Attachment D
Wetland Impact (WI) Assessment Protocol

Purpose

Wetlands play an important role in watershed ecology and hydrology. The functional value, or benefits, provided by wetlands include floodwater storage, pollutant removal, fish and wildlife habitat, bank and shore protection, and surface and ground water recharge. These benefits can be compromised by land use alterations that occur as part of the development process. These alterations and their associated impacts may be caused by polluted or excessive stormwater runoff, fragmentation, invasive species introduction, etc. As part of a comprehensive approach to watershed planning and wetland management, communities may need to rapidly assess individual wetlands in the field to identify sources of impairment(s) and make preliminary wetland management designations.

While dozens of wetland assessment methods exist, many are quite complex and communities may not have staff expertise or readily accessible professional consultant services and, therefore, may not be able to incorporate the information these methods provide to improve local wetland or watershed management efforts. To this end, the Wetland Impact (WI) form has been created as a supplement to the Unified Stream Assessment (USA). The USA is a streamwalk method designed to identify individual impairments and restoration opportunities within the urban stream corridor (e.g., stream bank erosion, buffer impairment, outfalls, sewer leaks, and other impairments). For more detail on the USA, please refer directly to the user's manual developed by Kitchell and Schueler (2004). The WI form specifically is intended to help watershed managers:

- Verify information in existing wetland inventories, including identifying any unmapped or unlisted wetlands
- Document observable evidence of wetland impacts or stressors
- Provide enough data to support more detailed investigations of potential for eliminating or reducing stressors to wetlands
- Develop, verify or update preliminary lists of potential wetland restoration sites, conservation sites, and sensitive wetlands

The WI is conducted in the wetland interior, the perimeter of the buffer and the contributing drainage area, if it exists. Field crews look for indicators of wetland impacts in each zone based on presence of physical indicators. The indicators have been borrowed from a variety of wetland assessment methods, most notably the Pennsylvania Stressor Checklist (Brooks et al. 2002). The WI is most useful for assessing depressional, flat, and slope wetlands, and is suggested for use in wetlands less than 25 acres (wetlands greater than 25 acres can be assessed with this method provided they are broken down into smaller assessment units).

The WI should be conducted as part of an overall watershed assessment strategy and is designed for municipal staff, natural resource planners, wetland consultants, and trained watershed groups. A field crew of three is ideal to perform the WI, although it may be conducted with two staff in a pinch. Crew members should possess a good local working knowledge of wetland types, wetland plant communities, and urban hydrology.

Survey sites are initially identified from NWI maps, or preferably, a more detailed GIS-based wetland inventory. The amount of time needed to survey each wetland site will vary based on the experience of field crew, wetland size and complexity, environmental conditions, accessibility, and complexity of impacts and upland conditions. The goal of the WI survey is to limit the assessment time needed at each wetland to approximately 30 to 60 minutes. As always, communities are encouraged to customize the WI to meet local assessment needs.

Advanced Preparation

The WI requires several advance preparation tasks before a crew can go out into the field, as follows:

- Identify which wetlands to evaluate
- Prepare base field maps
- Choose local wetland quality indicators
- Train and equip field crews
- Complete header information on the WI form

1. Identify which wetlands to evaluate
The first step is to identify which wetlands to evaluate. Communities that have developed a detailed wetland inventory and further screened their wetlands to identify priorities for field assessment will already have a list of sites to visit. Additional sites of interest may be identified through watershed fieldwork such as the USA.

Communities that have not conducted a detailed wetland inventory or gone through the screening process described in this article may wish to limit the types and sizes of wetlands to evaluate in the field, due to time or budget constraints. In general, the minimum size is set by the quality and resolution of wetland mapping data. If NWI maps are the primary wetland mapping unit, then the minimum size will be about one to three acres in area. More detailed wetland mapping, where available, can pick up wetlands less than an acre in size. A maximum wetland size may also be set since larger wetlands will be more difficult to characterize on a single form and will increase the amount of time spent in the field. A maximum size of 25 acres is probably most feasible for this protocol, given that wetlands larger than this are not often found in urban watersheds. Alternatively, larger wetland complexes may be subdivided into smaller survey units. Communities should develop their own wetland sizing criteria, based on local wetland and watershed conditions, goals and objectives of the assessment, wetland inventory, and staff, funding and time constraints.

Communities may also wish to identify local wetland types that are not suitable for surveys because of their unique hydrogeomorphic position. As general guidance, the WI is most helpful in assessing depressional, slope, and flat wetland types (as defined in Table 7 of Article 2) because these types are more heavily influenced by storm water runoff than riverine or fringe wetlands, which are largely dependant on water levels in adjacent waterbodies (e.g., rivers, lakes, estuaries). The WI is not as helpful in assessing riverine or fringe wetland types. In addition, the WI, by itself, is not particularly useful in assessing forested wetlands found along headwater streams (the full USA is a superior method for assessing these stream corridors).

2. Prepare base field maps
Good field maps need to be prepared to help guide field crews. The base maps transpose wetland boundaries from the NWI or a more detailed wetland mapping layer over recent aerial photos, topography, water features and road layers. Ideally, the map will also contain hydric soil layers superimposed over aerial photos so crews can get oriented to the potential boundaries of the wetland. It may also be helpful to delineate the contributing drainage areas to each wetland where possible.

3. Choose wetland quality indicators
The team needs to undertake some research to understand the best local indicators of wetland quality and stressors. The first task is to designate a list of wetland community types that are considered sensitive (see Principle 6). The second task is to compile an initial list that defines common invasive or sediment tolerant wetland plant species, as presence of either may be indicative of wetland impacts. The third task is to consult natural resource agencies to compile a third list of plant and animal species that indicate excellent wetland quality or high conservation potential (e.g., rare, threatened or endangered plant species, specific amphibian species that indicate good quality). It may also be advisable to contact a local college or university biology department. The last task is to assemble a fourth list of physical, plant or wildlife indicators that may indicate potential impacts or stressors to wetlands. Taken together, the four lists provide locally adapted wetland indicators to guide the work of the field crews. If the indicators chosen are different from the ones presented in the WI field form, the form should be modified accordingly.

It is important to note that wetlands that do not exhibit any indicators of high quality and are not identified as priority conservation sites, are not necessarily unworthy of conservation (it simply means that no indicators were observed). For these sites, additional field surveys of vegetation and wildlife communities can be used to make a better determination of quality, if this information is desired. This type of detailed survey is beyond the scope of the WI, whose purpose is to make a *rapid* assessment of wetland impacts and restorability and serves to screen a large number of wetlands to narrow the number of sites that require more detailed field assessment.

4. Train and equip field crews
While field crews do not need to be certified wetland scientists, they should be familiar with basic plant species identification, understand common wetland plant communities and recognize the four lists of wetland quality indicators selected in the previous step. This training is in addition to basic USA sampling protocol outlined in Kitchell and Schueler (2004).

The basic field equipment consists of waders, GPS units, digital cameras, and safety gear as needed for other USA forms. A first aid kit and compass may also be needed since walking within some large wetland complexes can be hazardous and disorienting. Crews should carry wetland and tree identification guides, as well as “cheat sheets” summarizing the wetland quality indicators. They should also carry an authorization letter, and contact property owners in advance for permission to access private property.

5. Complete header information on the WI form
The crew should try to complete as much of the header section of the WI form as possible before going out in the field. Each wetland survey site should be assigned a unique identification number. In addition, the NWI or detail local wetland inventory should be analyzed to determine the area NWI classification and HGM type, if known. Tiner (2005) describes a method for deriving HGM descriptors from NWI maps. Next, check the appropriate boxes if the wetland has been screened as a potential site for restoration or conservation, or has been designated as sensitive.

If the local GIS includes a delineation of wetland contributing drainage area (CDA) boundaries (e.g., surface drainage to the wetland), then all information related to the CDA, such as acreage, percent impervious cover, dominant land use, and future development potential should be extracted and entered into the header information box. Alternatively, if the CDA is small, it may be possible to draw CDA boundaries on field map and estimate metrics from the aerial photographs. The purpose of including this information on the field form is to allow for field verification of the desktop wetland inventory and to make preliminary management recommendations for each wetland based on a combination of desktop and field-derived information.

Field Protocol

Once in the field, the three-member field crew should review the map and decide on how to plan routes to conduct the WI as efficiently as possible. Upon arriving at the site, the crew should verify the header information derived back in the office. If header information is inaccurate, the appropriate box under the Updates to Wetland Inventory field (page 2 of the WI field form) should be checked as a trigger to update the inventory when back in the office. Next, the crew should walk the site to get a general sense of the approximate boundaries of the wetland. Note that precise wetland boundaries cannot be determined without the more detailed and comprehensive three-parameter delineation method as noted in the Corps of Engineers Wetlands Delineation Manual (1987) or Federal Manual for Identifying and Delineating Jurisdictional Wetlands (1989). If the crew cannot agree on the general boundaries for the survey, they should check the box that further wetland delineation is needed under the Additional Field Assessments Recommended field (page 2 of the WI field form) and move onto the next site.

Ideally, one crew member should walk several transects across the wetland to evaluate and make note of wetland conditions, locate and evaluate inlets and outlets, and begin the wetland sketch. A GPS reading should be fixed at the center of the wetland and entered into the header box. In some cases, it may not be possible to access the center of the wetland because of mucky soils, surface water, excessive vegetation, etc. These wetland areas generally have homogenous conditions, however, so they can usually be assessed from a distance, and GPS readings may be taken at a point along the wetland boundary and a description of this location recorded on the field sheet.

The other two crew members then walk in a circle around the entire wetland perimeter at a distance of 25 and 75 feet away from the assumed wetland boundary to evaluate buffer conditions and look for direct hydrologic connections such as channels or stormwater outfalls (Figure D-1). If any direct connections are found, the crew should stop at the discharge point closest to the wetland and take a GPS reading. The crew then tracks the channel or outfall back upstream to investigate conditions in the surrounding CDA. The

crew then returns back to the discharge point, and resumes its walk around the buffer perimeter. If the wetland has an outlet, the crew should GPS and sketch its location and then walk at least 200 feet downstream to look for flow constrictions. Digital photos should be taken at the wetland interior, within typical buffer conditions and at any inlet or outlet. This survey protocol assumes that the buffer extends 100 feet outward from the assumed wetland boundary, but the width of buffer surveyed can be increased or decreased to account for local buffer regulations, surrounding land uses, or specific wetland protection goals and objectives.

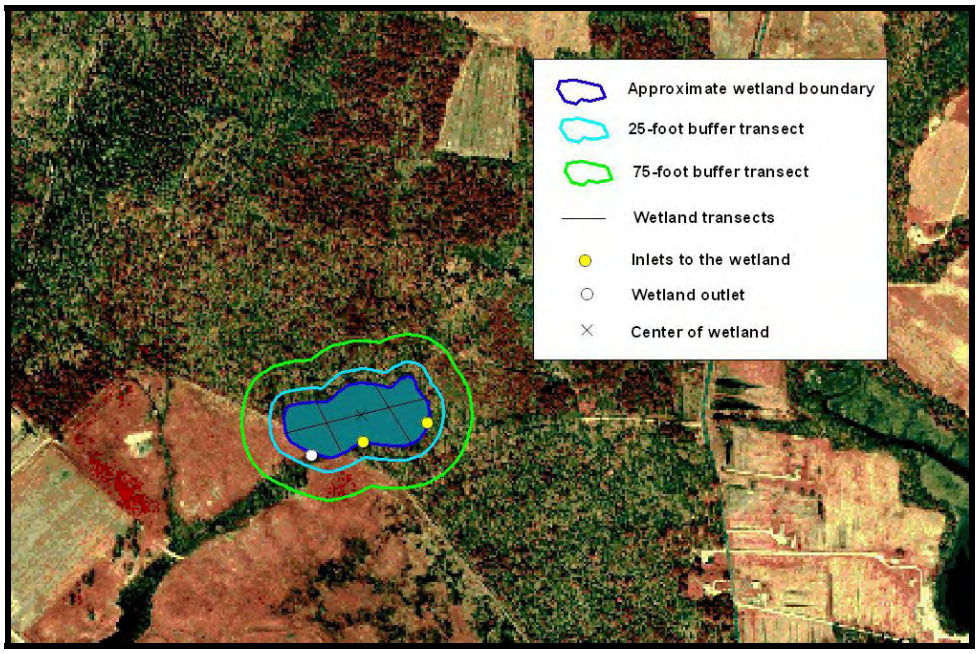
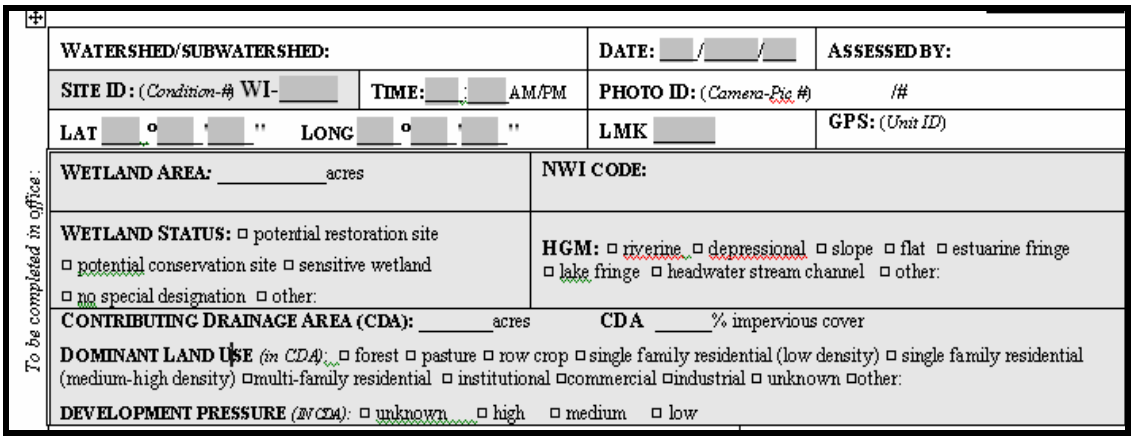


Figure D-1. Portions of a wetland evaluated using the Wetland Impact (WI) Assessment Protocol

While walking the site, the crew looks for indicators of hydrologic alterations, sedimentation, vegetative impacts, poor water quality, and other visual indicators of wetland impacts. In addition, crews should be looking for opportunities to minimize these impacts through restoration and management efforts. After walking the transects and the wetland boundary, the crew reconvenes and completes the field sheet together. The crew may need to revisit portions of the wetland or its surrounding uplands in order to determine if impacts are controllable and how best to manage them. The total process should ideally take an hour or less, but will depend on the wetland size, composition, accessibility and other factors. The following section describes each WI assessment question, and provides guidance on how to complete the field sheet.

A. Header Section

The header section (Figure D-2) should be completed in the office prior to going out in the field. This section related directly to data compiled during creation of a detailed local wetland inventory.



WATERSHED/SUBWATERSHED:		**DATE:** ___/____/___	**ASSESSED BY:**
SITE ID: (*Condition-#*) WI-_____	**TIME:** ___:___ AM/PM	**PHOTO ID:** (*Camera-Pic #*)	/#
LAT ___ º ___ ' ___ " **LONG** ___ º ___ ' ___ "		**LMK** _____	**GPS:** (*Unit ID*)

To be completed in office:

WETLAND AREA: _____acres	**NWI CODE:**
WETLAND STATUS: □ potential restoration site □ potential conservation site □ sensitive wetland □ no special designation □ other:	**HGM:** □ riverine □ depressional □ slope □ flat □ estuarine fringe □ lake fringe □ headwater stream channel □ other:

CONTRIBUTING DRAINAGE AREA (CDA): _____acres **CDA** _____% impervious cover

DOMINANT LAND USE (*in CDA*): □ forest □ pasture □ row crop □ single family residential (low density) □ single family residential (medium-high density) □multi-family residential □ institutional □commercial □industrial □ unknown □other:

DEVELOPMENT PRESSURE (*IN CDA*): □ unknown □ high □ medium □ low

Figure D-2. Header section of the WI form

B. Wetland Sketch and Characterization

This part of the form (Figure D-3) provides space to roughly sketch the wetland boundary and locate important features within it (e.g. inlets, invasive species, culverts). The sketch should show areas of inundation, whether seasonal, intermittent or perennial, within the wetland, major or clusters of different wetland plant species or communities, and location of transects walked during the assessment.

The sketch should show the approximate location of the wetland buffer and boundaries of the contributing drainage area, if known. The sketch should also clearly indicate any channels or storm drain pipes that contribute surface runoff to the wetland. The specific GPS coordinates where channels or pipes cross the wetland boundary should be directly noted on the sketch.

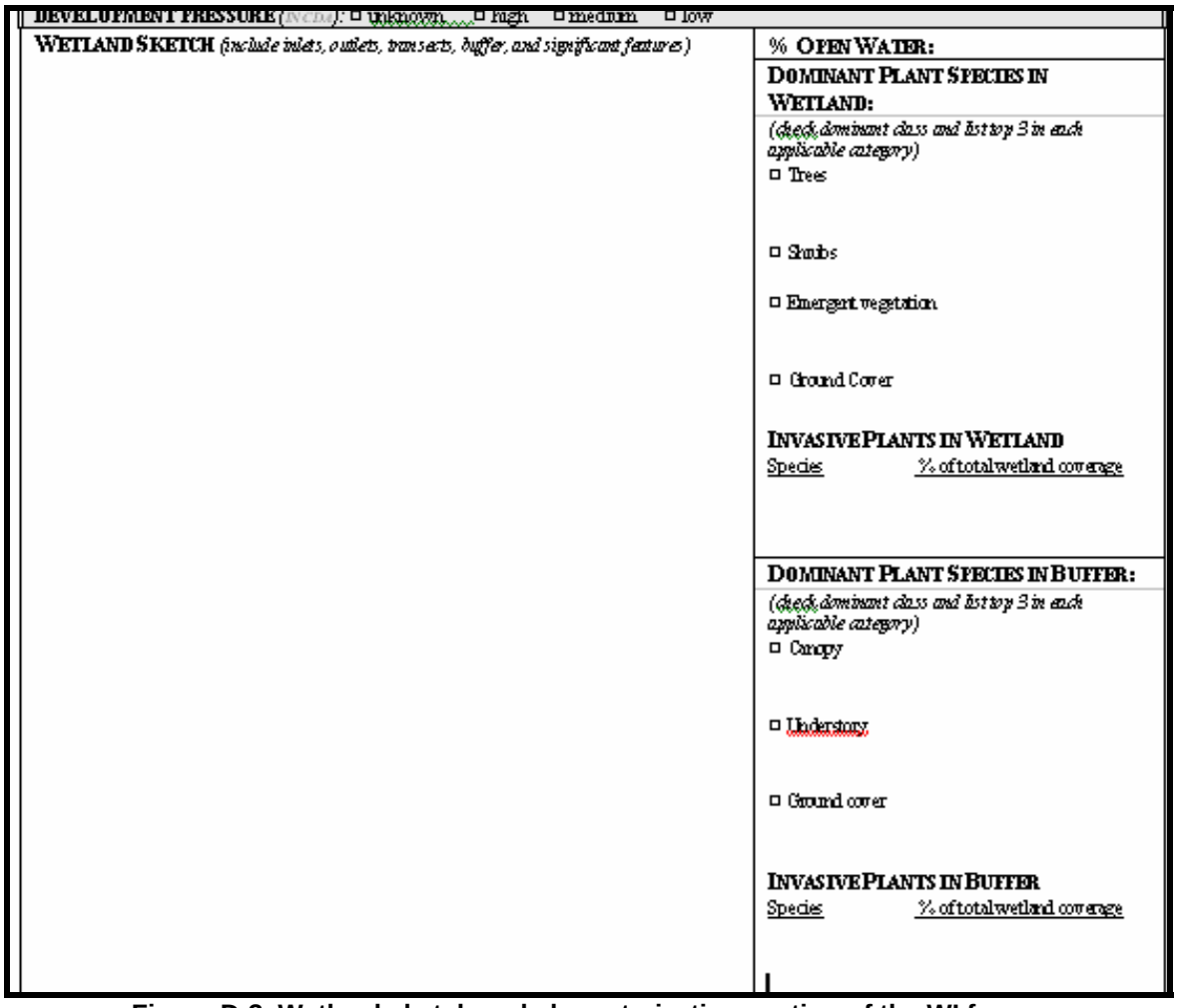


Figure D-3. Wetland sketch and characterization section of the WI form

% Open Water: After completing the sketch, the crew should visually estimate the percentage of the wetland considered to be open water.

Dominant Plant Species in Wetland: The crew should agree on the dominant plant species after it has thoroughly walked the wetland. The form asks the crew to identify the three dominant species found in each of four vegetative layers – trees/saplings, shrubs, emergent vegetation, and ground cover. The crew should also check which vegetative layer covers the most total wetland area.

Invasive Plants in Wetland: Invasive species can out-compete native species and often are an indicator of hydrologic or water quality stress in a wetland (see Article 1). Identify any invasive or exotic plant species from the pre-designated list and describe their extent as a percent of total wetland coverage.

Dominant Plant Species in Buffer: The crew members that walk the buffer perimeter need to agree on the three most dominant species observed within three vegetative class in the buffer-- the forest canopy, understory, and or ground cover. Understory is defined as trees and shrubs located below the top forest canopy that receive little or no sunlight from above or the sides. Herbaceous groundcover includes vegetation such as ferns. Check which vegetation layer covers the greatest total area of the buffer.

Invasive Plants in Buffer: The crew then describes the coverage of invasive plants within the understory and ground cover layer of the buffer and notes the species observed.

C. Wetland Impact Indicators

1. Evidence of Altered Hydrology: Changes in wetland hydrology can significantly diminish the quality of wetland vegetation and soils. This may entail increased inputs of stormwater runoff that cause greater ponding, surface scour, or water level fluctuations, or physical alterations outside the wetland such as constrictions, ditching, tiling or channelization. Refer to Article 1 for detailed information on each of these indirect wetland impacts. The crew uses the WI form to note any indicators of altered hydrology within the wetland, and in an upgradient and down gradient direction.

Within the Wetland

- Most wetlands do not have a lot of standing water throughout the year, so the presence of a lot of open water often signals that the wetland is receiving more runoff that it can handle (note this does not apply to emergent wetlands, as classified by Cowardin, 1979). The appropriate box can be checked if a high proportion of *open* water is present (e.g., covers 25% or more of the wetland, and is > 1 foot deep). Open water is defined as standing water of a particular depth that is not covered by tree or shrub canopy.

- The presence of dead or dying trees in the wetland is often a sign that the trees cannot tolerate the current depth or duration of water inundation.

- The crew should look for any recent evidence of recent fill, dumping, or dredging in the wetland.

- The crew should note if any sewer lines and other utilities cross the wetland that influence or redirect water flow or drainage from the wetland.

- The crew should also look for tile drains or mosquito control ditches that indicate past efforts to drain the wetland or are still impacting wetland hydrology.

- The crew should look for recent surface scouring of the wetland or the presence of rills or channel formation due to increased surface runoff.

- The crew should look for signs of water level fluctuation along the wetland boundaries using indicators such as water stains on trees, silt lines on vegetation, absence of leaf litter, and drift line deposition. In many urban wetlands, deposits of floatable trash can provide a clue to how high water levels get during wet weather conditions. WLF in an urban wetland typically increases due to increased inputs of storm water runoff from adjacent and upstream development. Cracked mud and bottom scour can indicate flashy flood volumes as well, or a lowering of the water table and reduced baseflows resulting from altered urban hydrology. Field crews do not necessarily need to differentiate between WLF due to urban impacts versus from the long-term, seasonal changes expected in a natural wetland with few impacts. If measurable changes in water lever are of interest, consider revisiting the site during various seasons and rainfall events, or comparing with reference wetlands of similar size and type. Local wetland

scientists may be able to provide guidance on the range of acceptable WLF for wetland types that are common in the region.

Upgradient from the wetland

- Any storm water outfall or channel that contributes runoff to the wetland should be fixed with GPS coordinates during the survey. The pipe diameter and/or cross-sectional channel area should be estimated and any dry weather flows measured. In general, the larger the outfall pipe diameter, the greater the stormwater impact to the wetland. If stormwater outfalls or channels empty directly into the wetland and effectively bypass the wetland buffer, this should be noted as well.

Downgradient of the wetland

Constrictions at downstream crossings can cause increased ponding in the wetland.

- The team should walk at least 200 feet below any natural wetland outlet to look for possible constrictions by gates, weirs, undersized culverts, dams or other alterations. If any potential constrictions are found, they should be marked with a GPS, photographed, and their location should be drawn on the sketch.

- Look for ditches or outfalls from tile drains below the wetland that drain wetland areas.

2. Evidence of Water Quality Problems: Wetland water quality can be affected by pollution from upstream stormwater runoff, illicit discharges, and leaking sewer lines. While field probes and sample bottles are needed to measure specific water quality parameters, the WI does not include water quality sampling, but instead asks the team to make simple visual observations with open or standing water to determine any potential water quality problems. Examples indicators include

- Excessive algal growth in ponded areas may signify excess nutrients.
- Cloudy or turbid water may indicate high sediment loadings.
- Dead fish or amphibians may signal toxicity or a low dissolved oxygen problem.
- Any non-clear flow from storm drain or other pipes during dry weather may indicate a potential illicit discharge.
- The accumulation of a lot of floatable trash in the wetland often suggests excessive stormwater flow or proximity of the wetland to a significant pollutant source.
- Presence of oil sheens on water or sediment surface.
- Sediment deposits within wetland.

3. Evidence of Sedimentation: Excessive sedimentation can reduce wetland storage capacity, pollutant removal ability, and diversity of the vegetative community. Sediment derived from urban CDAs can be generated from channel erosion, construction sites, road sanding, and stormwater runoff. The team is asked to look for indicators of sediment within the wetland, and look for probable sediment sources in the buffer and CDA.

Sediment Indicators Observed Within the Wetland

The first place to look for sediment indicators is near any storm drain outfall or channel discharging to the wetland. The crew should look for the following signs of excessive sediment deposition.

- Sediment plumes or delta deposits near inlets
- Observed silt stains on plants
- Cloudy or turbid water
- Presence of a freshly deposited sediment layer over the surface of wetland soils
- Dominant presence of sediment tolerant wetland plants (> 50% of wetland coverage), particularly near inlets

Sediment Sources in the Buffer or CDA
The crew should look for exposed soils or streambanks within the buffer or CDA that can potentially contributes sediment loads

- The crew should note any construction sites, row crops, or other areas of exposed soil in the wetland CDA

- The crew should note any buffer encroachments that are encountered in the wetland buffer. An intact wetland buffer provides some filtering of sediment in runoff before it enters the wetland.

- If the wetland is fed by a stream channel, check to see if it is stable or whether it is actively eroding in response to upland development.

4. Altered Vegetation*:* Since wetland vegetation is intrinsically linked to overall wetland health, changes in the vegetative community can be an obvious sign that something is amiss. The crew is asked to look for evidence of altered vegetation in both the wetland and buffer, as follows:

Within the Wetland
- The crew should note any direct physical alterations to wetland vegetation, such as grazing, mowing, tilling, or clearing.

- If there are only a few species of wetland plants present at the site, this is often a potential indicator of stress (note that some natural wetland communities may only support a few species under normal situations). As the wetland takes on more sediment or as ponding increases, it may begin to loose some of its edge habitat and variable bottom depths, which may reduce species diversity.

- A clear sign of wetland degradation is the presence of extensive stands of invasive plants (> 25% coverage) in the wetland (such as purple loosestrife, Japanese knotweed, or *Phragmites*). The team should consult the local list of invasive, exotic or sediment tolerant wetland species, and record the type and coverage of invasive species on the first page of the WI form.

- Look for signs of non-seasonal defoliation that can be caused by reaction to changes in WLF, often in the form of diseased or dying trees and shrubs.

- In some forested wetlands, a lack of canopy or understory structure may indicate an impaired community in a forested wetland.

Within the Buffer
The crew then turns its attention to the quality and management of the buffer around the perimeter of the wetland. The wetland buffer provides critical habitat to many wetland species as well as the potential to manage stormwater before it reaches the wetland.

- The team should look for signs of buffer encroachment (particularly if the wetland is subject to local or state wetland buffer requirements). The ideal buffer will have 50 to 100 feet of native forest cover or vegetation. Narrower buffers that lack native cover should be considered impacted. Encroachment may include grazing, mowing, tilling, clearing, or developing within the buffer.

- The team should look for indicators of poor vegetative conditions in the buffer, including few plant species present, extensive coverage by invasive species (> 25%), and lack of canopy or understory structure. Turf or grass cover in the buffer is generally not an acceptable form of buffer cover, unless it is native vegetation for the prevailing climate.

***5. Plant and Wildlife Sightings*:** The presence or absence of a particular plant or wildlife species may have larger wetland management implications that might influence the feasibility of restoration efforts (e.g., presence of deer or beaver can make establishment of vegetation more difficult). Because the WI is such a rapid survey, the crew will seldom encounter all the plant and animal species that inhabit the wetland (or use it seasonally) but when interesting sightings are made, they should be recorded here. Even if no sightings are made, crews should look for tracks, scat, nests, browse-lines and beaver marks on trees to get a sense about which animals frequent the wetland. The sightings should be classified as to whether they are indicators of potential problems or indicators of important wetland habitat.

Indicators of Potential Problems
- The presence of beaver alters the hydrology and vegetation of wetlands. Beaver create wetlands, expand the size of wetlands, and can improve wetland diversity; however, they may also kill trees and cause maintenance problems at restoration sites.
- Excessive deer browsing reduces quality of understory and for structure, and make buffer reforestation more difficult
- Nutria can deplete wetland plants, which often will be replaced by invasive species.
- Resident geese may contribute to water quality problems.
- A lot of mosquito larvae can indicate impaired aquatic community that lacks fish and insect predators.

Indicators of Important Wetland Habitat
On the other hand, sightings of unique or sensitive plant and animal species may indicate presence of important wetland habitat or sensitive wetland communities that deserve special protection. The individual plant and animal species that indicate excellent wetland quality will vary regionally and should be identified prior to conducting the WI. Examples of indicators of important wetland habitat include:

- Nesting or use by herons and other birds as well as animals can signify important wetland habitat or good wetland condition.

- Multiple or certain species of dragonflies and amphibians may also indicate high quality
- The presence of rare, threatened or endangered species suggests the wetland merits conservation and/or should be placed on the list of sensitive wetlands.

6. Potentially Untreated CDA Inputs: If a CDA delineation exists for the wetland, it is important to define any direct hydrologic or water quality connection to the wetland from the CDA.

- All hydrologic connections (e.g., outfalls, channels) should be tracked to their source and determine if the areas draining to them are controlled or uncontrolled by stormwater treatment practices. Crews should also look for evidence of uncontrolled storm water that may be causing changes in WLF, bank erosion, sedimentation, and water quality impairments. In some cases, this can be inferred by extensive impervious cover in the CDA (e.g., > 25%).

- Crews should also look for stormwater pollution hotspots (e.g., gas stations, landscaping companies) and the potential for those pollutants to enter the wetland through the surface drainage system.

If there is time, the crew may want to develop some preliminary ideas for managing uncontrolled inputs of storm water or pollutants in the wetland CDA. This can include storm water retrofits, such as infiltration or filtering practices, pollution prevention, and adoption/enforcement of local ordinances for storm water management, erosion and sediment control, site design, and wetland buffers. If the investigation of the CDA triggers a more detailed evaluation using USA or other assessment forms, the unique site ID should be cross-referenced to the WI form for later coordination.

D. Preliminary Wetland Management Options

Based on their observations of wetland impact indicators, the crew should determine preliminary management options for the wetland. This can include designating the wetland as a potential conservation site or sensitive wetland, or designating the wetland as a potential restoration site. If no impacts are observed or if indicators of important wetland habitat are present, the wetland is a potential conservation site or sensitive wetland. The screening criteria used to initially identify potential conservation sites and sensitive wetlands should be re-applied to these wetlands, based on the updated information collected in the field, to determine how best to manage them.

If indicators of wetland impacts are observed, then the wetland may be a potential restoration candidate. The crew should make a determination about whether the sources of impacts are controllable. If the sources of impacts are obvious and readily observable in the field, the crew should make initial recommendations for managing these stressors. For example, a crew may recommend enforcement of ESC regulations on an active construction site adjacent to the wetland, or recommend restricting mowing or clearing at the site to allow regeneration of wetland vegetation.

If the sources of impacts are not readily observable from the wetland site, additional field assessment in the CDA will be necessary to determine if impacts are controllable, and to make recommendations for reducing or eliminating them. Additional field assessments

that may be recommended are listed in Table D-1 along with the typical resulting management recommendations. In addition, changes to local regulations and programs, such as storm water management or erosion and sediment control regulations, may be needed to control the sources of wetland impacts (Article 3). If additional field assessments are recommended, the unique site ID should be cross-referenced to the WI form for later coordination of data.

Table D-1. Further Assessments Recommended to Evaluate Stressors to Wetlands

Assessment Protocol	Description	Recommendations Resulting from Assessment
Unified Stream Assessment (Kitchell and Schueler, 2004)	A continuous streamwalk method to evaluate impacts and identify restoration opportunities along the stream corridor	Storm water retrofits, stream repair, buffer reforestation, stream cleanups, illicit discharge investigations
Unified Subwatershed and Site Reconnaissance (Wright et al., 2004)	A windshield survey of upland areas to evaluate pollution sources and identify restoration opportunities. Includes four assessments described below.	See specific recommendations below
	The Neighborhood Source Assessment evaluates pollutant-producing behaviors in individual neighborhoods	Downspout disconnection, pet waste management, natural landscaping and reforestation, storm water retrofits
	The Pervious Area Assessment evaluates condition of natural area remnants and reforestation potential	Upland reforestation, soil amendments, invasive species control
	The Hotspot Site Investigation creates an inventory of storm water hotspots and rates severity with regard to potential for generating pollutants	Permit enforcement, storm water retrofits, pollution prevention
	The Streets and Storm Drains form estimates severity of pollutant accumulation in streets and storm drains	Storm drain stenciling, street sweeping, catch basin cleanouts, storm water retrofits
Retrofit Reconnaissance Inventory (CWP, in press)	Evaluates potential storage and on-site storm water retrofit sites to develop concept designs for storm water retrofits	Conversion of dry pond to wet pond, flow attenuation devices, storm water ponds and wetlands, filtering practices, rain barrels, compost amendments, rain gardens, green roofs
Stream Repair Inventory (Schueler and Brown, 2004)	Evaluates defined stream reaches to develop concept designs for stream repair projects	Stream cleanup, bank stabilization, flow deflection, grade control, in-stream habitat enhancement, flow diversion, fish barrier removal, comprehensive stream restoration
Urban Reforestation Site Assessment (Cappiella et al., 2006)	Evaluates urban planting sites to develop planting plans for reforestation projects	Reforestation
Outfall Reconnaissance Inventory (Brown et al., 2004)	Survey of storm water outfalls to detect suspected illicit discharges and track down and fix their specific sources	Infrastructure modification or repair, spill containment and cleanup procedures

It is important to note that these additional field assessments are primarily intended to evaluate whether a particular stressor is controllable, and do not evaluate the feasibility of restoring wetland *functions* once the stressor is eliminated. Restorability of wetland functions is dependent on a variety of factors, such as wetland type, and often will take years to determine if success has been achieved. Additional field assessments may determine that the sources of impacts to the wetland are not controllable. Examples of stressors that may be difficult to control include:

- Water quality problems due to groundwater contamination
- Storm water runoff from CDA that is too abundant to manage
- Limited space in CDA to install storm water treatment practices (may be indicated by > 25% impervious cover)
- Current stressors can be controlled but high development pressure and lack of storm water management regulations may undo any restoration efforts with new development
- Abundance of nuisance species or invasive species (may make restoration efforts difficult)

Finally, since one goal of the WI is to verify and update the desktop wetland inventory, the crew should make note of any updates needed to the wetland inventory. This includes changing the wetland status (e.g., observed impacts move site from conservation list to restoration list), changing the boundaries of the wetland, buffer, or CDA to reflect field conditions, changing the NWI or HGM classification, and changing the CDA characteristics to reflect actual conditions. The crew should check the appropriate box and be very explicit about any recommended changes to the inventory.

Wetland Impacts **WI**

WATERSHED/SUBWATERSHED:		**DATE:** ___/_____/___	**ASSESSED BY:**
SITE ID: (*Condition-#*) **WI-_____**	**TIME:**___:___AM/PM	**PHOTO ID:** (*Camera-Pic #*)	/#
LAT ____°____'____" **LONG** ____°____'____"		**LMK** _____	**GPS:** (*Unit ID*)

To be completed in office:

WETLAND AREA: _____acres	**NWI CODE:**
WETLAND STATUS: □ potential restoration site □ potential conservation site □ sensitive wetland □ no special designation □ other:	**HGM:** □ riverine □ depressional □ slope □ flat □ estuarine fringe □ lake fringe □ headwater stream channel □ other:

CONTRIBUTING DRAINAGE AREA (CDA): _____acres **CDA** _____% impervious cover

DOMINANT LAND USE *(in CDA)*: □ forest □ pasture □ row crop □ single family residential (low density) □ single family residential (medium-high density) □multi-family residential □ institutional □commercial □industrial □ unknown □other:

DEVELOPMENT PRESSURE *(IN CDA):* □ unknown □ high □ medium □ low

WETLAND SKETCH *(include inlets, outlets, transects, buffer, and significant features)*

% OPEN WATER:

DOMINANT PLANT SPECIES IN WETLAND:

(check dominant class and list top 3 in each applicable category)

□ Trees

□ Shrubs

□ Emergent vegetation

□ Ground Cover

INVASIVE PLANTS IN WETLAND

Species % of total wetland coverage

DOMINANT PLANT SPECIES IN BUFFER:

(check dominant class and list top 3 in each applicable category)

□ Canopy

□ Understory

□ Ground cover

INVASIVE PLANTS IN BUFFER

Species % of total wetland coverage

EVIDENCE OF ALTERED HYDROLOGY:

□ none □ high proportion of open water *(25% of wetland > 1 ft deep)* □ dead/dying trees □ evidence of fill or dumping
□ utility crossings □ presence of tile drains, ditches or other method of draining □ surface scour, rills, or channel formation
□ storm water runoff/outfall(s) to wetland □ downstream constrictions *(undersized culverts, dams, weirs)* □ evidence of increased WLF
□ other:

EVIDENCE OF WATER QUALITY PROBLEMS:

□ none □ excessive algal growth □ cloudy, turbid water □ dead fish or amphibians □ trash/debris/floatables □ oily sheen
□ non-clear dry weather flow from outfall to wetland □ other:

EVIDENCE OF SEDIMENTATION: *(in wetland)*

□ none □ sediment plumes/deposits near inlet □ silt stains on plants
□ cloudy/turbid water □ sediment deposits over wetland soils
□ dominant presence of sediment-tolerant species □ other:

(in wetland buffer or CDA)

□ none □ buffer encroachment
□ exposed land in CDA *(construction sites, row crops)*
□ channel/bank erosion in tributaries to wetland □ other:

ALTERED VEGETATION *(in wetland)*

□ none
□ direct physical alterations *(grazing, mowing, tilling, clearing)*
□ few plant species present
□ extensive coverage by invasive plant species *(>25%)*
□ diseased or dying vegetation
□ lack of canopy or understory *(forested wetlands only)*
□ other:

(in wetland buffer)

□ none
□ buffer encroachment *(grazing, mowing, tilling, clearing, development)*
□ few plant species present
□ extensive coverage by invasive plant species *(>25%)*
□ lack of canopy or understory *(forested wetlands only)*
□ other:

PLANT AND WILDLIFE SIGHTINGS *(indicators of potential problems)*

□ none □ beaver □ deer □ nutria □ geese □ mosquitoes
□ other:

(indicators of important wetland habitat)

□ none □ herons □ dragonflies □ amphibians
□ rare, threatened or endangered species □ other:

POTENTIALLY UNTREATED CDA INPUTS:

□ none □ unknown □ storm water pollution hotspots *(describe below)* □ uncontrolled storm water runoff *(describe below)* □ other:

NOTES:

PRELIMINARY WETLAND MANAGEMENT OPTIONS

□ Potential conservation site or sensitive wetland *(check if no wetland impacts are observed and/or indicators of important wetland habitat are present)*

□ Potential restoration site *(check if indicators of wetland impacts are observed)*

Are sources of impacts controllable? □ No □ Yes, recommendations described below □ Unknown, further assessment recommended

ADDITIONAL FIELD ASSESSMENTS RECOMMENDED:

□ None □ USA □ USSR □ Hotspot Site Investigation □ Neighborhood Source Assessment □ Pervious Area Assessment
□ Streets and Storm Drains □ Outfall Reconnaissance Inventory □ Retrofit Reconnaissance Inventory □ Stream Repair Inventory
□ Urban Reforestation Site Assessment □ Wetland delineation □ Comprehensive wetland functional assessment □ Other:

UPDATES TO WETLAND INVENTORY: □ None □ Wetland status □ Wetland area/boundary □ Wetland type □ Wetland CDA □ Other: