

August 14 2008

Joshua L. Martin, Director
Department of Planning, Preservation, and Economic Innovation
City of Charleston
75 Calhoun Street, Third Floor
Charleston, SC 29401

Re: Angel Oak Village Plans; Grading and Drainage Plan and Drainage Report, 6-24-08; Tree Variance Master Plan, 7-16-08

Dear Mr. Martin:

As Principal/Senior Scientist for Watershed Hydrology Consultants LLC (WatHydro), I have served as an advisor on hydrology, stormwater management, wetlands and soils issues throughout the process of planning and designing the proposed Angel Oak Village Planned Unit Development on Johns Island. Dr. Donald Ham, Principal of Laurus Group LLC, is advising on the tree preservation and management plan for Angel Oak Village. Dr. Ham and I have frequently discussed the environmental issues of the Angel Oak Village site with the development and design team.

The main focus of my input to the design process has been minimizing potential negative environmental impacts of Angel Oak Village related to hydrologic alterations. The key environmental issue, of course, is protection of the physical environment for the Angel Oak. However, the 42 acre site of Angel Oak Village contains an example of a degraded second-growth, coastal zone mixed hardwood-pine forest that has a number of grand trees. Preserving substantial elements of that forest in a suitable physical and ecological environment has been a major consideration in planning Angel Oak Village.

Environmental Issues of the Angel Oak Village Site

Specific environmental issues that I have addressed with the Angel Oak Village planning and design and team include:

1. Provision of a conservation area around the Angel Oak of sufficient size to preclude any disturbance to the root zone of the tree from development activities and maintain the ecological environment to which the tree is adapted.
2. Maintenance of the soil water and groundwater regimes on the site to which the Angel Oak and the other preserved trees are adapted.
3. Conserve significant elements of the depressional wetlands on the site to preserve their ecological functions and also to serve as integral elements of the stormwater management system.
4. Preserve elements of the forest around the Angel Oak.

Conservation Area Around the Angel Oak

Arborists and foresters use various rules-of-thumb in determining the zone of undisturbed soil needed around a large tree to protect the root system from damage during development. My original recommendation to River Birch Management LLC in a report dated November 4, 2005 was repeated in a report to CC&T Real Estate Services dated September 18, 2007. That recommendation was to incorporate a conservation area around the Angel Oak to provide a minimum radius of undisturbed area of at least 2.5 times the average crown radius or about 200 feet. In the current Angel Oak Village plans, a conservation area of 150 feet in width around Angel Oak Park provides a total conservation area of about 300 feet radius from the bole of the Angel Oak. On the west side of the Angel Oak, an additional 200+ feet of relatively undisturbed conservation area is included in the current Angel Oak Village plan. That large conservation area not only ensures that no damage will occur to the Angel Oak during construction of Angel Oak Village, it also provides a large enough area of undisturbed forest to maintain the microclimate and soil water infiltration capacity in the vicinity of the Angel Oak. An ecologically viable section of the native forest approximately 9 acres in size will also be maintained.

I recommend that the City of Charleston take several steps to reduce the negative anthropogenic impacts that currently affect the Angel Oak. These steps include:

- Close Angel Oak Road on the south side of the Angel Oak and purchase or obtain a conservation easement on the private land to the south of the tree to provide a conservation area at least 200 feet in width from the bole of the tree.
- Move the parking lot and the visitors building farther away from the tree to preclude the continuous soil compaction that occurs in that vicinity.
- Build board walks under the tree for visitor use and limit visitor use to those board walks. Mulch under the tree helps to minimize soil compaction but compaction still occurs due to high visitor numbers. Visitor use of the entire area inside the fence has resulted in significant soil compaction.

Maintenance of Soil Water and Groundwater Regimes

The Angel Oak and the other trees that will be preserved in Angel Oak Village are adapted to a soil water and groundwater regime on the site with several attributes:

- Deep sandy soils with very high infiltration capacity. Thus, most of the rainfall infiltrates into the soil and groundwater recharge rates are relatively high.
- Rolling terrain with estimated seasonal high water tables that range from the surface in the large depressional wetlands (lowest elevations) to about 5 feet below the surface on the ridges. The Angel Oak is located at an intermediate elevation on the site that slopes southward. The seasonal high water table ranges from about 4 feet north of the Angel Oak to about 2 feet south of the tree.
- Runoff to nearby streams is via subsurface flow in the near surface groundwater zone. Groundwater flow is generally southward across the site and under the Angel Oak toward Bohicket Creek.

The relatively high percent area of impervious surface envisioned for Angel Oak Village will have several impacts on the water balance of the site. Removal of much of the forest cover will result in

significant reduction of evapotranspiration losses, mainly in the summer and early fall. However, infiltration capacity and groundwater recharge will also be significantly reduced due to the impervious surface. Those two changes will convert rainfall to surface stormwater runoff. If that stormwater is discharged offsite, there is potential for a decline in soil water availability in the rooting zones of the Angel Oak and the other preserved trees and for the average water table depth to be significantly lower across the site compared to pre-construction conditions.

To preclude any negative impacts of the Angel Oak Development on soil water availability and the groundwater regime, I recommended that the stormwater management system of Angel Oak Village be designed to promote infiltration of stormwater rather than efficient offsite drainage as is typical for high density developments. To that end, the Angel Oak Village planning and design team has taken several steps to implement my recommendations:

1. I conducted an assessment of the soils on the Angel Oak Village site to confirm the soil mapping units and the soil physical properties described in Natural Resources Conservation Service descriptions of those soils.
2. A geotechnical exploration of the site in 2005 included studies of soil depth and soil infiltration rates that confirmed the estimates of these physical properties gleaned from soil mapping unit descriptions. The geotechnical studies confirmed that the sandy texture of the surface soils extends to an average depth of about 18 feet and that infiltration capacities are thus quite high across the site.
3. An innovative stormwater infiltration and management system has been designed for Angel Oak Village by HLA, Inc. that has three objectives:
 - a. Retain and infiltrate stormwater to maintain the water table regime and soil water availability to the Angel Oak and to the grand trees and other protected trees that will remain in the Village.
 - b. Detain stormwater to meet the City of Charleston post-development stormwater discharge criteria.
 - c. Provide for adequate discharge capacity to prevent flooding during very large rainfall events.

The stormwater infiltration and management system will retain much of the annual rainfall in infiltration ponds while providing detention storage and offsite drainage for the largest storm events. The Village has been divided into a series of catchments delineated by the principal streets that have several different Best Management Practices (BMPs) to promote rainfall infiltration. These include pervious pavement in parking lots plus bioswales and infiltration ponds to retain and infiltrate rain water runoff from impervious surfaces. The stormwater retention BMPs thus serve as groundwater recharge features. Flexible outlet structures in the retention/detention/infiltration ponds will allow for optimizing the hydrologic functions of the stormwater infiltration and management system based on operating experience. Additional fine-tuning of the plans for the stormwater infiltration and management system is ongoing but the key design principals of the system address the objectives listed above.

In summary, the planning and design team for Angel Oak Village has been receptive to my recommendations and has developed an innovative design for the Village that will be a model for stormwater management and tree protection. To reiterate the most important objective of the Angel Oak Village Plan – no damage to the Angel Oak will result from the construction of the development and opportunities are being provided for enhancing the environment of the tree and the experiences of the visitors to Angel Oak Park.

I will continue to assist the Angel Oak Village planning and design team as refinements of the plan are developed and implemented. If staff members of your department have questions of me, please feel free to contact me.

Regards,

A handwritten signature in cursive script that reads "James D. Gregory".

J

James D. Gregory, CPSS, PWS, Ph.D.
Principal/Senior Scientist