Table 2: Relative Amount of Soil Types on Project Site

Soil Type	Percentage of Site
3A&5A - Chewacla and Wehadkee	4.74
37B - Wedowee Sandy Loam (2-6% slopes)	18.18
37C&57C - Wedowee Sandy Loam (6-10% slopes)	21.25
37D - Wedowee Sandy Loam (2-6% slopes)	15.10
37E - Wedowee Sandy Loam (15-25% slopes)	8.17
39C - Wedowee Sandy Loam (15-35% slopes)	11.11
39E - Wedowee Sandy Loam (15-35% slopes)	13.98
51B - Helena Sandy Loam (2-6% slopes)	2.47
51C - Helena Sandy Loam (6-10 percent slopes)	0.73
57B - Vance Sandy Loam (2-6 percent slopes)	4.28

5.2.2 Environmental Impacts

The clearing and grading for the proposed Site will result in soil disturbance. At this time, a grading plan is not available. During grading, soil will be moved; in some areas, it will be removed, while in other areas it will be replaced. Thus, the location of soil types may change. During clearing and grading, some soils will be eroded, but the impacts from this will be minimized by following an approved site plan that conforms to the requirements of the North Carolina Sedimentation Pollution Control Act of 1973. (More information is provided in the water resources section). Finally, by using heavy equipment on the Site, soils will be compacted. No contamination of soils is expected from the development.

There is a development area west of Bennett Mountain where houses are located on steep slope areas with significant elevation differences. Selective clearing (removal of minimal trees) will occur in order to remove only the trees necessary to build individual homes which will minimize the soil disturbed and minimize the amount of cleared land. Good engineering and construction practices should be followed in this area and potential similar areas to avoid erosion and slope instability. Clearing/mulching/seeding will be completed lot-by-lot to minimize the amount and time of soil exposure (Barron, 2004).

5.2.3 Conclusion

The proposed land clearing and grading work on the Site will result in soil disturbance and compaction. Mass importing of offsite fill material should not be required due to the size of the Site. Measures that comply with the North Carolina Sedimentation Pollution Control Act of 1973 will be taken to minimize erosion. In the development area west of Bennett Mountain, selective clearing and mulching/seeding is planned on a lot-by-lot basis to minimize the time of soil exposure. Mulching/seeding is planned directly after land is cleared on these sites. Based on our understanding of the proposed development plan, the proposed grading operations are not atypical for this geographic area. Environmental impacts should not be significant if grading and erosion control activities are performed in accordance with state regulations and good construction practices.

5.10.1.2 Environmental Impacts

Water quality could be impacted by the Project in three ways. First, during construction, sediment could enter the waterways. Secondly, after construction is completed, stormwater runoff may impact the streams. Finally, the land application system could impact downstream surface water quality. Each of these is explored further below.

Grading and construction activities associated with the Project may temporarily increase siltation on and immediately downstream of the Site. During rain storms, erosion from a cleared site will be much higher than erosion from a forested site. The North Carolina Sedimentation Pollution Control Act of 1973 requires that a plan to control erosion and sedimentation be developed for any activity that disturbs one acre of land or more. This plan must include control measures that will prevent sediment impacts to water quality. Practices must be installed that will control sedimentation from the peak runoff generated by the 10-year storm.

One of the best methods to control sediment loading from construction sites is to minimize the time that land is exposed. Data collected by NCSU researchers at a site on the I-540 beltline indicate that mulching and seeding reduce erosion rates by approximately 95 percent. The State law requires that permanent ground cover be established within 15 working days from when grading is completed. The Project will meet or exceed that requirement. Another effective method to minimize the time that bare soil is exposed is to develop the Site in phases. The Briar Chapel development will be completed in phases. In addition, to the extent practical, entire areas of home sites will not be cleared at a given time; rather lots will be cleared individually as houses are built which will minimize the amount of land cleared and greatly reduce the amount of time that soil is bare. Finally, the riparian buffers that will be maintained on site will serve as a last line of defense in case one of the BMPs fails. By following the site plan and grading plan, implementing and maintaining BMPs to control sedimentation for the 10-year storm, completing the development in phases, and protecting the riparian buffers, the impacts to water quality during construction will be minimized and will not be significant.

Following construction, stormwater runoff from the development could impact water quality in two ways. First, stormwater runoff contains pollutants. For example, fertilizers and pesticides applied to the commercial and residential landscaping and oil that leaks from automobiles can run off into surface water during storms. This stormwater will be captured and treated through 37 stormwater BMPs as described in the *Briar Chapel Storm Water Management Plan* (Project Notebook Appendix H). These stormwater structures will be constructed outside of riparian buffer areas and wetlands. The stormwater control structures will be designed to meet 85 percent TSS removal and 25 percent total nitrogen removed in incoming runoff. In general, practices that remove TSS will also remove a large percentage of the total phosphorus as inorganic phosphorus will bind to the soil particles. The stormwater design included runoff from property offsite that drains to Briar Chapel.

The second way that post-construction runoff can impact water quality is through changed hydrology. As land is developed, there is more area that is impervious. With increased imperviousness, less rainfall infiltrates the soil, which results in a greater amount of rainfall

flowing directly to surface waters. This creates higher stormflows within the streams that causes higher instream erosion, which impairs aquatic habitat and reduces aquatic diversity. Low impact development practices which serve to mimic pre-development hydrology are being applied at the Briar Chapel Site. By clustering development in a smaller portion of the Site and preserving 50 percent of the Site as open space, imperviousness will be minimized and the pre-development hydrology will be preserved to a greater extent.

Other low impact development practices will also be implemented. For example, the Site has been broken up to drain to 37 identified stormwater management facilities that will each treat stormwater locally. The stormwater treatment facilities are being designed such that they control both peak flowrates and the one inch runoff volume. The peak flowrate for the one-year, 24-hour storm event after development will not exceed the pre-development condition (for commercial areas draining directly to offsite residential areas, the peak flow will be controlled for the one-, two-, five-, ten- and 25-year, 24-hour storm events). Runoff volume will be controlled such that the first inch of stormwater generated will be captured and released or infiltrated over a two to five day period.

Approximately 25 percent of the built-upon area of the Site will not drain to one of the 37 identified stormwater management facilities. Runoff from these areas will be collected in cisterns, treated in bioretention areas, infiltration trenches, hydrodynamic separators, or released to grassed swales. Each of these low-impact development practices helps maintain the pre-development hydrology. Finally wastewater will be treated through a water reclamation facility which will have backup power generation to avoid the discharge of untreated waste during power outages. The wastewater will be land applied without discharge, and the soil will serve to further filter any pollutants from the wastewater. DWQ prefers land application as a disposal method over discharge to surface waters.

Chlorine will be used as a disinfection method prior to filtration to ensure compliance with the 14 colonies/100 ml fecal coliform limit that will apply to the permit to ensure protection of public health. After filtration, the total residual chlorine level is estimated to be approximately 0.5 mg/l, a level lower than that found in drinking water. This water will then be stored in a pond for up to 110 days where much of this remaining chlorine will dissipate (Fleming, 2004).

The wastewater collection system will avoid riparian buffers to the maximum extent practicable. The spray irrigation system will avoid riparian buffer areas, and will be at least 30 feet from any ephemeral channels. The loading rates used to calculate the land needed for the spray application system were conservative to avoid applying effluent when the soils are somewhat saturated. The 110 day storage pond will also ensure that effluent is not applied under marginal conditions to avoid runoff to surface waters. The biosolids generated onsite will be hauled to a permitted facility offsite for disposal.

The downstream waters of the Haw River and Jordan Lake should not be impacted by the development. Again, the project is being designed to minimize environmental impacts, and BMPs are being used to protect the water resources on site from the impacts of stormwater runoff (both in terms of quantity and quality). In addition, there is some stream distance for any

pollutants to attenuate (4 miles on Wilkinson and 5 miles on Pokeberry Creek). Any runoff from the Site will need to travel an additional 5.4 to 7.7 miles to Jordan Lake. The Cary water supply intake is an additional 4.8 miles upstream on the New Hope Creek arm of Jordan Lake. While water from the Haw does move upstream on New Hope Creek, the amount of runoff from the development Site will be negligible based on the BMPs being used to attenuate and treat stormwater runoff onsite and the distance between the Site and these important water resources.

The Briar Chapel Community will be served by public water provided by Chatham County and will be designed in accordance with the Chatham County Public Works Water System Specifications and Details. The potable water use of the development will be minimized by including low water use fixtures in all buildings. In addition, the spray irrigation system described below will minimize the use of potable water for irrigation of public areas.

5.10.1.3 Conclusion

Any new development which increases imperviousness has the potential to impact surface water quality. This Project has been designed to minimize the impacts to water quality by preserving a large amount of open space, implementing erosion and sediment control practices, incorporating stormwater treatment facilities that will minimize and treat runoff, and managing the wastewater system. Based on our review of the Project documents, it is our opinion that the impacts to surface water will not be significant. The impacts to surface water quantity will also be insignificant.

5.10.2 Groundwater

5.10.2.1 Existing Environment

The Piedmont of North Carolina is underlain by crystalline-rock aquifers. These aquifers are lined by dense, almost impermeable bedrock that yields water from fractures and secondary porosity. Recharge predominantly occurs along the inter-stream areas through porous regolith and fractures in the bedrock. The majority of groundwater moves laterally and enters depressions in the landscape such as stream channels. According to USGS gathered data, well yields in crystalline-rock aquifers are very low, approximately 18 gallons per minute. Solum thickness has a direct correlation to groundwater storage, generally, the thicker the overlying regolith the greater the volume of water storage potential and subsequent well recharge/discharge capacity. Typically, groundwater recharge is greater in valleys and depressional areas due to the thicker regolith, and proximity to fracture zones in the bedrock. Groundwater quality is generally suitable for drinking and other uses, but iron, manganese, and sulfate can occur at undesirable levels (USGS 2001).

Most observable changes in groundwater quality are related to land use and waste disposal patterns. Underground storage tanks, waste lagoons and disposal landfills are commonly responsible for point source contamination. However, more dispersed contamination by non-point sources is increasing and is manifested by petroleum, pesticide and biological

contamination. No land uses commonly associated with groundwater contamination were encountered during the field inspections of this Site.

5.10.2.2 Environmental Impacts

The main potential source of impacts to groundwater quality is the land application of wastewater generated on the Site. The Soil Water and Environment Group completed the *Agronomist Report* in April 2004 (Project Notebook Appendix J). The wastewater from Briar Chapel will be treated to State water reuse standards and used to irrigate sprayfields and greenways. The State of North Carolina Division of Water Quality (DWQ) does not require a treatment process for the removal of nutrients such as phosphorus or nitrogen in their operating limitations. Using land application of the treated wastewater as a disposal system will further reduce nutrient loads. As the treated reuse water is irrigated, the trees and vegetation take up the available nutrients, specifically nitrogen and phosphorus, contained within the irrigated water. The study recommends that the Site receiving reused water be a combination of forage and forestland that assimilates hydraulic and nutrient loading from the wastewater treatment facility. After the plants use the nutrients for growth, the soil filters the remaining nutrients while improving water quality going into the groundwater table.

Eagle Resources completed the *Hydrogeologic Study* for the Project in April 2004 (Project Notebook Appendix K). The study objective was to provide information on the occurrence and movement of groundwater beneath and in the vicinity of the planned sprayfields to assess the potential for development of shallow water table conditions. The study recommended that the sprayfields be reconfigured to avoid potential adverse impacts to the groundwater, and this has been incorporated into the design. Irrigation will be conducted on those sprayfield areas with a depth to the water table that exceeds 4 feet under conditions with high natural groundwater recharge (January to April) and where 50% of the irrigation rate is recharge. This approach is very conservative as the North Carolina nondischarge rules (15A NCAC 2H .0200) only require the water table beneath sprayfields to be greater than 1 foot, and if between 3 feet and 1 foot, that a demonstration be made that ground water quality will not be adversely affected. With proper site management, and hydraulic and nutrient loading management, the site receiving reused water will work towards protecting groundwater and ultimately the surface waters entering the Cape Fear River Basin. Planned monitoring of the reclaimed water and soil testing will help ensure that groundwater quality is protected.

5.10.2.3 Conclusion

Based on the Hydrogeologic study and the conservative design described in that report, it is our opinion that there will be no significant impacts to groundwater.

5.11 Forest Resources

5.11.1 Existing Conditions

As shown in the Land Use Section, forestland occupies 88 percent of the Site. According to Division of Forest Resources (2004), the site is well suited for timber production with medium volume potential. According to Braham and Braham (2001), the forestland within Briar Chapel

property is composed of 4 basic types: Oak-Hickory (438 acres), Mesic Mixed Hardwood (27 acres), Bottomland Hardwood (37 acres) and Loblolly Pine (557 acres). Distribution and composition of the plant communities on and immediately adjacent to the Site reflects the landscape variations in topography, soils, hydrology, and past or present land use practices. The plant communities observed within the property were limited due to intense past silvicultural practices, topography, and soils. Figure 12 shows a map identifying the vegetation of the Site. Description of the four types of forestland and examples of the species present on those areas are presented as follows:

Dry Oak Hickory Forest and Dry Mesic Oak Hickory Forest occupy 38% of the property. The Dry Oak Hickory Forest occupies the drier topography where soils are thin, water inputs are limited to rainfall and strong sunlight and winds create high exposure. The soils are less dry in the Dry Mesic Oak Hickory Forest with more rainfall and subsoil percolation. The Dry Oak Hickory Forest contains more post oak (*Quercus stellata*) and scarlet oak (*Quercus coccinea*) while the Dry Mesic Oak Hickory contains more black oak (*Quercus velutina*) and southern red oak (*Quercus falcata*).

Mesic Mixed Hardwood Forest occupies 2% of the Briar Chapel property. The higher quality oak and pine has been logged while increasing the proportion of poorly formed trees. Some of the species found in the upper canopy of the Mesic Mixed Hardwood forest are yellow poplar (*Liriodendron tulipifera*), northern red oak (*Quercus rubra*), sweetgum (*Liquidambar styraciflua*), loblolly pine (*Pinus taeda*), white oak (*Quercus alba*), american beech (*Fagus grandifolia*), red maple (*Acer rubrum*), white ash (*Fraxinus americana*), sassafras (*Sassafras albidum*), blackgum (*Nyssa sylvatica*). Pignut hickory (*Carya glabra*), mockernut hickory (*Carya tomentosa*) and scattered black walnut (*Juglans nigra*). The lower canopy contains red mulberry (*Morus rubra*), umbrella magnolia (*Magnolia tripetala*), flowering dogwood (*Cornus florida*), persimmon (*Diospyros virginiana*), winged elm (*Ulmus alata*), sourwood (*Oxydendrum arboreum*), and musclewood (*Carpinus caroliniana*).

The Mountain/Piedmont Bottomland Forest occupies about 3% of Briar Chapel. Most of this type of forest is well drained with some scattered wetlands. This community is completely forested with the presence of some pockets that have been cleared and farmed. The current community is dominated by sweetgum (*Liquidambar styraciflua*), river birch (*Betula nigra*), yellow poplar (*Liriodendron tulipifera*) and loblolly pine (*Pinus taeda*).

The Loblolly Pine Forest covers 48% of the forestland. This community covers land previously heavily disturbed or cleared for farming. This land is dominated by loblolly pine (*Pinus taeda*), sharing the land with sweetgum (*Liquidambar styraciflua*), yellow poplar (*Liriodendron tulipifera*), shortleaf pine (*Pinus echinata*) and Virginia pine (*Pinus virginiana*).

Braham and Braham (2001) also examined the project area for old growth communities. They defined old growth as any stand that (1) was not initiated following agriculture or intensive logging, (2) contains at least 3 distinct age classes, (3) contains canopy gaps distributed

throughout the stand, and (4) contains at least a few individuals that are near the maximum size for the species given the site conditions. Stands lacking only the last criteria were termed older growth. Based on these definitions and the analysis, there are no old growth forested areas on the property. Bennett Mountain, a Dry-Mesic Oak Hickory Community, qualified as older growth. Braham and Braham (2001) also identified an area as Boulder Canyon which they classified as an older growth Mesic Mixed Hardwood Forest.

5.11.2 Environmental Impacts

Existing land use will be modified from silvicultural land to a residential mixed used community, and the land will be lost to timber production. However, the most important features are being preserved: riparian corridors and Bennett Mountain. The Project has been designed with large amounts of open space in the form of recreational areas, riparian buffers, ponds, and wetlands. These riparian corridors will be:

- At least one hundred (100) feet along all perennial streams;
- At least fifty (50) feet along all intermittent streams;
- At least fifty (50) feet along all ephemeral streams shown on the Soil Survey maps and having a drainage area of more than twenty-five (25) acres;
- At least thirty (30) feet along all ephemeral streams shown on the Soil Survey maps and having a drainage area of between ten (10) acres and twenty-five (25) acres.

These riparian corridors will serve to link the preserved forested area within the Site to forested areas outside the Site. If one assumes that only the riparian buffers (248 acres) and project boundary buffers (226 acres) are preserved as forest, 30 percent of the Site will remain in forested land. This number is low, as Bennett Mountain is being preserved, Bolder Canyon is being preserved (Hamak and Sanchez, 2004), and natural areas will be preserved in the planned parks, near schools, and around residential areas. The unimproved open space areas will be deeded to the Homeowners Association, and restrictive covenants will outline how the open space areas may be used (Barron, 2004). Conversation with John R. McAdams personnel indicated that in areas with larger lots, the roads will be installed, but each lot will be cleared individually, when possible, which will help preserve trees (Hamak, 2004). In addition, other open space areas may contain a forested environment. Finally, the project is providing a 66-acre park for other County residents to enjoy as open space.

5.11.3 Conclusion

While forested land will be reduced on site, much of the forested land will be preserved as open space. Using a conservative assumption that only riparian buffers and project boundary buffers will be forested, forest land will decrease from 88 percent to 30 percent. Since lots will be cleared individually to the maximum extent practical, the change will not be as dramatic as it would if the entire development was mass graded as often occurs.

Given that the Site comprises only approximately 0.36 percent of Chatham County's land area. The change in forested land will be insignificant in the context of the County as a whole.