



**Evaluation, Classification and Management of  
Headwater Drainage Features:  
Interim Guidelines**  
Updated March 2009



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## INTRODUCTION

Conservation Authorities are concerned with both rural and urban development activities that impact and/or eliminate headwater drainage features (HDFs), which could have broad implications for water quality and quantity, recharge/infiltration, and the overall health of downstream habitats. These headwater drainage features could provide permanent, seasonal or contributing fish habitat, and alterations to these features could have implications on aquatic integrity within our watersheds. The spatial extent of headwater drainage features can account for 70-80% of the total catchment area within a watershed. Furthermore, 90% of a river's flow may be derived from catchment headwaters. Headwater systems are considered important sources of food, sediment, water, nutrients, and organic matter for downstream reaches. However, due to their small size and because these functions are poorly understood and typically underestimated, headwater drainage features can be vulnerable to impacts resulting from agricultural and urban land uses, such as tile drainage, channel lowering, relocation, and enclosure (i.e. piping). In March 2007, TRCA completed a literature review summarizing the state of the science around the natural functions of headwater drainage features. We have also conducted some primary research to further our understanding of these systems specifically with respect to quantifying drift (invertebrates and detritus) inputs to downstream aquatic habitats. These guidelines are based on this most up-to-date information and the findings of our research support the management recommendations contained herein.

The 1998 amendments to the *Conservation Authorities Act*, and subsequent approval of individual Section 28(1) Regulations by the Minister of Natural Resources in May 2006, gave all Conservation Authorities the legal right to apply a consistent definition of "watercourse," which is: "*An identifiable depression in the ground in which a flow of water regularly or continuously occurs*" (Section 28 (5) of the CA Act). Features that qualify as an HDF could qualify as a watercourse under this definition.

These Interim Guidelines are intended to be used by both developers and their consultants and Conservation Authority staff in the preparation and review of development studies and/or applications as a comparative evaluation tool to review the integrative nature of flow, channel form, and vegetation with regard to fish habitat and hydrologic functions of headwater drainage features. This information should be incorporated and synthesized into an Environmental Impact Study, if applicable, in order to address other natural heritage features and functions. Upon consideration of the attributes and functions of HDFs, the evaluation (Part 1), classification (Part 2) and management (Part 3) of each drainage feature must be provided that addresses the protection and conservation of fish habitat (e.g. permanent, seasonal, refuge, invertebrates, sediment and nutrient regulation, etc.) and mitigation of hydrologic functions (e.g. flow conveyance, attenuation and infiltration/storage), as appropriate. While the evaluation and classification is undertaken at the site specific scale, the management recommendations should consider the cumulative effects on the drainage network. The management recommendations are to be implemented through the development design, including stormwater management and sustainable management practices, and must take into consideration the recommendations of the relevant Fisheries Management Plan (FMP) or Watershed Plans.

The Conservation Authority will undertake preliminary screening to determine the extent of field assessment required for drainage features within the site through both aerial photography interpretation, the application of ArcHydro, if feasible, and/or limited field verification, as necessary. Pre-screening of soils should also be undertaken by the Conservation Authority and/or proponent to confirm existing soil information, particularly if the site is located in known coarse-textured soil areas (e.g. Oak Ridges Moraine, Lake Iroquois Shoreline, etc.).

## PART 1: EVALUATION CRITERIA

This section is intended to provide proponents with guidance on assessing the aquatic, hydrologic, and geomorphic attributes of headwater drainage features. It provides guidance on when and how to collect the data during fieldwork, and includes

- flow assessment;
- fish habitat assessment;
- vegetation assessment;
- an evaluation of channel form; and
- an assessment of linkages.

This information will then be summarized in a table and will be used to classify the features and provide appropriate management options.

### REQUIRED FIELD WORK

Timing: Field work is to be generally conducted in late spring, e.g. decline of spring freshet or in April/May/June under clear conditions to catch seasonal fish use, if possible. Additional seasonal observations in summer may be required to document the duration and extent of permanent wetted conditions, including refuge habitat. NOTE: The spring dates also coincide with the onset of amphibian breeding that may occur in on-line ponded areas and/or riparian areas. All data submitted must be identified by the date the field work was conducted and by whom. Refer to Table 1 for the preferred timing for Evaluation Criteria. Multiple assessments will be needed for some criteria.

**Table 1: Preferred timing for Evaluation Criteria<sup>+</sup>**

| Preferred Timing     | Flow Assessment   | Channel Form                        | Aquatic Habitat Assessment | Vegetation and Wetland Assessment | Linkage        |
|----------------------|---|-------------------------------------|----------------------------|-----------------------------------|----------------|
| Multiple Assessments | Spring Freshet/Rain Events<br>Late April-May<br>July-August |                                     |                            |                                   |                |
| Single Assessment    |   | Growing season<br>(earlier is best) | Late April-May             | Growing season                    | Growing season |

<sup>+</sup>in an average year.

Protocol: Portions of the most current version of the Ontario Stream Assessment Protocol (OSAP) may be used, as appropriate. Unless the drainage feature is dry in April/May/June, fish should be sampled using nets, electrofishing or minnow traps at various points along the reach to be examined. Visual observations alone are insufficient to document fish presence. Undertake electrofishing from the downstream confluence and go as far upstream as flows permit and habitat indicates. Sample ponds, pools and all available habitat, to extrapolate use. All fish sampling locations should be geo-referenced and digital data should be provided using UTM Zone 17 NAD83 ESRI Native File Data (shapefiles). Photos of the features at different times of the year (see Table 1) are necessary to document conditions.

Surveyor: Identify surveyor/s and qualifications. Assessment should be undertaken by a qualified aquatic specialist familiar with fisheries, geomorphology, wetlands, and in aquatic/stream sampling.

**A) FLOW ASSESSMENT**

The Flow Assessment will consist of three components, including a flow description, a description of surface flows, and a description of groundwater flows.

Flow Description – Headwater drainage features may not flow year-round, but could flow for parts of the year due to seasonally high groundwater levels or in response to snowmelt or rain events. Describe flow within the feature by assessing its hydroperiod and water regime (the duration and depth of standing or flowing water). The feature should be examined at various times of the year to assess whether there are flowing conditions. Once the assessments are complete, identify the type of flow within the drainage feature/sub reach according to Table 2. Channel flow can influence channel form and presence of natural vegetation. Three assessment periods may be required to confirm duration and depth of flow. If no flow is observed in the feature during any of the assessment periods, no further observations will be required, and the feature will be confirmed as not qualifying as an HDF, unless it is a drought year. Flows will change annually and may become more unpredictable due to a changing climate. A conservative approach should be taken in assessing flow. Consider whether flows contribute only to downstream reaches or whether there is a connection to floodplain habitats. Photographs are required to provide support for flow assessment. A photo should be taken at each assessment period; the date of each photo should be provided. If flow assessment data are not provided for a particular assessment period, a conservative approach will be taken (i.e. assumed to flow during that period). Describe the headwater drainage feature according to the following definitions:

- perennial – continuous surface and/or subsurface flows most years - baseflow conditions are supported by year round groundwater discharge and/or wetland/surface storage areas – channel form has been defined by flows, there is defined bed and banks, and may be characterized by sorted substrate material, could have instream vegetation with, i.e. watercress, forget-me-nots, arrowhead; will have hydric soils.
- intermittent – water flows for several months during the year (usually 4-5 months), most commonly during the wetter periods or seasons because of a connection with seasonally high groundwater tables; or seasonally extended contributions from wetlands or other surface storage areas – channel form is generally defined by flows; however, greater presence of instream vegetation that may be wetland facultative species; streambed material that differs from the surface of the ground surrounding the stream (e.g. recent accumulations of silt, sand, gravel in streambed); may have hydric soils.
- ephemeral – water flows for a short period of time in response to localized precipitation (e.g. meltwater or storm events) – surface water channel is likely above the local groundwater table – ill-defined channel form that is generally well vegetated and scour is not evident (with the exception of gullies on higher gradient); will not have hydric soils.

**Table 2: Flow Assessment Classification**

| ASSESSMENT PERIOD | FLOWING CONDITIONS                |              |           |               |
|-------------------|-----------------------------------|--------------|-----------|---------------|
|                   | Spring Freshet or Rainfall Events | YES          | YES       | YES           |
| Late April – May* | YES                               | YES          | NO±       | NO            |
| July-August*      | YES                               | NO           | NO        | NO            |
| Flow Description  | Perennial                         | Intermittent | Ephemeral | Does Not Flow |

\*Flowing conditions assumes no antecedent precipitation (1 week) in an average year

±No further observations required

### Surface Flows

- define and quantify catchment of flow contributions, including off or on-line ponds, wetlands, floodplains, vernal pools, or other surface areas.
- describe soils and slope of catchment to assist in determining flow volumes, flow duration or recharge potential.
- describe functions related to conveyance, storage, attenuation and infiltration.
- describe or measure discharge (if possible) or provide surface flow measurements if available from other sources, e.g. Subwatershed studies.

### Groundwater Flows

- define catchment of flow contribution, if feasible. A hydrogeological study may be required depending on the scale of the development, use of soils mapping, etc.
- describe or measure groundwater discharge/contributions to the drainage feature, if apparent, e.g. discharge points, seeps, tile drains, etc. Could be based on soils and vegetation, i.e. wetness index – wetland indicators, e.g. cattails/sedges, watercress in permanent seeps, etc. If a hydrogeological study is required, piezometers may be necessary to measure groundwater flows. Provide a discussion around the connection of the feature to permanent or seasonal (fluctuating) groundwater flows and whether groundwater contributions are from shallow versus deep groundwater sources.
- describe functions related to conveyance, storage, infiltration and timing (i.e. relative to the drainage feature or to the main or downstream channel [next order]).

## B) CHANNEL FORM

Headwater drainage features, including swales can be ill-defined; however, there may be some morphological, vegetation or soils characteristics which can be measured or described. Channel form is the result of flow, vegetation, and longitudinal grade, and channel form may change as a result of variations in these conditions. Site photographs are required when describing these features; include the date the photo was taken. A sketch of the channel cross-section may also be provided to help describe the form.

- Outline reaches on an aerial photo, where possible;
- Measure bank height and width- can be defined by width of unique vegetation, including bent grass or flood debris;
- Channel stability (presence of erosion, excessive deposition, etc.);
- Morphology, e.g. pool, meanders - it may be possible to identify runs and flats – can find “steps” or evidence of downcutting that may act as barriers to fish movement;
- Channel slope (e.g. stream gradient);
- Bank and substrate materials;
- Discharge points, seeps, tile drain outlets, etc.;
- Width/depth of associated storage (flood prone) lands beyond the bank (e.g. depressional or wetland areas);
- May be differences in soil i.e. mapped “bottomlands” – can also check for water table via soil mottling;
- Condition of any channelization and/or bank stability works.

## C) AQUATIC HABITAT ASSESSMENT

As defined by the *Fisheries Act* - "fish habitat" means *spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes*. The assessment can be undertaken using portions of OSAP, as appropriate. Unless the drainage feature is dry in April/May/June, fish should be sampled using nets, electrofishing or minnow traps at various points along the reach to be examined. Visual observations alone are insufficient to document fish presence. Undertake electrofishing from the downstream confluence and go as far upstream as flows permit and habitat indicates. Sample ponds, pools and all available habitat, to identify

refuges and to extrapolate use. All fish sampling locations should be geo-referenced and digital data should be provided using UTM Zone 17 NAD83 ESRI Native File Data (shapefiles). The following should be identified to qualify the fish habitat and functions:

- List species and abundance of all species captured; and define status of any species of conservation concern (i.e. whether typical headwater species). Map the locations of any observed species of concern and describe and measure habitats;
- Identify location and abundance of any observed aquatic sensitivities and critical habitats, i.e. spawning redds, seeps, springs, refuge pools, upwellings;
- Identify and map any potential migration barriers, including culverts, natural steps (down cutting), steep gradients, dams, online ponds, etc.;
- Provide a qualitative field assessment to confirm the presence of other species, particularly food sources (invertebrates) that are also indicators of fish habitat or contribute to downstream habitat. Aquatic insects and snails are often direct indicators of water quality and flow conditions; some frog tadpoles indicate year round refuge pools (e.g. green frog is the most common indicator); or invertebrates such as crayfish (look for both aquatic species and burrowing chimney species in riparian zone)
- Provide a qualitative review of the functions of the riparian and instream vegetation such as: provides fish habitat for cover/nesting (e.g. sticklebacks); provides organic inputs (e.g. nutrients or food, such as leaf litter and woody debris); improves water quality of drainage flows, e.g. Nutrient uptake, trapping sediments, etc.; provides shading and cooling if flows are seasonally extended, or riparian cover from avian predators.
- Note: Instream vegetation is not considered to prevent fish access to connecting drainage features. During spring flows the vegetation is considered to provide velocity breaks, roughness and cover, in addition to providing spawning structures and food supplies. Failure to conduct fish sampling will result in the feature being assumed to support direct fish habitat.

**PONDS** - Both on-line ponds (potential source of the drainage feature) and off-line ponds (including isolated ponds in floodplain) may need to be examined to determine if they provide fish habitat or hydrological functions to the drainage feature on an annual/seasonal or occasional basis. Characteristics to consider include: type of connection to the drainage feature (i.e. outflow channel that permits fish ingress/egress, raised barriers/pipes that allows only outflow of fish, flows, benthic invertebrates, etc.); current use for irrigation, nutrient/pesticide sink, or fish stocking (i.e. that is not in accordance with the Conservation Authority's Fisheries Management Plan), etc.

**ROADSIDE DITCHES** - Roadside ditches are generally prominent engineered drainage features in the rural and semi-urban landscape, and depending on the ditch configuration (i.e. longitudinal slope, bottom width, vegetation, bed material, etc.), they may provide both fish habitat and hydrological functions. Roadside ditches will have to be examined where they connect/link flows between drainage features, including watercourses swales and wetlands.

## D) VEGETATION AND WETLAND ASSESSMENT

This guideline is intended to provide direction on evaluating, classifying and managing headwater drainage features to maintain aquatic, hydrologic and geomorphic functions. However, terrestrial functions are also important components that will also need to be addressed, and are connected to other functions (e.g. aquatic). In negotiating the protection, conservation and mitigation strategies for headwater drainage features, the proponents, municipalities and Conservation Authority must recognize and address the terrestrial and natural heritage attributes and functions, as well as considerations for their protection. This includes existing policies (e.g. Provincial Policy Statement, Greenbelt Plan, Oak Ridges Moraine Conservation Plan, etc.), buffering requirements, and ultimate ownership of the Natural Heritage System. Terrestrial information, including terrestrial species surveys and Ecological Land Classification should be synthesized as part of an Environmental Impact Study/Natural Heritage Evaluation (EIS/NHE), and relevant information could be withdrawn to tie back to aquatic functions, and vice versa. Ultimately, the results of this guideline should be incorporated into an EIS/NHE, if one is required. Specifically, the following information is necessary to assess aquatic functioning:

- Identify both riparian and instream vegetation with regard to form, species, density, and wetness indicator values (i.e. facultative or obligate wetland species)
- Confirm vegetation with regard to species of conservation concern and indicate locations of populations on a map.
- NOTE: Areas of facultative/obligate wetland species >0.5 ha and linked to other wetland areas may require an evaluation as per the Ontario Wetland Evaluation Manual for Southern Ontario (OWES, 3<sup>rd</sup> Edition) and OMNR, Aurora District Criteria for wetlands <2ha. Further discussion with Conservation Authority staff may be required.

**E) LINKAGE**

- Identify up and downstream (and across the floodplain) connections to other drainage features, particularly watercourses, ponds, wetlands and tile drains, etc.;
- Identify connections to terrestrial vegetation units, including both natural and cultural vegetation and hedgerows; and cultural/engineered features (e.g. pipelines, railways, hydro corridors, etc.).
- Describe any incidental wildlife habitat features and/or functions, including corridors, observed during field work. NOTE: Use by amphibians is most common and most prolific in some cases where fish do not have access, and may represent significant wildlife habitat.
- Identify impediments to connections, such as fish barriers.

Consultants should complete the following Evaluation, Classification and Management Table (Table 3) for reporting purposes.

**Table 3: Summary of information to be reported for each headwater drainage feature. A separate line should be completed for each reach, wetland and/or pond.**

| Drainage Feature Unit and Sub Reach | Date of Field Work (identify date, weather, protocol used and surveyor) | Soils | Flow Assessment (define type of flows and attributes) |               |                    | Aquatic Habitat Assessment        |                                  | Vegetation/Wetland Assessment (define form, species, density and functions) |          | Linkage                                 |           | Channel Form                            | Habitat Classification (based on fish habitat and flow characteristics) | Drainage Feature Management Recommendation |
|-------------------------------------|---|-------|---|---------------|--------------------|-----------------------------------|----------------------------------|---|----------|---|-----------|---|---|--|
|                                     |   |       | Catchment size  | Surface Flows | Ground water Flows | Attributes/Species/Abundance/Size | Life Cycle and Habitat Functions | Riparian  | Instream | Connections (up and downstream reaches) | Functions |   |   |  |
|                                     |   |       |   |               |                    |                                   |                                  |   |          |   |           | Create as many sub-columns as necessary |   |  |

## PART 2: HABITAT CLASSIFICATION

The purpose of this section is to use the information collected during the Evaluation section (Part 1 above) and apply the appropriate fish habitat classification for the headwater drainage feature(s) being assessed. Classification should occur on a reach-basis according to one of the 5 categories below. The classification will then be used to determine appropriate management options (Part 3). There may also be additional habitat value for wildlife such as amphibians and other taxa, which will need to be considered in the management options. Note that downstream barriers should be assessed to determine if the barriers are restricting fish use within the study reach. Discussion around the potential for fish to utilize the reach should be considered in the classification. The results of the classification should be summarized in Table 3 above.

1. **Permanent** - Provides direct habitat onsite (e.g. feeding, breeding, and/or migration) as a result of year round groundwater discharge and/or permanent standing surface water within a storage feature (i.e. ponds, wetlands). Habitat may be either existing or potential (i.e. isolated by a barrier). Permanent habitat also may include critical fish habitat (i.e. habitat that is limited in supply, essential to the fish life cycle, and generally habitat that is not easily duplicated or created). Hydrogeological studies and/or water balance calculations may be required to confirm groundwater contributions, as appropriate, with regard to the scale of the development application(s).
2. **Seasonal** - Provides limited direct habitat onsite (e.g. feeding, breeding, migration and/or refuge habitat), as a result of seasonally high groundwater discharge or seasonally extended contributions from wetlands or other surface storage areas that support intermittent flow conditions, or rarely ephemeral flow conditions. Occasionally, limited permanent refuge habitat may be identified within seasonal habitat reaches.
3. **Contributing** - Provides indirect (contributing) habitat to downstream reaches – functions generally increase with flow and/or as flows move downstream with increasing length of channel or channel density (e.g. extent of contributing area). There are two types of contributing habitat:
  - i. Complex contributing habitat – generally as a result of intermittent (or less commonly ephemeral) surface flows, can have marginal sorting of substrates – generally well vegetated features that influence flow conveyance, attenuation, storage, infiltration, water quality, sediment, food (invertebrates) and organic matter/nutrients (i.e. there are two types of nutrients, e.g. dissolved nutrients, and coarse/fine matter that can be used as cover). Generally, two types: a) defined features with natural bank vegetation consisting of forest, scrubland/thicket or meadow (as defined in OSAP or ELC); or b) poorly defined features (swales) typically distinguished by hydrophilic vegetation
  - ii. Simple contributing habitat – generally as a result of ephemeral (or less commonly intermittent) surface flows – generally not well-vegetated features that influence flow conveyance, attenuation, storage, infiltration, water quality and sediment transport. Generally two types: a) defined features characterized by crop cultivation, mowing or no vegetation; or b) poorly defined features (swales) may contain terrestrial vegetation.
4. **Not Fish Habitat** - The pre-screened drainage feature has been field verified to confirm that no features and/or functions associated with headwater drainage features is present – generally characterized by no definition or flow, no groundwater seepage or wetland functions, and evidence of cultivation, furrowing, presence of a seasonal crop, lack of natural vegetation, and fine textured soils (i.e. clay and/or silt).
5. **Recharge Zone** – Coarse-textured soils described as sand and/or gravel have been confirmed through field verification; majority of potential flow will be infiltrated. These features may have ill-defined channels as a relict of past flows; however the key function is groundwater recharge and maintenance of downstream aquatic functions via groundwater connections to streams. No direct fish habitat or indirect contributions through surface flow conveyance, allochthonous or sediment transport provided.

## PART 3: MANAGEMENT RECOMMENDATIONS

The Drainage Feature Management Recommendations have been structured as a science-based decision making framework. Upon the evaluation (Part 1) and classification (Part 2) of the fish habitat and flow attributes and functions of headwater drainage features, management recommendations for the protection and conservation of fish habitat and mitigation for the associated hydrologic functions (e.g. flow conveyance, attenuation and storage) are to be implemented through the development design, including stormwater management, incorporating Low Impact Development measures (see TRCA's Water Management Guidelines for further detail). The classification categories identified in Part 2 generally correspond to the categories identified for management recommendations (i.e. Category 1 class corresponds to Category 1 management option). While the evaluation and classification is undertaken on a site specific scale, the management recommendations should consider the cumulative effects on the drainage network, and recognize terrestrial and other natural heritage considerations. In the event that a lower level of protection is identified for a reach downstream of a reach with a higher level of protection, the more conservative approach shall be adopted for both reaches. Consideration should be given for climatic variability, and a conservative approach should be taken (i.e. in drought years and the effects of climate change). The management options provided should be considered where efforts to relocate or redesign the proposal have been exhausted and alteration to the natural feature is deemed necessary. Be aware that policies for certain areas could apply more restrictive requirements over what is presented below (e.g. fish habitat, both direct and indirect, qualifies as a Key Natural Heritage Feature in the Oak Ridges Moraine Conservation Plan, and is therefore subject to the associated policies).

**NOTE: - the elimination and/or removal of a headwater drainage feature without approval will not be permitted to result in a No Management Recommendation Required category being assigned. Restoration of the drainage feature may be required through the development design.**

### 1. **Protection – Permanent Fish Habitat, Critical Habitat and Species at Risk (SAR)** – (NB: a permit under the Endangered Species Act or Species at Risk Act may be required when contemplating alteration to habitat of at-risk species. Below are preferred recommendations; however the Ministry of Natural Resources and/or Fisheries and Oceans Canada will need to be consulted prior to finalizing management options).

*Protection 1* – permanent, critical fish habitat or habitat associated with species at risk. Generally associated with permanent groundwater discharge or wetland storage – either habitat and/or flow source characteristics may be difficult to replicate or maintain.

- Preserve the existing drainage feature and groundwater discharge or wetland in-situ, particularly if species at risk are present;
- Maintain external drainage;
- Incorporation of shallow groundwater and base flow protection techniques such as infiltration treatment;
- Use natural channel design techniques or wetland design to restore and enhance existing habitat features, if necessary; realignment not generally permitted;
- Drainage feature must connect to downstream watercourse/habitat;
- Stormwater management (e.g. extended detention outfalls) are to be designed and located to avoid and/or minimize impacts (i.e. sediment, temperature) to fish habitat;
- Examine need to incorporate groundwater flows through infiltration measures (i.e. third pipes, etc.) to ensure no net loss and potential gain.

*Protection 2* – permanent fish habitat generally with permanent standing surface water associated with a wetland and/or pond flows

- Preference is to maintain existing surface water source;
- Maintain external drainage or if catchment drainage has been previously removed due to diversion of SWM flows, restore lost functions through enhanced lot level controls (i.e. restore original catchment using clean roof drainage) as necessary;
- Replicate on-site surface water sources including wetland creation and incorporating extended detention outlets, if necessary;

- Use natural channel design techniques to replace and enhance existing habitat features only if features are easily replicated;
- Drainage feature must connect to downstream watercourse/habitat;
- Examine need to incorporate groundwater flows through infiltration measures (i.e. third pipes, etc.) to ensure no net loss and potential gain.

## 2. Conservation – Seasonal Fish Habitat

*Conservation 1* – seasonal fish habitat associated with seasonally high groundwater discharge or seasonally extended contributions from wetlands potential permanent refuge habitat may be provided by a storage feature.

- Maintain existing seasonal groundwater or wetland surface flows,
- If catchment drainage has been previously removed due to diversion of SWM flows, restore lost functions through enhanced lot level controls (i.e. restore original catchment using clean roof drainage), as feasible;
- Replicate on-site seasonal groundwater or surface flows using infiltration measures and/or wetland creation, if necessary;
- Maintain external flows,
- Use natural channel design techniques to replace existing habitat features to maintain overall fish productivity of the reach;
- Drainage feature must connect to downstream habitat.

*Conservation 2* – seasonal fish habitat associated with intermittent surface flows.

- Replicate on-site surface flows;
- Maintain external flows; or if catchment drainage has been removed restore lost functions through enhanced lot level controls, as feasible;
- Use natural channel design techniques to replace existing habitat features to maintain overall fish productivity of the reach;
- Drainage feature must connect to downstream habitat.

## 3. Mitigation – Contributing Fish Habitat

*Mitigation 1* – Complex contributing fish habitat: flows conveyed through natural vegetation communities that support complex, contributing fish habitat i.e. influences water quality, sediment, organic matter, food and nutrients to the downstream habitat.

- Replicate functions through enhanced lot level conveyance measures, such as well-vegetated swales (herbaceous, shrub and tree material) to mimic online wet vegetation pockets, or replicate through constructed wetland features
- Replicate on-site flow and outlet flows at the top end of system to maintain feature functions. If catchment drainage has been previously removed due to diversion of SWM flows, restore lost functions through enhanced lot level controls (i.e. restore original catchment using clean roof drainage);
- Feature form and flow that connects directly to downstream fish habitat (i.e. direct connection to other drainage features/watercourse or wetlands);

*Mitigation 2* – Simple contributing fish habitat: flows that support simple contributing fish habitat, i.e. influences flow conveyance, attenuation and storage to downstream reaches.

- Replicate functions by lot level conveyance measures (e.g. vegetated swales) connected to the natural heritage system, as feasible and/or Low Impact Development (LID) stormwater options (refer to TRCA's Water Management Guidelines for details);
- Replicate on-site flows and outlet flows at the top end of vegetated swales, bioswales, etc. to maintain feature functions.

**4. No Management Recommendation Required– Not Fish Habitat**

The pre-screened drainage feature has been field verified to confirm that no feature and/or functions associated with headwater drainage features are present – generally characterized by evidence of cultivation, furrowing, presence of a seasonal crop, and lack of natural vegetation.

**5. Recharge Protection – Recharge Zone -** No direct habitat or indirect habitat providing surface flow, sediment transport, or allochthonous contribution to downstream fish habitat. Maintain overall water balance by providing mitigation measures to infiltrate clean stormwater, unless the area qualifies as an Area of High Aquifer Vulnerability under the Oak Ridges Moraine Conservation Plan (ORMCP) or Significant Recharge Areas under the Source Water Protection Act. These areas will be subject to specific policies under their respective legislation.

Table 4 below summarizes the management recommendations that will typically be applied when a given evaluation criterion or habitat classification is identified for a headwater drainage feature. Note that these are typical, and may not be appropriate in every case, and that these criteria and classifications can be mutually exclusive.

**Table 4: Summary of Evaluation Criteria, Habitat Classification Generally Associated with Management Recommendation Categories**

| Management Recommendation     | Habitat Classification | Evaluation Criteria   |                       |                         |  |                 |
|-------------------------------|------------------------|---|-----------------------|-------------------------|--|-----------------|
|                               |                        | Flow Description  | Groundwater discharge | Channel Form            | Vegetation   | Wetland Storage |
| <b>Protection 1*</b>          | Permanent              | Perennial flow from groundwater discharge                   | Permanent             | Well-defined            | forest, scrubland/thicket or meadow; terrestrial or wetland                        | Present         |
| <b>Protection 2</b>           | Permanent              | Perennial flow from wetland or pond surface flow            | Permanent or Seasonal | Well-defined            | forest, scrubland/thicket or meadow; terrestrial or wetland                        | Present         |
| <b>Conservation 1</b>         | Seasonal               | Intermittent flow from wetland, or permanent standing water | Seasonal              | Well-defined or Defined | forest, scrubland/thicket or meadow; terrestrial or wetland                        | Present         |
| <b>Conservation 2</b>         | Seasonal               | Intermittent flow   | N/A                   | Defined                 | forest, scrubland/thicket or meadow; terrestrial or wetland                        | N/A             |
| <b>Mitigation 1</b>           | Complex Contributing   | Intermittent (or ephemeral)                                 | N/A                   | Defined or swale        | Defined: forest, scrubland/thicket or meadow<br>Swale: wetland instream vegetation | N/A             |
| <b>Mitigation 2</b>           | Simple Contributing    | Ephemeral (or intermittent)                                 | N/A                   | Defined or swale        | Defined: cultivated, manicured, none<br>Swale: terrestrial instream vegetation     | N/A             |
| <b>No Management Required</b> | None                   | Does not flow   | N/A                   | No definition           | cultivated, manicured, none  | N/A             |
| <b>Recharge Protection</b>    | Recharge Zone          | Does not flow   | Recharge only         | Ill-defined             | vegetated or unvegetated   | N/A             |

\*Protection 1 applies to any features with Species at Risk or Critical Habitat regardless of the results of the evaluation or habitat classification

Table 5 below summarizes the Management Recommendations and the associated implications on the development design.

**Table 5: Summary of Management Recommendations and implications on the development proposal**

| Management implications   | Headwater Drainage Feature Management Recommendation |                                  |   |                                  |  |  | No Management Recommendation Required | Recharge Protection **                      |
|---|--|----------------------------------|---|----------------------------------|--|--|---------------------------------------|---|
|   | Protection 1   | Protection 2                     | Conservation 1                          | Conservation 2                   | Mitigation 1   | Mitigation 2   |                                       |   |
| <b>Must remain open</b>   | Yes  | Yes                              | Yes                                     | Yes                              | Preferred  | Preferred  | N/A                                   | N/A   |
| <b>Relocate using natural channel design</b>                    | Not permitted, enhancement only                      | May be considered, not preferred | May be considered, not preferred        | May be considered                | Natural Channel Design not required*                     | Natural Channel Design not required*                     | N/A                                   | N/A   |
| <b>Maintain or replicate on-site water sources</b>              | Maintain or enhance                                  | Maintain                         | Maintain preferred, restore if possible | Replicate or restore if possible | Replicate or restore if possible                         | Replicate through LID <sup>+</sup> measures, as feasible | N/A                                   | Maintain overall infiltration rates at site |
| <b>Maintain external sources of flow</b>                        | Maintain   | Maintain                         | Maintain                                | Maintain                         | Maintain   | N/A  | N/A                                   | N/A   |
| <b>Direct connection to downstream</b>                          | Maintain   | Maintain                         | Maintain                                | Maintain                         | Maintain   | Preferred  | N/A                                   | N/A   |
| <b>Replicate function through enhanced lot level conveyance</b> | N/A  | N/A                              | N/A                                     | N/A                              | Replicate using vegetated swales or constructed wetlands | LID <sup>+</sup> measures or swales/wetlands if possible | N/A                                   | N/A   |

\* Unless the management actions calls for restoration of lost function or enhancement and creation of direct fish habitat

\*\*Recharge zone may qualify as an High Aquifer Vulnerability Area and is therefore subject to the policies of the Oak Ridges Moraine Conservation Plan

<sup>+</sup>LID means Low Impact Development measures (see TRCA's Water Management Guidelines for further detail)

**APPENDIX I: PHOTOGRAPHIC EXAMPLES OF HEADWATER DRAINAGE FEATURE CLASSIFICATION**

Below are examples of the types of classifications that could result from using these guidelines and the some of the factors used in classifying them.

**PERMANENT FISH HABITAT**



wetland storage with groundwater discharge, not easily replicated



roadside ditch supporting brook trout, artesian flow



year-round flow, groundwater discharge, brook trout

**SEASONAL FISH HABITAT**



refuge pool with fish use year round, intermittent flow



pumpkinseed present April 22, no flow in July



cyprinids present in May, no flow in August

**COMPLEX CONTRIBUTING FISH HABITAT**



Photo series (1): April 23 - no fish present



(2) July 4 – no flow, same as (1)



(3) October 25 – no flow, autumn leaf litter, same as (1)

**COMPLEX CONTRIBUTING FISH HABITAT**



April 15, cattails in bottom of broad ditch



September 15, patch of cattails in swale.



April 15, grasses growing on hummocks indicating prolonged wet conditions

**SIMPLE CONTRIBUTING FISH HABITAT**



April 15, flows directly into seasonal habitat, plus two shallow on-line dug ponds that dry up in summer



April 15, approximately 200m upstream of complex habitat



April 15, flow through terrestrial grasses

**NOT FISH HABITAT**



rills or furrows, no flow



September 16, though vegetation is discoloured, crops planted through, no/minimal surface flow



September 5, no flow in spring or summer

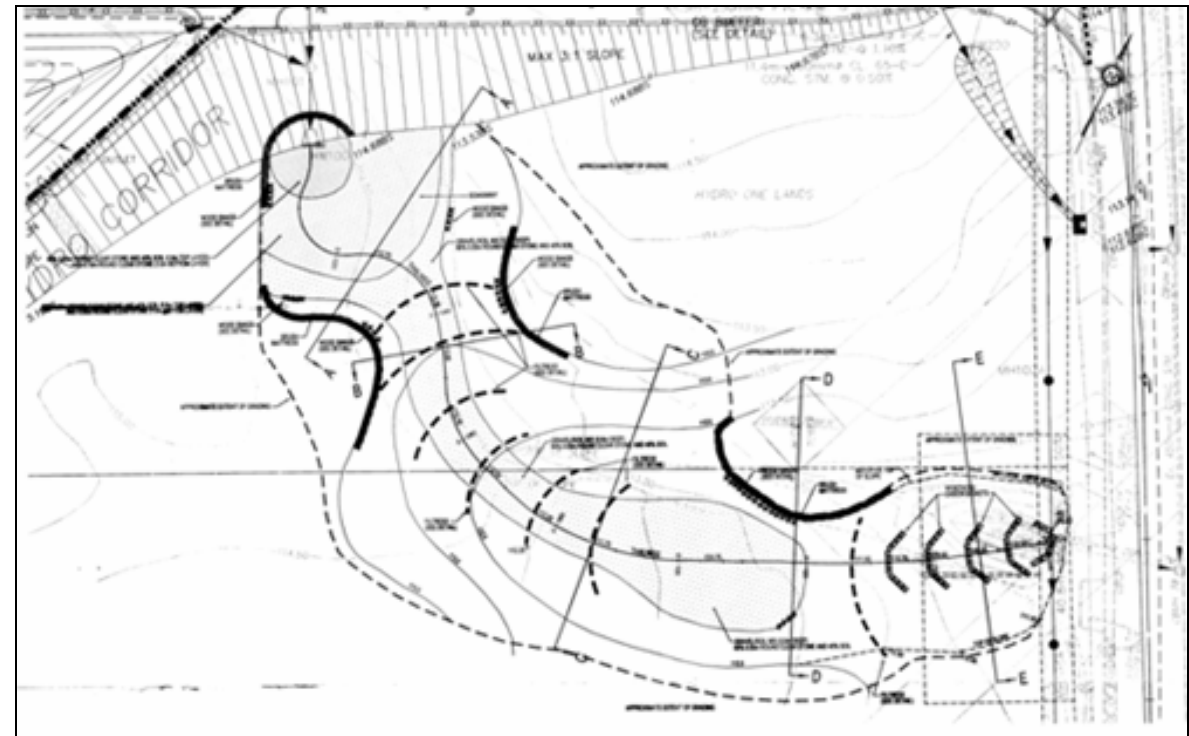
Photo credits: Halton Region Conservation, Credit Valley Conservation, Cam Portt, George Coker and the Toronto and Region Conservation Authority

**APPENDIX II: EXAMPLES- IMPLEMENTING THE GUIDELINE**

The following are examples of how the guideline has been successfully implemented through the development review and permitting processes.

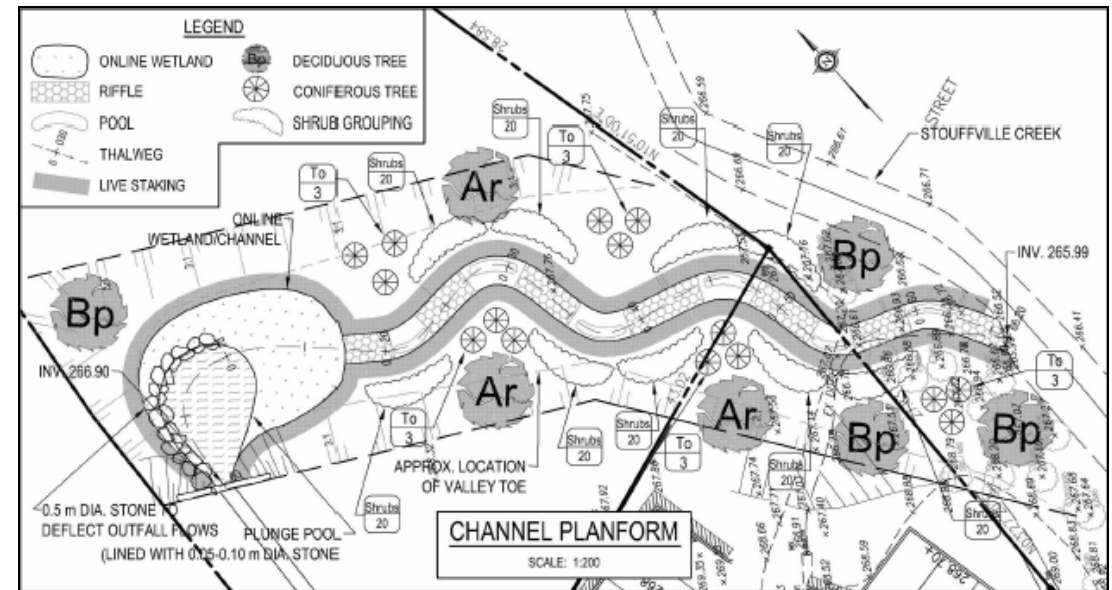
**Example 1: Site Plan, Town of Ajax**

This example includes a Site Plan for commercial development in the Town of Ajax. The site (shown in red) was highly constrained by grading issues and the feature could not be maintained in-situ. There was minimal riparian cover, except for a small wetland pocket along the feature, and it had been recently ploughed through. The flow was ephemeral and downstream sections had been previously piped. Simple contributing habitat classification led to a management recommendation (Mitigation 2) to replicate functions through swales, wetlands or stormwater management. The watercourse functions were able to be replicated with the creation of a wetland feature that accepted both external drainage and treated stormwater to provide additional polishing, allochthonous inputs, storage, flow attenuation, and amphibian habitat. The substrates for the new wetland will be over-excavated and replaced with a sand base to promote infiltration. A series of vegetated filtersoxx will be constructed perpendicular to flows to enhance attenuation and promote water quality improvements. Green gabions will be installed where grades are too steep for filtersoxx; because of the small drainage area, erosion concerns were minimal. The new feature will be located on Hydro Lands, and a monitoring program was developed to determine if design objectives are achieved.



**Example 2: Site Plan, Town of Stouffville**

This second example is a Site Plan in the Town of Whitchurch-Stouffville. The site (shown in red) was an infill development and was very constrained with existing development on one side and the valley on the other side. A headwater drainage feature (shown in dark blue) was situated towards the north end of the site and was proposed to be piped to accommodate the development footprint. The existing headwater feature accepted untreated stormflows from the existing upstream development. It had good riparian tree cover, however garbage and debris littered the channel. There were also entrenchment and erosion concerns. The feature was assessed as complex contributing habitat with no existing direct fish use. The management recommendation (Mitigation 1) was to replicate functions through vegetated swales or a created wetland. A new feature designed as an enhanced headwater stream was located on purchased lands to the north (shown in green), and was designed to enhance fish habitat because of the proximity to the main stream confluence. A wetland was created at the upstream end to slow and deflect diverted flows, reduce erosion and partially treat flows. The feature was constructed several years ago and now supports fish!



**Example of Completed Table:**

| Drainage Feature Unit and Sub Reach | Date of Field Work (identify date, weather protocol used and surveyor) | Flow Assessment (define type of flows and attributes) |                     | Fish and Fish Habitat Assessment        |   | Vegetation and Wetland Assessment (define form, species, density and functions) |                     | Linkage  |   | Channel Form                            | Habitat Classification (based on fish habitat and flow characteristics) | Drainage Features Management Recommendations  |
|-------------------------------------|--|---|---------------------|---|---|---|---------------------|--|---|---|---|---|
|                                     |  | Surface Flows   | Ground water Flows  | Attributes / Species / Abundance / Size | Life Cycle and Habitat Functions                                | Riparian  | Instream            | Connections (Up and downstream reaches)                                    | Functions   | Create as many sub-columns as necessary |   |   |
| Reach #1                            | Consultant 06/07/08  | Nil during study, Ephemeral                           | Nil                 | None observed                           | Indirect Habitat: Seasonal flow conveyance only                 | Terrestrial grasses, Immature willows   | Terrestrial Grasses | Upstream: Reach #2, Irrigation pond<br>Downstream: xxx Creek               | Limited to conveyance                                   | See text for descriptions               | Indirect Simple Contributing  | Mitigation: Provide equivalent flows  |
| Reach #2                            | Consultant 06/07/08  | Nil during study, Intermittent                        | Nil                 | None observed                           | Indirect Habitat: Seasonal flows, possible allochthonous inputs | Terrestrial Grasses, trees, Lawn  | Terrestrial Grasses | Upstream: development, Drainage area reduced, Clean water input from north | Limited to conveyance and some nutrient, organic inputs | See text for descriptions               | Indirect Complex Contributing   | Mitigation: Provide equivalent flows, allochthonous inputs and additional created habitat |
| Irrigation pond                     | Consultant 06/07/08  | Artificial pond                                       | Pumped water source | Brown Bullhead                          | Not considered fish habitat                                     |   |                     | Isolated from watercourse adjacent   |   |   |   | Not required  |
|                                     |  |   |                     |   |   |   |                     |  |   |   |   |   |
|                                     |  |   |                     |   |   |   |                     |  |   |   |   |   |
|                                     |  |   |                     |   |   |   |                     |  |   |   |   |   |
|                                     |  |   |                     |   |   |   |                     |  |   |   |   |   |
|                                     |  |   |                     |   |   |   |                     |  |   |   |   |   |

**APPENDIX III: REPORTING CHECKLIST**

| EVALUATION CRITERIA                      | Assessment Item  | Required<br>(TBD through<br>preconsultation) | Completed/<br>Information<br>Provided | Surveyors<br>listed      | Photos Taken             |
|--|--|--|---------------------------------------|--------------------------|--------------------------|
| <b>Flow Assessment</b>                   | Sampled Spring Freshet or Rain Events                            | <input type="checkbox"/>                     | <input type="checkbox"/>              | <input type="checkbox"/> | <input type="checkbox"/> |
|  | Sampled Late April-May   | <input type="checkbox"/>                     | <input type="checkbox"/>              | <input type="checkbox"/> | <input type="checkbox"/> |
|  | Sampled July-August  | <input type="checkbox"/>                     | <input type="checkbox"/>              | <input type="checkbox"/> | <input type="checkbox"/> |
|  | Soils information  | <input type="checkbox"/>                     | <input type="checkbox"/>              |                          |                          |
|  | Catchment size, surface/groundwater flows                        | <input type="checkbox"/>                     | <input type="checkbox"/>              |                          |                          |
| <b>Channel Form</b>                      | Channel dimensions, slope, morphology                            | <input type="checkbox"/>                     | <input type="checkbox"/>              |                          |                          |
|  | Bank and substrate materials, stability                          | <input type="checkbox"/>                     | <input type="checkbox"/>              |                          |                          |
|  | Discharge, seeps, tile drains, etc.                              | <input type="checkbox"/>                     | <input type="checkbox"/>              |                          |                          |
| <b>Aquatic Habitat Assessment</b>        | Sampled late April-May   | <input type="checkbox"/>                     | <input type="checkbox"/>              |                          |                          |
|  | List of species  | <input type="checkbox"/>                     | <input type="checkbox"/>              |                          |                          |
|  | Species of conservation concern listed and mapped                | <input type="checkbox"/>                     | <input type="checkbox"/>              |                          |                          |
|  | Fish Habitat Mapping   | <input type="checkbox"/>                     | <input type="checkbox"/>              |                          |                          |
|  | Qualitative presence of other food sources                       | <input type="checkbox"/>                     | <input type="checkbox"/>              |                          |                          |
|  | Ponds  | <input type="checkbox"/>                     | <input type="checkbox"/>              |                          | <input type="checkbox"/> |
|  | Roadside ditches   | <input type="checkbox"/>                     | <input type="checkbox"/>              |                          | <input type="checkbox"/> |
| <b>Vegetation and Wetland Assessment</b> | Species of conservation concern listed and mapped                | <input type="checkbox"/>                     | <input type="checkbox"/>              | <input type="checkbox"/> |                          |
|  | Qualitative review of riparian and instream vegetation functions | <input type="checkbox"/>                     | <input type="checkbox"/>              |                          |                          |
|  | Identify wetlands and functions                                  | <input type="checkbox"/>                     | <input type="checkbox"/>              |                          |                          |
| <b>Linkage</b>                           | Linkage to other drainage features                               | <input type="checkbox"/>                     | <input type="checkbox"/>              |                          |                          |
|  | Linkage to terrestrial vegetation units                          | <input type="checkbox"/>                     | <input type="checkbox"/>              |                          |                          |
|  | Identify fish barriers   | <input type="checkbox"/>                     | <input type="checkbox"/>              |                          | <input type="checkbox"/> |