

Protecting Florida's Endangered Springs

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Photo by John Moran, Ginnie Springs, Fla.

*"The wrong of unshapely things is a wrong too great to be told;
I hunger to build them anew and sit on a green knoll apart,
With the earth and the sky and the water, re-made, like a casket of gold..."*

William Butler Yeats

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INTRODUCTION

Florida is home to approximately 600 freshwater springs; perhaps the greatest concentration of these aquatic gems on Earth.¹ Florida's springs and spring runs are a treasured state resource, having provided untold natural, recreational and economic value to residents and visitors alike for more than a century.² Indeed, archeological evidence indicates that humans have been drawn to Florida's crystal clear springs for thousands of years, an allure that persists to this day, with Florida's twelve state parks named for springs drawing over two million visitors in 1999.³ Privately owned springs, such as Silver and Weeki Wachee, were Florida's first major tourist attractions,⁴ and they still provide substantial economic benefits to both the state and local economies.⁵ State owned springs also contribute significantly to Florida's economy. A study commissioned by the Florida Department of Environmental protection (FDEP) found that in 2002, more than 1.2 million visitors to just four spring-based state parks (Ichetucknee, Wakulla, Homosassa and Blue Springs State Parks) contributed approximately \$68.5 million to the surrounding local economies.⁶ However, despite the longstanding sentimental and economic association between Floridians and their springs, the future ecological health and aesthetic beauty of Florida's springs are being jeopardized by overpopulation and development.

Florida's freshwater springs, defined by Florida Geological Survey (FGS) as points "where underground water emerges onto the Earth's surface . . .,"⁷ are a product of Florida's distinctive karst⁸ geology. Florida, once covered

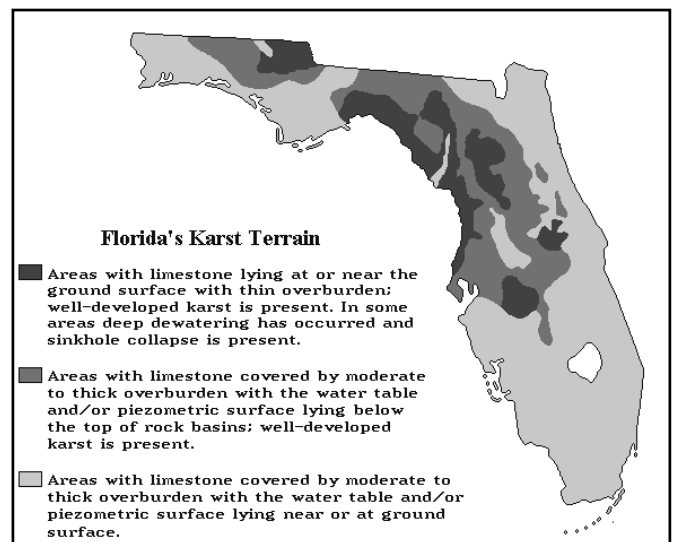
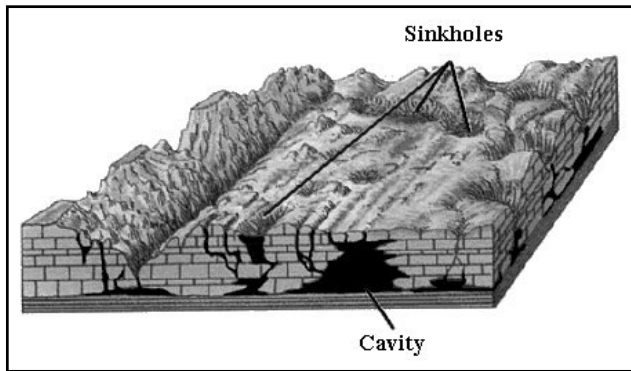


Figure 1. Map showing the extent of Florida's karst terrain. Reprinted from FLORIDA DEPARTMENT OF COMMUNITY AFFAIRS, PROTECTING FLORIDA'S SPRINGS: LAND USE PLANNING STRATEGIES AND BEST MANAGEMENT PRACTICES (2002).

Figure 2. Diagram of a cross section of limestone illustrating sinkholes, solution cavities and other karst features.



by warm, shallow seas, now rests on a bed of sedimentary limestone, covered to varying thickness with sand and clays (see Fig. 1).⁹ This limestone is the starting point for Florida's karst geology. Rainwater, made slightly acidic by carbon dioxide picked up as it falls through the atmosphere,¹⁰ seeps through overlying sand

and clays and into the limestone where it slowly dissolves channels and cavities into the carbonate rock (see Fig. 2).¹¹ These solution cavities sometimes create large caverns in the limestone, the roofs of which may collapse, forming sinkholes.¹² When sinkholes connect to the aquifer, they serve as direct conduits of pollutants into the groundwater, or, if the groundwater level is high enough, relative to the surface, they can form a spring (see Fig. 3).¹³ But, while the general characteristics of Florida's karst geology and are well studied and defined, the specifics of any particular area's karst features, and the connectivity those features create between the

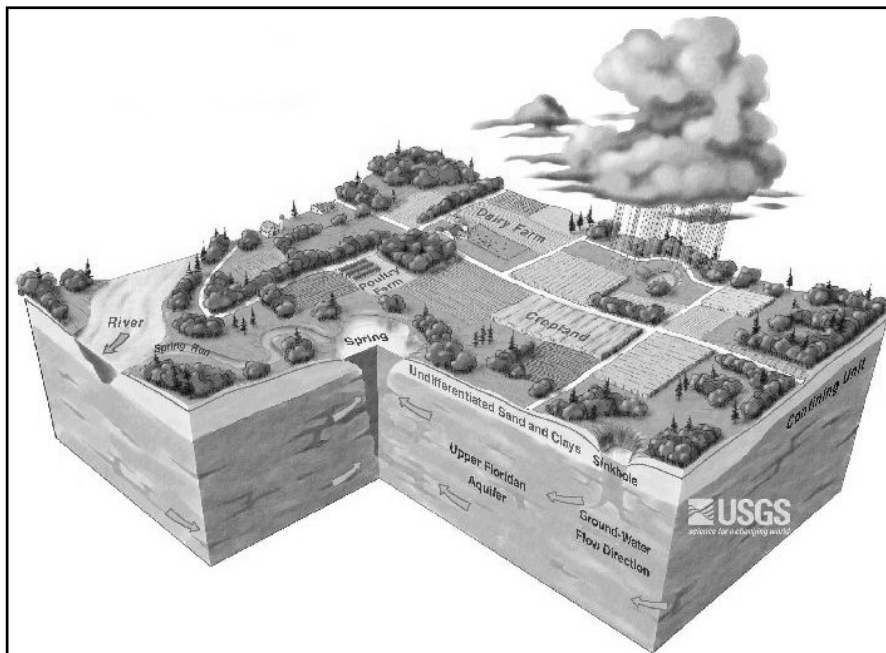


Figure 3. Diagram of a cross section of limestone illustrating the relationship between the aquifer, karst features such as sinkholes, and springs. Reprinted from FLORIDA SPRINGS TASK FORCE, FLORIDA'S SPRINGS: STRATEGIES FOR PROTECTION AND RESTORATION 13 (2003).

surface and springs, are largely unknown. Given the immense scale and constantly changing nature of Florida’s karst geology, those specifics will likely never be understood for all springs. What is understood however, is that because of Florida’s karst geology, and the direct connection it creates between activity at the surface and the aquifer, Florida’s groundwater and springs are especially vulnerable to contamination from the surface.¹⁴

Springs are classified by their rate of discharge, ranging from first magnitude springs, which discharge more than 64 million gallons of water per day, to eighth magnitude, which discharge a mere pint per minute (see table 1).¹⁵

Table 1. Summary of spring classification by magnitude. FLORIDA GEOLOGICAL SURVEY, SPECIAL PUBLICATION NO. 52, FLORIDA SPRING CLASSIFICATION SYSTEM AND SPRING GLOSSARY 13 (2003).

Average Flow (Discharge)			
Magnitude	Metric Units	English Units	
1 st	≥ 2.83 cms	≥ 100 cfs	(≥ 64.6 mgd)
2 nd	≥ 0.283 cms to 2.83cms	≥ 10 to 100 cfs	(≥ 6.46 to 64.6 mgd)
3 rd	≥ 0.028 cms to 0.28 cms	≥ 1 to 10 cfs	(≥ 0.646 to 6.46 mgd)
4 th	≥ 0.0063 cms to 0.028 cms	≥ 100 gpm to 1 cfs (≥ 100 to 448 gpm)	
5 th	≥ 0.631 to 6.308 lps	≥ 10 to 100 gpm	
6 th	≥ 0.063 to 0.631 lps	≥ 1 to 10 gpm	
7 th	≥ 0.473 to 3.85 lpm	≥ 1 pint/min to 1 gpm	
8 th	< 0.473 lpm	< 1 pint/min	

cms = cubic meters per second	lps = liters per second
cfs = cubic feet per second	pint/min = pints per minute
mgd = million gallons per day	lpm = liters per minute
gpm = gallons per minute	

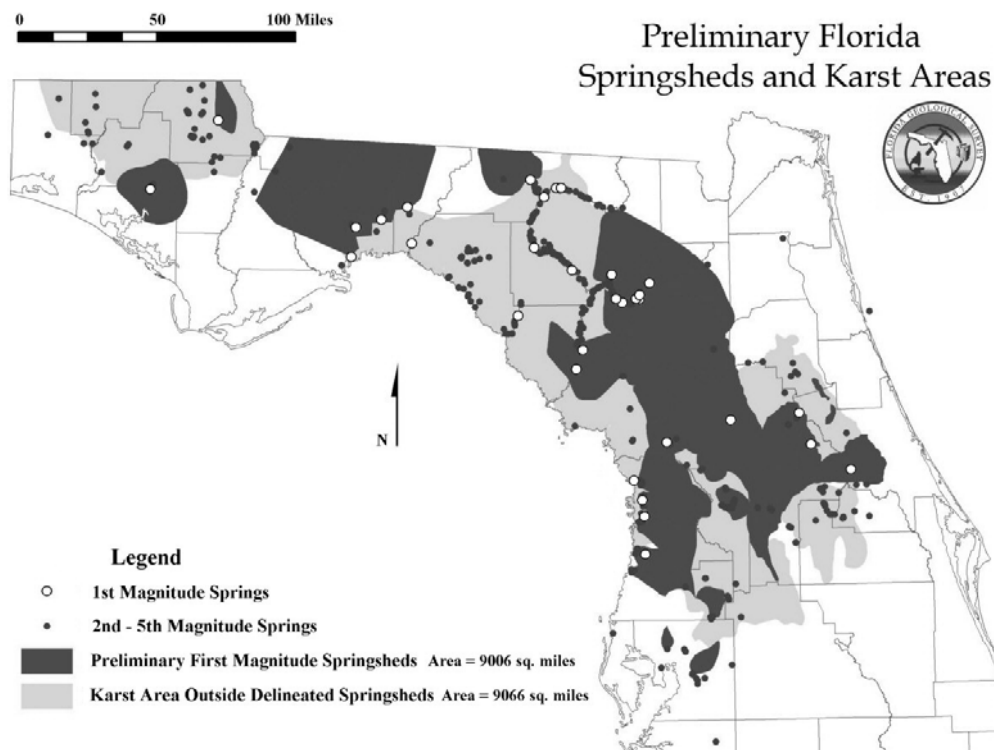
These classifications are based on average or historic flows however, and, because spring discharge fluctuates according to numerous environmental variables, at any one moment an individual spring may not be discharging an amount of water consistent with its classification.¹⁶

Currently, including river rises,¹⁷ FGS recognizes 33 first magnitude¹⁸ and 191 second magnitude¹⁹ springs. While first magnitude springs, because they are the largest, are often the most well known and utilized for recreation, many of the hundreds of second magnitude and

smaller springs also figure prominently in Floridian’s appreciation and enjoyment of springs. Indeed, many of Florida’s most popular springs, such as Juniper, Sulphur, Ginnie, Crystal, and Wekiwa Springs, are of second magnitude. All of these springs that are so important to Floridians are at risk of experiencing reduced groundwater recharge or contamination from activities at the surface.

The groundwater that supplies springs is recharged by rain and surface water that seeps into the aquifer from the surface, and through direct karst-feature conduits such as sinkholes.²⁰ Depending on the spring, water discharged from springs is of varying age, having entered the aquifer anywhere from a few days to thousands of years ago,²¹ though on average, the water discharged from most springs is about a decade old.²² Those areas within groundwater and surface water basins that contribute to the discharge of a particular spring are known as that spring’s “spring recharge basin” or “springshed” (see Fig. 4).²³ In other words, a springshed is

Figure 4. Map showing the location of Florida’s known first through fifth magnitude springs, currently delineated first magnitude springsheds, and karst areas located outside delineated springsheds. Springshed boundaries were determined using data from Water Management Districts and the United States Geological Survey. Courtesy Florida Geological Survey.



the area within which a spring is both vulnerable to contamination from surface activities²⁴, and in which a reduction in groundwater recharge can result in reduced spring discharge.²⁵ As illustrated in Figure 4, Florida's springs, and therefore springsheds, are located almost exclusively in the karst areas of the northern half of the state (see also Fig. 1). Though some first magnitude springsheds remain to be delineated,²⁶ those that have been total a combined 9006 square miles (or 5,763,840 acres or approximately 15% of Florida's land area), and fall within 35 of Florida's 67 counties. Consequently, development and other activities over a significant portion of Florida's land area, and in more than half of Florida's counties, have the potential to affect the quantity and quality of water discharging from springs.

Because of the close link between surface activities and groundwater, land use is having a measurable negative impact on Florida's springs. Stormwater runoff can carry hazardous contaminants such as oil, gasoline, pesticides, and bacteria into the aquifer.²⁷ In addition, industrial, residential, agricultural, and golf course stormwater runoff, and septic tank seepage, can introduce excess nutrients to the aquifer as well.²⁸ These excess nutrients, in particular soluble forms of nitrogen (e.g. urea and ammonia from animal waste, nitrogen from automobile and industrial emissions, and inorganic nitrates from lawn, golf course or agricultural crop fertilization), essentially fertilize the water in springsheds, leading to the growth of nuisance and exotic plants and algae and the destabilization of spring ecosystems.²⁹

Numerous studies conducted by Florida's Water Management Districts and Department of Environmental Protection, and the United States Geological Survey have identified spring nutrient contamination, and subsequent ecological changes, attributable to changes in land use in springsheds.³⁰ For example, from 1946 to 1999, a six-fold increase in the populations living in the springshed of Weeki Wachee Springs in Hernando County was followed, with a 10-15 year

time lag, by a six-fold increase in nitrate concentrations in the spring (see Fig. 5). In addition, according to DEP bioassessments, Crystal, De Leon, Fanning, Lithia, Manatee, Ponce De Leon, Rainbow, Silver, Wakulla, and Wekiwa Springs currently have elevated and

increasing nutrient concentrations, the result of excess nitrogen loading in the

springshed.³¹ The excess nitrogen has led to a deterioration of spring ecosystems,³² decreasing water clarity, promoting the growth of nuisance plants and algae, and decreasing biodiversity.³³ Such nutrient enriched springs are not only less aesthetically pleasing, their once crystal clarity being replaced with a greenish hue, and their once sandy bottoms being covered with encrusting algae, but their ecosystems are generally less stable, and less able to support a variety of wildlife, some of which may be threatened or endangered.³⁴

The ultimate cause of the decline in many Florida springs is human population growth and its accompanying development and demand for water. Between 1950 and 1990, Florida's population more than quadrupled.³⁵ In the ten years from 1990 to 2000, as in each of the two decades before it, Florida's population grew by more than three million persons,³⁶ the third highest increase of any state.³⁷ The great majority of this growth, 85%, is due to immigration – people moving into the state at a rate of more than 700 people per day.³⁸ At current growth rates,³⁹ Florida's population is projected to double by 2032.⁴⁰

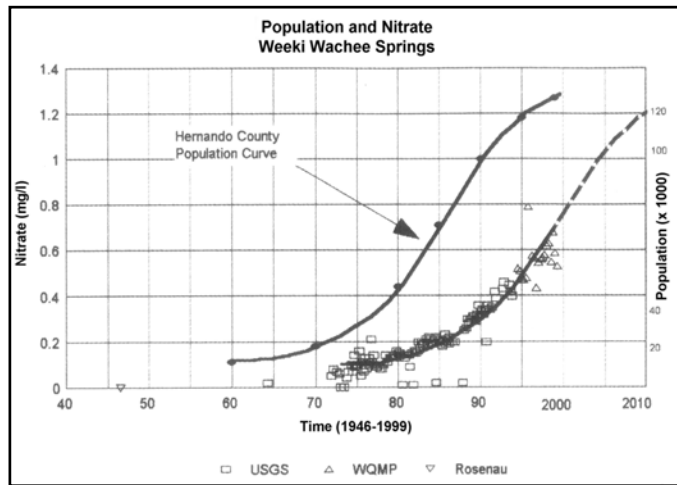


Figure 5. Graph showing relationship between human population and nitrate concentrations over time at Weeki Wachee Springs. Reprinted from FLORIDA DEPARTMENT OF COMMUNITY AFFAIRS, PROTECTING FLORIDA'S SPRINGS: LAND USE PLANNING STRATEGIES AND BEST MANAGEMENT PRACTICES 8 (2002).

As Florida's population has grown, so has the demand for development and water. In 2002 alone, Florida granted building permits for 85,431 housing units.⁴¹ Along with this housing has come infrastructure, such as roads and parking lots for shopping malls, which act as impervious surfaces that reduce groundwater recharge.⁴² Water that would otherwise seep into the aquifer, and potentially contribute to spring flow, instead runs off into rivers and streams or evaporates.⁴³ Also, as evidenced by Weeki Wachee and other impacted springs, development in the springshed increases nutrient loading to the spring. Moreover, although Florida is home to one of the world's largest underground water reserves, this reserve is being taxed by consumptive use.⁴⁴ According to United States Geological Survey estimates, withdrawals of freshwater for all uses averaged 7.5 billion gallons per day in 1990, which is almost a doubling of the rate of withdrawals estimated for 1960.⁴⁵ Given the magnitude of withdrawals of fresh water from the aquifer, it is even more important to protect the potential for groundwater recharge in springsheds.

Yet there is still hope for Florida's springs, as there are currently several springs initiatives underway. As part of a comprehensive springs protection effort established by the Governor and supported by the Florida Legislature (and by \$5 million in State funding) the secretary of the DEP in 1999, created the Florida Springs Task Force.⁴⁶ The Task Force is composed of state agency officials, scientific experts and private citizens, meets periodically, and is charged with recommending strategies for the protection and restoration of Florida's springs.⁴⁷ In November 2002, the Task Force a report entitled "Strategies for Protection and Restoration," which outlines steps for "protecting and restoring the springs and the underground aquifer through on-going scientific research, biological and water quality monitoring, regulation and management, education and outreach, and landowner assistance and land acquisition projects."⁴⁸

In addition to the Task Force the Florida Department of Community Affairs, developed, and in 2002, published a springs protection manual entitled “Protecting Florida’s Springs: Land Use Planning Strategies and Best Management Practices.” This manual outlines the danger posed to Florida’s springs of development in the absence of a consideration of its effects on springs, and provides land use planning strategies that can be incorporated into the state’s comprehensive planning process to protect springs.⁴⁹ In association with this manual, DCA, in collaboration with the University of Florida Levin College of Law Center for Governmental Responsibility, has commissioned a Model Land Development Code.⁵⁰ Where the DCA manual provides a general framework of strategies for implementing spring sensitive land use planning, the Model Land Development Code is intended to provide local governments with the specific planning guidance they will need to ensure that future development is accomplished in a manner that protects springs from decreased recharge and increased nutrient (and other) contamination.

Supporting these initiatives, the Florida Geological Survey is currently developing the Florida Aquifer Vulnerability Assessment (FAVA), a model that, based on geology, predicts the vulnerability of the aquifer to contamination from a specific land area.⁵¹ FAVA uses as input such variables as intermediate confining unit thickness,⁵² soil drainage,⁵³ and proximity to karst features,⁵⁴ as well as data from 62 aquifer monitoring wells,⁵⁵ and produces a map in which the entire land surface of Florida is classified into one of five categories of aquifer vulnerability, ranging from low to high.⁵⁶ While FAVA was not designed to address spring vulnerability specifically, because springs are inextricably linked to the aquifer, it is expected that this model, combined with knowledge of springshed locations, will provide information key to devising appropriate springs protection measures.

This remainder of this document will address Florida state law, and its ability to protect Florida's springs. Part III is an analysis of state law pertaining to state-level control, and whether state agencies have the authority to enact or enforce regulations that mandate springs protection. Part IV is an analysis of local government control, and whether local governments have the authority to enact and enforce land development regulations that protect springs. Part V is an analysis of several case studies, presented as examples of attempts to protect springs using both state and local government control. Finally, Part VI presents a draft Florida Springs Protection Act: model legislation that goes beyond merely authorizing state and local governments to take steps to protect Florida's springs, and in fact requires them to do so.

¹ FLORIDA DEPARTMENT OF COMMUNITY AFFAIRS, PROTECTING FLORIDA'S SPRINGS: LAND USE PLANNING STRATEGIES AND BEST MANAGEMENT PRACTICES 3 (2002). *See also* James Call & Frank Stephenson, *Spring Time in Florida*, 8 Florida State University Research in Review 12, 15 (2003)(stating that Florida has more than 700 identified springs) and Florida Springs Task Force, Florida's Springs: Strategies for Protection and Restoration 8 (2003) (estimating the number of springs at "nearly 600").

² FLORIDA SPRINGS TASK FORCE, FLORIDA'S SPRINGS: STRATEGIES FOR PROTECTION AND RESTORATION 8 (2003).

³ *Id.*

⁴ *Id.*

⁵ FLORIDA SPRINGS TASK FORCE, FLORIDA'S SPRINGS: STRATEGIES FOR PROTECTION AND RESTORATION 4 (2003). It is estimated that these springs provide several million dollars per year to local economies. *Id.*

⁶ MARK A. BONN & FREDERICK W. BELL, ECONOMIC IMPACT OF SELECTED FLORIDA SPRINGS ON SURROUNDING LOCAL AREAS 88, available at <http://www.dep.state.fl.us/springs/reports/EconomicImpactStudy.doc>. The economic impact stemmed from spending on lodging, restaurants, groceries, fees, transportation, and shopping. *Id.*

⁷ FLORIDA GEOLOGICAL SURVEY, SPECIAL PUBLICATION NO. 52, FLORIDA SPRING CLASSIFICATION SYSTEM AND SPRING GLOSSARY 12 (2003). The definition includes underground water that emerges onto the Earth's surface at the bottom of the ocean. *Id.*

⁸ "Karst," derived from the German word for the limestone plateau near Trieste, Slovenia, is a term describing geological landforms that have been modified by the dissolution of soluble rock. In Florida, the soluble rock is predominantly limestone, a sedimentary rock composed principally of calcite (calcium carbonate, CaCO₃) and dolomite (calcium magnesium carbonate, CaMg(CO₃)₂). *Id.* at 9. *See also* What is the geology of the limestone, shell, and dolomite formations? at <http://www.dep.state.fl.us/water/mines/geouse.htm>.

⁹ Florida Department of Community Affairs, Protecting Florida's Springs: Land Use Planning Strategies and Best Management Practices 4 (2002). Florida's limestone was created as microscopic marine organisms died and settled to the bottom over a period of millions of years. Bill Walker, *Basic Central Florida Geology*, Florida Speleological Society, at <http://www.caves.com/fss/pages/misc/geoflorida.htm>.

¹⁰ Water (H₂O) and carbon dioxide (CO₂) spontaneously combine to form carbonic acid (H₂CO₃).

¹¹ FLORIDA SPRINGS TASK FORCE, FLORIDA'S SPRINGS: STRATEGIES FOR PROTECTION AND RESTORATION 12 (2003).

¹² *Id.* This describes a rock-collapse sinkhole, and there are other types such as alluvial and cover-subsidence sinkholes. FLORIDA GEOLOGICAL SURVEY, SPECIAL PUBLICATION NO. 52, FLORIDA SPRING CLASSIFICATION SYSTEM AND SPRING GLOSSARY 5-11 (2003).

¹³ *Id.* For a more detailed description of Florida's aquifers and karst geology, *see Id.*

¹⁴ FLORIDA SPRINGS TASK FORCE, FLORIDA'S SPRINGS: STRATEGIES FOR PROTECTION AND RESTORATION 12 (2003).

¹⁵ FLORIDA GEOLOGICAL SURVEY, SPECIAL PUBLICATION NO. 52, FLORIDA SPRING CLASSIFICATION SYSTEM AND SPRING GLOSSARY 15 (2003).

¹⁶ *Id.*

¹⁷ FLORIDA SPRINGS TASK FORCE, FLORIDA'S SPRINGS: STRATEGIES FOR PROTECTION AND RESTORATION 13 (2003). A river rise is a place where a stream that sinks below ground reappears at the surface. *Id.*

¹⁸ FLORIDA SPRINGS TASK FORCE, FLORIDA'S SPRINGS: STRATEGIES FOR PROTECTION AND RESTORATION 13 (2003). These include: Gainer, Jackson/Blue, St. Marks, Spring Creek, Wakulla, ALA 112971, Hornsby, Columbia, Col 61981, Ichetucknee, Devils Ear, Santa Fe Rise, Alapaha Rise, Holton Creek Rise, Lafayette/Blue, Troy, Fannin, Manatee, Madison/Blue, Lime Run Sink, Wacissa, Nutall Rise, Steinhatchee Rise, Alexander, Silver, Silver Glen, Volusia Blue, Chassahowitska, Kings Bay, Homosassa, Weeki Wachee and Rainbow Springs. *Id.* at 62-63.

¹⁹ FLORIDA GEOLOGICAL SURVEY, GEOLOGICAL BULLETIN NO. 66 (forthcoming 2004).

²⁰ FLORIDA DEPARTMENT OF COMMUNITY AFFAIRS, PROTECTING FLORIDA'S SPRINGS: LAND USE PLANNING STRATEGIES AND BEST MANAGEMENT PRACTICES 7 (2002).

²¹ **NEED TO GET THIS**

²² **NEED TO GET THIS**

²³ FLORIDA GEOLOGICAL SURVEY, SPECIAL PUBLICATION NO. 52, FLORIDA SPRING CLASSIFICATION SYSTEM AND SPRING GLOSSARY 14 (2003).

²⁴ By definition, any substances that enter the groundwater within a springshed will eventually be discharged at the spring.

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- ²⁵ Similarly, by definition, since springs are recharged by water that enters the aquifer in the springshed, any decrease in recharge within a springshed will eventually reduce spring discharge.
- ²⁶ As illustrated by the first magnitude springs in figure 4 that are not associated with a delineated springshed.
- ²⁷ *Id.*
- ²⁸ *Id.*
- ²⁹ *Id.* at 7-8. See also FLORIDA SPRINGS TASK FORCE, FLORIDA'S SPRINGS: STRATEGIES FOR PROTECTION AND RESTORATION 16 (2003).
- ³⁰ FLORIDA DEPARTMENT OF COMMUNITY AFFAIRS, PROTECTING FLORIDA'S SPRINGS: LAND USE PLANNING STRATEGIES AND BEST MANAGEMENT PRACTICES 7 (2002).
- ³¹ These bioassessments are performed for many water bodies in addition to springs, and are referred to by DEP as "ecosummaries." Available at <http://www.dep.state.fl.us/central/Home/Watershed/EcoSummaries/EcoSummaries.htm>.
- ³² It should be noted that while the positive relationship between dissolved nitrate concentrations and algal and plant growth generally is clear, a causal link between elevated nitrate concentrations in springs, and increased nuisance plant and algal growth has not yet been scientifically demonstrated. The DEP is currently sponsoring research to investigate this causal link.
- ³³ A decrease in biodiversity, measured by a decrease in the number and variety of species present, typically results not only in less attractive springs, but in a less healthy ecosystem.
- ³⁴ FLORIDA DEPARTMENT OF COMMUNITY AFFAIRS, PROTECTING FLORIDA'S SPRINGS: LAND USE PLANNING STRATEGIES AND BEST MANAGEMENT PRACTICES 8 (2002).
- ³⁵ FLORIDA SPRINGS TASK FORCE, FLORIDA'S SPRINGS: STRATEGIES FOR PROTECTION AND RESTORATION 8 (2003).
- ³⁶ According to the U.S. Census Bureau, Florida's population grew from 12,938,071 on April 1, 1990 to 15,982,378 on April 1, 2000, an increase of 3,044,307, or 23.5%. See UNITED STATES CENSUS BUREAU, FLORIDA QUICK FACTS, available at <http://quickfacts.census.gov/qfd/states/12000.html>.
- ³⁷ Florida's absolute growth rate is third, behind California and Texas. BUREAU OF ECONOMIC AND BUSINESS RESEARCH, UNIVERSITY OF FLORIDA, FLORIDA POPULATION: CENSUS SUMMARY 2000 (2001), summary available at: <http://www.fluspop.org/pages/floridagrowthsources.htm>. This figure actually underestimates Florida's population growth, as it includes only permanent Florida residents, and not the large number of persons who live in Florida only part of the year. *Id.*
- ³⁸ 3,044,307 persons over 10 years/10 years/365 days per year = 834 persons per day x 85% = 709 persons per day.
- ³⁹ Florida's current population growth rate is 2.6% per year. BUREAU OF ECONOMIC AND BUSINESS RESEARCH, UNIVERSITY OF FLORIDA, FLORIDA POPULATION: CENSUS SUMMARY 2000 (2001), summary available at: http://www.fluspop.org/docs/florida_population_facts.htm.
- ⁴⁰ *Id.*
- ⁴¹ UNITED STATES CENSUS BUREAU, FLORIDA QUICK FACTS, available at <http://quickfacts.census.gov/qfd/states/12000.html>.
- ⁴² See FLORIDA DEPARTMENT OF COMMUNITY AFFAIRS, PROTECTING FLORIDA'S SPRINGS: LAND USE PLANNING STRATEGIES AND BEST MANAGEMENT PRACTICES 42-54 (2002).
- ⁴³ *Id.*
- ⁴⁴ ROY R. CARRIKER, UNIVERSITY OF FLORIDA INSTITUTE OF FOOD AND AGRICULTURAL SCIENCES, FLORIDA'S WATER: SUPPLY, USE, AND PUBLIC POLICY (2000), available at http://edis.ifas.ufl.edu/BODY_FE207.
- ⁴⁵ *Id.*
- ⁴⁶ See Florida Springs Task Force: Developing Strategies to Protect Florida's Springs, at <http://www.floridasprings.org/protection/taskforce/>.
- ⁴⁷ *Id.*
- ⁴⁸ *Id.*
- ⁴⁹ See generally FLORIDA DEPARTMENT OF COMMUNITY AFFAIRS, PROTECTING FLORIDA'S SPRINGS: LAND USE PLANNING STRATEGIES AND BEST MANAGEMENT PRACTICES (2002).
- ⁵⁰ This model code is currently being drafted by Lane Kendig, Inc.
- ⁵¹ FLORIDA GEOLOGICAL SURVEY, FLORIDA AQUIFER VULNERABILITY ASSESSMENT (2003), available at http://www.dep.state.fl.us/geology/programs/hydrogeology/fava_poster.pdf.
- ⁵² The intermediate confining unit includes "all sediments that lie between and collectively retard the exchange of water between the overlying surficial aquifer system and the underlying Floridan aquifer system." *Id.*

⁵³ Soil drainage refers to “the frequency and duration of wet periods. There are seven natural drainage classes: (E) excessively drained, (SE) somewhat excessively drained, (W) well drained, (MW) moderately well drained, (SP) somewhat poorly drained, (P) poorly drained and (VP) very poorly drained”. *Id.*

⁵⁴ Proximity to karst features such as sinkholes, which may be a direct conduit to the aquifer, increases the potential for contamination of the aquifer. *Id.*

⁵⁵ These wells, known as “training points,” consist of DEP and HRS wells that have nitrate concentrations equal to or greater than 0.10 mg/L. *Florida Geology Forum*, Florida Geological Society, March, 2002 at 4-5.

⁵⁶ *Id.*