# Case Study Analyses of DEP's Wastewater Program and Associated Challenges for Groundwater Protection in Florida's Springsheds

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# Case Study Analysis of DEP's Wastewater Program and Associated Challenges for Groundwater Protection

This paper provides two case studies that illustrate ways in which the DEP's wastewater regulatory program is currently applied with regard to groundwater protection, and discusses how these regulatory practices may or may not be consistent with the goals of springshed protection. The information contained in the case studies was obtained through discussions with knowledgeable citizens, interviews with government officials, and an inspection of public records. Although these case studies are a small sample of the many relevant permit applications on file, key informants and agency personnel indicate that these cases provide a good representation of current regulatory practices. Thus, the problems identified within these cases are presumed to be indicative of systemic problems that must be corrected if the overall goals of springshed protection are to be achieved.

## Wastewater in Florida: A Regulatory Overview

The Air and Water Pollution Control Act makes it the policy of the State that wastes discharged into state waters must be treated to the extent necessary to protect beneficial uses of water bodies.[1] To protect these beneficial uses, DEP is charged with regulating facilities that discharge wastewater into the waters of Florida. DEP currently regulates about 2750 facilities with discharges classified as domestic wastewater and about 1380 facilities with discharges classified as industrial wastewater.[2]

Although any discharge of wastewater within springsheds is of potential concern to the water quality of springs, domestic and agricultural wastewater facilities are of particular concern because they discharge large amounts of nutrients, including nitrogen and nitrate, which have

been associated with ecological decline in many Florida springs.[3] For this reason, discussion and analyses in this section will be limited to the domestic and agricultural wastewater portions of DEP's wastewater regulation authority.

***Domestic Wastewater***

Domestic wastewater facilities are considered to be one of the most serious sources of pollution interfering with the beneficial uses of surface waters. In an attempt to counter the negative effects of domestic wastewater discharges, DEP has adopted what it calls an "Antidegradation Policy."[4] This policy expressly "prohibits new or expanded surface water discharges from domestic wastewater treatment facilities unless the facility can demonstrate that the new or expanded surface water discharge is 'clearly in the public interest.'"[5]

Because adverse ecological impacts on a surface water body caused by nutrients (e.g., proliferation of noxious algae and/or nuisance weeds) are considered contrary to the public interest and can be triggered by relatively small increases in nutrient loadings, surface water discharges of domestic wastewater are generally not favored by DEP.[6] Advanced wastewater treatment is often mandated for those domestic wastewater facilities that do discharge into surface waters,[7] with minimum standards of 5 mg/L of Biological Oxygen Demand (CBOD), 5 mg/L of Total Suspended Solids (TSS), 3 mg/L of Total Nitrogen (TN), and 1 mg/L of Total Phosphorus (TP).[8] By contrast, domestic wastewater facilities that discharge into groundwater are generally only required to meet secondary treatment standards,[9] which are 30 mg/L for CBOD,[10] 30 mg/L for TSS,[11] and 10 mg/L for TN.[12] Discharges also cannot result in violations of applicable drinking water standards, including the 10 mg/L drinking water standard for nitrate.[13]

***Agricultural Wastewater***

Large animal feeding facilities are also deemed by DEP to pose considerable risks to surface waters and aquifers due to the large amounts of nutrients and bacteria associated with animal wastes.[14] In an attempt to minimize risks to state waters, many large animal feeding operations[15] are regulated by DEP through its industrial wastewater program, with specific provisions dedicated to the regulation of poultry[16] and dairy operations.[17] Receipt of an agricultural wastewater permit is contingent upon the facility meeting the relevant technical criteria as defined in the statutes and administrative codes, as well as a determination by DEP that wastewater discharges will not cause water quality violations within the receiving water body.[18]

The current regulatory standards and monitoring requirements for agricultural wastewater, like those of domestic wastewater, are generally more stringent for surface water discharges than groundwater discharges. This is because surface water discharges of agricultural wastewater can be regulated to protect the public's interest in the beneficial uses and native ecology of the surface water, while the default standards for aquifers are the drinking water standards – which are not necessarily protective of the beneficial uses of many aquatic systems, including springs.[19]

For example, adverse ecological impacts from wastewater runoff in Lake Okeechobee resulted in the adoption of particularly strict wastewater discharge standards for dairies operating within the confines of the Lake Okeechobee Drainage Basin.[20] By contrast, contamination of groundwater, traced largely dairy and poultry operations within the Suwannee River Basin[21] has not resulted in strict regulatory action from DEP. Rather, DEP's groundwater protection strategy in the Suwannee has been largely centered on a voluntary program, the Suwannee River

Partnership, that provides technical assistance for those farmers willing to adopt best management practices (BMPs) designed to lessen groundwater nitrate loadings associated with agricultural activities. Although participants and observers have noted some successes with the Suwannee River Partnership's cooperative approach,[22] DEP's reliance on the Partnership as a proxy for direct regulation of agricultural wastewater is currently a matter of political and legal controversy.[23]

***Wastewater Regulation and Springshed Protection***

The discrepancy in the standards for wastewater discharges into surface water and the standards for wastewater discharges into groundwater is highly problematic for springshed protection. This is because lesser standards for groundwater are not only a likely driving force behind the preferential construction of wastewater facilities and intensive agricultural operations that discharge directly into the groundwater, but the porous top soils and high aquifer recharge potential within many springsheds are ideal for the effective operation of rapid infiltration basins (RIBs) and spray fields commonly used to discharge large amounts of wastewater into aquifers.[24]

Studies have shown that large nitrogen loadings from wastewater facilities located within springsheds are a major source of elevated nitrates in some of Florida's springs.[25] However, conversations with DEP officials reveal that concerns about the potential impact of wastewater discharges on the water quality of springs have not been explicitly addressed within the permit applications of many existing wastewater facilities located within springsheds, largely because of the lack of firm scientific understanding of many springs systems and uncertainties surrounding the connection of specific groundwater discharges to a spring.[26]

Because springs are surface waters directly contiguous with groundwater, there are provisions of the Florida Administrative Code that, in theory, do give DEP some authority to

consider the potential effects on springs when regulating wastewater. Most specifically, F.A.C. §62-520.300 (8) states that wastewater "discharge to ground water shall not impair the designated use of contiguous surface waters," while F.A.C. §62-610.850 states that reuse and land application of wastewater shall not "cause or contribute to violations of water quality standards in surface waters" including those that "flow by interflow and affect water quality in surface waters." However, the following case studies demonstrate that the substantial technical challenge of showing a direct effect from any one facility within a springshed on the water quality of a corresponding spring makes it extremely difficult in practice for DEP to utilize these provisions to protect springsheds from wastewater impacts.

The first case study describes the unsuccessful attempt of several businesses and environmental organizations to stop DEP from issuing an industrial wastewater permit for a dairy farm within a major springshed area in Gilchrist County due to concerns that the dairy would impact the water quality of the Santa Fe River and several of its associated springs. This case is notable because of the public controversy it initially created, the content of both the Administrative Hearing and the ruling of the presiding Administrative Law Judge (ALJ), and the regulatory relief granted by DEP to the dairy farm owners several years after issuing the initial permit.

The second case study discusses the permitting of a domestic wastewater disposal facility in the Wekiva Study Area in 2003, and DEP's unsuccessful attempts to reduce nitrate discharges within this facility due to concerns about the potential effects of the facility on Wekiwa Springs. This case is particularly interesting because DEP did take a more critical stance on the potential effects of nitrate discharges into the groundwater of a springshed than it had in most previous cases, even though the particular project in question was probably superior for springshed

protection than most other existing wastewater discharges within the Wekiva River springshed area. Analysis of a report issued by a consultant working on behalf of the applicants also demonstrates the high degree of scientific uncertainty often associated with springs issues, and how selective interpretation of sparse and uncertain data can be used to put forth technical opinions that, while highly questionable, may be enough to satisfy permitting requirements.

In both cases, the applicants and their hired experts made technical arguments which raised doubts about the ability to adequately predict, or even detect, that pollutants discharged into groundwater from a particular wastewater facility could be identified as the specific cause of water quality problems within springs or rivers. The reasoning behind these arguments is that if any facility both meets groundwater discharge standards and provides credible evidence that it will not be *the* cause of a potential surface water quality problem, the permit must be given because the applicant has met the standard of providing the DEP with "reasonable assurances"[27] that its discharges will not violate Florida law. The case studies show that both DEP and ALJs have been inclined to concur that this kind of reasoning is adequate for the lawful issuance of permits to wastewater facilities located within springsheds.

However, it should be noted that the logical upshot of such reasoning in springshed areas experiencing increased residential and/or intensive agricultural development is, more likely than not, the steady decline of water quality in springs from the cumulative impact of many permitted pollutant sources (none of which are the specific cause of overall water quality declines, although all contribute to the general problem). Clearly, such a framework for the regulation of wastewater discharges into groundwater must be modified if greater springshed protection is to be achieved.

## Case Study of Watson Dairy

In 1997, Craig Watson (hereinafter "Watson") submitted an application to DEP for an industrial wastewater permit authorizing him to "construct and operate a 'rotational grazing' dairy" composed of up to 850 cows at a 511 acre site located approximately six miles to the south of the Santa Fe River in Gilchrist County.[28] The permit application indicated that wastes would be stored in an 80 x 84 foot concrete storage lagoon, with effluent from the lagoon applied by a spray gun onto a 245-acre pasture.[29] In order to ensure compliance with groundwater quality standards, the application also called for a series of four monitoring wells to be built along the northern perimeter of the property in an area assumed to be "co-extensive with the boundary of the discharge zone" of the wastewater.[30]

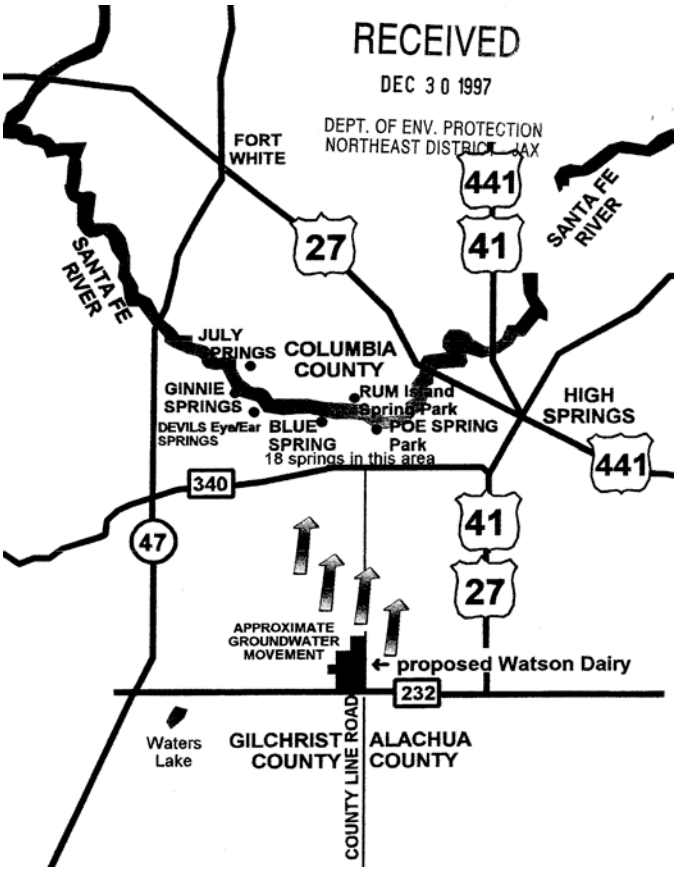


Figure 1: Map of Watson Dairy site and regional groundwater flow in relation to Santa Fe River and associated springs. Map adapted from Trina King, Map of Watson Dairy and regional groundwater flow (December 30, 1997) (within permit file FLA017396 at DEP Northeast District, 7825 Baymeadows Way, Suite B200, Jacksonville, FL 32256-7590).

Citing what they perceived as the high risk of nitrates leaching from the proposed dairy site causing adverse impacts on the Santa Fe River (a designated Outstanding Florida Water) and a number of major springs located along the river, several local citizens and businesses responded by submitting letters to DEP recommending that the permit for the dairy be denied.[31] After review of the permit application, DEP, however, found that all applicable industrial wastewater standards were met by the applicant and "issued a notice of intent to issue" the permit to Watson.[32]

Petitions challenging DEP's notice of intent to issue the permit were filed on February 12, 1998, by Ginnie Springs, Inc.; the Professional Assocation of Diving Instructors, Inc. and Georgia Shemitz (joint petitioners); and Alachua County.[33] These petitions were consolidated by the Division of Administrative Hearings into one case, with Gilchrist County and Save Our Suwannee, Inc. granted status as Intervenors.[34] A formal hearing on the case was presided over by Administrative Law Judge (ALJ) P. Michael Ruff on October 12-20, 1998, in Gainesville.[35]

Witnesses for Watson and DEP included two experts in agricultural engineering and dairy waste management, Dr. Dale Bottcher, PhD., P.E., and Michael Holloway, P.E.; two experts in geology and hydrogeology, Dr. Thomas Kwader, Ph.D., P.G., and John J. Davis, P.G.; and an expert in environmental engineering, Edward Dane Cordova, P.E.[36] Witnesses for the Petitioners included two experts in geology, hydrogeology, and geophysics, Robert J. Windshauer, P.G. and Sam B. Upchurch, Ph.D.; an expert in biogeochemistry and the modeling, fate, and transport of organic and inorganic contaminants, Dr. Curtis D. Pollman; and a cave diver, Wes Skiles.[37]

The expert testimony presented at the Administrative Hearing was quite complex. Many aspects of the dairy's management plan were discussed by experts from both sides of the case,

including: calculations for a stormwater system designed to capture all wastewater in a 25 year storm event, detailed water and nutrient budgets, crop and herd management plans, detailed descriptions of the wastewater treatment and disposal systems, determinations of groundwater depth and flow, a topographic site plan, ground penetrating radar surveys, site borings to determine soil properties, construction of on-site monitoring wells, an inventory of potable wells within ½ mile of the dairy property, and determinations of current groundwater quality.[38]

The crux of the Respondents' testimony was that rotational grazing methods[39] to be employed at the proposed dairy were specifically "designed to prevent the ground water quality violations frequently associated with traditional dairy operations."[40] Because of both the dairy design and management plan set forth in the wastewater permit, the Respondents argued that nitrate would not be expected to exceed the drinking water standard of 10 mg/L within the underlying Floridan aquifer[41] and that the Santa Fe River would be adequately protected and not be significantly degraded by the operations of the dairy.[42] These findings were largely agreed to by the ALJ in his "Findings of Fact."[43]

Experts for the Petitioners questioned the validity of the nitrogen balancing and wastewater nitrate leachate rates presented by the Respondents,[44] and argued that there was substantial possibility that the dairy site contains fissures, fractures, sand pipes, "and other substrate anomalies, which might serve as conduits for percolating water to reach the aquifer before it has had a chance to have the nitrates removed or treated adequately."[45] These concerns, if valid, would have indicated more threat from the dairy to the Santa Fe River and its springs than indicated by the Respondents. However, the ALJ largely rejected the relevance of these points made by the Petitioners' witnesses in his "Finding of Fact."[46]

In his "Conclusions of Law," the ALJ noted that "[t]he applicant has the burden of providing reasonable assurance[47] that the proposed project will not violate Department standards, that the proposed dairy will abate and prevent water pollution to the extent required by Department rules and policies and that the project will not discharge or cause pollution in violation of relevant statutes, rules and policies."[48] The ALJ continued by pointing out that once the applicant has "made a preliminary showing of reasonable assurance, a challenger must present 'contrary evidence of equivalent quality' to that presented by the permit applicant."[49]

Although acknowledging that some of the evidence presented by the Petitioners may have been "of 'equivalent quality' in terms of the scientific investigation and study involved", the ALJ ruled that the Petitioners' evidence "lies in large part, in the area of informed speculation or conjecture"[50] and did not constitute "'contrary evidence' in terms of being preponderant over that adduced by the applicant's and the Department's witnesses."[51] But going further, the ALJ also ruled that even if nitrates in wastewater from the dairy operation were to travel through the groundwater and reach the Santa Fe River and/or its associated springs, there would be no credible way to determine if "the feared nitrate levels in the river in the future would come from the farm or would be attributable to the subject dairy farm in operation, as opposed to some other source."[52]

As a result of these findings, the ALJ recommended that that DEP issue a Final Order "granting the permit requested by Craig Watson to construct and operate the proposed dairy waste management system."[53] The permit was then issued by DEP, with the standard requirement that the discharge not cause violations of drinking water quality standards within the groundwater – including the nitrate drinking water standard of 10 mg/L.[54]

After the dairy farm became operational, there were indications of some groundwater quality problems caused by dairy waste leaching into underlying aquifers. Although the majority of samples from monitoring wells within the Watson file indicate nitrate levels under the drinking water standard, Figure 2 contains a DEP chart indicating that nitrate measurements in monitoring wells exceeded the drinking standard of 10 mg/L on at least two occasions, including one reading over 24 mg/L from a well within the intermediate aquifer (IW 5). This chart also shows one monitoring well within the Floridan aquifer (CW 4) having consistently elevated nitrates, with a minimum reading of 7 mg/L and maximum reading of 10 mg/L.

While not specifically naming the Watson Dairy operation as a possible culprit, the Florida Springs Task Force noted in 2000 that the Ginnie Springs group is being "affected by increasing nitrates" likely caused by a mix of agricultural operations and residential development within the recharge basin.[55] Information presented by both sides within the Watson case indicates that groundwater from the Watson Dairy generally flows towards the Ginnie Springs group,[56] which would suggest, at the very least, that nitrates from the dairy could be expected to exacerbate an existing problem if not regulated and managed rigorously.

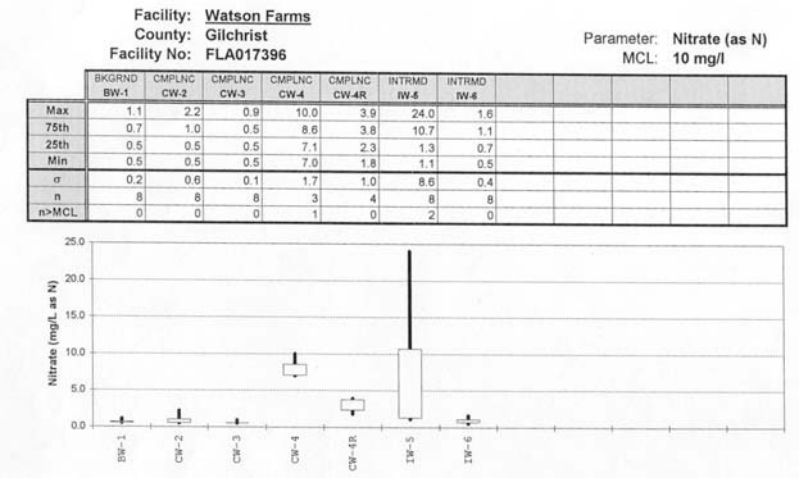


Figure 2: Nitrate levels in Watson Dairy monitoring wells. Chart adapted from Department of Environmental Protection, Statistical Summary (undated) within permit file FLA017396 at DEP Northeast District, 7825 Baymeadows Way, Suite B200, Jacksonville, FL 32256-7590.

In November 2001, Watson petitioned the DEP for regulatory relief from the permit's water monitoring requirements due to economic hardship and associated decreases in his herd to about 400 dairy cattle.[57] Noting that Watson's "past 10 quarters of compliance well monitoring indicates compliance with the requirements of your permit[58] and groundwater quality of the state," DEP quickly granted relief by eliminating the requirement that Watson monitor two of the wells and reducing monitoring requirements on the other three wells from quarterly to yearly[59] – a sampling regime that would be far less likely to detect seasonal nutrient pulses often associated with dairy farms. [60] DEP also noted that an "on-going dairy compliance initiative[61] and your economic hardship further supports [sic] our granting a reduction in groundwater monitoring requirements."[62]

While it is clear that the mitigation of groundwater contamination in springsheds is a long-term process that can be aided by cooperative approaches for better managing agricultural wastewater, it seems equally clear that these cooperative approaches should also be accompanied by adequate monitoring regimes and, as necessary, enforcement mechanisms to ensure that best management practices are implemented in a manner that protects groundwater quality.[63] To be fair, Florida's DEP is not unique among governmental agencies of the world in its relative lack of monitoring, enforcement, and mitigation strategies for protecting groundwater quality – such problems are endemic to a resource that is underground and largely invisible.[64] However, the increased scientific understanding of Florida's springs and the associated political pressure to better protect the groundwater feeding these springs may make DEP's current regulatory stance on agricultural wastewater discharges into groundwater increasingly untenable.[65]

Ironically, the potential regulatory benefits of a more aggressive enforcement strategy were demonstrated when several months before granting regulatory relief to Watson, DEP's

northeast district office launched surface water quality enforcement actions against a poultry facility owned by Gold Kist Incorporated. The actions against Gold Kist were due to egregious water quality violations and associated increases of nitrates in the Suwannee River attributed to surface water discharges from the facility.[66] DEP's enforcement actions against Gold Kist directly led to an agreement that calls for the construction of additional treatment facilities to reduce the nitrogen loadings from the poultry farm to the Suwannee River by half.[67] Similar regulatory assertiveness by DEP in combating groundwater contamination from agricultural operations will be needed in the future if the goals of springs protection are to be more fully realized.

## Case Study of Lake Cora Lee Project

A recent review of facilities within the Wekiva Study Area[68] revealed that this area contains at least 46 domestic wastewater facilities permitted to discharge into groundwater through rapid infiltration basins (RIBs), drain fields, spray fields, and various forms of reuse (or reclamation).[69] The combined discharge capacities of these facilities exceeds 40 million gallons a day (mgd),[70] with a level of treatment far below what would be required if the wastewater was directly discharged into surface waters.[71]

Given that the total spring discharge into the Wekiva River is approximately 152 mgd,[72] existing wastewater discharges within the springshed are equal to a number that is well over one quarter of the spring flow. Although the complexities of subsurface travel times and flow pathways make it difficult to determine the exact amount that these wastewaters are, or will be, contributing to spring flow in the Wekiva River, the overall effect of these facilities on the water quality of springs within the Wekiva Basin is cause for great concern.[73]

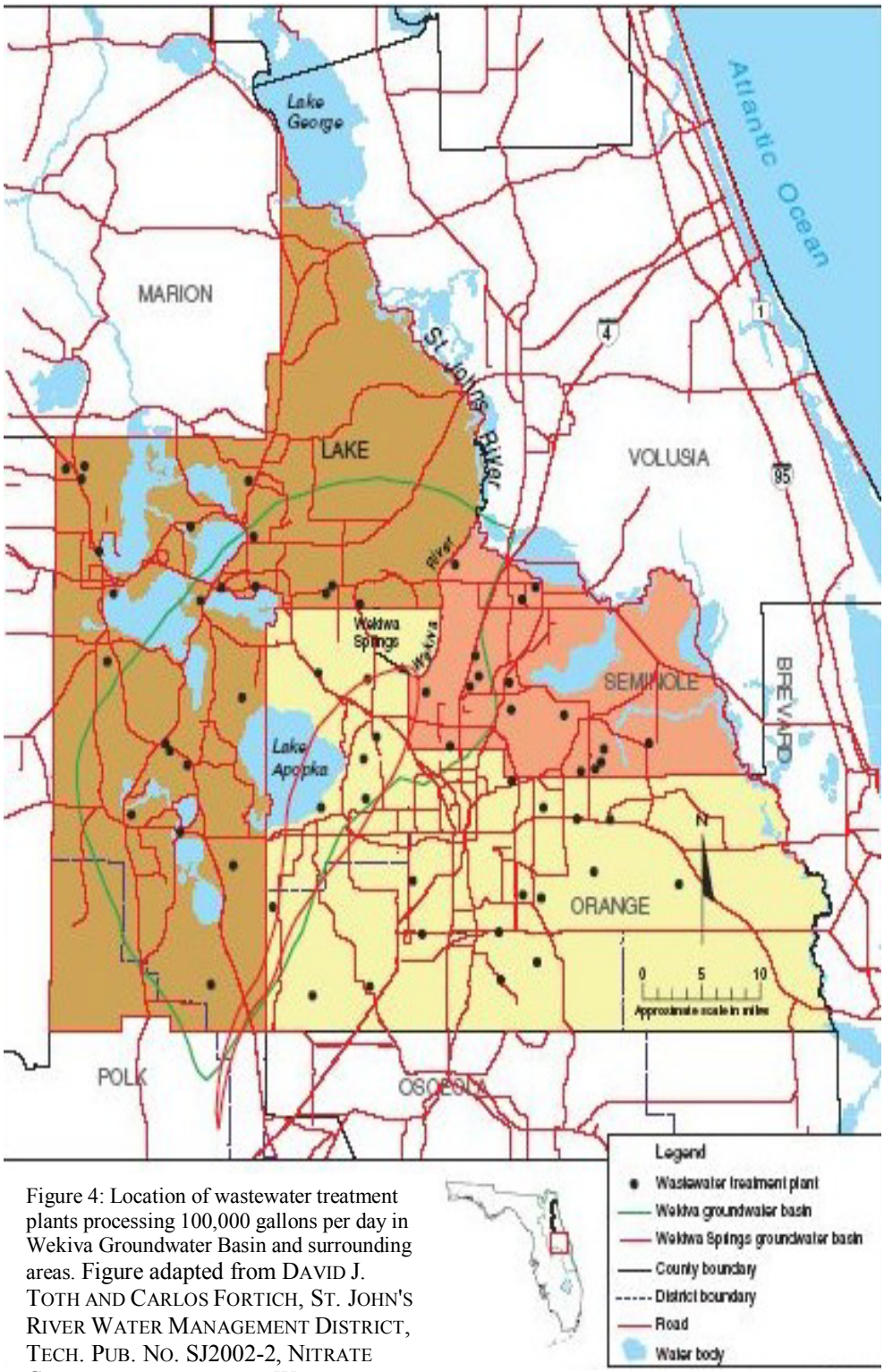


Figure 4: Location of wastewater treatment plants processing 100,000 gallons per day in Wekiva Groundwater Basin and surrounding areas. Figure adapted from DAVID J. TOTH AND CARLOS FORTICH, ST. JOHN'S RIVER WATER MANAGEMENT DISTRICT, TECH. PUB. NO. SJ2002-2, NITRATE CONCENTRATIONS IN THE WEKIVA GROUNDWATER BASIN WITH EMPHASIS ON WEKIWA SPRINGS 39 (2002).

Due to the rising concerns about the potential impacts of wastewater in the Wekiva River Basin, DEP recently gave increased scrutiny to a permit application for the expansion of Orange County's Northwest Wastewater Reclamation Facility (NWWRF).[74] The NWWRF is located within the Wekiva groundwater basin approximately 6 miles southwest of Wekiwa Springs and is designed to provide secondary treatment for up to 7.5 mgd of wastewater. The NWWRF was previously permitted to provide secondary treatment to 4.5 mgd of wastewater, which is discharged into a series of 13 RIBs.[75] Like other RIB facilities within the Wekiva Study Area, the NWWRF has a permitted nitrate discharge limit of 12 mg/L.[76]

The expansion project is called the Lake Cora Lee Augmentation Project (hereinafter, the Lake Cora Lee Project), and, according to the permit application, is designed to bring the NWWRF up to full operational capacity by providing means to dispose of an additional 3 mgd of wastewater.[77] Located directly east of the existing NWWRF site, the Lake Cora Lee Project is designed as a constructed wetland receiving system intended to provide additional biological and chemical treatment to the wastewater before it is eventually discharged into Lake Cora Lee.[78] The proposed nitrate limit for discharges into the receiving wetland is 12 mg/l, but it is estimated in the permit application that treatment provided by the wetland would reduce the nitrate concentration of wastewater entering Lake Cora Lee down to approximately 1.14 mg/l.[79]

In a July 16, 2003, letter to the Orange County Utilities Wastewater Department, DEP expressed concern about "the proposed nitrate level of 12.0 mg/l being discharged to the proposed wetland system."[80] DEP noted that "[t]he facility and all the proposed augmentation projects are in the springsheds for the Wekiva Spring [sic] and other springs located around the City of Apopka" and that nitrates "are of significant concern for the protection and management of the springs."[81] DEP then instructed the applicants to "indicate the expected nitrate levels of the

effluent discharging from the proposed wetland cells to Lake Cora Lee and discuss the direction of ground water flow and any other information that would provide reasonable assurance that this project will not degrade spring water quality."[82] On September 12, 2003, DEP received a response to these concerns from an environmental consulting firm, PB Water, reporting on behalf of Orange County.[83]

PB Water's response begins by noting that although the NWWRF site "is within the Wekiva drainage basin identified by the SJRWMD," it is not "within the State of Florida designated Springshed Protection Area."[84] Despite this discrepancy, it is acknowledged that hydrologic models show groundwater flow within the Floridan aquifer underneath "the NWWRF is generally to the northeast," meaning "that reclaimed water entering the groundwater system at the NWWRF could have a travel path towards the 'springs area,' and if not intercepted by another hydraulic sink or preferential flow path in the Floridan aquifer, could ultimately reach one of the springs."[85]

PB Water follows this acknowledgement of a hypothetical threat to Wekiwa Springs with a series of arguments intended to provide reasonable assurance[86] that the NWWRF has not been, is not currently, and will not be responsible for degraded water quality in Wekiwa Springs. The next several paragraphs summarize these arguments made by PB Water, while also criticizing several technical or scientific weaknesses within the case presented. The intention of these criticisms is not to attack the credibility of PB Water or to suggest that the Lake Cora Lee Project poses an undue threat to Wekiwa Springs. Rather, the purpose is to show that hydrologic complexities, limited data, and scientific uncertainties often associated with springs may allow for the construction of radically different interpretations of environmental risk, and that, in light

of such uncertainty, the "reasonable assurance" evidentiary standard for issuing wastewater permits may not be adequate for protecting springs.

PB Water begins its case by claiming that Wekiwa Springs showed increases in nitrates from the late 1970s and early 1980s, with this increase followed by "a significant downward trend in total nitrogen at Wekiva Springs [sic] from 1988 to 2000."[87] Noting that the NWWRF has been operating at its existing capacity of 4.5 mgd since 1988,[88] PB Water uses these dates and numbers to make two points: 1) that the disposal of wastewater from the NWWRF was obviously not responsible for any observed increase in nitrate observed before the facility opened; and 2) that since the operation of NWWRF is correlated with a period in which nitrates are purportedly decreasing within the Wekiwa Springs, the facility is likely not a threat to the springs.

Both of these points, however, are questionable. Although it is quite obvious that any increase in nitrate in Wekiwa Springs observed before the NWWRF opened was not caused by the NWWRF, the claim that there was, in fact, a "substantial increase" in nitrates over the late 1970s and early 1980s appears to be based simply upon a connecting line drawn between one measurement taken in 1978 and another measurement taken in 1983 (See Fig. 3). While the fact that no subsequent nitrate measurements in Wekiwa Springs have been as low as the one taken in 1978 does suggest that nitrate levels have generally increased within the springs since that time, the claim that two nitrate measurements taken 6 years apart indicate any sort of "trend" is not sound because nitrate levels within springs are known to show very high variation from one sampling event to the next, with much higher sampling frequencies needed to find any clear trends within the data.[89]

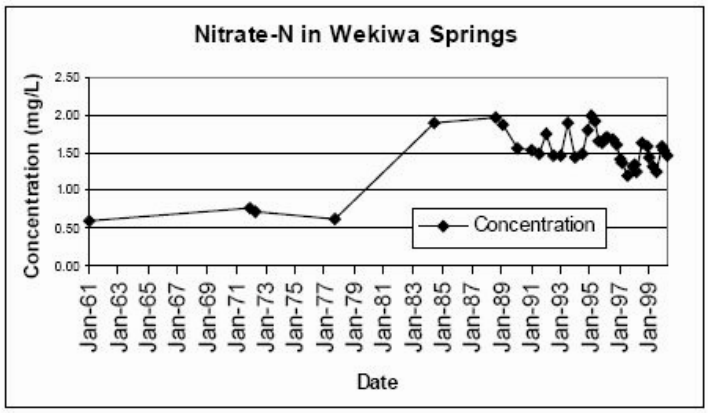


Figure 3: Nitrate concentrations in Wekiwa Springs. Reprinted from DAVID J. TOTH AND CARLOS FORTICH, ST. JOHN'S RIVER WATER MANAGEMENT DISTRICT, TECH. PUB. NO. SJ2002-2, NITRATE CONCENTRATIONS IN THE WEKIVA GROUNDWATER BASIN WITH EMPHASIS ON WEKIWA SPRINGS 21 (2002).

The second point is based upon the premise of a downward trend in nitrates of 1988-2000. Although it is true that nitrate measurements do show something of a downward trend line over this period, the measurements also indicate a historical peak of 2 mg/L in 1995 and show fairly high variability (See Fig. 3), which may raise doubts about the adequacy of the sampling regime utilized by SJRWMD for distinguishing trend lines for nitrate levels at Wekiwa Springs.[90]

But even if it is granted that the nitrate trend is downward at Wekiwa Springs over the period in which NWWRF has operated, the inference that any such trend is an indication that nitrate discharges from NWWRF are not a potential problem for Wekiwa Springs does not necessarily hold. On the one hand, there is, as PB Water itself admits, currently no way to "precisely predict travel time" within the Floridan aquifer.[91] Therefore, it is quite conceivable that travel times between the NWWRF site and Wekiwa Springs are greater than the time period in which the facility has been operating, which means that significant contaminant plumes from the NWWRF may have simply not yet reached the springs. On the other hand, it is also conceivable that contaminants from the NWWRF have already reached Wekiwa Springs, but measured nitrate levels have not been rising in the spring because the NWWRF contaminants

have, in essence, replaced previous contaminant plumes that have worked their way through the groundwater system and are no longer contributing appreciable nitrates to the spring water.[92]

PB Water continues with its case by noting that SJRWMD[93] indicates that the source of nitrogen in Wekiwa Springs can be traced to "septic tank leachate and recharge water from fertilized lawns in the high recharge areas" located south and southwest of the springs.[94] PB Water also notes that SJRWMD does not specifically point to "land application systems such as RIBs or lake augmentation projects" as primary nitrate sources within Wekiwa Springs.[95]

Although PB Water does correctly report the suspected sources of nitrate as identified by SJRWMD,[96] the conclusion drawn by PB Water is not necessarily sound. This is because the chemical signatures for groundwater nitrate originating from septic tanks and nitrate originating from other organic sources, including animal sources and wastewater treatment plants, are not readily distinguishable.[97] Thus, it is conceivable that at least some portion of the nitrates attributed to septic tanks in the SJRWMD report could have their origin in wastewater treatment facilities such as the NWWRF.[98]

PB Water then notes that SJRWMD data indicate a diminishment of nitrate concentrations "in a northeasterly direction from the NWWRF down to a series of observations in the range of 0.0 – 0.2 mg/l between the NWWRF and the Wekiva [sic] Springs," with "an increase in nitrate nitrogen to the range of 0.2 – 2.0 mg/l" observed "in a northeasterly direction from this area of low nitrate concentrations" to Wekiwa Springs.[99] Although careful to admit that there is no accepted methodology or sufficient information to model nutrient removal within the Floridan aquifer, PB Water speculates that biological activity within "high recharge zones of the Floridan aquifer in east-central Florida" may "tend to remove nutrients such as nitrate" associated with discharges from the NWWRF before they reach Wekiwa Springs.[100]

PB Water then presents what it calls "a worst case assessment" of the "potential increase in nitrates at the springs that would occur if all the water from the proposed Lake Cora Lee augmentation project reached the spring without being modified by any nutrient removal in Lake Cora Lee or in the aquifer."[101] Using this methodology, it is assumed that all of the water discharging from the treatment wetland is discharged directly into Wekiwa Springs through a preferential flow path. This "conservative approach" of "determining the upper limit of any increase in nitrates that could occur at the springs" is said to result in a predicted increase of nitrates of 0.021 mg/l at Wekiwa Springs – an increase that would not be expected to result in significant harm to the ecological community.[102] PB Water concludes its response by implying that this approach overestimates the potential impact on Wekiwa Springs from the Lake Cora Lee Project because it is likely "that there would be significant additional removal of nitrate through conversion of nitrate to organic nitrogen in Lake Cora Lee, followed by further attenuation and removal of nitrate as the infiltrated water travels approximately six and a half miles through the Floridan aquifer from the NWWRF to the Wekiva Springs area."[103]

Although these final analyses and opinions may be reasonable, it is important to note that, in making its "worst case assessment," PB Water uses an assumed nitrate discharge value of 1.14 mg/l, not 12 mg/l.[104] This lower value represents the expected nitrate concentration of the 3 mgd of wastewater exiting the treatment wetland into Lake Cora Lee, and not the maximum concentration that can be discharged from the wastewater plant into the wetland. Even if highly unlikely, a true "worst case assessment" would assume that an undetected sinkhole opens up in the wetland and provides rapid conduit flow of wastewater containing 12 m/L of nitrate toward Wekiwa Springs. Using this true "worst case scenario," the predicted nitrate increase at Wekiwa Springs would be more on the order of 0.2 mg/L, which would not be insignificant. If one uses

this same methodology and adds the other 4.5 mgd discharged from the RIBs at the NWWRF into the calculation, the predicted nitrate increase at Wekiwa Springs is approximately 0.5 mg/L, which would be highly detrimental.

The totality of PB Water's response was enough to satisfy DEP that it had received reasonable assurance that the Lake Cora Lee Project did not pose a significant nitrate threat to Wekiwa Springs, and the project was permitted with a nitrate discharge limit of 12 mg/l into the treatment wetland. Despite the potential weaknesses in the PB Water Report noted above, DEP's determinations in this case were likely the only defensible legal[105] and technical[106] ones that could be made based upon both DEP's explicit regulatory authority and the available facts.

## Conclusions and Recommendations

These two case studies suggest that the fundamental problem for springs protection within the current framework for wastewater permitting is that water quality standards for wastewater discharged into groundwater are substantially less stringent than the standards for wastewater discharged into surface water. In order to institute stricter permitting standards that are more protective of springs, DEP has the burden of showing that a particular facility is causing, or could potentially cause, water quality problems within a spring. However, it is extremely difficult for DEP to show that any one facility is causing adverse effects at a particular spring due to uncertainties about the hydrologic behavior of the Floridan aquifer and the inability to effectively distinguish between various sources of nitrates. Even in cases where DEP may, in fact, be inclined to deny or substantially modify a permit based upon predicted or demonstrated water quality degradation at a spring, DEP faces a difficult evidentiary and technical burden to sufficiently counter the reasonable assurances given by experts working for the applicants.

Because DEP likely lacks the sufficient technical expertise and associated legal authority needed to take more effective regulatory actions in most wastewater permitting cases, the current logic for wastewater permitting is consistent with increasing loads of wastewater being discharged into springsheds and an associated deterioration of water quality within springs. Due to the serious nature of these problems, serious modifications to the framework for wastewater permitting likely will have to be made if more effective springshed protection is to be achieved.

The following are several suggestions for improving DEP's regulatory position and facilitating better protection of springs from wastewater sources, with some discussion of potential advantages and disadvantages offered by each suggested approach. These suggestions are intended only to serve as a starting point for discussion of possible policy options, and should not be considered exhaustive.

**1. Institute stricter nitrate standards for groundwater within springsheds.**

**Potential advantages:** Avoidance of regulatory wrangling over the possible effects of discharges from any one facility on a spring, straightforward monitoring criteria, and groundwater standards consistent with the maintenance of springs ecosystems.

**Potential disadvantages:** Variable residence and travel times of groundwater and vagaries in the chemical signatures of nitrate may make it difficult to determine the source of elevated nitrates,[107] excessive nitrates in some areas might be the result of past activities long since ceased, and stricter nitrate standards may have negative impacts on agriculture.[108]

**2. Institute a mandatory requirement for advanced treatment of municipal wastewater within designated springsheds.**

**Potential advantages:** Avoidance of regulatory wrangling over the possible effects of discharges from any one facility on a spring and a straightforward permitting process.

**Potential disadvantages:** The high cost of building advanced treatment facilities, and the possibility that some sites within a groundwater basin could be utilized in a manner consistent with springshed protection using means less costly and energy intensive than advanced treatment facilities.[109]

**3. Institute rules mandating waste management and monitoring programs designed to protect groundwater quality at levels consistent with springs protection for all dairy and poultry farms located within high groundwater recharge and springshed areas.**

**Possible advantages:** Stricter regulatory standards and practices that would bring DEP in compliance with a recent court ruling that orders the state to cease using voluntary agreements with Suwannee River Basin farmers to reduce pollution.[110]

**Possible disadvantages:** Fierce resistance from farmers, adverse economic consequences from regulation, and the possible collapse of the Suwannee River Partnership – which has shown some success at getting farmers to institute BMPs that may help reduce nutrient loadings to springsheds.[111]

**4. Institute a Total Maximum Daily Loading (TMDL) program that would effectively "cap" nutrient loadings within a springshed at some maximum threshold that would protect the water quality of springs.**

**Potential advantages:** Enable regulators to take a holistic view of springshed management and require applicants wishing to load additional nutrients into a basin to work with existing sources to achieve reductions so that maximum thresholds are not exceeded. Ideally, such a "cap and trade" approach might produce market efficiencies in reducing nutrient loadings within a springshed.[112]

**Potential disadvantages:** The technical difficulties, long time horizon, and substantial resources that would likely be associated with establishing TMDLs for springsheds. A TMDL approach may result in permitted point sources taking the burden of regulation even in cases where non-point sources may be more important nutrient sources, and there may be substantial complications associated with a cap and trade system for nutrient loading.

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[1] F.S. §403.021

[2] Domestic wastewater is defined as coming from centralized facilities "principally designed to collect and treat sanitary wastewater or sewage from dwellings or homes, business buildings, institutions, and the like." Florida Department of Environmental Protection, *Wastewater in Florida* (visited June 8, 2004) <http://www.dep.state.fl.us/water/wastewater/index.htm>. Industrial wastewater is a more general term that encompasses a wide variety of industries and pollutant discharges, including pulp and paper mills, phosphate mines, electrical power plants, laundromats, and some large agricultural operations. Florida Department of Environmental Protection, *Industrial Wastewater Program* (visited June 8, 2004) <http://www.dep.state.fl.us/water/wastewater/iw/index.htm>.

[3] Background levels for nitrate in uncontaminated spring water from Florida springs are estimated to be below .2 mg/L. Nitrate levels above 1 mg/L are usually considered to be highly detrimental to the native ecology of springs. FLORIDA SPRINGS TASK FORCE, FLORIDA SPRINGS: STRATEGIES FOR PROTECTION AND RESTORATION 11 (NOVEMBER 2000) <http://www.dep.state.fl.us/springs/reports/FloridaSpringsReport.pdf >.

[4] F.A.C. §62-4; F.A.C. §62-302; Florida Department of Environmental Protection, *The Antidegradation Policy for Reuse Projects* (visited June 8, 2004) <http://www.dep.state.fl.us/water/reuse/antideg.htm>.

[5] *Id.*

[6] *Id.*
[7] F.S. §403.086(4)(a).
[8] Florida Department of Environmental Protection, *Domestic Wastewater* (visited June 8, 2004) <http://www.dep.state.fl.us/southwest/water/DomWNar.htm>; F.S. §403.086.
[9] F.A.C. §62-600.420(1)(c).
[10] F.A.C. §62-600.420 (1)(b)2.
[11] *Id.*
[12] F.A.C. §62-600.420(2)(a)3.
[13] Florida Department of Environmental Protection, *Inorganic Contaminants* (visited June 8, 2004) <http://www.dep.state.fl.us/water/drinkingwater/inorg_con.htm>. Despite the nitrate drinking water standard of 10 mg/L, permits are issued for domestic wastewater discharges containing total nitrogen and/or nitrate concentrations up to 12 mg/L. The assumption behind the lower discharge standard is that dilution and treatment in the sub-surface matrix will reduce nitrogen and/or nitrate levels to the drinking water standard before reaching underlying aquifers. Interview with Denisse Judy, Program Manager for Domestic Waste Permitting, and Christianne C. Ferraro, Program Administrator for Water Resource Management, in DEP Central District; 3319 Maguire Boulevard, Suite 232; Orlando, FL 32803-3767 (February 17, 2004).
[14] Florida Department of Environmental Protection, *Industrial Wastewater Program: Agriculture Industry* (visited June 8, 2004) <http://www.dep.state.fl.us/water/wastewater/iw/agri.htm>.
[15] The formulas and definitions used to determine the animal feeding operations that can be regulated by DEP's industrial wastewater program are found in F.A.C. §62-670.200. Dairy and poultry farms are the most common types of intensive animal feeding operations in Florida, and are specifically regulated in
[16] F.A.C. §62-670.600.
[17] F.A.C. §62-670.500.
[18] Florida Department of Environmental Protection, *supra* note 14.
[19] *See, e.g.,* WEKIVA RIVER BASIN COORDINATING COMMITTEE, FINAL REPORT 25 (March 16, 2004) [hereinafter Wekiva Committee Report].
[20] F.A.C. §62-670.50.
[21] For more information on sources of nitrate in the Suwannee River Basin, *see* BRIAN G. KATZ AND J.K. BOHLKE, . UNITED STATES GEOLOGICAL SURVEY, MONTHLY VARIABILITY AND POSSIBLE SOURCES OF NITRATE IN GROUNDWATER BENEATH MIXED AGRICULTURAL LAND USE, SUWANNEE AND LAFAYETTE COUNTIES FLORIDA (Water-Resources Investigations Report 00-4219, 2000).
[22] *See* Aysin Dedekorkut, *Suwannee River Partnership*, *in* Adaptive Governance and Florida's Water Conflicts: The Case Studies. 92 (June 2003). Dedekorkut claims that the Suwannee River Partnership helped farmers keep "77 tons of nitrates from dairy wastes and 475 tons of nitrates from poultry wastes out of the aquifer."
[23] *See* Save Our Suwannee, Inc. *et al.* v. Department of Environmental Protection, No. 2001-CA-001266 (Fl. 2nd Jud. Cir. Mar. 8, 2004). The circuit judge ruled that DEP's reliance on voluntary programs to regulate wastewater from large animal farms "is so inadequate as to closely resemble a delegation of its duties to the industry it is required to regulate," and ordered DEP to require all dairy farms containing over 700 mature dairy cattle to apply for a wastewater permit. *Id.* at 3-4, 7. A bill introduced in the Florida Senate contained language that would have allowed the voluntary program to continue in place of wastewater permits, but failed to pass in the 2004 legislative session. SB 1518 (Florida 2004) <http://www.flsenate.gov/data/session/2004/Senate/bills/billtext/pdf/s1518c1.pdf>. *See* also, Tallahassee Democrat, *The Issues* (May 2, 2004) <http://www.tallahassee.com/mld/democrat/news/local/8569858.htm>.
[24] Judy and Ferraro, *supra* note 13.
[25] *E.g.,* Katz and Bohlke, *supra* note 21; Wekiva River Basin Coordinating Committee, *supra* note 19; W.J. ANDREWS, UNITED STATES GEOLOGICAL SURVEY, NITRATE IN GROUND WATER AND SPRING WATER NEAR FOUR DAIRY FARMS IN NORTH FLORIDA, 1990-93, (Water-Resources Investigations Report 94-4162, 1994); B.G. KATZ, *et al.,* UNITED STATES GEOLOGICAL SURVEY, SOURCES AND CHRONOLOGY OF NITRATE CONTAMINATION IN SPRING WATERS, SUWANNEE RIVER BASIN, FLORIDA (Water-Resources Investigation Report 99-4252, 1999).
[26] Judy and Ferraro, *supra* note 13; Interview with John Davis, P.G., DEP Wastewater Engineer, and Jeff Martin, P.E., DEP Supervisor of Domestic Waste Program, in DEP Northeast District, 7825 Baymeadows Way, Suite B200, Jacksonville, FL 32256-7590 (February 25, 2004).
[27] The "reasonable assurance" standard for issuing permits is defined in F.A.C. §62-4.070(1). The DEP is authorized to give permits when an "applicant affirmatively provides the Department with reasonable assurance based on plans, test results, installation of pollution control equipment, or other information, that the construction, expansion,

modification, operation, or activity of the installation will not discharge, emit, or cause pollution in contravention of Department standards or rules."

[28] Ginnie Springs, Inc. *et al.* vs. Craig Watson and Department of Environmental Protection, 98-0945, 98-1070, 98-1071 DOAH 2 (DEP1999) (final order) [hereinafter Watson Final Order].

[29] Ginnie Springs, Inc. *et al.* vs. Craig Watson and Department of Environmental Protection, 98-0945, 98-1070, 98-1071 DOAH 8 (DOAH 1999) (recommended order) [hereinafter Watson Recommended Order].

[30] *Id.* at 12.

[31] *E.g.*, Letter from Barbara Wray Suggs, President, Ginnie Springs, Inc., to Virginia B. Wetherell, DEP Secretary (December 28, 1997) (within permit file FLA017396 at DEP Northeast District, 7825 Baymeadows Way, Suite B200, Jacksonville, FL 32256-7590); Letter from Wes Skiles, Karst Environmental Services, to Jerry Owen, DEP Water Facilities Administrator (December 30, 1997) (within permit file FLA017396 at DEP Northeast District, 7825 Baymeadows Way, Suite B200, Jacksonville, FL 32256-7590).

[32] Watson Final Order*, supra* note 28, at 2.

[33] *Id.* at 3.

[34] *Id.*

[35] *Id.*

[36] Watson Recommended Order, *supra* note 29, at 4.

[37] *Id.* at 5

[38] *Id.* at 9-10.

[39] "Traditional dairy farms" are described as "intensive livestock use areas, which result in denuding of vegetation and consequent compacting of the soil." Such practices are said to prevent "the effective plant root zone uptake method of treating dairy waste and waste water for prevention of ground water quality violations." The rotational grazing method is said "to avoid such problems by dividing a dairy farm's surface area into numerous pastures which cows can graze upon with constant and frequent rotation of cows between such pastures. This avoids overgrazing or denuding of the cover crop upon which cows graze," and thus ensures "proper treatment of wastes through root zone uptake." *Id.* at 6.

[40] *Id.*

[41] *Id.* at 15.

[42] *Id.* at 28.

[43] *Id.* at 28-29

[44] *Id.* at 19-20.

[45] *Id.* at 33.

[46] *Id.* at 20, 26-27.

[47] *See* F.A.C. §62-4.070(1), *supra* note 27.

[48] Watson Recommended Order, *supra* note 29, at 31-32.

[49] *Id.* at 32.

[50] *Id.* at 33.

[51] *Id.* at 34.

[52] *Id.* at 33.

[53] *Id.* at 38.

[54] Department of Environmental Protection, Industrial Wastewater Facility Permit 4 (Permit No. FLA017396/001, 1999) (within permit file FLA017396 at DEP Northeast District, 7825 Baymeadows Way, Suite B200, Jacksonville, FL 32256-7590).

[55] Florida Springs Task Force, *supra* note 3, at 16.

[56] *E.g.,* Michael Holloway, Engineering Report in Support of Permit Application 8 (August 1997) (within permit file FLA017396 at DEP Northeast District, 7825 Baymeadows Way, Suite B200, Jacksonville, FL 32256-7590).

[57] Letter from Craig Watson to DEP (November 14, 2001) (within permit file FLA017396 at DEP Northeast District, 7825 Baymeadows Way, Suite B200, Jacksonville, FL 32256-7590).

[58] Although violations have been recorded (*e.g.,* Figure 2), DEP's characterization of compliance within "the past 10 quarters" from the issuance of relief is correct.

[59] Letter from Jerry M. Owen, DEP Water Facilities Administrator to Craig Watson [hereinafter DEP Relief Letter] (November 26, 2001) (within permit file FLA017396 at DEP Northeast District, 7825 Baymeadows Way, Suite B200, Jacksonville, FL 32256-7590).

[60] *See* Katz and Bohlke, *supra* note 21, at 26-27, for more information about the substantial seasonal variability associated with groundwater nitrate in the Suwannee River groundwater basin.

[61] The Suwannee River Partnership is the program that DEP refers to as its "dairy compliance initiative," *see* Dedekorkut, *supra* note 22.
[62] DEP Relief Letter, *supra* note 59.
[63] *See* Joel A. Mintz, *Scrutinizing Environmental Enforcement: A Comment on a Recent Discussion at the AALS*, 17(1) Journal of Land Use and Environmental Law 127 (2001), for a defense of the position that a hybrid system utilizing both the carrot of compliance assistance with the stick of deterrence is likely to produce the most effective environmental regulation.
[64] JAMES L. WESCOTT, JR. AND GILBERT F. WHITE, WATER FOR LIFE: WATER MANAGEMENT AND ENVIRONMENTAL POLICY 108 (2003).
[65] That is, if its stance has not already been untenable by the circuit judge's recent ruling against DEP's reliance on voluntary programs as a means of regulating dairy farms *in* Save Our Suwannee, Inc. *et al.* v. Department of Environmental Protection, *supra* note 23.
[66] Nitrate concentrations in effluent were measured to be as high as 131.8 mg/L, causing nitrates in the Suwannee River to rise by as much as 300% from 0.5 mg/L to 2.1 mg/L as a result of the discharge. Letter from Jerry M. Owen, DEP Water Facilities Administrator to Donald W. Mabe, Jr., Vice President of Operation Gold Kist Incorporated (May 1, 2001) (within permit file FL0001465 at DEP Northeast District, 7825 Baymeadows Way, Suite B200, Jacksonville, FL 32256-7590) [hereinafter, Gold Kist Letter].
[67] Department of Environmental Protection, Memorandum of Agreement between DEP and Gold Kist, Inc., (December 6, 2002) (within permit file FL0001465 at DEP Northeast District, 7825 Baymeadows Way, Suite B200, Jacksonville, FL 32256-7590).
[68]The Wekiva Study Area was delineated by the Wekiva River Basin Coordinating Committee in August 2003, and is the area believed to contribute the majority of surface and groundwater inputs into the Wekiva River. The Wekiva River Basin Coordinating Committee was created and appointed on July 1, 2003, by Governor Jeb Bush through Executive Order 2003-12. Wekiva Basin Report, *supra* note 19, at 9-10.
[69] Department of Environmental Protection, Domestic Wastewater Facilities with Ground Water Discharges in the Wekiva Study Area (undated) (document obtained from Denisse Judy, Program Manager for Domestic Waste Permitting, and Christianne C. Ferraro, Program Administrator for Water Resource Management at DEP Central District, 3319 Maguire Boulevard, Suite 232; Orlando, FL 32803-3767) [hereinafter Wekiva Area Wastewater Discharges].
[70] *Id.*
[71] The RIBs and drain fields in the Wekiva Study Area generally utilize secondary treatment and have application rates of up to 9 inches per day, with a nitrate limit of 12 mg/L, *id.* Spray fields also utilize secondary treatment and have application rates of 2 inches per week or less, *id*. There are no nitrate limits on water discharged from most spray fields within the Wekiva Study Area, but an ideal spray field is designed in such a way that cover crops can take up many of the nutrients, *id*. Reclaimed water is generally treated beyond secondary standards for Total Suspended Solids and disinfection, and is usually applied at a fairly diffuse rate across the service area, *id*. Like spray fields, reclaimed water used within the Wekiva Study Area generally does not have a limit for nitrate, *id*. Wastewater discharges to surface water generally require advanced treatment, *see* F.S. §403.086(4)(a), *supra* note 7, with total nitrogen limits of 3 mg/L, *see* F.S. §403.086, *supra* note 8 and accompanying text.
[72] Spring flow estimates are from Wekiva Basin Report, *supra* note 19, at 23.
[73] Identified sources of nitrates within the Wekiva River Basin include fertilizers, septic tanks, and sewage treatment facilities, *id*. at 25.
[74] Judy and Ferraro, *supra* note 13.
[75] Department of Environmental Protection, Domestic Wastewater Facility Permit Application (2003) (within permit file FLA010798-003-DW1P at DEP Central District, 3319 Maguire Boulevard, Suite 232, Orlando, FL 32803-3767).
[76] *Id.*
[77] *Id.*
[78] *Id.*
[79] *Id.*
[80] Letter from Christine C. Ferraro, DEP Program Administrator, Water Facilities, to Raymond Hanson, Wastewater Division Manager; Orange County Domestic Waste; OCUD/Northwest WWTF (July 16, 2003) (within permit file FLA010798-003-DW1P at DEP Central District, 3319 Maguire Boulevard, Suite 232, Orlando, FL 32803-3767).
[81] *Id.*
[82] *Id.*

[83] PB Water, Orange County Utilities Lake Cora Lee Augmentation Project Modification to Florida Department of Environmental Protection Wastewater Operational Permit No. FLA010798: Response to Request for Additional Information 16 (September, 16, 2003) (within permit file FLA010798-003-DW1P at DEP Central District, 3319 Maguire Boulevard, Suite 232, Orlando, FL 32803-3767) [hereinafter PB Water Report].
[84] *Id.* The Wekiva groundwater basin delineated by SJRWMD is located to the southwest of the river and springs. The Wekiva Protection Area was drawn by the State of Florida, and is largely to the north of the springs. Thus, the Wekiva Protection Area captures very little of the groundwater basin. For more details on the SJRWMD delineation of the Wekiva groundwater basin, *see* DAVID J. TOTH AND CARLOS FORTICH, ST. JOHN'S RIVER WATER MANAGEMENT DISTRICT, TECH. PUB. NO. SJ2002-2, NITRATE CONCENTRATIONS IN THE WEKIVA GROUNDWATER BASIN WITH EMPHASIS ON WEKIWA SPRINGS (2002).
[85] PB Water Report, *supra* note 83, at 16.
[86] *See* F.A.C. §62-4.070(1), *supra* note 27.
[87] PB Water Report, *supra* note 83, at 16.
[88] *Id.*
[89] For more on nitrate variation within springs and the necessity of frequent sampling regimes to establish clear trends, *see* Jonathan B. Martin and Sheryl L. Gordon, *Surface and Groundwater Mixing, Flow Paths, and Temporal Variations in Chemical Compositions of Karst Springs*, *in* Groundwater Flow and Contaminant Transport in Carbonate Aquifers 65 (Ira D. Sasowsky and Carol M. Wicks eds., 2000).
[90] *See id.*
[91] PB Water Report, *supra* note 83, at 17
[92] Although neither of these hypothetical examples has any conclusive supporting data, there is also no sure evidence indicating that they are impossible.
[93] The SJRWMD publication cited by PB Water is DAVID TOTH, ST. JOHNS WATER MANAGEMENT DISTRICT, TECH. PUB. NO. SJ2003-1, WATER QUALITY AND ISOTOPE CONCENTRATIONS FROM SELECTED SPRINGS IN THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT, PART 2 (2003).
[94] PB Water Report, *supra* note 83, at 17.
[95] *Id.*
[96] The SJRWMD source is Toth, *supra* note 93.
[97] For more on the chemical signatures of organic and inorganic nitrate sources, *see* Katz and Bohlke, *supra* note 21, at 23.
[98] The Wekiva Basin Report, *supra* note 19, at 25 does list wastewater treatment facilities as a source of nitrates in Wekiwa Springs.
[99] PB Water Report, *supra* note 83, at 17.
[100] *Id.*
[101] *Id.*
[102] *Id.*
[103] *Id.*
[104] *Id.*
[105] The case law draws a distinction between "reasonable assurances," *see* F.A.C. §62-4.070(1), *supra* note 27, and "absolute guarantees." It has been consistently ruled that the evidentiary burden for a permit applicant is not one of "absolute guarantees," *see* Manasota-88, Inc., v. Agrico Chemical, 12 F.A.L.R. 1319, 1325 (DER 1990). Even though conjectures about potential weaknesses in PB Water's case may show that the applicants did not demonstrate an "absolute guarantee" that Wekiwa Springs would not be harmed, it is unlikely that any of these conjectures rise to a level of seriousness that would threaten the reasonable assurance evidentiary standard.
[106] The Lake Cora Lee Project wetland system is, at the very least, likely quite superior to existing RIBs, drain fields, and spray fields within the Wekiva groundwater basin for springs protection, because PB Water's contention that the constructed wetland can be expected to greatly attenuate nitrogen through biological and chemical means before wastewater is recharged into the groundwater, PB Water Report, *supra* note 83, at 17, is supported by numerous case studies of using constructed wetlands to effectively treat wastewater nutrients. For an example of a successful wastewater wetland facility located in Orange County, *see* EPA, *Orlando Florida – Wetland Treatment Systems: A Case History – The Orlando Easterly Wetlands Reclamation Project* (visited June 14, 2004) <http://www.epa.gov/owow/wetlands/construc/orlando.html>.
[107] *See* Martin and Gordon, *supra* note 89; Katz and Bohlke, *supra* note 21.
[108] For example, increased regulation of dairies in the Lake Okeechobee Basin to control phosphorus is thought to be largely responsible for the closing of 56% of the dairy farms in that region since 1991. Those that remain report a

number of adverse economic consequences from complying with the regulations. *See* Russ Giesy *et al*., *Florida Dairy Environmental Update 2003* (April 2003) <http://sumter.ifas.ufl.edu/FL%20Dairy%20Environmental%20Update%202003.htm>.

[109] *See* Hans Brix, *Use of Constructed Wetlands in Water Pollution Control: Historical Development, Present status, and Future Perspectives*, 30 Water Science and Technology 209 (1994); A. Mulder, *The Quest for Sustainable Nitrogen Removal Technologies*, 48 (1) Water Science and Technology 67 (2003).

[110] *See* Save Our Suwannee, Inc. *et al.* v. Department of Environmental Protection, *supra* note 23.

[111] *See* Dedekorkut, *supra* note 22. However, Dedekorkut notes that even with high levels of BMP adoption and compliance, it will take many years for improvements to be seen in rivers and springs, *id*., at 93.

[112] The "cap and trade" approach for pollutant reduction is a centerpiece of the 1990 Clean Air Act Amendments. For commentary on both the efficacy and efficiency some see with this approach, *see, e.g.,* Robert D. Brenner, *Clean Air Act: Progress and Challenges Ahead*, 20 St. Louis University Pub. L. Rev. 7, 8 (2001).