

**BEST MANAGEMENT PLAN: NUTRIENT MANAGEMENT & WATER QUALITY MONITORING**

**Nutrient Management**

This nutrient management plan addresses Conditions #11 and #12 delineated in the Special Area Study for Hickory Sink Strategic Ecosystem (SAS-01-22) and complies with Florida Department of Environmental Protection adopted [Orange Creek Basin Management Action Plan](#) and the [Santa Fe River Basin Management Action Plan](#).

The UF Golf Course will adopt the Best Management Practices (BMPs) described in FDEP's golf course BMP manual, [Best Management Practices for the Enhancement of Environmental Quality on Florida Golf Courses](#) (DEP, 2021).

The UF Golf Course Nutrient Management Plan is designed to maintain high-quality turfgrass playing surfaces while protecting environmental resources through responsible nutrient management. Nutrient applications in all forms (e.g., fertilizer, reclaimed water, soil amendments, etc.) will be based on plant needs, soil and tissue testing, and research-based recommendations to ensure that nutrients are applied efficiently and only when necessary. Management practices follow established Best Management Practices and the principles of the 4Rs—right source, right rate, right time, and right place—to maximize plant uptake and minimize nutrient loss through leaching, runoff, or volatilization. Program performance will be evaluated through measurable indicators including soil and tissue testing, fertilizer application records, turf quality assessments, and routine water quality sampling to ensure continuous improvement and regulatory compliance.

The goals of the UF Golf Course Nutrient Management Plan are to:

1. Maintain Healthy, Playable Turfgrass on a Championship Level Golf Course
2. Protect Water Quality and Reduce Environmental Risk
3. Base Nutrient Application Decisions on Science-Based Data
4. Optimize Nutrient Use Efficiency
5. Ensure Regulatory Compliance and BMP Adoption
6. Promote Continuous Improvement and Education

Specific actionable items to meet the goals include:

- 1. Maintain Healthy, Playable Turfgrass on a Championship Level Golf Course** – the golf course turfgrass areas will receive sufficient nutrients to support turf vigor, recovery from play, and acceptable playing conditions.

- a. Maintain turfgrass density, color, and growth necessary for safe and playable surfaces.
- b. Adjust nutrient programs based on turfgrass species, site conditions, and seasonal growth patterns.
- c. Prevent nutrient deficiencies that may compromise turf health and playability.
- d. Do not exceed UF/IFAS Turfgrass Fertilization Guidelines for various turfgrass species, including nitrogen from reclaimed water.

Golf Course Feature	Typical Turfgrass	North Florida (lbs N 1,000 ft <sup>2</sup> /yr)	Management Intensity
Putting Greens	Ultradwarf bermudagrass	3.5-7.0	Very high
Tees	Bermudagrass	3.0 – 6.0	High
Fairways	Bermudagrass	3.0 – 5.0	Moderate-high
Roughs	Bermudagrass	2.0 – 4.0	Low-moderate
Out-of-play/ Naturalized	Low-input turf (e.g., bahiagrass, centipedegrass)	0 – 1.0	Minimal

- e. Prevent nutrient deficiencies that may compromise turf health and playability.

**2. Minimize Environmental Risk from Nutrient Applications** – nutrient management practices will be designed to minimize the risk of nutrient movement to adjacent water bodies, groundwater, and non-target areas.

- a. Follow the principles of nutrient stewardship including Right Source, Right Rate, Right Time, and Right Place.
- b. Fertilizer shall not be applied when a rainfall event that is likely to produce 1.0 inch or more of rainfall within 24 hours is forecasted.
- c. Use fertilizer sources and application practices that maximize plant uptake and utilization.
- d. Account for nutrients in reclaimed water and soil amendments (i.e., compost).
- e. Reduce the potential for nutrient loss through leaching, runoff, and volatilization.

**3. Base Nutrient Application on Data and Turfgrass Response** – nutrient applications will be guided by soil testing, tissue analysis, turfgrass performance observations, and research-based recommendations.

- a. Conduct annual soil testing to monitor soil pH and soil nutrient status.
- b. Utilize turfgrass tissue testing to evaluate nutrient uptake and to detect deficiencies.

- c. Maintain historical records of soil and tissue testing to track long-term trends.
- 4. Improve Nutrient Use Efficiency** – fertilizer programs will prioritize efficient nutrient use to maximize plant uptake while reducing unnecessary nutrient inputs from all sources.
  - a. Utilize slow-release nitrogen sources or spoon-feeding strategies when appropriate to improve nutrient utilization.
  - b. Coordinate fertilizer application with irrigation scheduling.
  - c. Match nutrient application rates with turfgrass growth potential.
  - d. Fertigation
- 5. Ensure Compliance with Regulations and Best Management Practices** – all nutrient applications will comply with applicable regulations and align with established golf course Best Management Practices.
  - a. Strictly adhere to the stormwater plans pertaining to golf courses as delineated in the applicable Basin Management Action Plans.
  - b. Produce and submit, as required, an annual nutrient management plan to Alachua County and FDEP that maintains uniform plant growth while preventing nutrient losses to the Floridan aquifer and surrounding surface waters.
  - c. Maintain accurate nutrient application records (i.e., fertilizer, reclaimed water, soil amendments, etc.).
  - d. Fertilizer rates must not exceed UF/IFAS recommendations, including nutrients from reclaimed water, to prevent excessive nutrient loss.
- 6. Promote Continuous Improvement and Education**
  - a. Provide continuing education for staff responsible for nutrient management.
    - i. At minimum, personnel with supervisory roles on the agronomic team will obtain and maintain certification through the [UF-IFAS Florida Golf Courses Best Management Practices Program](#) to ensure proper BMP implementation and understanding of nutrient-related water quality issues and the role of golf courses in water quality restoration and protection.
    - ii. All individuals tasked with maintaining landscaped areas around the clubhouse amenity, cottages, and entrance roadways will obtain and maintain certification through the [UF-IFAS Green Industry Best Management Practices Program](#) (GI-BMPs). The golf course superintendent and staff will create and maintain a facility BMP manual using the [Golf Course Superintendents Association of America’s Facility BMP Manual tool](#).
  - b. Conduct an annual review of the nutrient management program to evaluate fertilizer practices, soil and tissue testing trends, and turf performance data to identify opportunities for improving nutrient use efficiency and environmental stewardship.
  - c. Incorporate new research findings and emerging technologies.

### **Water Quality Monitoring**

A Surface Water and Groundwater Quality Monitoring Program will be implemented at the UF Golf Course to evaluate potential impacts of golf course operations on adjacent water resources and to demonstrate compliance with applicable environmental regulations. The purpose of this monitoring program is to document baseline conditions, detect trends, verify BMP effectiveness, and identify whether golf course operations are affecting nearby surface water or groundwater quality. The goal of the water quality monitoring program is to ensure that nutrient additions to the golf course support the Santa Fe River BMAP goal of achieving the TMDL target of 0.35mg/L of nitrate-nitrite to be protective of the aquatic flora and fauna. If compliance monitoring data indicates an exceedance of this target (or any other state or federal water quality standard) attributable to the UF Golf Course operations, the nutrient management plan will be re-evaluated by UF and County staff to identify and implement strategies to achieve compliance and protection of water resources.

#### Monitoring Locations:

##### *Surface Water*

Selected ponds, lakes, and/or conveyances located within the golf course, especially those receiving runoff from intensively managed turf such as greens, tees, fairways, fertilizer storage/loading areas, and reclaimed-water-irrigated zones will be selected for monitoring.

##### *Groundwater*

Upon final golf course design and in consultation with a hydrogeologist and County staff, an appropriate number of monitoring wells for the site conditions will be installed. Existing wells monitored by the Florida Department of Health (<https://gis.floridahealth.gov/ehwater/>) will be reviewed to see if they provide relevant information.

Monitoring wells will be sited in locations that reflect likely nutrient and pesticide transport pathways. Locations will include upgradient of managed turf to characterize background groundwater quality. An appropriate number of downgradient wells placed between intensively fertilized areas and the nearest sensitive receptor such as ponds, lakes, or known high-recharge zones.

Monitoring sites will be determined during Final Development Plan process. Existing residential and monitoring wells will be considered in locating wells for the monitoring plan.

#### Sampling Frequency:

*Baseline phase*

Baseline monitoring samples to establish pre-disturbance water quality conditions will be taken at a minimum every three months prior to disturbance. Baseline data provide the reference condition needed to distinguish natural variability from construction- or management-related impacts.

*Routine operational monitoring*

Once the golf course is established, surface water quality monitoring will be conducted quarterly to capture seasonal variability pursuant to ULDC 404.66.5(b) and 406.59.1, with continued monitoring through the first three years and then seasonally every third year thereafter if conditions remain stable and BMPs continue to be implemented. Quarterly monitoring shall include the beginning of historical wet season, toward the end of wet season and the middle of typical dry season. Groundwater monitoring will be conducted semiannually, once in the wet season and once in the dry season.

A surface and ground water quality monitoring report will be provided annually to the Alachua County Environmental Protection Department by December 31.

Sampling Parameters:

*Surface Water Analytes (Karst window)*

Florida guidance for managed turf monitoring recommends:

Total Nitrogen	pH
Nitrate-N + Nitrite-N	Specific conductance
Ammonium-N	Temperature
Total Phosphorus	Dissolved Oxygen
Orthophosphate	Alkalinity
Total Suspended Solids (TSS)	
(Turbidity)	
Chlorophyll-a	
TKN	
Chloride	
Sodium	

Monitoring of specific pesticides will be conducted if such pesticides have characteristics such as:

- High water solubility
- Low soil adsorption (low Koc)
- Long half-life (persistent)
- Products with groundwater advisory statements

- Known groundwater detections historically

If monitoring is required based on pesticide characteristics, samples will be collected quarterly for the first three years and then biannually thereafter through the period of use of the selected pesticide.

*Groundwater Analytes*

Florida guidance for managed turf monitoring recommends:

Nitrate-N + Nitrite-N	pH
Ammonium-N	Specific conductance
Total Kjeldahl Nitrogen	Temperature
Total Phosphorus	Water table elevation/depth to groundwater
Orthophosphate	
TKN	
Total Nitrogen	
Chloride	
Sodium	
Turbidity	
Total Suspended Solids	

Quality Assurance / Quality Control (QA/QC):

The UF Golf Course Water Quality Monitoring Program will include the following minimum QA/QC elements:

- Written SOPs and station map with coordinates, photos, and station descriptions
- Instrument calibration records for pH, conductivity, dissolved oxygen, temperature, and turbidity meters
- Field blanks / equipment blanks at a minimum frequency consistent with DEP QA procedures
- Field duplicates on at least 10% of routine samples
- Chain-of-custody forms for every sampling event
- Field logbook or digital forms documenting weather, flow, calibration, and observations
- Laboratory certification and method reporting limits appropriate for Florida water quality work

- Data review and validation before interpretation

Data Evaluation and Decision Rules:

Trend analysis will be used to evaluate:

- Pre-Construction Impacts
- Upstream/reference vs downstream/outfall.
- Upgradient vs downgradient groundwater.
- Wet season vs dry season.

The golf course superintendent will initiate management review when any of the following occurs:

- Repeated increase in downstream or downgradient nitrate or phosphorus relative to reference sites.
- Recurring spikes after fertilizer applications or storm events.
- Evidence of algal blooms, low dissolved oxygen, or persistent turbidity.