Final

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Water Resource Management, Bureau of Watershed Management

NORTHWEST DISTRICT • OCHLOCKONEE-ST. MARKS BASIN

TMDL Report

Fecal Coliform TMDL for Juniper Creek, WBID 682

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Acknowledgments

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Websites

Florida Department of Environmental Protection, Bureau of Watershed Management

TMDL Program

http://www.dep.state.fl.us/water/tmdl/index.htm

Identification of Impaired Surface Waters Rule

http://www.dep.state.fl.us/legal/Rules/shared/62-303/62-303.pdf

STORET Program

http://www.dep.state.fl.us/water/storet/index.htm

2006 305(b) Report

http://www.dep.state.fl.us/water/tmdl/docs/2006_Integrated_Report.pdf

Criteria for Surface Water Quality Classifications

http://www.dep.state.fl.us/water/wqssp/classes.htm

Basin Status Report

http://www.dep.state.fl.us/water/tmdl/stat_rep.htm

Water Quality Assessment Report

http://www.dep.state.fl.us/water/tmdl/stat_rep.htm

HSPF and EFDC/EFDC_Explorer Training

www.dsllc.com

U.S. Environmental Protection Agency

National STORET Program

http://www.epa.gov/storet/

Region 4: Total Maximum Daily Loads in Florida

http://www.epa.gov/region4/water/tmdl/florida/

Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Load (TMDL) for fecal coliform for Juniper Creek, located in the Ochlockonee–St. Marks Basin. Juniper Creek was verified as impaired for fecal coliform, and was included on the Verified List of impaired waters for the Ochlockonee–St. Marks Basin that was adopted by Secretarial Order in June 2008. The TMDL establishes the allowable loadings to Juniper Creek that would restore this waterbody so that it meets its applicable water quality criterion for fecal coliform.

1.2 Identification of Waterbody

The Juniper Creek watershed, located in Gadsden County, Florida, has an 8.84-square-mile (mi^2) drainage area (**Figure 1.1**). There are no major population centers in the watershed. However, the small community of Sawdust lies at the creek's headwaters. The city of Quincy is located several miles to the northeast.

Juniper Creek is about 4.6 miles long, extending from State Road (SR) 65 west to SR 65A and Telogia Creek. A second-order stream fed by the Floridan aquifer, Juniper Creek receives water from Long Branch Creek as well as several other small tributaries. Both waterbodies are fed by the Floridan aquifer. Additional information about the creek's hydrology and geology are available in the Basin Status Report for the Ochlockonee–St. Marks Basin (Florida Department of Environmental Protection [Department], 2006). The Telogia Creek wasteload allocation report (Wieckowicz, 1981) provides additional historical information about Telogia Creek and Juniper Creek.

For assessment purposes, the Department has divided the basin into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed or stream reach. The Ochlockonee–St. Marks Basin has been divided into numerous segments, as shown in **Figure 1.2.** This TMDL addresses primarily Juniper Creek (WBID 682).

Figure 1.1. Juniper Creek in Florida, and Major Geopolitical Features

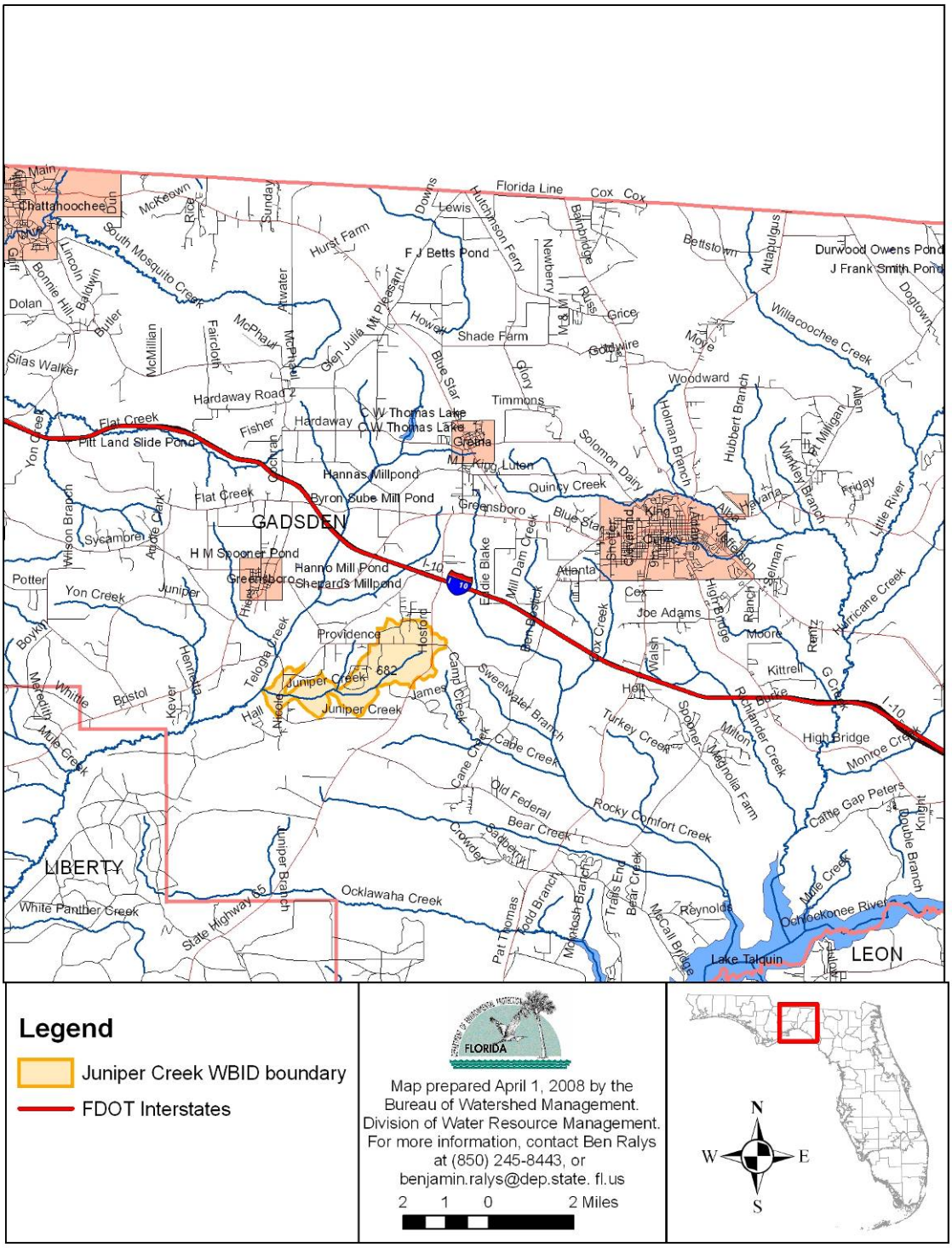
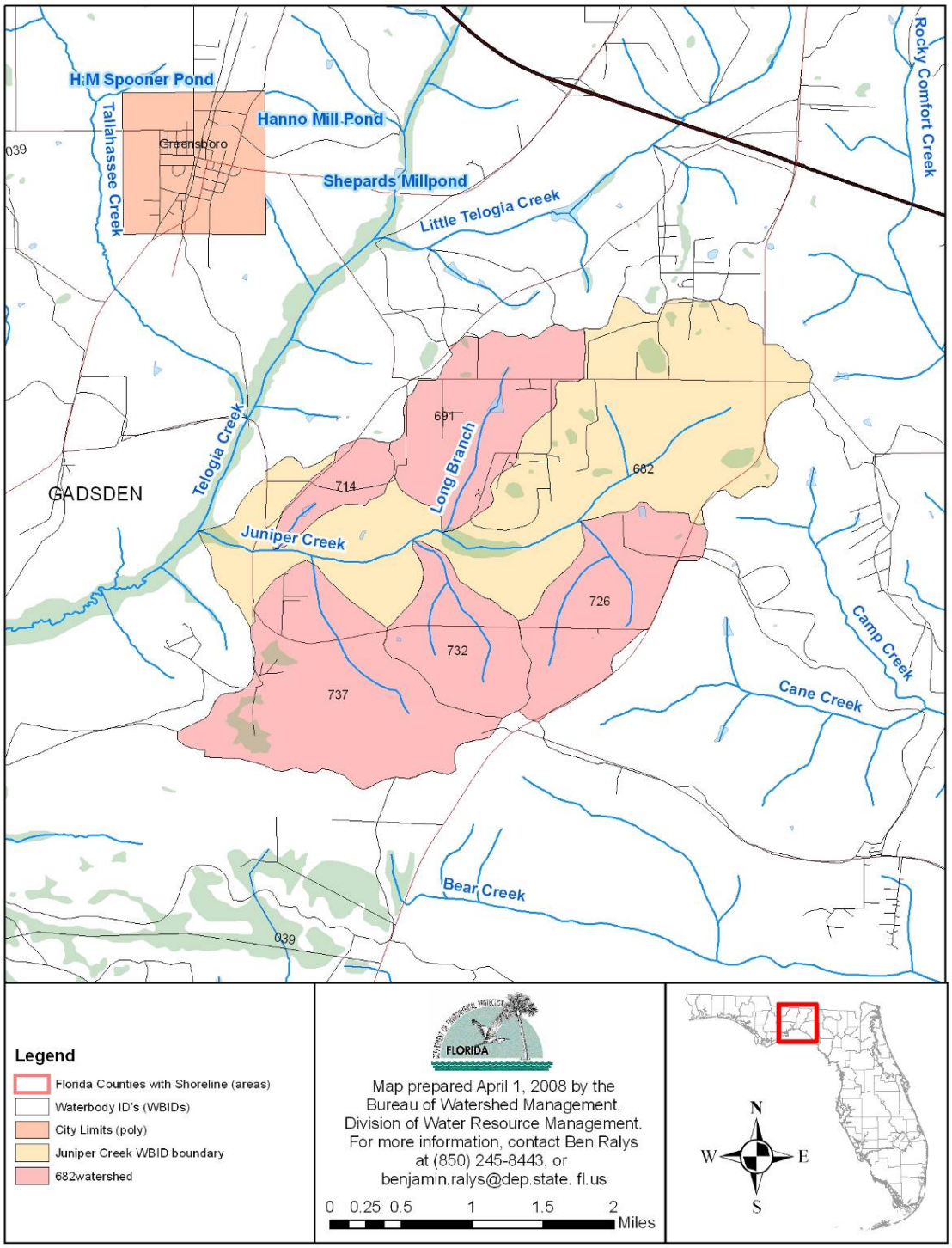


Figure 1.2. WBIDs in the Juniper Creek Watershed, Including WBIDs 682, 691, 714, 737, 732, and 726



1.3 Background

This report was developed as part of the Department's watershed management approach for restoring and protecting state waters and addressing TMDL Program requirements. The watershed approach, which is implemented using a cyclical management process that rotates through the state's 52 river basins over a 5-year cycle, provides a framework for implementing the TMDL Program–related requirements of the 1972 federal Clean Water Act and the 1999 Florida Watershed Restoration Act (FWRA) (Chapter 99-223, Laws of Florida) (also see **Appendix A** for background information on the federal and state stormwater programs).

A TMDL represents the maximum amount of a given pollutant that a waterbody can assimilate and still meet water quality standards, including its applicable water quality criteria and its designated uses. TMDLs are developed for waterbodies that are verified as not meeting their water quality standards. They provide important water quality restoration goals that will guide restoration activities.

This TMDL report will be followed by the development and implementation of a Basin Management Action Plan, or BMAP, to reduce the amount of fecal coliform that caused the verified impairment of the Juniper Creek Watershed. These activities will depend heavily on the active participation of the Northwest Florida Water Management District (NWFWMD), local governments, businesses, and other stakeholders. The Department will work with these organizations and individuals to undertake or continue reductions in the discharge of pollutants and achieve the established TMDLs for impaired waterbodies.

Chapter 2: DESCRIPTION OF WATER QUALITY PROBLEM

2.1 Statutory Requirements and Rulemaking History

Section 303(d) of the federal Clean Water Act requires states to submit to the U.S. Environmental Protection Agency (EPA) a list of surface waters that do not meet applicable water quality standards (impaired waters) and establish a TMDL for each pollutant causing the impairment of listed waters on a schedule. The Department has developed such lists, commonly referred to as 303(d) lists, since 1992. The list of impaired waters in each basin, referred to as the Verified List, is also required by the FWRA (Subsection 403.067[4], Florida Statutes [F.S.]), and the state's 303(d) list is amended annually to include basin updates.

Florida's 1998 303(d) list included 24 waterbodies in the Ochlockonee–St. Marks Basin. However, the FWRA (Section 403.067, F.S.) stated that all previous Florida 303(d) lists were for planning purposes only and directed the Department to develop, and adopt by rule, a new science-based methodology to identify impaired waters. After a long rulemaking process, the Environmental Regulation Commission adopted the new methodology as Rule 62-303, Florida Administrative Code (F.A.C.) (Identification of Impaired Surface Waters Rule, or IWR), in April 2001; the rule was updated in 2006 and 2007.

2.2 Information on Verified Impairment

The Department used the IWR to assess water quality impairments in the Ochlockonee–St. Marks Basin and has verified the impairments listed in **Table 2.1**. **Table 2.2** provides selected assessment results for fecal coliform within the verification period for Juniper Creek, which was January 1, 2000, through June 30, 2007. This TMDL addresses the fecal coliform impairment in the Juniper Creek Watershed. There were a total of 29 fecal coliform samples collected within the verified period. The samples used in the TMDL calculation range from 72 colony-forming units per 100 milliliters (cfu/100mL) to 2,700 cfu/100mL. **Table 2.3** briefly summarizes the fecal coliform data for Juniper Creek.

Table 2.1. Verified Impaired Segments in the Ochlockonee–St. Marks Basin

WBID	Waterbody Segment	Parameters Assessed using the IWR	Priority for TMDL Development	Projected Year of TMDL Development
427	Swamp Creek	Fecal Coliform	Low	2008
563	Unnamed Drain	Fecal Coliform, Turbidity	Low	2018
582	Lake Jackson Outlet	Unionized Ammonia	Low	2014
628	Black Creek	Fecal Coliform	Low	2018
647	Alford Arm	DO	Medium	2008
682	**Juniper Creek**	**DO, Fecal Coliform**	**Medium**	**2008**
684	Mule Creek	Fecal Coliform	Low	2018
689	Lake Overstreet Drain	Fecal Coliform	Low	2018
716	Caney Branch	Fecal Coliform	Low	2018
756	Lake Lafayette Drain	DO	Medium	2008
757	Bear Creek	Fecal Coliform	Low	2018
807	Munson Slough (below Lake Munson)	DO, Unionized Ammonia	Medium	2013
808	Copeland Sink Drain	DO	Low	2014
809	Megginnis Arm Run	Fecal Coliform	Low	2018
820	Godby Ditch	Fecal Coliform	Low	2018
879	Hammock Creek	DO	Low	2014
896	Polk Creek	Fecal Coliform	Low	2018
913	Big Creek	Fecal Coliform	Low	2018
919	Unnamed Slough	Fecal Coliform	Low	2018
921	Harvey Creek	Fecal Coliform	Low	2018
965	Sweetwater Branch	Fecal Coliform	Low	2018
971	Chicken Branch	Fecal Coliform	Low	2018
977	Moore Branch	Fecal Coliform	Low	2018
1006	Wakulla River	Biology	Medium	2008
1024	Black Creek	Fecal Coliform	Low	2008
1028	McBride Slough	Fecal Coliform	Low	2018
1049	Big Branch	Fecal Coliform	Low	2018
1054	Black Creek	DO	Low	2014
1124	Big Boggy Branch	Fecal Coliform	Low	2018
1300	Telogia Creek	Fecal Coliform, Iron	Medium	2008
1303	Quincy Creek	Fecal Coliform, Iron	Low	2018
8026	Coastapalach Gulf West	Shellfish	Medium	2008
8999	Gulf Coast	Mercury (in Fish Tissue)	Low	2011

WBID	Waterbody Segment	Parameters Assessed using the IWR	Priority for TMDL Development	Projected Year of TMDL Development
1248B	Ochlockonee Bay	Fecal Coliform	Low	2018
1248C	Ochlockonee Bay	Fecal Coliform	Low	2018
1297B	Ochlockonee River	Iron	Medium	2013
1297C	Lake Talquin	DO, TSI	Medium	2013
1297D	Lake Talquin	TSI	Medium	2013
1297E	Ochlockonee River	Iron	Medium	2013
1297F	Ochlockonee River	Iron	Medium	2013
540A	Tallavanna Lake	TSI	Medium	2008
756A	Upper Lake Lafayette	Fecal Coliform, DO	Low	2018
756B	Lake Piney Z	DO, TSI	Medium	2008
756C	Lower Lake Lafayette	DO, TSI	Medium	2008
791N	Lake Miccosukee	TSI	Low	2014
8025B	Mashes Island	Bacteria	High	2008
8026B	Shell Point	Bacteria	Low	2018
807C	Lake Munson	DO, TSI, Turbidity	Medium	2008
807D	Munson Slough (above Lake Munson)	DO, Fecal Coliform, Turbidity	Low	2008
971B	Lake Weeks	DO	Medium	2008

Note: The parameters listed in **Table 2.1** provide a complete picture of the impairment in the Ochlockonee–St. Marks Basin, but this TMDL only addresses fecal coliform impairment in the Juniper Creek watershed.

DO – Dissolved oxygen
TSI – Trophic State Index

Table 2.2. Verified Period Fecal Coliform Data for the Juniper Creek Watershed

WBID	STATION	DATE	TIME	RESULT
682	21FLPNS 303148084441501	4/26/2006	1200	72
682	21FLPNS 303148084441501	2/15/2006	1420	170
682	21FLPNS 303148084441501	3/1/2006	1415	88
682	21FLPNS 303148084441501	3/21/2006	1400	2700
682	21FLPNS 303148084441501	3/29/2006	1130	620
682	21FLPNS 303148084441501	5/3/2006	1025	114
682	21FLPNS 303148084441501	5/18/2006	1115	102
682	21FLPNS 303148084441501	5/31/2006	1030	2000
682	21FLPNS 303148084441501	6/8/2006	1200	230
682	21FLPNS 303148084441501	6/19/2006	1050	90
682	21FLPNS 303148084441501	7/20/2006	1205	390
682	21FLPNS 303148084441501	8/10/2006	1040	630
682	21FLPNS 303148084441501	8/21/2006	1317	645
682	21FLPNS 303148084441501	8/31/2006	1130	530
682	21FLPNS 303148084441501	9/27/2006	1145	450
682	21FLPNS 303148084441501	10/25/2006	1510	809
682	21FLPNS 303148084441501	11/13/2006	1145	605
682	21FLPNS 303148084441501	11/28/2006	1130	250
682	21FLPNS 303148084441501	12/6/2006	1045	736
682	21FLPNS 303148084441501	12/20/2006	1234	1200
682	**21FLBRA 682-A**	**7/2/2007**	**1539**	**1110**
682	21FLBRA 682-A	8/13/2007	1632	110
682	21FLBRA 682-A	8/27/2007	1122	170

Notes: The entire period of record is located in **Chapter 5.**
Bold rows signify that values have been averaged.

Table 2.3. Summary of Verified Period Fecal Coliform Data for Juniper Creek, WBID 682

Waterbody (WBID)	Parameter	Fecal Coliform
Juniper Creek (682)	Total number of samples	23
	IWR-required number of exceedances for the Verified List	5
	Number of observed exceedances	12
	Number of observed nonexceedances	11
	Number of seasons during which samples were collected	4
	Highest observation (MPN/100mL)*	2,700
	Lowest observation (MPN/100mL)*	72
	Median observation (MPN/100mL)*	450
	Mean observation (MPN/100mL)*	362.60
	Final Assessment	**Impaired**

* Most probable number per 100 milliliters

Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

3.1 Classification of the Waterbody and Criteria Applicable to the TMDL

Florida's surface waters are protected for five designated use classifications, as follows:

Class I	**Potable water supplies**
Class II	**Shellfish propagation or harvesting**
Class III	**Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife**
Class IV	**Agricultural water supplies**
Class V	**Navigation, utility, and industrial use (there are no state waters currently in this class)**

The Juniper Creek Watershed contains several Class III fresh waterbodies, i.e., Juniper Creek and Long Branch, as well as a few smaller tributaries. Class III waterbodies have a designated use of recreation, propagation, and the maintenance of a healthy, well-balanced population of fish and wildlife. The water quality criterion applicable to the impairment addressed by this TMDL is the Class III criterion for fecal coliform.

3.2 Applicable Water Quality Standards and Numeric Water Quality Target

Numeric criteria for bacterial quality are expressed in terms of fecal coliform bacteria concentrations. The water quality criterion for the protection of Class III waters, as established by Rule 62-302, F.A.C., states the following:

> ***Fecal Coliform Bacteria:***
> *The most probable number (MPN) or membrane filter (MF) counts per 100 mL of fecal coliform bacteria shall not exceed a monthly average of 200, nor exceed 400 in 10 percent of the samples, nor exceed 800 on any one day.*

The criterion states that monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period. However, during the development of load curves for the impaired waterbody (as described in subsequent sections), there were insufficient data (fewer than 10 samples in a given month) available to evaluate the geometric mean criterion for fecal coliform bacteria. Therefore, the criterion selected for the TMDL was not to exceed 400 in 10 percent of the samples.

Chapter 4: ASSESSMENT OF SOURCES

4.1 Types of Sources

An important part of the TMDL analysis is the identification of pollutant source categories, source subcategories, or individual sources of nutrients in the watershed and the amount of pollutant loading contributed by each of these sources. Sources are broadly classified as either "point sources" or "nonpoint sources." Historically, the term "point sources" has meant discharges to surface waters that typically have a continuous flow via a discernable, confined, and discrete conveyance, such as a pipe. Domestic and industrial wastewater treatment facilities (WWTFs) are examples of traditional point sources. In contrast, the term "nonpoint sources" was used to describe intermittent, rainfall-driven, diffuse sources of pollution associated with everyday human activities, including runoff from urban land uses, agriculture, silviculture, and mining; discharges from failing septic systems; and atmospheric deposition.

However, the 1987 amendments to the Clean Water Act redefined certain nonpoint sources of pollution as point sources subject to regulation under the EPA's National Pollutant Discharge Elimination System (NPDES) Program. These nonpoint sources included certain urban stormwater discharges, including those from local government master drainage systems, construction sites over five acres, and a wide variety of industries (see **Appendix A** for background information on the federal and state stormwater programs).

To be consistent with Clean Water Act definitions, the term "point source" will be used to describe traditional point sources (such as domestic and industrial wastewater discharges) **and** stormwater systems requiring an NPDES stormwater permit when allocating pollutant load reductions required by a TMDL (see **Section 6.1**). However, the methodologies used to estimate nonpoint source loads do not distinguish between NPDES stormwater discharges and non-NPDES stormwater discharges, and as such, this source assessment section does not make any distinction between the two types of stormwater.

4.2 Potential Sources of Coliform in Juniper Creek

4.2.1 Point Sources

Currently, one permitted wastewater treatment facility discharges loads either directly or indirectly into Juniper Creek. Quincy Farms; a mushroom growing and processing facility, has discharged to the headwaters of the creek near SR 65, southwest of Quincy, since 1982 (EPA, 1988) (**Table 4.1** and **Figure 4.1**).

Table 4.1. Point Sources in the Juniper Creek Watershed

Permit Number	Facility Name	City	Type of Facility	Facility Status	Design Capacity (mgd)	Watershed	WBID
FLA010088	Quincy Farms	Quincy	Industrial	Active	0.179	Juniper Creek	682

mgd – million gallons per day

Municipal Separate Storm Sewer System Permittees

There are currently no NPDES municipal separate storm sewer system (MS4) permittees in the watershed.

4.2.2 Land Uses and Nonpoint Sources

Additional fecal coliform loadings to the Juniper Creek watershed are generated from nonpoint sources in the watershed. These include loadings from surface runoff, wildlife, livestock, pets, and leaking septic tanks.

Land Uses

The spatial distribution and acreage of different land use categories were identified using the 1995 NWFWMD land use coverage (scale 1:40,000) contained in the Department's geographic information system (GIS) library. Land use categories in the watershed were aggregated using the simplified Level 1 codes tabulated in **Tables 4.2a** and **4.2b. Figures 4.2a** and **4.2b** show the acreage of the principal land uses in the watershed. As shown in **Table 4.2a**, land use (WBIDs 682, 691, 714, 737, 732, and 726) is heavily dominated by upland forests, which comprise 57.68 percent of the entire watershed. Other measurable land uses include agriculture (28.17 percent), urban and built-up (5.39 percent), and wetlands (5.67 percent).

Figure 4.1. Wastewater Facilities in the Juniper Creek Watershed

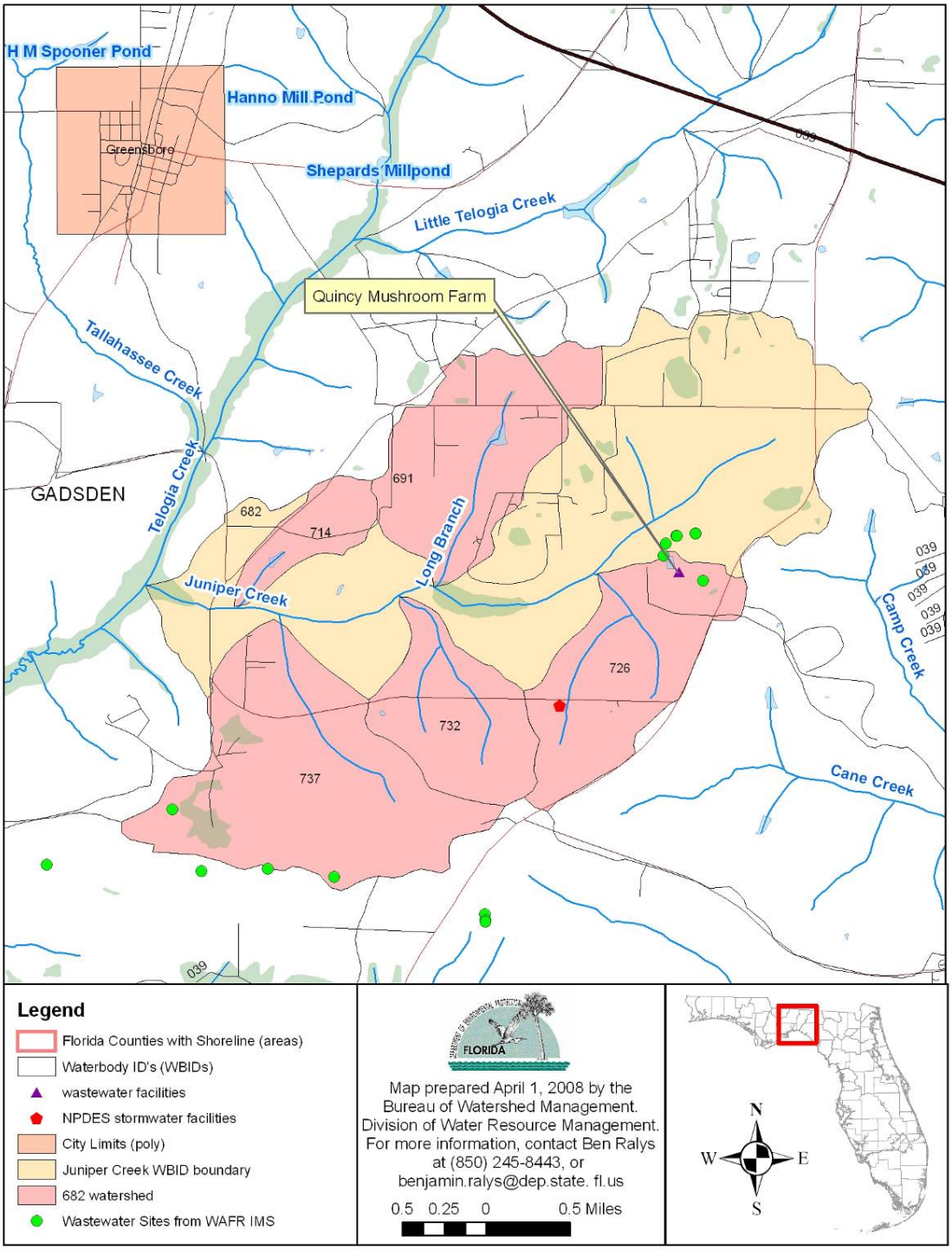


Table 4.2a. Classification of Land Use Categories in the Juniper Creek Watershed

Level 1 Code	Land Use	Acreage	Mi^2	% of WBID Watershed
WBID 682, Juniper Creek				
1000	Urban and Built-up	128.26	0.20	5.17
2000	Agriculture	913.28	1.43	36.84
3000	Rangeland	78.30	0.12	3.16
4000	Upland Forests	1,104.91	1.73	44.57
5000	Water	8.46	0.01	0.34
6000	Wetlands	245.87	0.38	9.92
7000	Barren Lands	0.00	0.00	0.00
8000	Transportation, Communication, and Utilities	0.00	0.00	0.00
	Total	**2,479.07**	**3.87**	**100.00**

Level 1 Code	Land Use	Acreage	Mi^2	% of WBID Watershed
WBID 691, Long Branch				
1000	Urban and Built-up	57.17	0.09	7.97
2000	Agriculture	327.78	0.51	45.71
3000	Rangeland	21.15	0.03	2.95
4000	Upland Forests	273.54	0.43	38.15
5000	Water	14.33	0.02	2.00
6000	Wetlands	23.05	0.04	3.22
7000	Barren Lands	0.00	0.00	0.00
8000	Transportation, Communication, and Utilities	0.00	0.00	0.00
	Total	**717.03**	**1.12**	**100.00**

Level 1 Code	Land Use	Acreage	Mi^2	% of WBID Watershed
WBID 714, Unnamed Run				
1000	Urban and Built-up	40.66	0.06	21.92
2000	Agriculture	47.88	0.07	25.81
3000	Rangeland	0.00	0.00	0.00
4000	Upland Forests	88.43	0.14	47.67
5000	Water	1.13	0.00	0.61
6000	Wetlands	7.40	0.01	3.99
7000	Barren Land	0.00	0.00	0.00
8000	Transportation, Communication, and Utilities	0.00	0.00	0.00
	Total	**185.49**	**0.29**	**100.00**

Level 1 Code	Land Use	Acreage	Mi^2	% of WBID Watershed
WBID 737, Unnamed Run				
1000	Urban and Built-up	14.56	0.02	1.26
2000	Agriculture	88.90	0.14	7.72
3000	Rangeland	11.01	0.02	0.96
4000	Upland Forests	993.55	1.55	86.32
5000	Water	1.28	0.00	0.11
6000	Wetlands	38.96	0.06	3.39
7000	Barren Land	0.00	0.00	0.00
8000	Transportation, Communication, and Utilities	2.70	0.00	0.23
	Total	**1150.95**	**1.80**	**100.00**

Level 1 Code	Land Use	Acreage	Mi^2	% of WBID Watershed
WBID 732, Unnamed Run				
1000	Urban and Built-up	8.75	0.01	1.86
2000	Agriculture	36.22	0.06	7.69
3000	Rangeland	18.27	0.03	3.88
4000	Upland Forests	400.22	0.63	84.92
5000	Water	1.48	0.00	0.32
6000	Wetlands	6.32	0.01	1.34
7000	Barren Land	0.00	0.00	0.00
8000	Transportation, Communication, and Utilities	0.00	0.00	0.00
	Total	**471.27**	**0.74**	**100.00**

Level 1 Code	Land Use	Acreage	Mi^2	% of WBID Watershed
WBID 726, Unnamed Run				
1000	Urban and Built-up	55.33	0.09	8.41
2000	Agriculture	177.34	0.28	26.96
3000	Rangeland	12.29	0.02	1.87
4000	Upland Forests	398.30	0.62	60.56
5000	Water	3.74	0.01	0.57
6000	Wetlands	10.75	0.02	1.63
7000	Barren Land	0.00	0.00	0.00
8000	Transportation, Communication, and Utilities	0.00	0.00	0.00
	Total	**657.75**	**1.03**	**100.00**

Level 1 Code	Land Use	Acreage	Mi^2	% of WBID Watershed
Juniper Creek Watershed				
1000	Urban and Built-up	304.73	0.48	5.39
2000	Agriculture	1,591.40	2.49	28.17
3000	Rangeland	141.02	0.22	2.49
4000	Upland Forests	3,258.95	5.09	57.68
5000	Water	30.42	0.05	0.54
6000	Wetlands	332.34	0.50	5.67
7000	Barren Land	0.00	0.00	0.00
8000	Transportation, Communication, and Utilities	2.70	0.00	0.05
	Total	**5,661.56**	**8.83**	**100.00**

Table 4.2b. Classification of Land Use Categories in Gadsden County

Level 1 Code	Land Use	Acreage	Mi^2	% of County
Gadsden County				
1000	Urban and Built-up	21,691.60	33.89	6.42
2000	Agriculture	43,886.81	68.57	12.98
3000	Rangeland	8,764.68	13.69	2.59
4000	Upland Forests	233,163.80	364.32	68.98
5000	Water	9,152.93	14.30	2.71
6000	Wetlands	18,175.10	28.40	5.38
7000	Barren Land	52.56	0.08	0.02
8000	Transportation, Communication, and Utilities	3,115.13	4.87	0.92
	Total	**338,002.61**	**528.13**	**100.00**

Figure 4.2a. Principal Land Uses in Juniper Creek, WBID 682

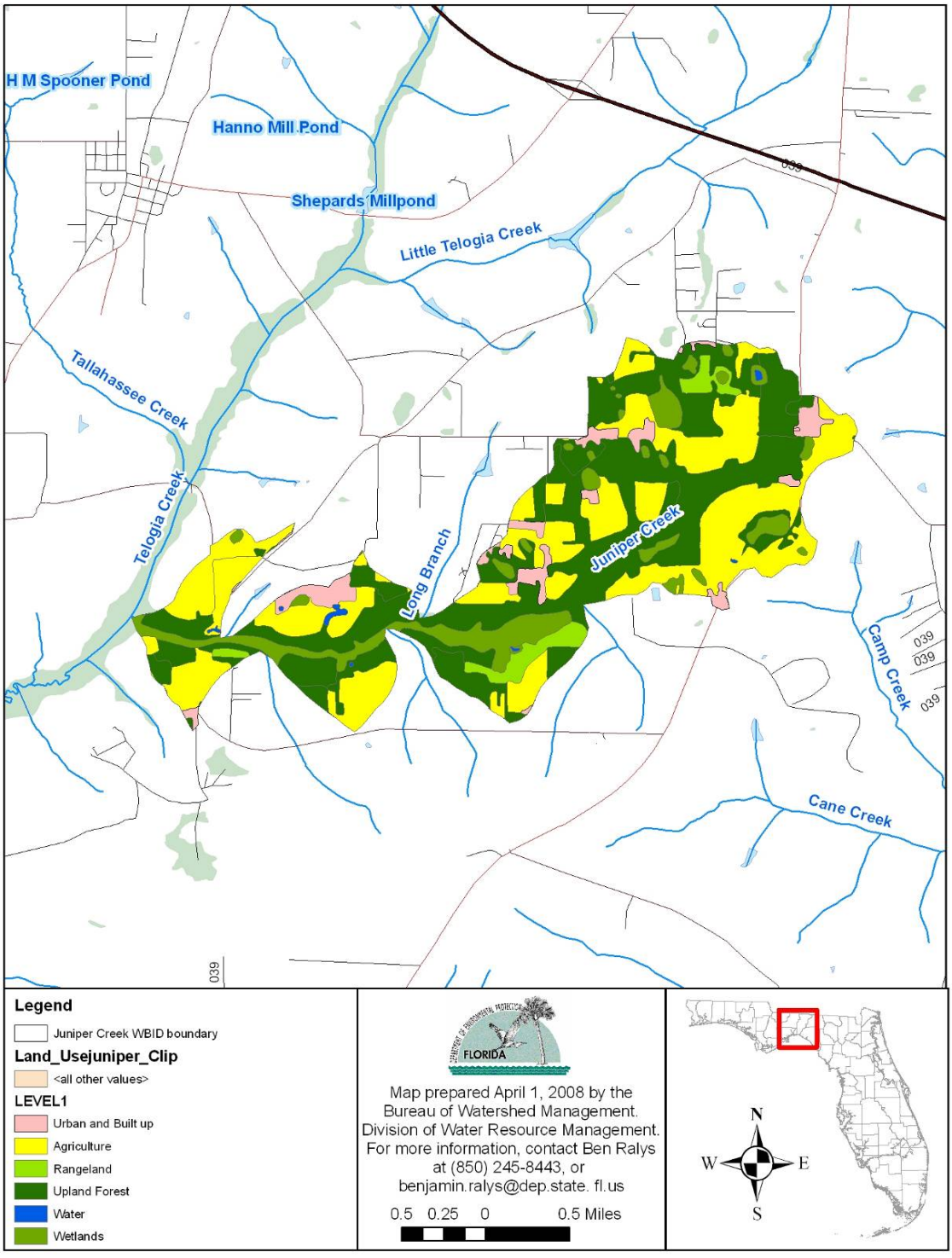
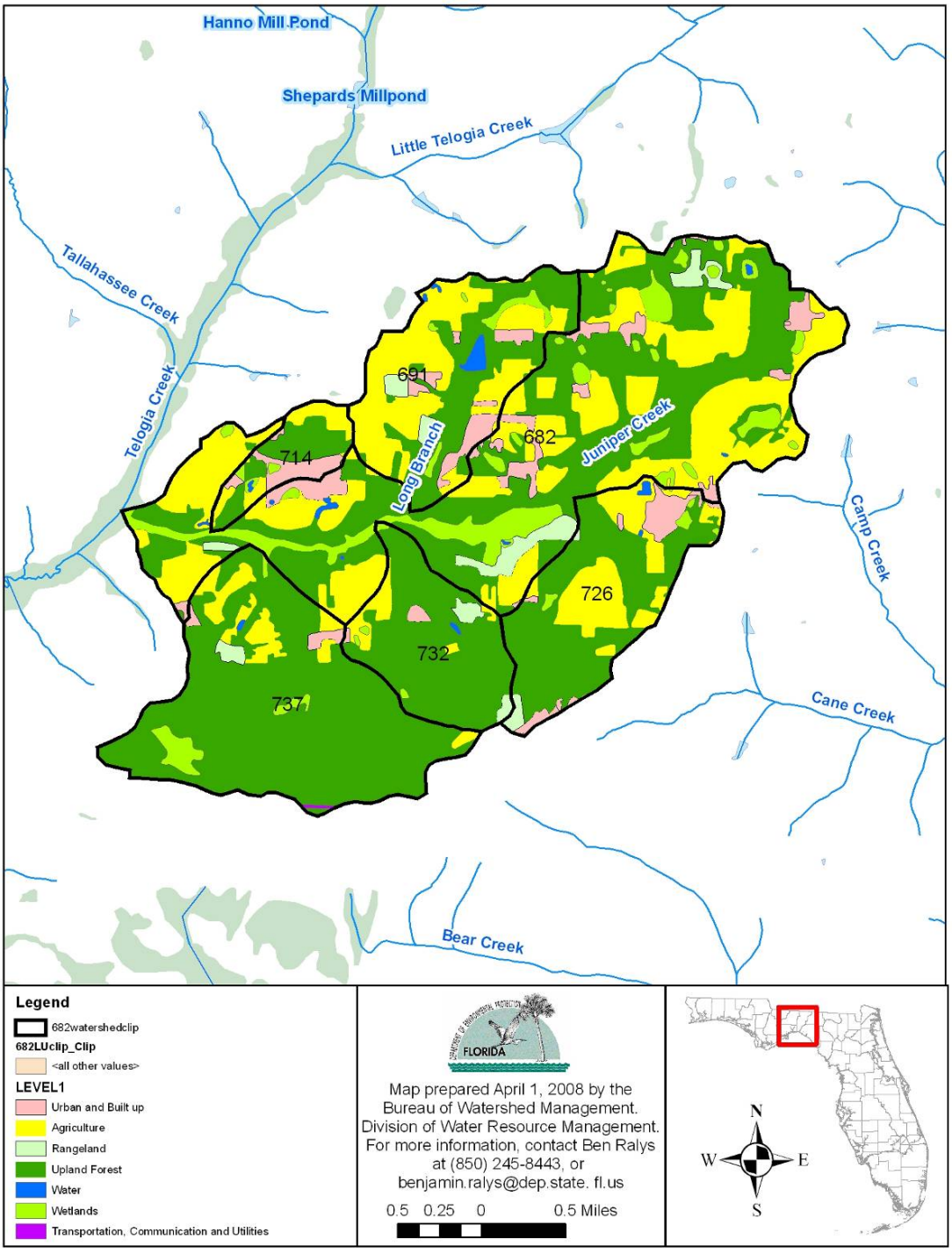


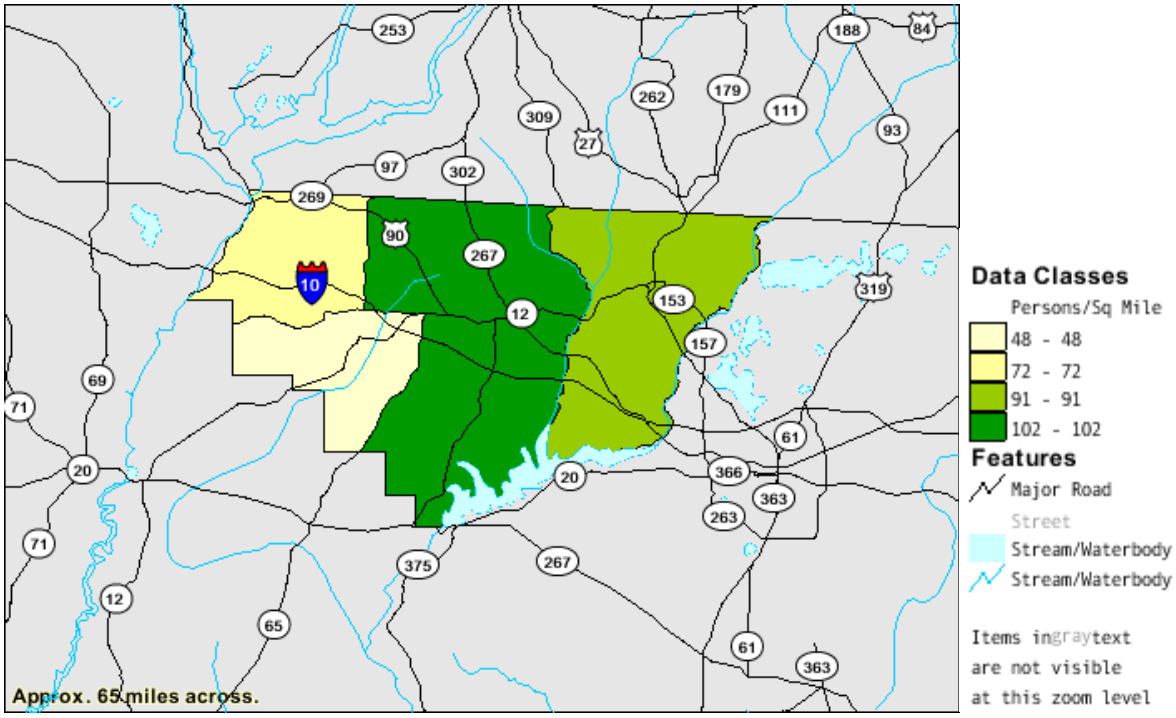
Figure 4.2b. Principal Land Uses in the Juniper Creek Watershed, WBIDs 682, 691, 714, 737, 732, and 726



Population

According to the U.S Census Bureau (2008), the population density in Gadsden County in the year 2000 was at or less than 87.4 people/mi^2 (10 persons/mi^2 is the minimum used by the Census Bureau) (**Figure 4.3**). The Bureau reports that in Gadsden County, which includes WBIDs 682, 691, 714, 737, 732, and 726, the total population for 2000 was 45,087, and the county has 15,867 occupied housing units and 17,703 total housing units. For all of Gadsden County, the Census Bureau reported a housing density of 34.3 housing units/mi^2, placing the county among the lowest in housing densities in Florida (U.S. Census Bureau Website, 2008). This is also supported by land use coverage, which shows that only 5.39 percent of land use in the Juniper Creek Watershed is delineated as urban and built-up.

Figure 4.3. Population Density in Gadsden County, Florida



Septic Tanks

Onsite sewage treatment and disposal systems (OSTDS's), including septic tanks, are commonly used where providing central sewer is not cost-effective or practical. When properly sited, designed, constructed, maintained, and operated, OSTDS's are a safe means of disposing of domestic waste. The effluent from a well-functioning OSTDS is comparable to secondarily treated wastewater from a sewage treatment plant. When not functioning properly, OSTDS's can be a source of coliforms, pathogens, and other pollutants to both ground water and surface water.

As of 2007, Gadsden County had roughly 16,381 septic systems (Florida Department of Health [FDOH] Website, 2008). Data for septic tanks are based on 1970 to 2007 Census results, with year-by-year additions based on new septic tank construction. The data do not reflect septic tanks that have been removed going back to 1970. From fiscal years 1991 to 2007, 1,761 permits for repairs were issued (FDOH Website, 2008). Based on the number of permitted septic tanks and housing units located in the county, approximately 8 percent of the housing units are connected to a wastewater treatment facility, with the remaining 92 percent using septic tank systems.

The Juniper Creek Watershed comprises 8.83 mi^2, or approximately 1.7 percent of the total land area of Gadsden County (528.13 mi^2). The number of septic tanks in the watershed is not known, but using the ratio of Level 1 urban and built-up land use in the watershed to that in Gadsden County (5.913E-03), the number of septic tanks is estimated to be about 97. Using these numbers (FDOH Website, 2007) and an estimate of 70 gallons/day/person (EPA, 2001), a loading of 3.445 X 10^{10} colonies/day is derived. These estimations, as shown in **Table 4.3,** constitute 0.212 percent of the total load to the Juniper Creek Watershed.

Table 4.3. Estimation of Fecal Coliform Loading from Failed Septic Tanks in the Juniper Creek Watershed

Estimated Population Density and Area	Estimated Number of Septic Tanks in Area	Estimated Number of Tank Failures	Estimated Concentration from Failed Tanks (cfu/100mL)	Gallons/ Person/ Day	Estimated Number of People per Household	Estimated Load from Failing Tanks (cfu/day)
Standard Loading	1.0	1.0	1.000E+06	70	2.6	6.624E+09
Juniper Creek Watershed	97.00	5.00	1.000E+06	70	2.6	3.445E+10
Gadsden County	16,381.00	819.00	1.000E+06	70	2.6	5.643E+12

Sanitary Sewer Overflows

Sanitary sewer overflows (SSOs) can also be a potential source of fecal bacteria pollution. Human sewage can be introduced into surface waters even when storm and sanitary sewers are separated. Leaks and overflows are common in many older sanitary sewers where capacity is exceeded, high rates of infiltration and inflow occur (i.e., outside water gets into pipes, reducing capacity), frequent blockages occur, or sewers are simply falling apart due to poor joints or pipe materials. Power failures at pumping stations are also a common cause of SSOs. The greatest risk of an SSO occurs during storm events; however, few comprehensive data are available to quantify SSO frequency and bacteria loads in most watersheds.

Fecal coliform loading from sewer line leakage can be calculated, based on the number of people in the watershed, typical per household generation rates, the typical fecal coliform concentration in domestic sewage, and assuming a leakage rate of 5 percent (Culver et al., 2002). Based on these assumptions, a rough estimate of fecal coliform loads from leaks and

overflows of sanitary sewer lines in the Juniper Creek Watershed is equal to 1.315E+10 (see **Appendix B** for the full calculation).

Livestock

Another potential nonpoint source of coliform includes livestock and other agricultural animals. **Table 4.4a** summarizes cattle populations (U.S. Department of Agriculture [USDA], 2002) in Gadsden County for 2002, and **Table 4.4b** summarizes populations of other agricultural animals in the county in 2002. Gadsden County ranked as one of the lowest counties in the state in terms of the total number of cattle and calves and beef cows. Approximately 28.17 percent of the Juniper Creek Watershed is specifically categorized as agriculture under the Level 1 land use system.

Table 4.4a. Summary of the Cattle Population in Gadsden County, 2002

Livestock	Year 2002	
	Inventory	Sold
Cattle and Calves	4,564	2,518
Dairy Cattle	46	
Beef Cattle	2,710	

Source: USDA, 2002.

Table 4.4b. Summary of Agricultural Animal Populations (Excluding Cattle)

Livestock	Year 2002	
	Inventory	Sold
Hogs and Pigs	551	
Poultry		
Layers and pullets 20 weeks and Older	100	
Broilers		
Sheep and Lambs	66	
Horses	500	5
Milk Goats		
Goats, except Angora and Milk	365	46
Ducks	22	
Geese	25	
Pheasants	6	
Other Poultry		
Mules, Burros, and Donkeys	14	
Rabbits		

Source: USDA, 2002.

Pets–Domestic Animals

Another possible source of fecal coliform bacteria in the Juniper Creek Watershed could be pets or domestic animals. The Department has been unable to obtain data on the number of dogs in the area; however, estimates can be made using literature-based values of dog ownership rates. Using dog-to-household ratio estimates from the American Veterinary Medical Association (AVMA) (2007), the approximate loading to the watershed from dogs is 2.7207E+11 counts per day. Similarly, the number of horses and ponies can be estimated for a load of 1.9701E+09 counts per day. The total domestic animal load (excluding cats) is 2.7404E+11 counts per day, which is 1.25 percent of the total internal load.

Boats

There are no houseboats in the Juniper Creek Watershed.

Wildlife

The most recent TMDL work (Benham, 2007) quantifying wildlife contributions to fecal coliform divides the load among eight categories of wildlife: deer, raccoons, muskrats, beavers, geese, ducks, wild turkeys, and other. Wildlife are assigned to a habitat they would normally frequent. For example, beaver, geese, and ducks are assigned to a buffer 91 meters wide along the perimeter of main streams and impoundments, while deer are assigned to the entire watershed. The white-tailed deer population has been estimated (Department, 1998) at various densities (12.8/mi^2), as shown in **Appendix B**. Migratory waterfowl and other bird populations have been estimated annually from 1998–2006 (Florida Fish and Wildlife Conservation Commission [FFWCC], 2008). The value used for bird density (0.44/ mi^2) is a composite of the largest species by size for the county. The total load from wildlife is estimated as 3.41E+10 counts per day, or 0.155 percent of the total.

Spills

The Florida Department of Community Affairs (FDCA) (2007) maintains a Website (www.eoconline.org) that lists pollutant spills by date, time, county, reported amount, and description. Pollutants may be wastewater, petroleum, or other types of waste. **Appendix C** lists the summaries (Ziegmont, 2005) for Gadsden County. Using the annual estimate of gallons spilled and a fecal concentration corresponding to raw sewage, an estimate of annual loading can be made. However, at this time, basin-specific data are not available to make this calculation.

4.3 Source Summary

Table 4.5 summarizes the daily average fecal coliform loadings (from 1997 through 2006) from runoff, septic tank leakage, wildlife, pets, and livestock in the Juniper Creek watershed. **Appendix D** provides additional details

Table 4.5. Estimated Average Daily Quantity of Internal Fecal Coliform Loads to the Juniper Creek Watershed, 1997–2006

Nonpoint Source Category	Internal Loads to Juniper Creek Watershed	% of Total Load
Total Livestock	2.16E+13	9.84E+01
Total Wildlife	3.41E+10	1.55E-01
Total Domestic Animals (Excluding Cats)	2.74E+11	1.25E+00
Total Septic	4.65E+10	2.12E-01
Total	**2.19E+13**	**1.00E+02**

Note: Total septic includes sewer line leaks and failed septic tanks.
See **Appendix B.**

The information provided in this chapter consists of estimates and is presented for reference purposes to help guide the BMAP process. It was not used in the percent reduction calculation of this TMDL.

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

The methodology used for this TMDL was the "percent reduction" methodology. The Department generally prefers to use the load duration curve or "Kansas" method for coliform TMDLs, but this method could not be used because there are no stream-gauging stations on Juniper Creek. To determine the TMDL, the percent reduction that would be required for each of the exceedances to meet applicable criteria was determined, and the median value of all of the reduction for fecal determined the overall required reduction, and therefore the TMDL.

5.1.1 Data Used in the Determination of the TMDL

Six sampling stations in the Juniper Creek Watershed that have coliform observations. The Department was the primary data collector. The 6 sampling stations were sampled between August 29, 1979, and August 27, 2007. Of the 28 samples collected, 14 samples exceeded the 400 cfu/100mL fecal coliform criterion. Additional sampling was conducted by the NWFWMD and Biological Research Associates, as well as permitted facility sampling of the creek for Quincy Farms. **Figure 5.1** shows the locations of these sites, while **Tables 5.1a** and **5.1b** provide a brief statistical overview of the observed data at these sites. **Figure 5.2** contains a chart showing the observed data over time.

Figure 5.1. Monitoring Sites in the Juniper Creek Watershed, WBIDs 682, 691, 714, 737, 732, and 726

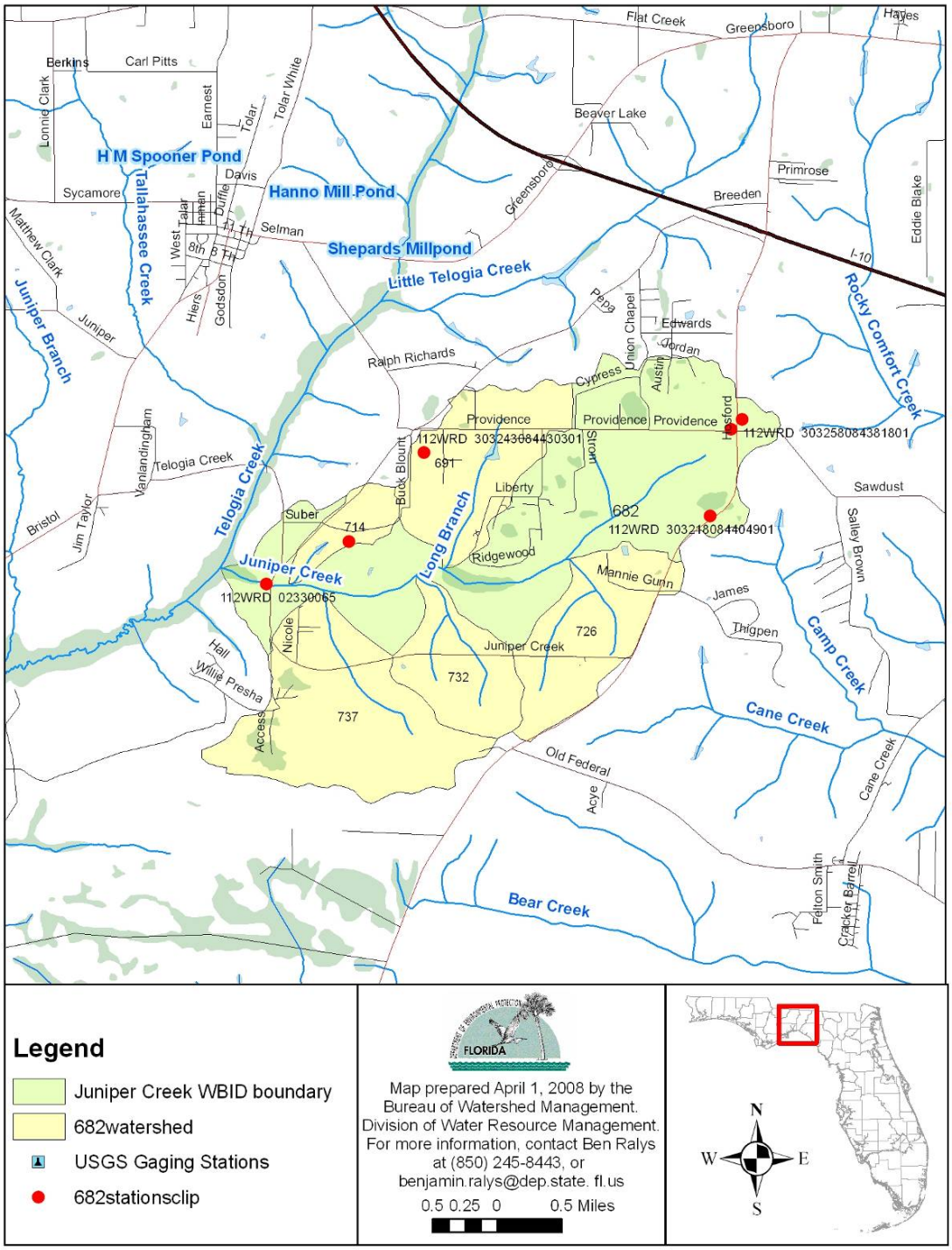


Table 5.1a. Statistical Table of Observed Data for Juniper Creek, WBID 682

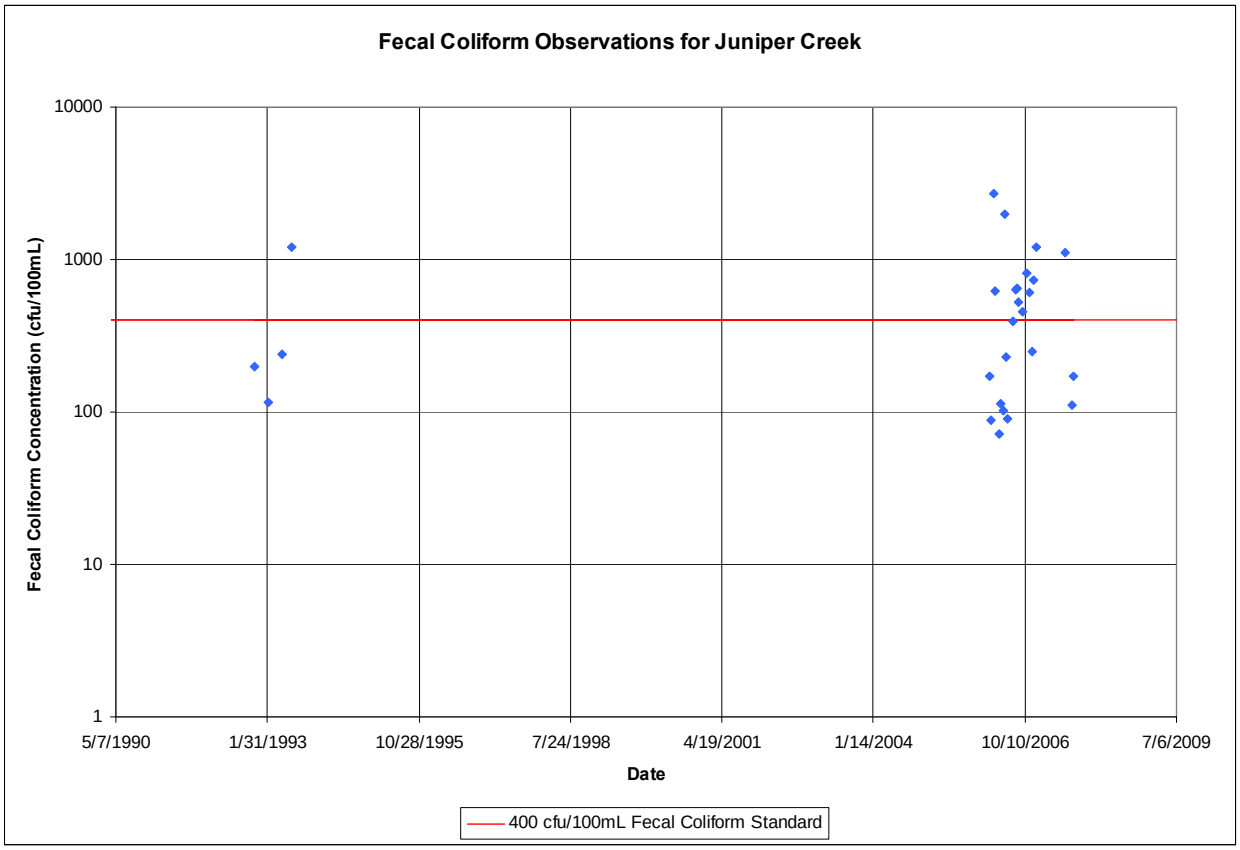
WBID	Station	Date	Time	Result (counts/ 100mL
682	21FLPNS 303148084441501	4/26/2006	1200	72
682	21FLQA	8/29/1979	1315	1,024
682	21FLNWFD303148084441501	11/9/1992	845	200
682	21FLNWFD303148084441501	2/8/1993	1330	116
682	21FLNWFD303148084441501	5/10/1993	1200	240
682	21FLNWFD303148084441501	7/12/1993	1200	1,200
682	21FLPNS 303148084441501	2/15/2006	1420	170
682	21FLPNS 303148084441501	3/1/2006	1415	88
682	21FLPNS 303148084441501	3/21/2006	1400	2,700
682	21FLPNS 303148084441501	3/29/2006	1130	620
682	21FLPNS 303148084441501	5/3/2006	1025	114
682	21FLPNS 303148084441501	5/18/2006	1115	102
682	21FLPNS 303148084441501	5/31/2006	1030	2,000
682	21FLPNS 303148084441501	6/8/2006	1200	230
682	21FLPNS 303148084441501	6/19/2006	1050	90
682	21FLPNS 303148084441501	7/20/2006	1205	390
682	21FLPNS 303148084441501	8/10/2006	1040	630
682	21FLPNS 303148084441501	8/21/2006	1317	645
682	21FLPNS 303148084441501	8/31/2006	1130	530
682	21FLPNS 303148084441501	9/27/2006	1145	450
682	21FLPNS 303148084441501	10/25/2006	1510	809
682	21FLPNS 303148084441501	11/13/2006	1145	605
682	21FLPNS 303148084441501	11/28/2006	1130	250
682	21FLPNS 303148084441501	12/6/2006	1045	736
682	21FLPNS 303148084441501	12/20/2006	1234	1,200
682	**21FLBRA 682-A**	**7/2/2007**	**1539**	**1,110***
682	21FLBRA 682-A	8/13/2007	1632	110
682	21FLBRA 682-A	8/27/2007	1122	170

*Bold rows indicate that values have been averaged.

Table 5.1b. Summary of Statistical Table of Observed Data for Juniper Creek, WBID 682

WBID	Total Number of Samples	Geometric Mean (N/100mL)	Number of Samples above Standard Concentration (FC>400[N/100mL])	Minimum Concentration (N/100mL)	Maximum Concentration (N/100mL)
682	**28**	**363.74**	**14**	**72**	**2,700**

Figure 5.2. Chart of Recent Observations of Fecal Coliform in the Juniper Creek Watershed, WBIDs 682, 691, 714, 737, 732, and 726



5.1.2 TMDL Development Process

Exceedances of the state criterion were compared with the criterion of 400 counts/100mL. For each individual exceedance, an individual required reduction was calculated using the following:

$$\textbf{(1)}\ \frac{\textbf{[(observed value) – (state criterion)] x 100}}{\textbf{(observed value)}}$$

After the individual results were calculated, the median of the individual values was calculated, which is 48.10 percent. This means that in order to meet the state criterion of 400 counts/100mL, a 48.10 percent reduction in current loading is necessary, and this would therefore be the TMDL for Juniper Creek. **Table 5.2** shows the individual reduction calculations for Juniper Creek, including all exceedances, and **Table 5.1.b** provides a summary of data used in the calculation of the TMDL.

Table 5.2. Calculation of Reductions for the Fecal Coliform TMDL for Juniper Creek, WBID 682

WBID	Station Number	Date	Time	Result	Required Reduction
682	21FLPNS 303148084441501	9/27/2006	1145	450	11.111
682	21FLPNS 303148084441501	8/31/2006	1130	530	24.528
682	21FLPNS 303148084441501	11/13/2006	1145	605	33.884
682	21FLPNS 303148084441501	3/29/2006	1130	620	35.484
682	21FLPNS 303148084441501	8/10/2006	1040	630	36.508
682	21FLPNS 303148084441501	8/21/2006	1317	645	37.984
682	21FLPNS 303148084441501	12/6/2006	1045	736	45.652
682	21FLPNS 303148084441501	10/25/2006	1510	809	50.556
682	21FLQA	8/29/1979	1315	1024	60.938
682	**21FLBRA 682-A**	**7/2/2007**	**1539**	**1110**	**63.964**
682	21FLNWFD303148084441501	7/12/1993	1200	1200	66.667
682	21FLPNS 303148084441501	12/20/2006	1234	1200	66.667
682	21FLPNS 303148084441501	5/31/2006	1030	2000	80.000
682	21FLPNS 303148084441501	3/21/2006	1400	2700	85.185
	Median			**772.5**	**48.104**

*Bold rows indicate that values have been averaged.

Results are in Counts/ 100mL

5.1.3 Critical Conditions/Seasonality

The critical condition for coliform loadings in a given watershed depends on many factors, including the presence of point sources and the land use pattern in the watershed. Typically, the critical condition for nonpoint sources is an extended dry period followed by a rainfall runoff event. During the wet weather period, rainfall washes off coliform bacteria that have built up on the land surface under dry conditions, resulting in the wet weather exceedances. However, significant nonpoint source contributions can also appear under dry conditions without any major surface runoff event. This usually happens when nonpoint sources contaminate the surficial aquifer, and fecal coliform bacteria are brought into the receiving waters through baseflow. In addition, as described above, livestock that have direct access to the receiving water can also contribute to the exceedance during dry weather. The critical condition for point source loading typically occurs during periods of low stream flow, when dilution is minimized.

Chapter 6: DETERMINATION OF THE TMDL

6.1 Expression and Allocation of the TMDL

The objective of a TMDL is to provide a basis for allocating acceptable loads among all of the known pollutant sources in a watershed so that appropriate control measures can be implemented and water quality standards achieved. A TMDL is expressed as the sum of all point source loads (wasteload allocations, or WLAs), nonpoint source loads (load allocations, or LAs), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$\mathbf{TMDL = \sum WLAs + \sum LAs + MOS}$$

As discussed earlier, the WLA is broken out into separate subcategories for wastewater discharges and stormwater discharges regulated under the NPDES Program:

$$\mathbf{TMDL \cong \sum WLAs_{wastewater} + \sum WLAs_{NPDES\ Stormwater} + \sum LAs + MOS}$$

It should be noted that the various components of the revised TMDL equation may not sum up to the value of the TMDL because (a) the WLA for NPDES stormwater is typically based on the percent reduction needed for nonpoint sources and is also accounted for within the LA, and (b) TMDL components can be expressed in different terms (for example, the WLA for stormwater is typically expressed as a percent reduction, and the WLA for wastewater is typically expressed as mass per day).

WLAs for stormwater discharges are typically expressed as "percent reduction" because it is very difficult to quantify the loads from MS4s (given the numerous discharge points) and to distinguish loads from MS4s from other nonpoint sources (given the nature of stormwater transport). The permitting of stormwater discharges also differs from the permitting of most wastewater point sources. Because stormwater discharges cannot be centrally collected, monitored, and treated, they are not subject to the same types of effluent limitations as wastewater facilities, and instead are required to meet a performance standard of providing treatment to the "maximum extent practical" through the implementation of best management practices (BMPs).

This approach is consistent with federal regulations (40 CFR § 130.2[I]), which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or **other appropriate measure**. The TMDL for the Juniper Creek Watershed is expressed in terms of percent reduction, and represents the maximum annual fecal coliform load the watershed can assimilate and maintain the fecal coliform criterion (**Table 6.1**).

Table 6.1. TMDL Components for the Juniper Creek Watershed, WBID 682

WBID	Parameter	TMDL (% Reduction)	WLA		LA (% Reduction)	MOS
			Wastewater (cfu/100mL)	NPDES Stormwater		
Juniper Creek (682)	Fecal Coliform	48.10%	Point sources must meet permit limits	N/A*	48.10%	Implicit

† The percent reduction is based on the 10th through 90th percentile of recurrence intervals minus the WLA; see **Table 5.4**.
* Any newly permitted stormwater discharges are subject to achieving the Class III water quality criterion for fecal coliform to the maximum extent practicable.

N/A –Not Applicable

6.2 Load Allocation

Based on a load duration curve approach similar to that developed by Kansas (Stiles, 2002), a fecal coliform reduction of 48.10 percent is needed from nonpoint sources in the Juniper Creek Watershed. It should be noted that the LA includes loading from stormwater discharges regulated by the Department and the water management districts that are not part of the NPDES Stormwater Program (see **Appendix A**).

6.3 Wasteload Allocation

Currently, there is only one point source permitted NPDES wastewater discharge in the watershed. Any new potential discharger is expected to comply with the Class III water quality criterion for coliform bacteria.

6.3.1 NPDES Wastewater Discharges

As mentioned previously, there is only one permitted wastewater facility with a discharge permit in the Juniper Creek Wwatershed. Any new potential discharger is expected to comply with the Class III water quality criterion for coliform bacteria.

6.3.2 NPDES Stormwater Discharges

There are currently no NPDES MS4 permits in the Juniper Creek watershed.

6.4 Margin of Safety

Consistent with the recommendations of the Allocation Technical Advisory Committee (Department, 2001), an implicit MOS was used in the development of this TMDL. An implicit MOS was provided by the conservative decisions associated with a number of modeling assumptions and the development of assimilative capacity.

For fecal coliform, an implicit MOS was inherently incorporated by using 400 MPN/100mL of fecal coliform as the water quality target for each and every sampling event, instead of setting the criterion as no more than 10 percent of the samples exceeding 400 MPN/100mL. For fecal coliform TMDLs, using the correlation lines fitting through only the existing loadings that exceeded the allowable loadings could overestimate the actual existing loading, which makes the estimation more conservative and therefore adds to the MOS. An additional MOS was included in the TMDL by not allowing any exceedances of the state criterion, even though intermittent natural exceedances of the criterion would be expected and would be taken into account when determining impairment.

Chapter 7: NEXT STEPS: IMPLEMENTATION PLAN DEVELOPMENT AND BEYOND

7.1 Basin Management Action Plan

Following the adoption of this TMDL by rule, the next step in the TMDL process is to develop an implementation plan for the TMDL, which will be a component of the BMAP for the Juniper Creek Watershed. This document will be developed over the next year in cooperation with local stakeholders and will attempt to reach consensus on more detailed allocations and on how load reductions will be accomplished. The BMAP will include the following:

- *Appropriate allocations among the affected parties;*
- *A description of the load reduction activities to be undertaken;*
- *Timetables for project implementation and completion;*
- *Funding mechanisms that may be utilized;*
- *Any applicable signed agreement;*
- *Local ordinances defining actions to be taken or prohibited;*
- *Local water quality standards, permits, or load limitation agreements; and*
- *Monitoring and follow-up measures.*

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Appendix A: Background Information on Federal and State Stormwater Programs

In 1982, Florida became the first state in the country to implement statewide regulations to address the issue of nonpoint source pollution by requiring new development and redevelopment to treat stormwater before it is discharged. The Stormwater Rule, as authorized in Chapter 403, F.S., was established as a technology-based program that relies on the implementation of BMPs that are designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Rule 62-40, F.A.C. In 1994, the Department's stormwater treatment requirements were integrated with the stormwater flood control requirements of the state's water management districts, along with wetland protection requirements, into the Environmental Resource Permit regulations.

Rule 62-40, F.A.C., also requires the water management districts to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a Surface Water Improvement and Management (SWIM) plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL. To date, stormwater PLRGs have been established for Tampa Bay, Lake Thonotosassa, the Winter Haven Chain of Lakes, the Everglades, Lake Okeechobee, and Lake Apopka. No PLRG had been developed for Newnans Lake when this report was published.

In 1987, the U.S. Congress established Section 402(p) as part of the federal Clean Water Act Reauthorization. This section of the law amended the scope of the federal NPDES permitting program to designate certain stormwater discharges as "point sources" of pollution. The EPA promulgated regulations and began implementing the Phase I NPDES stormwater program in 1990. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific standard industrial classification (SIC) codes, construction sites disturbing 5 or more acres of land, and master drainage systems of local governments with a population above 100,000, which are better known as MS4s. However, because the master drainage systems of most local governments in Florida are interconnected, the EPA implemented Phase I of the MS4 permitting program on a countywide basis, which brought in all cities (incorporated areas), Chapter 298 urban water control districts, and the Florida Department of Transportation throughout the 15 counties meeting the population criteria. The Department received authorization to implement the NPDES stormwater program in 2000.

An important difference between the federal NPDES and the state's stormwater/environmental resource permitting programs is that the NPDES Program covers both new and existing discharges, while the state's program focuses on new discharges only. Additionally, Phase II of the NPDES Program, implemented in 2003, expands the need for these permits to construction sites between 1 and 5 acres, and to local governments with as few as 1,000 people. While these urban stormwater discharges are now technically referred to as "point sources" for the purpose of regulation, they are still diffuse sources of pollution that cannot be easily collected and treated by a central treatment facility, as are other point sources of pollution such as domestic and industrial wastewater discharges. It should be noted that all MS4 permits issued in Florida include a reopener clause that allows permit revisions to implement TMDLs when the implementation plan is formally adopted.

Appendix B: Summary of Land Use Loads by Category

Land Use Information for the Juniper Creek Watershed

LAND USE LEVEL 1		GADSDEN COUNTY FL		JUNIPER CREEK	
		TOTAL		TOTAL	
		SQMI	%	SQMI	%
1000	URBAN AND BUILT UP	3.39E+01	6.42E+00	2.00E-01	5.17E+00
2000	AGRICULTURE	6.86E+01	1.30E+01	1.43E+00	3.68E+01
3000	RANGELAND	1.37E+01	2.59E+00	1.22E-01	3.16E+00
4000	UPLAND FORESTS	3.64E+02	6.90E+01	1.73E+00	4.46E+01
5000	WATER	1.43E+01	2.71E+00	1.32E-02	3.41E-01
6000	WETLANDS	2.84E+01	5.38E+00	3.84E-01	9.92E+00
7000	BARREN LAND	8.21E-02	1.56E-02	0.00E+00	0.00E+00
8000	TRANSPORTATION AND UTILITIES	4.87E+00	9.22E-01	0.00E+00	0.00E+00
	TOTAL LAND	5.14E+02	9.73E+01	3.86E+00	9.97E+01
	TOTAL LAND+WATER	5.28E+02	1.00E+02	3.87E+00	1.00E+02
	TOTAL CENSUS 2000	5.28E+02		3.12E+00	
	URBAN RATIO WBID/COUNTY	1		5.91E-03	
	AGRICULTURE RATIO WBID/COUNTY	1		2.08E-02	
	NATURAL RATIO WBID/COUNTY	1		7.71E-03	
	TOTAL SEPTIC TANKS THRU 2006	16381		9.69E+01	
	TOTAL REPAIRS 1991 THRU 2006	1761		1.04E+01	
	TOTAL FAILURES	8.19E+02		4.84E+00	
	TOTAL 2000 HOUSEHOLDS	15867		9.38E+01	
	TOTAL HOUSEBOATS				
	TOTAL 1990 PUBLIC SEWER	6046		3.57E+01	
	TOTAL 1990 SEPTIC	8455		5.00E+01	
	TOTAL 1990 OTHER	358		2.12E+00	
	TOTAL 2000 POPULATION	4.51E+04		2.67E+02	

Fecal Coliform Loading from Animals in the Juniper Creek Watershed

Animal Type	Fecal Coliform Load Produced by Animal (cts/animal/day)	Number of Animals in Gadsden County	County Area (mi^2)	Animal Density in Leon County (#/mi^2)	References	Juniper Creek Watershed Drainage Area (mi^2)	Number of Animals in Juniper Creek Watershed	Load Produced by Animals in Juniper Creek Watershed (cts/day)
LIVESTOCK								
Cattle and Calves Inventory	1.04E+11	4564	5.28E+02			3.87E+00	9.50E+01	9.88E+12
Cattle and Calves Sold	1.04E+11	2518	5.28E+02			3.87E+00	5.24E+01	5.45E+12
Dairy Cattle Inventory	1.01E+11	46	5.28E+02		C	3.87E+00	9.57E-01	9.65E+10
Beef Cattle Inventory	1.04E+11	2710	5.28E+02		C	3.87E+00	5.64E+01	5.87E+12
Sheep and Lambs Inventory	1.20E+10	66	5.28E+02		C	3.87E+00	1.37E+00	1.65E+10
Sheep and Lambs Sold	1.20E+10	0	5.28E+02			3.87E+00	0.00E+00	0.00E+00
Horses and Ponies Inventory	4.20E+08	500	5.28E+02		C	3.87E+00	1.04E+01	4.37E+09
Horses and Ponies Sold	4.20E+08	5	5.28E+02			3.87E+00	1.04E-01	4.37E+07
Mules, Burros, and Donkeys Inventory	4.20E+08	14	5.28E+02		C,E	3.87E+00	2.91E-01	1.22E+08
Mules, Burros, and Donkeys Sold	4.20E+08		5.28E+02			3.87E+00	0.00E+00	0.00E+00
Llamas (~Sheep)	1.20E+10		5.28E+02		C,E	3.87E+00	0.00E+00	0.00E+00
Bison (~Beef Cattle)	1.04E+11		5.28E+02		C,E	3.87E+00	0.00E+00	0.00E+00
Deer	5.00E+08		5.28E+02		C,E	3.87E+00	0.00E+00	0.00E+00
Elk	5.00E+08		5.28E+02		C,E	3.87E+00	0.00E+00	0.00E+00
Goats, All (~Sheep) Inventory	1.20E+10	365	5.28E+02		C,E	3.87E+00	7.60E+00	9.11E+10
Goats, All (~Sheep) Sold	1.20E+10	46	5.28E+02			3.87E+00	9.57E-01	1.15E+10
Hogs and Pigs Inventory	1.08E+10	551	5.28E+02		C	3.87E+00	1.15E+01	1.24E+11
Hogs and Pigs Sold	1.08E+10		5.28E+02			3.87E+00	0.00E+00	0.00E+00
Layer Chickens Inventory	1.40E+08	70	5.28E+02		C	3.87E+00	1.46E+00	2.04E+08
Layer Chickens Sold	1.40E+08		5.28E+02			3.87E+00	0.00E+00	0.00E+00

Animal Type	Fecal Coliform Load Produced by Animal (cts/animal/ day)	Number of Animals in Gadsden County	County Area (mi^2)	Animal Density in Leon County (#/mi^2)	References	Juniper Creek Watershed Drainage Area (mi^2)	Number of Animals in Juniper Creek Watershed	Load Produced by Animals in Juniper Creek Watershed (cts/day)
Broilers Inventory	1.40E+08		5.28E+02		C	3.87E+00	0.00E+00	0.00E+00
Broilers Sold	1.40E+08		5.28E+02			3.87E+00	0.00E+00	0.00E+00
Turkeys Inventory	9.50E+07	18	5.28E+02		C	3.87E+00	3.75E-01	3.56E+07
Turkeys Sold	9.50E+07		5.28E+02			3.87E+00	0.00E+00	0.00E+00
Ducks Inventory	2.50E+09	22	5.28E+02		C	3.87E+00	4.58E-01	1.14E+09
Ducks Sold	2.50E+09		5.28E+02			3.87E+00	0.00E+00	0.00E+00
Geese Inventory	4.90E+10	25	5.28E+02		C	3.87E+00	5.20E-01	2.55E+10
Geese Sold	4.90E+10		5.28E+02			3.87E+00	0.00E+00	0.00E+00
Emus (~Geese)	4.90E+10		5.28E+02		C,E	3.87E+00	0.00E+00	0.00E+00
Ostriches (~Geese)	4.90E+10		5.28E+02		C,E	3.87E+00	0.00E+00	0.00E+00
Pheasants (~Geese) Inventory	4.90E+10	6	5.28E+02		C,E	3.87E+00	1.25E-01	6.12E+09
Pheasants (~Geese) Sold	4.90E+10		5.28E+02			3.87E+00	0.00E+00	0.00E+00
Pigeons or Squab Inventory	1.60E+08		5.28E+02		C	3.87E+00	0.00E+00	0.00E+00
Pigeons or Squab Sold	1.60E+08		5.28E+02			3.87E+00	0.00E+00	0.00E+00
Quqil (~Pigeon)	1.60E+08		5.28E+02		C	3.87E+00	0.00E+00	0.00E+00
Other			5.28E+02		C	3.87E+00	0.00E+00	0.00E+00
Rabbits Inventory	2.53E+09		5.28E+02		J,K	3.87E+00	0.00E+00	0.00E+00
Rabbits Sold	2.53E+09		5.28E+02		J,K	3.87E+00	0.00E+00	0.00E+00
TOTAL LIVESTOCK			**5.28E+02**		**C**	**3.87E+00**	**0.00E+00**	**2.16E+13**
WILDLIFE			5.28E+02		C	3.87E+00		
Alligators			5.28E+02		C	3.87E+00	0.00E+00	0.00E+00
Black Bears			5.28E+02		C	3.87E+00	0.00E+00	0.00E+00
Raccoons	1.25E+08		5.28E+02		C	3.87E+00	0.00E+00	0.00E+00
Beavers	2.50E+08		5.28E+02		C	3.87E+00	0.00E+00	0.00E+00
Deer	5.00E+08	8.70E+03	5.28E+02		CI	3.87E+00	6.71E+01	3.35E+10
Dolphin, Porpoise, Manatee			5.28E+02		C	3.87E+00	0.00E+00	0.00E+00
Waterfowl	4.90E+10	1.44E+00	5.28E+02		CI	3.87E+00	1.11E-02	5.45E+08
Wild Pigs	1.08E+10		5.28E+02		CI	3.87E+00	0.00E+00	0.00E+00
TOTAL WILDLIFE			**5.28E+02**		**C**	**3.87E+00**		**3.41E+10**

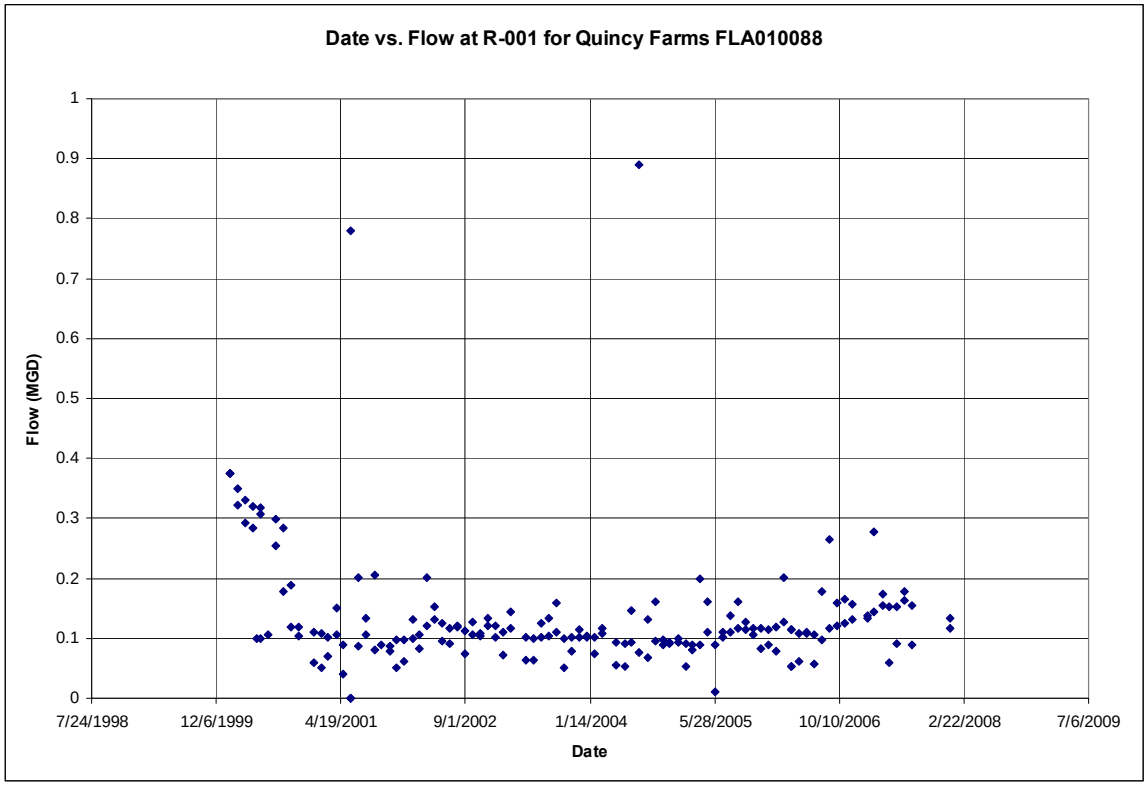
Animal Type	Fecal Coliform Load Produced by Animal (cts/animal/ day)	Number of Animals in Gadsden County	County Area (mi^2)	Animal Density in Leon County (#/mi^2)	References	Juniper Creek Watershed Drainage Area (mi^2)	Number of Animals in Juniper Creek Watershed	Load Produced by Animals in Juniper Creek Watershed (cts/day)
DOMESTIC ANIMALS			5.28E+02		C	3.87E+00		
Dogs	5.00E+09	4.64E+03	5.28E+02	0.58*H H	F	3.87E+00	5.44E+01	2.72E+11
Cats	5.00E+09	5.28E+03	5.28E+02	0.66*H H	F	3.87E+00	6.19E+01	3.10E+11
Horses and Ponies–Pets	4.20E+08	4.00E+02	5.28E+02	0.05*H H	F	3.87E+00	4.69E+00	1.97E+09
TOTAL DOMESTIC			**5.28E+02**			**3.87E+00**		**5.84E+11**
SEPTIC - HUMAN IMPACTS			5.28E+02			3.87E+00		
Human	2.00E+09		5.28E+02			3.87E+00		
Sewer Line Leaks	6.89E+09		5.28E+02			3.87E+00		1.32E+10
Houseboats–Nonmarina	2.00E+09		5.28E+02		C	3.87E+00		
Boats–Marina Slips	2.00E+09		5.28E+02			3.87E+00		0.00E+00
Septic Tanks Failed	6.89E+09		5.28E+02			3.87E+00	4.84E+00	3.34E+10
Septic Tanks Normal			5.28E+02			3.87E+00		
Septic Tanks–ATU	2.76E+08		5.28E+02		H	3.87E+00		
TOTAL SEPTIC			**5.28E+02**			**3.87E+00**		**4.65E+10**
AQUACULTURE								
Fish Farms			5.28E+02			3.87E+00	0.00E+00	
Fish Farms Sold			5.28E+02			3.87E+00	0.00E+00	
Oyster Houses			5.28E+02			3.87E+00	0.00E+00	
TOTAL AQUACULTURE			5.28E+02			3.87E+00	0.00E+00	
TOTAL			**5.28E+02**			**3.87E+00**	**0.00E+00**	**2.22E+13**

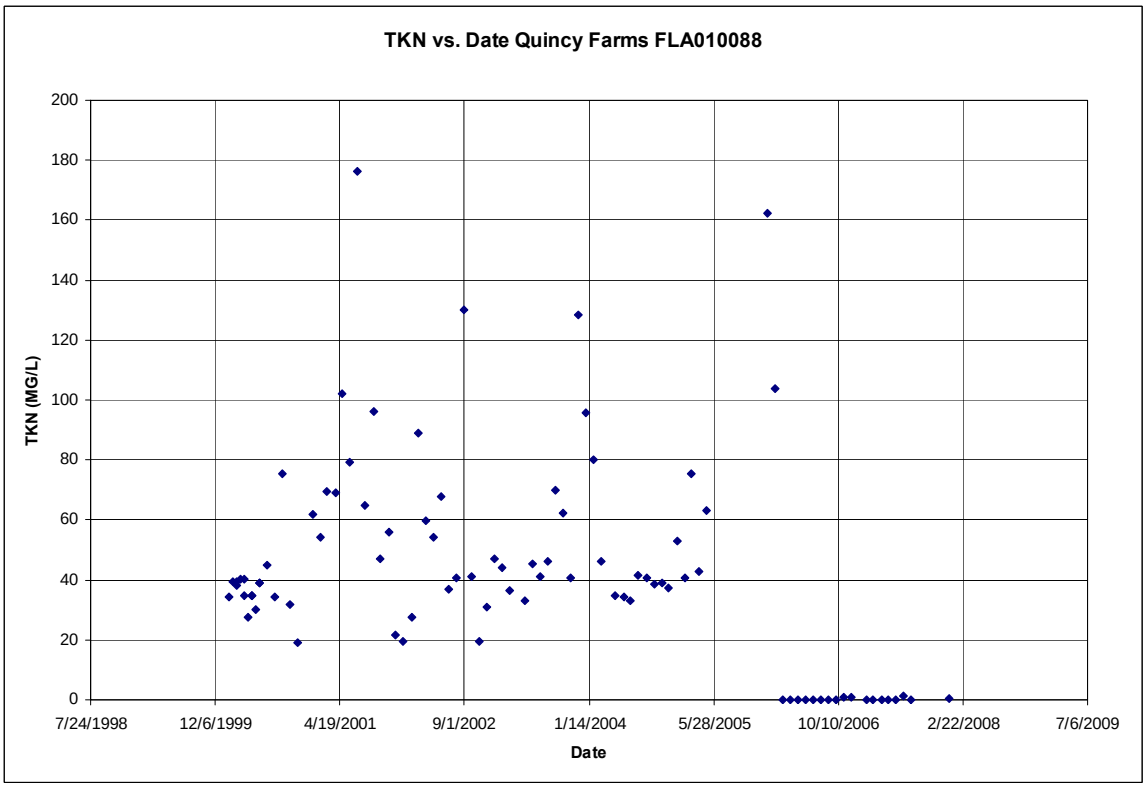
References:

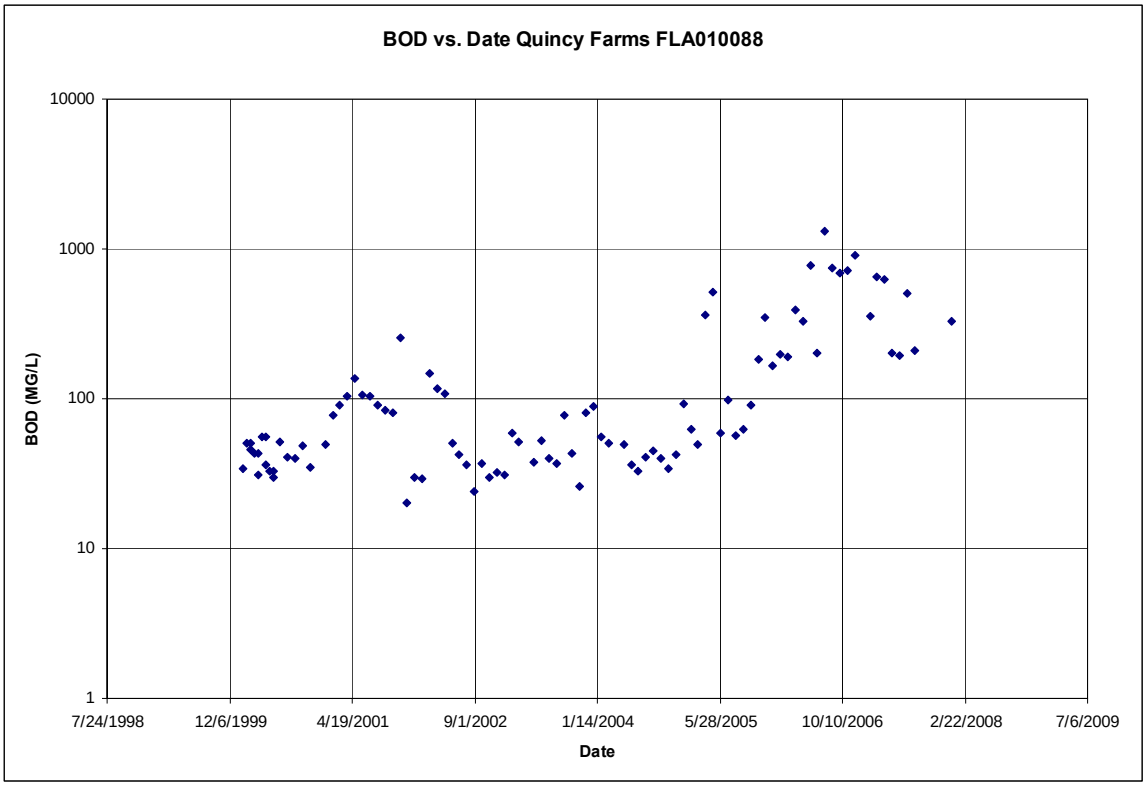
A	USDA Census, 2002; Note A–D indicates confidential data not available at
B	Assume 1 animal per household* 7,180 housing units=7,180.
C	EPA, 2001. Available: http://www.epa.gov/owow/tmdl/pathogen_all.pdf.
D	American Society of Agricultural and Biological Engineers, 1998. Available: http://www.asae.org.
E	Estimated from similar animals.
F	American Veterinary Medical Association, 2002. Available: http://www.avma.org. Dogs=0.58*Households, Cats=0.66*HH, Horses=0.05*HH.
G	Speas, 2004. Range of 500 to 1,900 cfu/100mL or 96 percent removal, use one ATU=0.04*6.89E09 cfu/day.
H	EPA, 2008. Available: http://www.epa.gov/region1/assistance/ceitts/wastewater/techs/delta.html.
I	Knight, 2003.
J	Available: http://www.bae.ncsu/edu/programs/extension/manure.
K	Rhode Island Department of Environmental Management, 2003. Table 8.

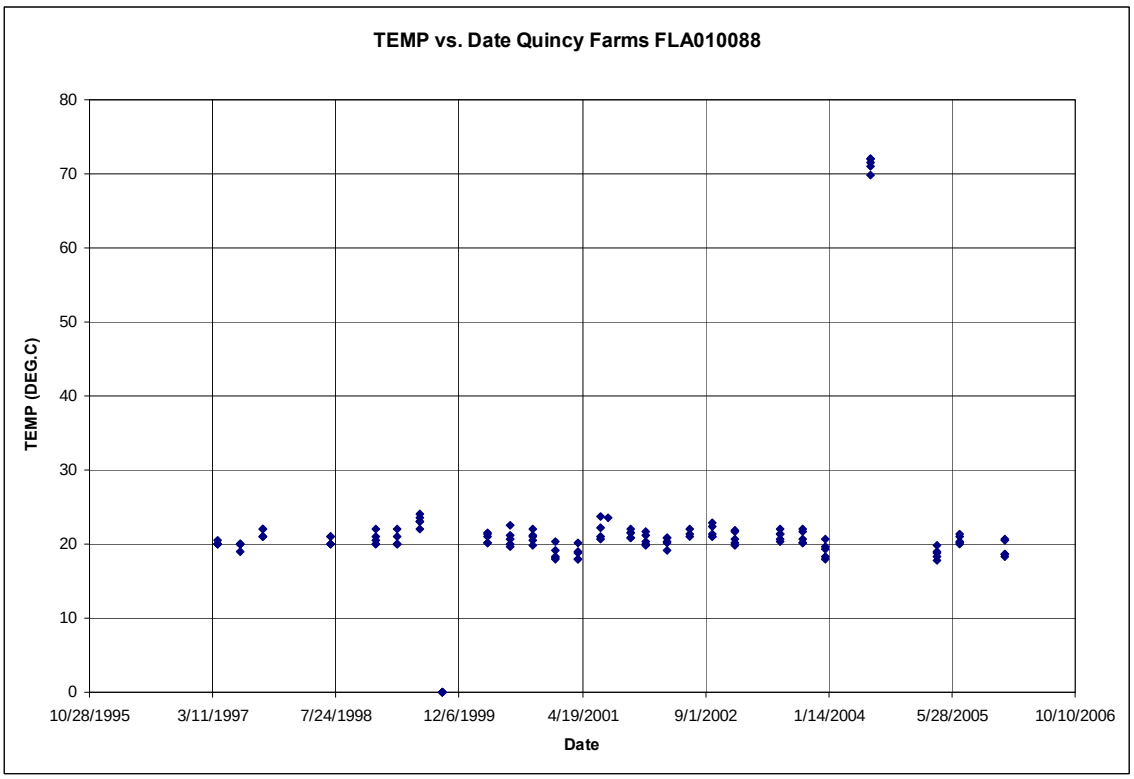
Appendix C: Summary of Permitted Point Source Loads

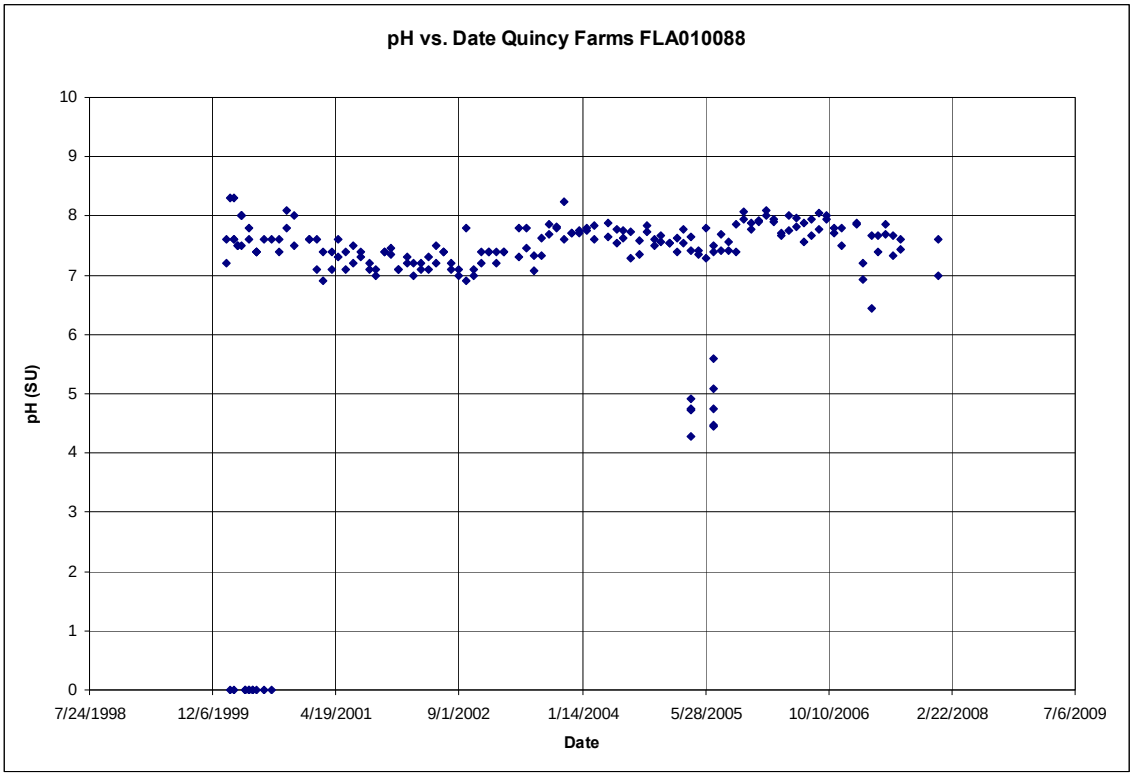
NPDES Permit Number	Facility Name	Units	Max/Min	Annual Average	Monthly Average	Weekly Average	Single Sample	Monitoring Frequency	Sample Type	Monitoring Location Site Number	Discharges to the Juniper Creek Watershed
FLA010088	Quincy Farms			See Permit							Yes

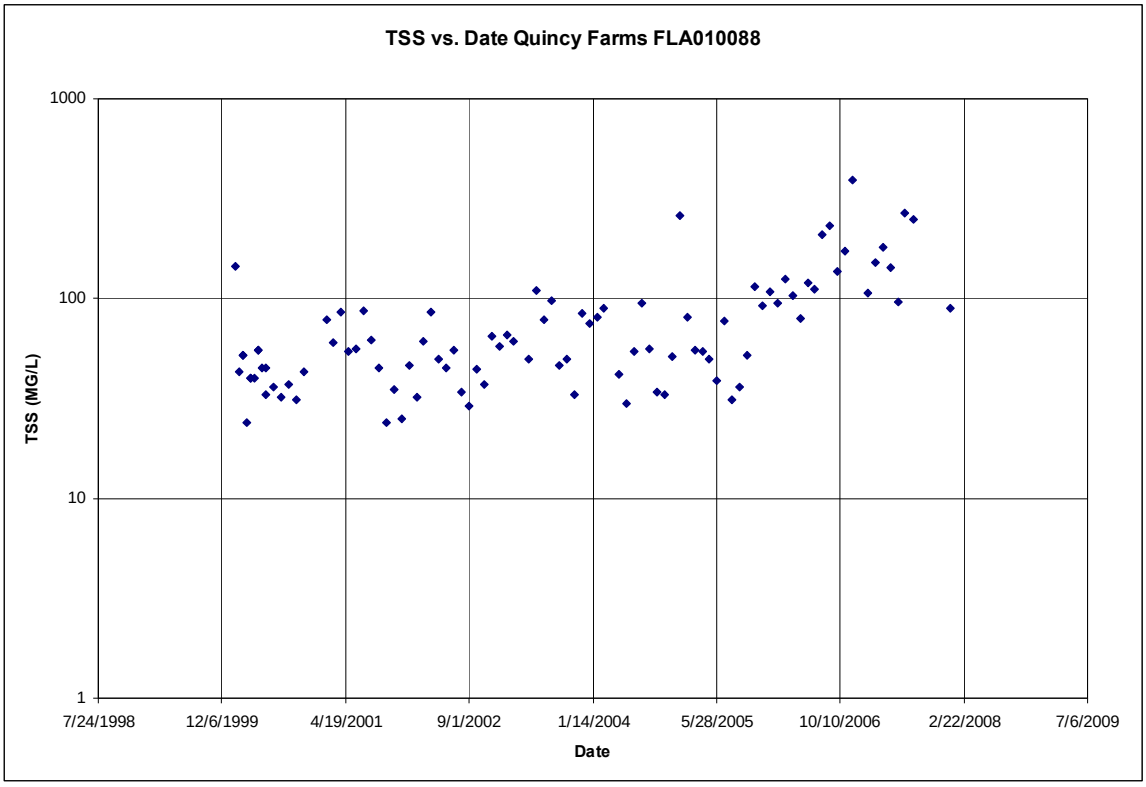



TKN vs. Date Quincy Farms FLA010088
TKN (MG/L)
200
180
160
140
120
100
80
60
40
20
0
7/24/1998
12/6/1999
4/19/2001
9/1/2002
1/14/2004
5/28/2005
10/10/2006
2/22/2008
7/6/2009
Date


BOD vs. Date Quincy Farms FLA010088
BOD (MG/L)
10000
1000
100
10
1
7/24/1998
12/6/1999
4/19/2001
9/1/2002
1/14/2004
5/28/2005
10/10/2006
2/22/2008
7/6/2009
Date


TEMP vs. Date Quincy Farms FLA010088
TEMP (DEG.C)
80
70
60
50
40
30
20
10
0
10/28/1995
3/11/1997
7/24/1998
12/6/1999
4/19/2001
9/1/2002
1/14/2004
5/28/2005
10/10/2006
Date


pH vs. Date Quincy Farms FLA010088
pH (SU)
10
9
8
7
6
5
4
3
2
1
0
7/24/1998
12/6/1999
4/19/2001
9/1/2002
1/14/2004
5/28/2005
10/10/2006
2/22/2008
7/6/2009
Date


TSS vs. Date Quincy Farms FLA010088
1000
100
10
1
TSS (MG/L)
7/24/1998
12/6/1999
4/19/2001
9/1/2002
1/14/2004
5/28/2005
10/10/2006
2/22/2008
7/6/2009
Date

Appendix D: Summary of Measured External Loads

Calculation of External Loads to the Juniper Creek Watershed

Appendix E: Summary of Effluent Data

Facility ID	Facility Name	Office	Facility Type	County	Monitoring Group	Date	Monitoring Location	PCS Code	NODI	Parameter Code	Description	Result Qualifier	Result	Units	Statistical Base
FLA010088	QUINCY MUSHROOM FARM	NWD	IW	GADSDEN	MWB-1	3/31/1999				P 31615	Fecal Coliform, Mpn,Ec Med, 44 5c		ANC	#/100ML	SA
FLA010088	QUINCY MUSHROOM FARM	NWD	IW	GADSDEN	MWI-2	3/31/2001				P 31615	Fecal Coliform, Mpn,Ec Med, 44 5c		ANC	#/100ML	SA
FLA010088	QUINCY MUSHROOM FARM	NWD	IW	GADSDEN	MWC-3	3/31/2001				P 31615	Fecal Coliform, Mpn,Ec Med, 44 5c		ANC	#/100ML	SA
FLA010088	QUINCY MUSHROOM FARM	NWD	IW	GADSDEN	MWC-5A	3/31/2001				P 31615	Fecal Coliform, Mpn,Ec Med, 44 5c		ANC	#/100ML	SA
FLA010088	QUINCY MUSHROOM FARM	NWD	IW	GADSDEN	MWC-6A	3/31/2001				P 31615	Fecal Coliform, Mpn,Ec Med, 44 5c		ANC	#/100ML	SA
FLA010088	QUINCY MUSHROOM FARM	NWD	IW	GADSDEN	MWB-1	3/31/2001				P 31615	Fecal Coliform, Mpn,Ec Med, 44 5c		ANC	#/100ML	SA
FLA010088	QUINCY MUSHROOM FARM	NWD	IW	GADSDEN	MWB-1	6/30/2001				P 31615	Fecal Coliform, Mpn,Ec Med, 44 5c		ANC	#/100ML	SA
FLA010088	QUINCY MUSHROOM FARM	NWD	IW	GADSDEN	MWI-2	7/31/2001				P 31615	Fecal Coliform, Mpn,Ec Med, 44 5c		ANC	#/100ML	SA
FLA010088	QUINCY MUSHROOM FARM	NWD	IW	GADSDEN	MWC-3	6/30/2001				P 31615	Fecal Coliform, Mpn,Ec Med, 44 5c		ANC	#/100ML	SA
FLA010088	QUINCY MUSHROOM FARM	NWD	IW	GADSDEN	MWC-5A	6/30/2001				P 31615	Fecal Coliform, Mpn,Ec Med, 44 5c		ANC	#/100ML	SA
FLA010088	QUINCY MUSHROOM FARM	NWD	IW	GADSDEN	MWB-1	12/31/2001				P 31615	Fecal Coliform, Mpn,Ec Med, 44 5c		anc	#/100ML	SA
FLA010088	QUINCY MUSHROOM FARM	NWD	IW	GADSDEN	MWI-2	12/31/2001				P 31615	Fecal Coliform, Mpn,Ec Med, 44 5c		anc	#/100ML	SA
FLA010088	QUINCY MUSHROOM FARM	NWD	IW	GADSDEN	MWC-3	12/31/2001				P 31615	Fecal Coliform, Mpn,Ec Med, 44 5c		anc	#/100ML	SA
FLA010088	QUINCY MUSHROOM FARM	NWD	IW	GADSDEN	MWC-5A	12/31/2001				P 31615	Fecal Coliform, Mpn,Ec Med, 44 5c		anc	#/100ML	SA
FLA010088	QUINCY MUSHROOM FARM	NWD	IW	GADSDEN	MWC-6A	12/31/2001				P 31615	Fecal Coliform, Mpn,Ec Med, 44 5c		ANC	#/100ML	SA
FLA010088	QUINCY MUSHROOM FARM	NWD	IW	GADSDEN	MWC-5A	10/31/2001				P 31615	Fecal Coliform, Mpn,Ec Med, 44 5c		ANC	#/100ML	SA
FLA010088	QUINCY MUSHROOM FARM	NWD	IW	GADSDEN	MWC-6A	10/31/2001				P 31615	Fecal Coliform, Mpn,Ec Med, 44 5c		ANC	#/100ML	SA

Refer to the CD to obtain the entire dataset.

Appendix F: Summary of Photos and News Articles

	
STA.# 7450 - Long Branch @ SR 274	STA. # 7450 - Long Branch @ SR 274

STA. # 7520 - Juniper Creek @ SR 65A

STA.# 7520 - Juniper Creek @ SR 65A

Trib.25 yards east Of Nicole Rd.: Puddle

Trib. east Of Nicole Rd.

STA # 7430 - Trib. 1 east of Nicole Rd.

STA.# 7430 - Trib. 1 east Of Nicole Rd.

STA. # 7410 - Trib. 3 east of Nicole Rd.

STA. # 7410 - Trib. 3 east of Nicole Rd.

STA.# 7400 - Trib. 4 east of Nicole Rd.

STA.# 7400 - Trib. 4 east of Nicole Rd.

Trib. 5 Just west of SR 65 on 65A. - Dry

Trib. 5 just west of 65 on 65A. - Dry

Florida Department of Environmental Protection
Division of Water Resource Management
Bureau of Watershed Management
2600 Blair Stone Road, Mail Station 3565
Tallahassee, Florida 32399-2400
www.dep.state.fl.us/water/