.

Danielson, T. J. 2014. *Protocols for Collecting Water Grab Samples in Rivers, Streams, and Freshwater Wetlands* Maine Department of Environmental Protection, Augusta, ME. DEPLW-0637A-2014.

DiFranco, J.L. 2014. *Protocols for Sampling Aquatic Macroinvertebrates in Freshwater Wetlands.* Maine Department of Environmental Protection, Augusta, ME. DEPLW-0640A-2014.

UMaine and MEDEP, 2005. *A Field Guide to Aquatic Phenomena*. University of Maine U.S. Geological Survey Water Resources Research Institutes Program, Orono, ME. (http://www.umaine.edu/waterresearch/).

7. Appendix A

Wetland Human Disturbance Assessment (WHDA) Form
Maine Department of Environmental Protection Biomonitoring Program

Name of wetland and/or associated waterbodies: _____
Station #:_____ Date: _____ Town: _____ Evaluator(s): _____

The purpose of this assessment is to characterize the degree of human disturbance in and around a wetland Biomonitoring station, and to document environmental stressors. Note that this human disturbance assessment is a stressor identification tool and not a direct measure of biological condition. See *Protocols for Completing the Biological Monitoring Wetland Human Disturbance Assessment (DEP-LW1259)* for scoring procedures and guidance.

For each wetland station assessed, score all factors in each section below using the following scale:

Severity	Severity Description	Rank
Not Observed or Unknown	The stressor is not observed or has no detrimental impact on wetland condition.	**0**
Observed; Minimal Disturbance	The stressor is present and appears to have negligible impacts on wetland condition.	**1**
Low Disturbance	The stressor is present and appears to have minor impacts on wetland condition.	**2**
Moderate Disturbance	The stressor is present and appears to moderately impact wetland condition.	**3**
High Disturbance	The stressor is present and appears to significantly impact wetland condition.	**4**
Severe Disturbance	The stressor is present and appears to have major impacts on wetland condition.	**5**

Section 1. Hydrologic Modifications to Wetland	Check if present	Score 0 to 5
Impoundment structures		
dams		
dikes		
man-made berms		
tide gates		
Other:		
Other structures that impede water flow		
causeways/roads		
railroad beds		
bridge abutments (and associated structures)		
inadequate, hanging or obstructed culverts (and associated structures)		
additional retaining walls/riprap (not included above)		
Other:		
Draining/Dewatering		
ditching		
drain tiles		
agricultural water withdrawal		
non-agricultural water withdrawal (fire hydrant, intake pipe)		
Other:		
Unnatural inputs of water		
stormwater drain/discharge		
combined sewer overflow		
municipal/industrial point source discharge		
agricultural irrigation		
spray irrigation (non-agricultural, waste discharge, etc.)		
Other:		
Filling and excavation		
fill – recent and/or ongoing		
fill – older, stabilized		

grading or bulldozing (elimination of micro-topography)		
plowing/tilling		
excavated farm pond		
other excavated pond		
excavated area associated with culvert or bridge		
channelization		
Other:		
Natural hydrologic modifications (specify but do not score)		
beaver activity		
debris dams		
land slide		
major flooding/storm damage		
Other:		
Section 1 Comments:	**Section Score**	

Section 2. Vegetative Modifications to Wetland Score based on vegetation impacts directly in the wetland, not in the buffer or watershed.	Check if present	Score 0 to 5
Clearing/removal of vegetation		
roads		
recreation trails (atv, hiking, snowmobile, etc.)		
utility lines		
buildings, structures, parking lots, etc.		
mowing (in the wetland, not a lawn)		
brush hogging		
intentional/controlled burning		
human-caused accidental/arson fires		
chemical removal (herbicides, etc.)		
Other:		
Clearing/removal of wetland vegetation – forestry activities		
clear cut		
selective cut		
logging roads		
skidder trails/staging areas		
replacement of wetland vegetation by tree plantation		
Other:		
Clearing/removal of wetland vegetation - agricultural activities		
plowing/conversion to cropland		
pasture/grazing		
hayfield		
farm roads		
Other:		
Wetland vegetation changes due to other human activities (hydrological alterations, nutrient inputs, etc.)		
dead or dying vegetation due to inundation or flooding		
dead or dying vegetation due to desiccation (draining, water withdrawal, water diversion, upstream dam, etc.)		
replacement of natural plant community (excessive Typha sp., etc.)		
change in historic wetland class (conversion from PFO to PEM, etc.)		
Other:		
Presence of Non-aquatic Invasive Plants (total cover, all known species)		
Estimate total percent cover of non-aquatic invasive species in the assessment area using cover classes below and score accordingly. Check appropriate box if presence unknown and/or not assessed.		

1 < 5% ☐	2 5-10% ☐	3 11-25% ☐	4 26-50% ☐	5 51-75% ☐	6 76-100% ☐	unknown/not assessed ☐		
purple loosestrife								
Phragmites								
Other(s):								
Presence of Aquatic Invasive plants (check if present**):** ☐ unknown/not assessed								
For aquatic invasive plants (floating or submerged), indicate if observed (positive ID) or known to be present through signs or other means. Check appropriate box if presence unknown and/or not assessed.								
Eurasian water- milfoil								
Variable water-milfoil								
Hydrilla								
Other(s)								
Natural vegetative modifications (specify but do not score)								
herbivory (insect damage, animal browsing, beavers, etc.)								
fires								
floods								
storm damage (blow downs, etc.)								
Other:								
Section 2 Comments:							**Section Score**	

Section 3. Evidence of Chemical Pollutants Score based on observations in the wetland and adjacent/upstream sources that may potentially impact the wetland.	Check if present	Score 0 to 5
Direct discharge present		
stormwater		
industrial discharge		
treatment plant		
combined sewer overflow		
leachate plume		
fish hatchery		
Other:		
Other evidence of contaminants		
documented previous oil/chemical spill		
free oil, petroleum, chemicals observed on site		
unusual water color/turbidity		
sheen (not from natural causes)		
soil staining (not from natural causes)		
foam (not from natural causes)		
chemical odor present		
sewage odor present		
evidence of CSO discharge (solids)		
sewage fungus present		
Other:		
Herbicide, pesticide and fertilizer application		
utility line maintenance		
agricultural application		
forestry application		
insect pest control (specify):		
invasive species management (plants, fish, etc.); Only score impacts to non-target species		
Other:		
Solid Waste		

municipal dump/landfill		
sludge spreading		
household trash/dumping		
petroleum, chemical containers, drums, etc.		
abandoned vehicles, tires, etc.		
demolition debris		
stump dump		
litter		
Other:		
Evidence of toxic effects to vegetation, aquatic life or wildlife in wetland		
dead, dying or stressed vegetation (no apparent natural causes)		
dead or dying fish, amphibians or other aquatic life/wildlife (no other apparent natural causes)		
Other:		
Section 3 Comments:	**Section Score**	

Section 4. Watershed Characterization and Potential NPS Pollution Impacts Score based on potential for erosion and sedimentation, urban runoff, nutrient enrichment, etc. in the wetland watershed.	Check if present	Score 0 to 5
Residential Development in watershed (including homes, lawns, residential roads)		
low density		
medium density		
high density		
Commercial/Industrial/Municipal Development in watershed (including associated roads, paved areas)		
stores/businesses/office buildings		
schools, universities		
landfills/transfer stations		
sewage treatment plants		
power generation facility		
composting facility		
manufacturing plants/factories		
gravel pits/mining		
airports		
railroads (tracks, rail yards, etc.)		
military facilities		
additional parking lots/ pavement (not associated with any of the above)		
Other:		
Recreation facilities in watershed		
lawn/park/picnic areas		
ball fields, tennis courts, basketball courts, etc.		
campgrounds		
boat launches		
piers/docks		
golf course		
trails (atv, hiking, snowmobile, etc.)		
boardwalks		
Wildlife Management Area (ME IF&W, US F&WS)		
Other:		
Additional Roads in watershed (not associated with any of the above)		
gravel, small, low usage		
gravel, large, more heavily used (the Golden Road)		
1 or 2 lane, paved		
>2 lane, paved		
Other:		
Forestry activities in watershed		
clear cut, recent/ongoing		

selective cut, recent/ongoing		
clear cut, older/recovering		
selective cut, older/recovering		
tree farm/plantation		
mixed or unknown type(s)		
Other:		
Agriculture in watershed		
pasture		
livestock		
feedlots		
manure piles/spreading		
row crops		
hayfield		
fallow field		
commercial blueberry operations		
commercial cranberry operations		
commercial nursery		
commercial orchard		
sod farm		
mixed or unknown type(s)		
Other:		
Evidence of erosion, sedimentation and nutrient enrichment		
unstable soil in a position to wash into wetland or associated water body		
erosional gullies or washed out areas		
excess accumulated sediment		
sediment plume in water		
unnatural turbidity		
nuisance algae bloom		
presence of excessive duckweed (Lemna sp.)		
unusually heavy growth of epiphytic algae		
unusually dense or large growth habit of aquatic macrophytes or other vegetation		
Other:		
Alterations to wetland buffer (within 100 feet of wetland edge)		
Estimate total percent of buffer altered using cover classes below and score accordingly: **1** **2** **3** **4** **5** **< 5%** **5-10%** **11-25%** **26-50%** **51-75%** **76-100%** ☐ ☐ ☐ ☐ ☐ ☐		
Section 4 Comments:	**Section Score**	

WHDA Scores

Section 1 total: _____ (Hydrological Modifications to Wetland)
Section 2 total: _____ (Vegetative Modifications to Wetland)
Section 3 total: _____ (Evidence of Chemical Pollutants)
Section 4 total: _____ (Watershed Characterization and Potential NPS Pollution Impacts)

Total Wetland Human Disturbance Score (WHDS) _____

Additional Comments:

_____
_____
_____
_____
_____
_____
_____