Appendix K. **Proposal for Evaluating of Fecal Coliform Bacteria "Hot Spots" In the Gainesville Urban Creeks**

Prepared for

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May 1, 2007

Introduction

Fecal coliform bacteria, a microbiological indicator of human and warm-blooded animal fecal pollution, continue to be found at elevated levels in our streams. In the Orange Creek Basin (OCB), three streams in urban Gainesville, Hogtown Creek, Tumblin Creek and Sweetwater Branch, are designated by the Florida Department of Environmental Protection (FDEP) as Impaired Waters due to elevated levels of fecal coliform bacteria. Alachua County Environmental Protection Department (ACEPD) continues to monitor ambient, baseflow fecal coliform bacteria levels in the Gainesville urban creeks within the OCB. Fecal coliform levels vary widely in Alachua County's waters under differing hydrologic conditions. Typically, baseflow levels in our streams are one or more orders of magnitude lower than samples collected under stormflow conditions.

Based on the results of ambient fecal coliform monitoring, microbial source tracking (MST), alternative bacteriological monitoring, and optical brighteners analyses, a number of sites warrant further evaluation. There are 10 sites with consistently high levels of fecal coliform bacteria, eight of which have shown a presence of human markers in MST samples. The evidence of human markers is a specific concern, as there may be a continuing source of fecal coliform bacteria from humans, such as failing infrastructure, impacting the creeks. These sources of bacteria may be preventable and must be defined in order to develop strategies to reduce fecal pollution in the creeks.

The FDEP in cooperation with the ACEPD, Alachua County Health Department (ACHD), City of Gainesville Public Works Department (COGPWD), Florida Department of Transportation (FDOT) and Gainesville Regional Utilities (GRU), collectively referred to as "OCB TMDL stakeholders," propose to evaluate and remediate the sources.

Background

The 10 locations where elevated fecal coliform bacteria persist under baseflow conditions include four areas in the Sweetwater Branch watershed, three areas in the Hogtown Creek watershed and one area in each of the Tumblin Creek, Lake Forest Creek and Little Hatchet Creek watersheds (Figure 1 and Table 1). Each of these areas has unique considerations that may require specific techniques to evaluate the areas and determine the best solution for reducing fecal coliform bacteria concentrations.

The work conducted in evaluating the fecal coliform "hot spots" may cover large portions of a given watershed. It is estimated the approximately 30 to 40% of the Hogtown Creek watershed, including Elizabeth Creek and Rattlesnake Branch and excluding Possum Creek), will be evaluated (Tasks 3 and 6). The area of concern for the Possum Creek watershed is in the area of the lower 10% of watershed; the upper 90% will be screened to further identify the area(s) of concern and percentage of the watershed to further evaluate. Approximately 30% of the Tumblin creek watershed will be evaluated (Task 4). An estimated 50% of Sweetwater Branch watershed will be evaluated, including Rosewood Branch (Task 5). The area of concern on Lake Forest Creek includes approximately 15% of the watershed. The area of concern on Little Hatchet creek is downstream of approximately 40% of the watershed; this area will also be refined based on additional baseflow monitoring. All these percentages are estimates and will be refined during GIS mapping the field activities.

Tasks
The OCB TMDL stakeholders propose a series of tasks to further evaluate elevated fecal coliform bacteria levels and infrastructure in the Gainesville urban creek watersheds. Tasks include:

- Performing initial confirmatory baseflow fecal coliform sampling;
- Assessing existing programs and activities focused on reducing coliforms in the creeks and identifying areas needing improvement;
- Mapping infrastructure components into a GIS format within specific study areas;
- Conducting coordinated field evaluations of public and private sanitary sewer lines (including connection and laterals), septic systems, and storm sewer lines;
- Repairing infrastructure as necessary; and
- Performing post evaluative sampling to document water quality improvements.

Task 1 – Initial Confirmatory Baseflow Fecal Coliform and MST Sampling – In addition to quarterly monitoring of fecal coliform bacteria levels in Gainesville's creeks, ACEPD conducts high frequency, short duration intensive sampling during selected weeks in the summer and winter to evaluate trends. The routine baseflow sampling does not allow detailed evaluation of the fecal coliform levels in the vicinity of each of the "hot spots." ACEPD proposes to conduct an initial baseflow sampling event, consisting of sample collection at ~30 sites, with 2-5 sites in proximity to each of the "hot spots" (Table 2). This initial baseflow sampling would include sampling each of the sites daily for three consecutive days, collecting samples for fecal coliform each day, measuring flow once, setting and retrieving samplers for analyses of optical brighteners, and collecting samples for selected MST parameters to verify the presence of human markers. This work is proposed to be conducted in the dry season, April and May 2007, by ACEPD and is currently funded. Upon completion of the sampling efforts, a stakeholders meeting will be held to present the results.

There are two locations, one in each of the Little Hatchet Creek and Lake Forest Creek and watersheds (Figure 1) that warrant further evaluation and assessment for fecal coliform bacteria. These locations are Little Hatchet Creek at Waldo Road and Lake Forest Creek at NE25th Street. At the present time, no human markers have been found as part of the MST work conducted in these areas. It is likely that the levels of fecal coliform at these sites are related to animals (wild and/or domestic) in these areas. Prior to developing plans for evaluating the infrastructure in these two areas additional confirmatory sampling will be conducted. If human markers are found, additional work will be conducted in these locations.

Task 2 – Assessment of Existing Programs
The OCB TMDL stakeholders have been working collaboratively for a number of years to address elevated levels of fecal coliform in Gainesville's urban creeks. Past and existing efforts being taken by all the OCB TMDL stakeholders will be reviewed and summarized to provide a point of reference for future studies. The summary will include dates of activities, goal of activities, results of activities, and potential use for future

efforts. In addition, an assessment of existing efforts to reduce fecal coliform will be made. Current outreach activities (i.e. pet waste BMPs) related to fecal coliform bacteria in each of "hot spots" will be evaluated. Based on the evaluation of existing outreach programs and the source(s) of fecal coliform bacteria present, targeted outreach programs may be developed. The assessment will identify data needs and make recommendations for adding new efforts or improving existing efforts. The assessment will include a detailed plan for conducting the pilot study to be completed in Task 3.

Task 3 - Pilot Study in the Upper Elizabeth Creek Watershed – In order to develop a protocol for evaluating the fecal coliform "hot spots" a pilot study is proposed for the upper reaches or headwaters of Elizabeth Creek (Figure 1) in the Hogtown Creek watershed. The pilot study will begin with detailed GIS mapping of all infrastructure in the area from available data. Following the mapping, coordinated field evaluations of area private and public sanitary sewer lines (including connection and laterals), septic systems and storm sewer (MS4) lines will be conducted. Work conducted to evaluate the sanitary sewer and MS4 lines will likely consist of techniques such as camera surveys to evaluate line integrity and locate cross connections, dye studies to determine the natural and man-made flow paths, and smoke testing to locate inappropriate connections to the systems. It is proposed that GRU will conduct the evaluation of their wastewater system lines. The ACHD will conduct inspections of vicinity septic systems to determine system functionality, soil characteristics, horizontal setback to creek, and vertical setback to estimated "Season High Water Table" (SHWT). The ACHD will also create a GIS map of the evaluated septic systems. Camera surveys of storm sewer systems (MS4) will be contracted out to a private vendor. COGPWD staff will assist the other entities by providing access to the MS4 for sample collection and camera surveys. Additional fecal coliform and/or MST sampling may be needed to further define source areas. Any failing infrastructure detected through these surveys or by other means will be reported. An evaluation of stream corridor pet and wildlife usage will be conducted, and may include transects through representative areas adjacent to the creek to evaluate those contributions. Public education and outreach support materials will be developed and programs implemented based the results of the sampling and findings of the infrastructure assessment(s). Follow-up baseflow sampling to evaluate fecal coliform levels after repairs are made will be conducted by ACEPD. Upon completion of the pilot study, a stakeholders meeting will be held to present the results, evaluate the field efforts, and make modifications to the approach for addressing other hot-spot areas.

Task 4– Evaluation of Fecal Coliform in the Tumblin Creek Watershed – There is one location in the Tumblin Creek watershed that warrants further evaluation and assessment for fecal coliform bacteria. This area extends from the headwaters that exit the MS4 beneath SW 5th Avenue to PK Yonge School on the University of Florida campus. High levels of fecal coliform bacteria have plagued this area, due in part to the highly urbanized character of the watershed. The techniques described in Task 3 (GIS mapping of all infrastructure from available data; field evaluation of area public and private sanitary sewer lines, septic systems and storm sewer lines; and repairing infrastructure) will be used to at each location. The University of Florida Physical Plant and Planning staff will be encourage to participate in this evaluation to assure that the

area is completely evaluated. The domestic wastewater system that serves the PK Yonge campus is owned and operated by the University of Florida. In addition to the University involvement, additional efforts are anticipated to involve a number of private wastewater systems within this area. Prior to commencing with this task, a plan will be developed for evaluating private wastewater systems. An evaluation of stream corridor pet and wildlife usage will be conducted, and may include transects through representative areas adjacent to the creek to evaluate those contributions. Public education and outreach support materials will be developed and programs implemented based the results of the sampling and findings of the infrastructure assessment(s). Baseflow fecal coliform monitoring will be conducted by ACEPD as a follow-up to surveys and repairs. Upon completion of the efforts in the Tumblin Creek watershed, a stakeholders meeting will be held to present the results, evaluate the field efforts, and make modifications to the approach for addressing other hot-spot areas.

Task 5 – Evaluation of Fecal Coliform in the Sweetwater Branch Watershed – There are three locations in the Sweetwater Branch watershed that warrant further evaluation and assessment for fecal coliform bacteria. These areas are Sweetwater Branch at NE10 Avenue (extending Sweetwater Branch at SE1st Avenue), Sweetwater Branch at SE 8th Avenue and Rosewood Branch mid-point in the watershed to the confluence with Sweetwater Branch. Some of these areas may be combined for assessment, as are close to one another (i.e. Sweetwater Branch at SE 8th Avenue and Rosewood Branch). The techniques described in Task 3 (GIS mapping of all infrastructure from available data; field evaluation of area public and private sanitary sewer lines, septic systems and storm sewer lines; and repairing infrastructure) will be used to at each location. An evaluation of stream corridor pet and wildlife usage will be conducted, and may include transects through representative areas adjacent to the creek to evaluate those contributions. Public education and outreach support materials will be developed and programs implemented based the results of the sampling and findings of the infrastructure assessment(s). Baseflow fecal coliform monitoring will be conducted by ACEPD as a follow-up to surveys and repairs. Upon completion of the efforts in the Sweetwater Branch watershed, a stakeholders meeting will be held to present the results, evaluate the field efforts, and make modifications to the approach for addressing other hot-spot areas.

Task 6 – Evaluation of Fecal Coliform at two sites in the Hogtown Creek Watershed There are three additional locations in the Hogtown Creek watershed (Figure 1) that warrant further evaluation and assessment for fecal coliform bacteria. These areas are Possum Creek from NW 16th Avenue to its confluence with Hogtown Creek, Hogtown Creek from NW 23rd Avenue south and Rattlesnake Branch. These areas are relatively large, and are generally less urbanized than Tumblin Creek and Sweetwater Branch. The techniques described in Task 3 (GIS mapping of all infrastructure from available data; field evaluation of area public and private sanitary sewer lines, septic systems and storm sewer lines; and repair of failing infrastructure) will be used to at each location. It is anticipated that the efforts in the Hogtown Creek watershed with involve evaluating a number of privates systems in the area. Prior to commencing with this task, a plan will be developed for evaluating private wastewater systems. An evaluation of stream corridor pet and wildlife usage will be conducted, and may include transects through

representative areas adjacent to the creek to evaluate those contributions. Public education and outreach support materials will be developed and programs implemented based the results of the sampling and findings of the infrastructure assessment(s). Evaluative baseflow fecal coliform monitoring will be conducted by ACEPD as a follow-up to surveys and repairs. Upon completion of the efforts in the Hogtown Creek watershed, a stakeholders meeting will be held to present the results, evaluate the field efforts, and make modifications to the approach for addressing other hot-spot areas.

Task 7 – Post Survey and Retrofit Confirmatory Baseflow Fecal Coliform and MST Sampling – ACEPD proposes to conduct a follow-up baseflow sampling event, consisting of sample collection at ~30 sites, 2-5 selected sites in proximity to each "hot spot" (Table 2). The purpose of the sampling is to evaluate water quality improvements as a whole in the entire Gainesville urban area. This confirmatory baseflow sampling would follow the protocols and include all the sites sampled in Task 1. This work is proposed to be conducted in the dry season, November and December 2007 (if work is complete) or April and May 2008 by ACEPD. An evaluation of outreach and public education efforts through a follow-up survey of participation will be conducted for each watershed area evaluated. A summary of outreach programs specific to these watershed areas and the source(s) of fecal coliform bacteria present will be provided and their successes or failures discussed in the final report (Task 8). Upon completion of the sampling efforts, a stakeholders meeting will be held to present the results.

Task 8 – Report – Upon completion of Tasks 1 through 7, a report will be prepared for distribution by FDEP that integrates the results of the tasks. The budget, which has yet to be determined, must allow for a minimum of one round of editing after FDEP and OCB TMDL stakeholder review. Once the report is complete, a final presentation will be made to FDEP and the OCB TMDL stakeholders.

Deliverables

The deliverable for this project will include a written report that has the following:

- A summary of the pre- and post-sampling results completed in Tasks 1 and 7;
- A summary of the assessment of existing efforts performed under Task 2 literature review and synthesis of previous investigations;
- A summary of the pilot study conducted in Task 3 with discussion of investigative methods, surveys and field investigations performed and a detail of all repairs, upgrades, retrofits and remedial measures taken to reduce fecal coliform levels,
- Summaries for efforts completed for each hot-spot area conducted in Tasks 4 through Task 6 with details of all repairs, upgrades, retrofits and remedial measures taken to reduce fecal coliform levels.
- Recommendations for future activities

In addition to the report, GIS based maps will be prepared to depict each of the "hot spots" and will detail the infrastructure in those areas. The GIS coverages will be made available to the OCB TMDL stakeholders.

Timeframe

It is estimated that the project will be conducted in a phased approach, as local government resources are not available to concentrate efforts on all sites at one time. The literature review and synthesis of previous investigations shall be completed and made available for review by July 1, 2007. The results of the pilot study on Elizabeth Creek should be made available to within six to eight weeks of the completion of the work. A one-year time frame is proposed for project completion, as many of the tasks must be conducted in the dry portions of the year. I think this will take longer, but it will depend on funding and who facilitates the work.

Figure 1. Sites for Further Evaluation of Fecal Coliform Bacteria.

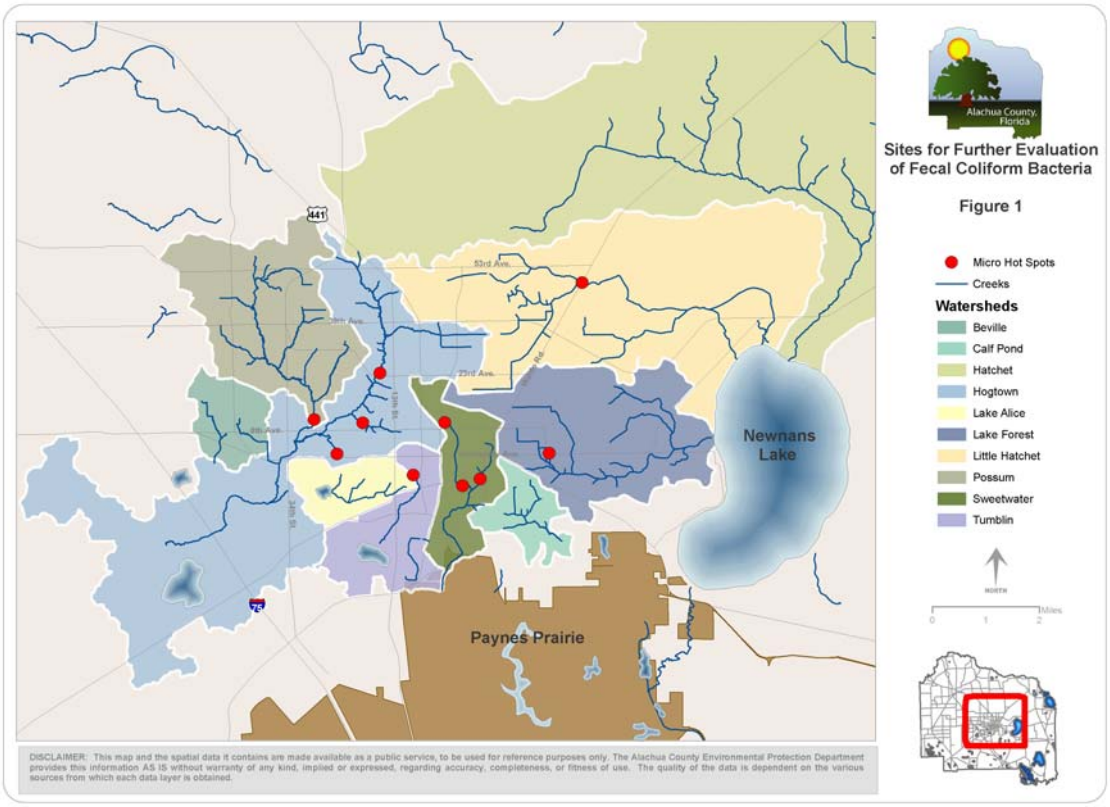

Table 1. Sites for Further Evaluation of Fecal Coliform Bacteria.

Watershed	Location	Area
Hogtown Creek	ELIZNW7DS	Headwaters near University Avenue
Hogtown Creek	HOGNW23	NW23 Avenue to 8th NW Avenue
Hogtown Creek	POSNW16	NW 16th Avenue to confluence with Hogtown Creek
Hogtown Creek	RATTLESNAKE	Entire creek
Sweetwater Branch	SWBNE10	NE 10th Avenue to SE 1st Avenue
Sweetwater Branch	SWBSE8	SE 8th Avenue
Sweetwater Branch	ROSEWOOD	Mid-point in the watershed to confluence with Sweetwater
Tumblin Creek	TUMBLIN	SW 5th Avenue to PK Yonge School
Little Hatchet Creek	LHTWALDO	Vicinity of Waldo Road
Lake Forest Creek	LFCNE25	NE 25th Street north of University Avenue

Table 2. Selected Sites for Initial Baseflow Fecal Coliform Sampling by Watershed.

Elizabeth Creek	Tumblin Creek	Sweetwater Branch*	Hogtown Creek**	Lake Forest Creek	Little Hatchet Creek
ELIZ UNIV	TUMPorters	SWB NE 10 AVE	HOG NW 23	LFC NE 25	LHAT WALDO
ELIZ ARBOR	TUM SW5	SWBSE1	HOGCETRIB	(No flow in additional sites)	LHATNB
ELIZ NW 23	TUMSW11	SWBSE8 ST	HOG GHSN		
ELIZ NW 7 DS	TUM441	SWBLF	HOGNW23		
		SWB 331	HOGNW8		
		ROSE UNIV	RATNW8		
		ROSE SE 7	RAT US HOG		
		ROSE SE9	HOG US RAT		
			POSNW16		
			POSNW36DR		
			POSNW8		

* Includes Rosewood Branch

** Includes Possum Creek and Rattlesnake Branch