North Carolina Piedmont and coastal streams are predominantly low gradient (<5%), meandering channels incising through the finer fraction of sediment size distribution (small gravel, sand, silt and clay). Relevant literature includes meander geometry relationship to stream discharge, planform and bank erosion (Carlston et.al 1965, Begin et.al. 1981, Carson et.al. 1983). Rinaldi et.al. (1997) specifically address meander restoration by testing the suitability of empirical equations used in restoration practices. They found a large bias when comparing measured meander parameters to those computed by Leopold and Wolman equations. They investigated appropriate equations for use and recommended a combination of stream reconnaissance and analysis for determining appropriate regression equations for use in restoration design.

Several studies have been conducted specifically for North Carolina streams including bankfull identification (Harman et.al. 1999, Henson et.al, unpublished), rhythmic spacing and origin of pools and riffles (Keller et.al. 1978), channel geometry of the North Carolina Piedmont as related to flood frequency (Kilpatrick et.al. 1964), and active channel geometry and discharge relations (Kolberg et.al. 1997). These studies are important in application to stream restoration in North Carolina since they are specific to the region and include field reconnaissance and verification. The most revealing of these articles is the finding by Kolberg and Howard (1997) that the least-squared regression relationships between channel geometry and discharge deviated significantly between channels with high silt and clay, gravel or cobble beds, and those with 30% or greater sand beds. This finding has implications to stream restoration in obtaining accurate discharge-width relationships for restoration design.

Stream Classification

Two stream classifications were included in the review based on their popularity and use in the United States. Montgomery and Buffington (1993) developed a classification system based on channel process that is most useful in high relief regions. Rosgen (1994) developed a classification system that includes mountain streams, but is most useful in its explanation of low gradient streams and techniques for restoration. Classification systems are invaluable for use in various stream studies, including restoration, since they aid in dividing stream networks into discrete working units, allowing for better understanding of the whole network. However, Kondolf (1995) warns against the application of classification systems in oversimplifying channel form and process and in confusing the stream classification exercise with understanding channel process.

Restoration Structures

Structures used in stream restoration include vegetation, wood, and constructed rock and wood structures. The majority of research has been conducted on vegetative and wood structures, including both natural and engineered installments. Brone et.al (1998) examined the effectiveness of vegetative filter strips in reducing nonpoint source pollution. They found the strips were highly effective in reducing runoff volumes and concentrations of sediment and nutrients, but were not as effective in reducing total fecal contaminants. They suggest vegetative strips be used in conjunction with pre-treatment of animal waste. Similar findings are reported by Osborne et al (1993) in a literature review of vegetated buffer strips used in restoration.

Shields et al (1995) studied the effect of specific woody vegetation combined with rock bank protection finding native woody species, especially willow, to be best adapted to streambank environments. However, success of vegetation was successful only in reaches where the streambed was not degrading and banks were stabilized by grading or toe protection. In a similar study, Shields et al (1995) combined stone placement with willow planting in a deeply incised