H

Appendix H: Stream Habitat Assessment

Introduction

CH2MHill and Greenways Incorporated conducted Stream Habitat Assessments on several streams throughout Wake County to determine the affect of development density and stream buffers on water quality. The two reasons that these assessments were done was:

- to see how well various widths of buffers work with different types of development densities; and
- to establish base information for prescriptive buffers for future development.

Two types of stream testing were used. Stream Habitat was observed to determine the opportunity for wildlife. Stream Stability was rated to show the amount a stream will change because of human influences. (See attached form).

Methodology

Visual stream habitat assessment protocols have evolved from approaches that generally focused on using habitat indices (such as physical features) to relate the population of a target species (such as trout) to habitat characteristics in a stream. The usual goal of such work is to define limiting habitat factors to allow managers to manipulate stream habitat conditions to enhance fish populations. Another use of habitat indices is to determine the minimum or optimal stream flows that would protect habitat characteristics essential to the life history of one or more target species.

Most recently, habitat indices have been used as an integral part of water pollution control programs. These habitat assessment programs are visually based and use habitat indices to characterize the conditions in streams and help verify the potential for waters to support aquatic communities. Most of these habitat techniques focus on aquatic community response rather than species-specific responses to changes in habitat quality, although the concepts are similar.

In 1999, the Mecklenburg County Department of Environmental Protection (MCDEP) conducted a watershed-scale pilot study evaluating the usefulness of three standardized habitat assessment protocols that were selected from a detailed screening and selection process of several standardized stream habitat assessment forms. Three habitat protocols

that were selected for further evaluation were the method adopted by the Georgia Department of Natural Resources (GDNR); the North Carolina Department of Environment and Natural Resources (NCDENR) protocol; and the Ohio EPA's Qualitative Habitat Evaluation Index (QHEI) (Mecklenburg County, 2000).

The results of the pilot study demonstrated that the GDNR protocol, with some minor modifications, was the most appropriate protocol for integrating the Mecklenburg County habitat assessment data with existing biological and water quality program data. This revised GDNR protocol was named Mecklenburg Habitat Assessment Protocol (MHAP). MHAP was selected because of its overall responsiveness and capabilities to semi-quantitatively document habitat conditions. Also, this protocol included a user-friendly procedure (dichotomous key) that minimizes some of the subjectivity inherent in the habitat assessment protocols as a whole. DWQ has concurred with the use of MHAP in North Carolina.

The MHAP protocol has been slightly revised based on refinements made during other projects in Georgia and Virginia. This revised MHAP protocol will be used to collect physical habitat data for the Wake County Open Space Plan. See attached habitat form.

The revised MHAP approach includes assessment parameters for riffle/run-prevalent streams and a different set of parameters more appropriate for glide/pool-prevalent streams. Riffle/run-prevalent streams are those in moderate to high gradient landscapes that sustain water velocities of about 1.0 feet per second (ft/sec) or greater. These streams typically have stream bed sediments (called substrates) primarily composed of coarse sediment particles (such as gravel or larger) or frequent coarse particulate accumulations along the stream reaches. Glide/pool-prevalent streams are those in low to moderate gradient landscapes that have water velocities rarely greater than 1.0 ft/sec, except during storm events. Glide/pool streams have substrates of fine sediment or infrequent accumulations of coarser sediment particles (gravel or larger) along the stream reaches (Barbour and Stribling, 1994).

The physical parameters of the habitat assessment are divided into primary, secondary, and tertiary categories. Primary parameters refer to those in-stream physical characteristics that directly affect the biological community. Primary conditions include substrate and available cover (e.g., logs, rocks to hide under), the extent to which rocks and snags are covered by silt (embeddedness), velocity and depth regimes, and pool variability. Field personnel can evaluate the primary parameters within the location of the riffle/pool sequence.

Secondary parameters (channel alteration, bottom scouring and deposition, channel shape, and channel sinuosity [how much the stream turns or meanders]) relate to channel morphology, which controls the behavior of stream flow and the sediment deposits the stream collects.

The tertiary parameter set deals with the riparian vegetation and stream bank structure. The stability of a stream bank indirectly affects the type of

habitat available within a stream. Vegetated banks reduce the amount of sediment that washes from the stream bank by absorbing energy from the raindrops, binding soil particles, and reducing the velocity of runoff. Less sediment to cover rocks and logs results in more habitats available for colonization by invertebrates or fish (Plafkin et al., 1989; Ball, 1982; Platts et al., 1983).

The habitat assessments conducted followed the methodology outlined in the draft MHAP (2000). (See attached habitat assessment forms). Habitat assessments were conducted to document how various land practices can impact aquatic habitat and potentially the diversity of the aquatic community.

Location Identification

Greenways Incorporated contacted the planning staff of each municipality in Wake County for nominations of testing locations. Eight types of development scenarios were nominated and tested. They include:

- Forest
- Farm with 50-foot Buffer
- Pasture with 25 to 50-foot buffer
- Low Density with buffer
- Low Density without buffer
- Medium Density with buffer
- High Density with buffer
- High Density without buffer

Ten of the nominated sites were then picked in the Cary, Garner and Zebulon areas. The site were picked for their proximity to each other, ease of access and how well they fit the above descriptions. Though the site conditions will vary, keeping all of the sites relatively close to each other helps limit outside influential conditions.

Results

The stream habitat and stream stability assessments reinforced several theories about the relationship between development and water quality:

1. Buffers help protect water quality, as measured by aquatic habitat.
2. Larger buffers do appear to help protect water quality, although buffers by themselves do not protect water quality in developed areas.
3. In order to favorably influence water quality, buffers must be kept intact.
4. It is important to not only buffer major streams, but all tributaries that flow into them.
5. The higher the development density, the lower the habitat score.

Sites with a buffer were more likely to have a higher habitat score and a higher stream stability score than those without buffers. (See graph on page H-6). In each case where there is similar density, the score on the sites with buffers are higher than the sites without buffers. The two exceptions were the low density subdivision without a buffer, Cloverdale,

and the medium density subdivision with a buffer, Hunter's Mark. Cloverdale's habitat score was higher than expected and stability score was lower than expected because it was a well established neighborhood that was over 30 years old. Hunter's Mark, on the other hand, was still under construction, so the scores were not as good as expected. The runoff from construction will temporarily influence the stream's stability and habitat because of the increased sediment load and disturbance. As the Cloverdale site did, these influences will stabilize over time.

Even if a significant buffer is preserved, several other things can influence stream habitat and stability. Some of the favorable influences are Best Management Practices (BMP), like roadside ditches, porous concrete and sand filters, as seen in the Bryarton Subdivision. The age of a project can also favorably influence its stability scores. The older a development becomes, the more stable it becomes, as the Cloverdale Neighborhood showed. Some unfavorable influences to stream habitat and stability are sediment and erosion control failure, mowing and edging of a stream bank, dumping and even the behavior of the property owner across the stream. As an example, even though the Pony Road site was forested on the right side, the homeowner on the left side was mowing his lawn to the edge of the stream. He also increased the instability of the stream bank by filling soil up to the edge to extend his yard. His actions affected the health of the entire stream, despite the ample buffer on the right side.

Even if buffers are sufficient widths, they must be kept intact to be effective. This is apparent at the Rolling Hills Pasture site. Even though the mature buffer was between 25 and 50-feet, cows had eaten all of the herbaceous and shrubby growth. As a result, the buffer was now insufficient to filter the sediment and nitrogen from the pasture. The cows were also allowed to drink from the stream. This practice may have caused the most damage to the stream by breaking up the banks and making them increasingly more unstable. Stepping on the banks also contributes to the amount of sediment in the stream.

If runoff bypasses the majority of a buffer, it does not get filtered. This is exemplified by the Rolling Hills Pasture site. A tributary that was flowing into the main channel split the 50 foot buffer in half. Therefore, the water flowing into this tributary only had a 25-foot buffer, instead of the 50-foot buffer. This bypass influenced the habitat scores of this stream.

The final conclusion from this study is that as the development density increases, the stream habitat score decreases. The influential factor in this relationship is the percentage of impervious surface. The higher the density, the higher the impervious surface. Buffers can help, along with BMP's, as seen in Bryarton Subdivision. The preservation of the buffers and the uses of BMP's, such as porous concrete and roadside ditches, positively influenced the habitat and stability scores of this site. In fact,

the scores were almost as high as the low density neighborhood because of them. Without these BMP's and buffers, the habitat scores decrease rapidly and the stream become more unstable with increased density.

In conclusion, this study shows: density negatively influences stream habitat and stability and BMP's, and buffers can be used to mitigate the impact of development on streams.

The following table summarizes the habitat and stability scores from all of the sites. A habitat score can range from 0 to 200, with 200 being the

Wake County Water Quality Site Visits 3/11/02 - 3/12/02
Habitat Assessments

Density	Site	Habitat	Stability	Comments
1) Farm/Forrest with 100' Buffer	Cedar Fork Creek Reach 2 - Upper	137	3	just downstream of pond, pond will catch sediments, also bed-rock bottom
2) Farm with 50' buffer	Cedar Fork Creek Reach 1 - Lower	130.5	1	sediment from field washing down ditch to bridge (outside of reach)
3) Farm with buffer/ Pasture with no buffer	Pony Road	60.5	21	fill from adjacent pond mass wasting, 15 yr. old buffer on one side, horse damage
4) Pasture with Buffer	Rolling Hills	57		no shrubs in buffer, trib cut buffer in half for 1/2 of the reach
5) Low Density with Buffer (.75 to 1 acre lots)	Rolling Hills	95.5		highly erodible clay soil, some landsliding
6) Low Density without Buffer	Cloverdale	87.25 (113.5+ 61/2)	8	older nieghborhood, yard waste and animal waste dumping
7) Medium Density with Buffer	Hunter's Mark	58	11	lots of sediment, new development, double buffer b/c of sewer easement
8) High Density with Buffer	Bryanton Subdivision	88.5	13.5	hurricane damage, porous concrete, roadside ditches, gutters run into gravel filter
9) High Density without Buffer	George Towne Manor (townhomes)	60	23.5	townhome
10) High Density without Buffer	Forrest Hills (apartments)	43.5	5.5	all rip rap channel, straight, sewer overflows, down-stream highly eroded

best habitat. The opposite is true for stability scores; the lower the better. In general, the breaking point is 20. Any stream over 20 is considered an unstable stream.

References

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