

## Hydrologic Function

### Surface Water – Headwater Catchment Cover Target –Hydrologic Function

This value is related to the location of natural cover within the watershed.

The purpose of setting a target on this value is to ensure that the preferred scenario includes areas of natural cover by headwater areas by Watershed Planning Area to maintain good water quality and quantity.

There is a great deal of literature associated with stream orders or the position of a stream in the hierarchy of tributaries which make up the watershed. Generally speaking the headwaters are made up of first through third order streams in the upper reaches of the watershed.

In terms of the hydrologic function, natural cover in the headwater areas of the system aids in the attenuation of flood waters and releases them slowly over a longer period of time increasing the base flow to the stream and protecting the banks from the erosive force of the water. Cover in these reaches also helps to filter sediments and contaminants before they enter the stream.

Riparian vegetation along these headwater streams has greatest benefit to the system as a whole since the headwater streams are generally narrow with less flow. Therefore, the vegetation has the maximum effect for limiting thermal pollution, providing in stream cover and food, and stabilizing the banks. By achieving these ecological functions in the upper reaches, the entire system benefits.

### Datasets

1. NPCA NAI ELC Community Series Mapping
2. NPCA Watershed Planning Areas
3. MNR WRIP ArcHydro Quaternary Watershed Session Catchments
4. OMAFRA Soils Mapping (County Soil Surveys)

Headwaters are the initial drainage areas that catch water and funnel it into primary surface water features such as creeks and streams. First order catchments from the provincial hydrology base data were used to initially define headwater areas. These were refined by removing those draining into municipal drains or overlapping build up urban areas. This developing surrogate for headwater areas was further reduced by removing the remaining 1<sup>st</sup> order catchments that drain into 3<sup>rd</sup> and greater order streams. The catchments from this process result in the best reflection of headwater areas currently available...preliminary drainage areas still likely to have natural drainage pattern and function associated with them.

Pre-settlement Natural Community Types were inferred from Soils data to use as a guideline to estimate the historic 50:50 ratio between upland and lowland cover types in headwater areas.

Wetland/Lowland cover is determined by combining all of the mature wetland community types from the ELC mapping. This means that Swamps, Marshes, and Bog dominant communities are considered part of the broader and more general concept of 'wetland cover' as it pertains to habitat. It should be noted that there are many sub dominant wetland communities complexed into the watershed's ELC mapping units.

The Upland cover is determined by combining all of the remaining non-wetland community types from the ELC mapping. This means the mature tree dominated communities used to define forest cover are joined by the succession thicket and meadow communities to depict Upland cover..

The refined 1<sup>st</sup> order catchments were used to determine current ratios of upland and lowland cover in

headwater areas. The analysis identified that 20.4% of the Niagara Watershed land base is headwater area and that 29.6% of the headwater areas are covered with natural vegetation; 13.7% wetland, 15.9% other natural cover types.

**Discussion**

The discussion around this target began with the Largest Patch discussion in that it was decided that there was a greater impact in terms of protection of water quality and quantity if the cover was in the headwater area.

The group also discussed the ratio of cover types (12.5% wetland, 17.1% other cover) in the headwater areas. This seemed to be disproportionate to pre-settlement estimates that would have been closer to 50:50, upland: lowland split.

There was a great deal of discussion related to agricultural and municipal drains and whether any first order catchments associated with them should be included in the dataset.

**Data Gap**

None noted.

**Decision**

Date: April 7, 2011

**A minimum of 50% of the headwater catchment land area within the Watershed Planning Areas be in natural cover, where 25% is in upland and 25% is in lowland. Where we are below that minimum target, the target is set at 100% of existing natural cover.**

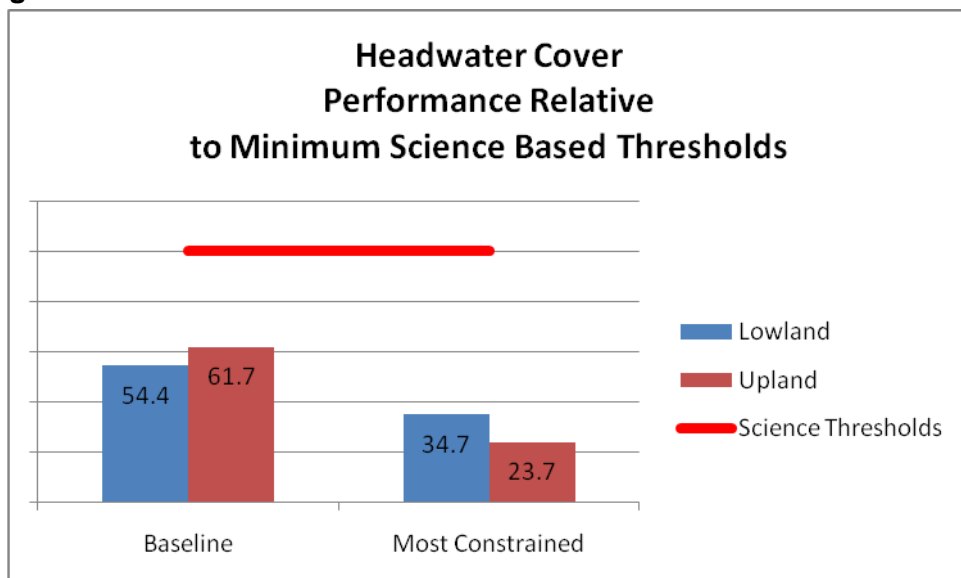
**Representation in the Learning Scenarios**

Much of the cover in headwater areas was estimated to be wetland/lowland areas based on a 49.5% result using soils analysis. The aim here was to achieve a balance of upland to lowland in headwater that would best resemble the pre-settlement condition of 50:50, upland to lowland ratio.

**Representation in the Final Scenarios**

Under the Baseline Scenario, Headwater Cover Upland achieved 61.7% of the target value while Lowland Cover achieved 54.4%.

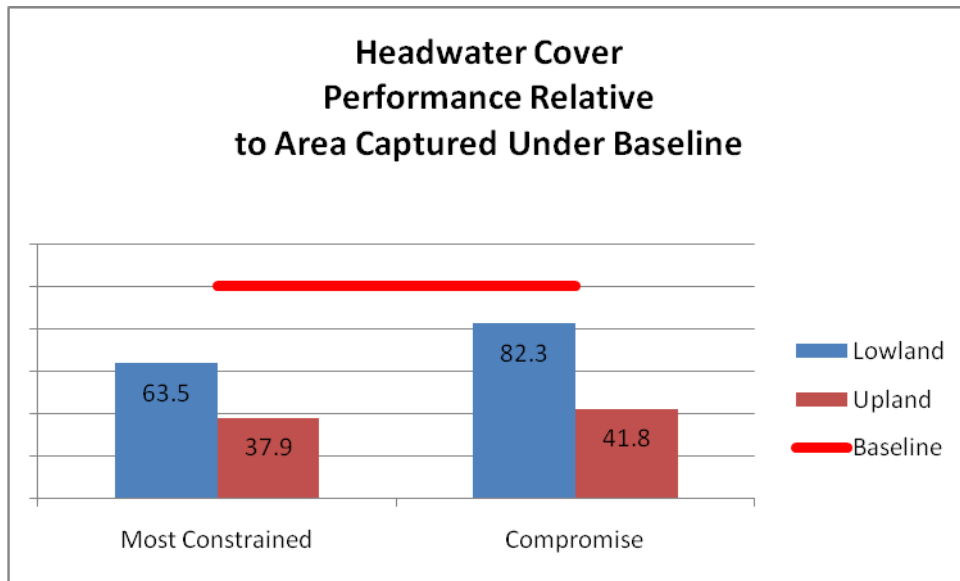
**Figure 31: Headwater Cover Performance Relative to Science Thresholds**



Under the Most Constrained Scenario, the cover within the Headwaters would have been limited to those areas that were not found on agricultural capable soils or in urban areas. Under this scenario, the exclusions were the driving factor for the spatial distribution not the fragmented natural cover.

Headwater Cover Upland achieved 23.7% of the target value which represents 37.9% of the value held by the Baseline. Lowland Cover achieved 34.7% of the target value, and 63.5% of the value in the Baseline.

**Figure 32: Headwater Cover Performance Relative to Baseline Comparator**



The Compromise Scenario showed much higher percentages of Lowland Cover than Upland Cover. This is attributed to the fact that meadow communities were not able to contribute to targets in this scenario and were obviously providing significant contributions to upland cover in headwater areas in the baseline.

Under the Compromise Scenario, Headwater Cover Upland achieved 41.8% of the value in the Baseline. Lowland Cover achieved 82.3% of the value in the Baseline.

**Recommendations**

Further refine headwater areas mapping, current data used is a surrogate off of a course source. Catchments orders would ideally be derived from the 1:2000 base mapping when time and resources permit.

An assessment of drainage area thresholds instead of stream ordering could be considered as well.