

TECHNICAL PUBLICATION

WR-2019-001

**Antecedent Land Use of the Everglades
Stormwater Treatment Areas**

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September 2019

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Introduction

The Everglades Stormwater Treatment Areas (STAs) were designed to remove excess phosphorus from stormwater runoff before it enters the Everglades Protection Area. The STAs have been constructed over the past 20+ years, generally on land used for agricultural purposes. These STAs currently (2018) include approximately 57,000 acres (ac) of effective treatment area (total of 68,000 ac including infrastructure), divided into 5 large constructed wetlands operated by the South Florida Water Management District (SFWMD; Chimney et al. 2019). Although multiple construction and management activities were intended to ensure that the STAs achieve their intended treatment performance, prior land use affects management and operation of each STA. For example, the quantity and quality of soil can influence the ability to establish and sustain vegetation or promote the presence of exotic plant species that require judicious use of herbicides to control.

This report details prior documented and interpreted land use of the current Everglades STAs: STA-1 East (STA-1E), STA-1 West (STA-1W), STA-2, STA-3/4, and STA-5/6 using historical reports, aerial imagery and interpreted land cover/land use maps. Some of this information has been presented in abbreviated form in published and unpublished reports; however, detailed spatially/temporally published information on crop histories is very limited as many in the agricultural industry consider this information proprietary. Thus, historical aerial imagery (Appendix A) and interpreted land cover/land use maps were frequently used to fill information gaps. Crops may have changed intermittently between image capture and survey dates; however, most reports suggest that the primary crops were consistent over long time scales.

In addition to antecedent land use, soil characterization and treatment performance information is included in this report for each STA. Soil data were collected by University of Florida and SFWMD personnel (Reddy et al. 2009, Zamorano et al. 2010), and are reported as average values across each STA. All soil data reported are from the 0-10 cm soil horizon. Past soil sampling methodology was not standardized, so only sampling events within 2 years of STA start up, sampling the 0-10 cm soil horizon were included. More detailed soil information is included in Appendix B. All treatment performance data included were for the period-of-record (POR) for each STA ending in WY2018.

Definitions

Multiple land cover types and agricultural practices are referenced in this report, the definitions of which are described below:

Citrus grove – Cultivated tree grove that may contain oranges, grapefruit or tangerines.

Fallow cropland – Agricultural land taken out of the normal crop rotation. Does not necessarily indicate complete abandonment as the land may be in transition to a new land use.

Forested wetland – A wetland vegetation community dominated by shrubs and/or trees. Includes species such as red maple, willow, water oak, cabbage palm, bay, cypress etc.

Herbaceous wetland – A wetland vegetation community, which includes native wetland emergent plants with no trees present.

Improved pasture – Pastureland that is periodically improved through clearing, tilling, reseeding, brush control, and fertilizing for cattle grazing. May contain watering ponds, troughs, feed bunkers, fencing, and barns.

Rangeland – Also known as upland non-forested area. Upland areas with natural plant cover composed principally of native grasses, forbs and shrubs suitable for cattle forage. Management practices include brush control and regulation of grazing intensity.

Row crops – Cultivated annual crops such as corn, tomatoes, potatoes, cabbage, beans, tobacco etc. Excludes any field crops, trees, shrubs, or ornamentals.

Tree nursery – Nurseries used to grow trees for transfer to other destinations. Includes a wide variety of species that are grown in ground or in containers, which also may contain ornamental or timber species.

Unimproved pasture – Pastureland with a low-level intensity of management. Likely includes native grasses and is not actively managed with fertilizer or brush control.

Upland forest – Broad category indicating xeric or mesic forest vegetation communities (excludes wetland forests) with no evidence of current timber production.

STA-1E

STA-1E was designed and constructed by the U. S. Army Corps of Engineers (USACE). STA-1E includes 4,994 acres of effective treatment area, and 1,057 acres in the East and West Distribution Cells that are not included as effective treatment area (**Figure 1**; Piccone et al. 2014). The STA has eight treatment cells in three separate flow-ways. STA-1E was completed and first flooded in WY2005 and initially was used for emergency flood-control operations before receiving an operating permit in WY2006 (Pietro 2012). Soil sampling was completed by WY2005. Soil was characterized by an average bulk density of $1.08 \pm 0.34 \text{ g/cm}^3$, and total phosphorus (TP) content of $189 \pm 127 \text{ mg/kg}$. STA-1E has treated ~ 1.48 million ac-ft of water throughout its POR, retaining 262.7 metric tons (t) of TP since it has been in operation (78% mass retention; Chimney et al. 2019).

The area of STA-1E was originally a patchwork assemblage of land uses, consisting of multiple small farms and groves when it was purchased for STA construction. Many of these farms were operated as “hobby” farms, so farming operations and extent were limited (J. Sullivan [AECOM], personal comm.). The Eastern Flow-way (Cells 1 and 2) was used for both improved and unimproved pasture beginning around 1973 with intermittent patches of herbaceous wetland and upland forest (primarily the invasive exotic Brazilian pepper, *Schinus terebinthifoliosus*). Row crops and sugar cane were grown in the Cell 1 inflow region sometime after 1973 through the late 1990s (**Figure 2**). The Central Flow-way (Cells 3, 4N, and 4S) includes citrus groves and sugar cane. Cells 3 and 4N were citrus groves with interspersed patches of herbaceous wetland and upland forest since 1973, while Cell 4S was farmed primarily for sugar cane after 1973. The Western Flow-way (Cells 5, 6, and 7) was split between citrus groves dominating Cell 5 and sugar cane making up all of Cells 6 and 7. Both the citrus groves and pastures in STA-1E existed from the 1970s until the late 1990s. Sugar cane plots appeared sometime later in the 1980s.

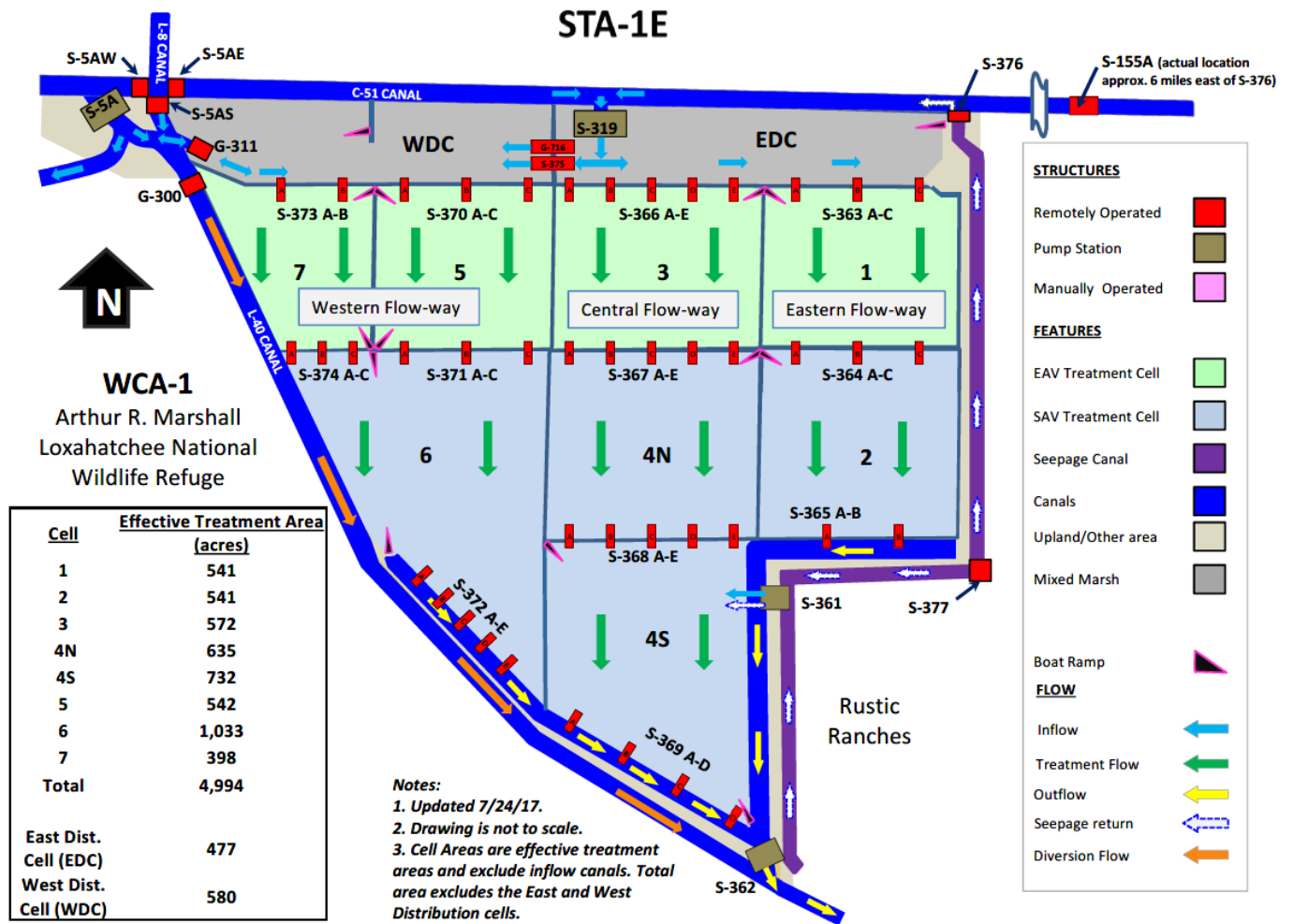


Figure 1. Schematic drawing of STA-1E illustrating the layout of the treatment cells and the flow direction in the flow-ways.

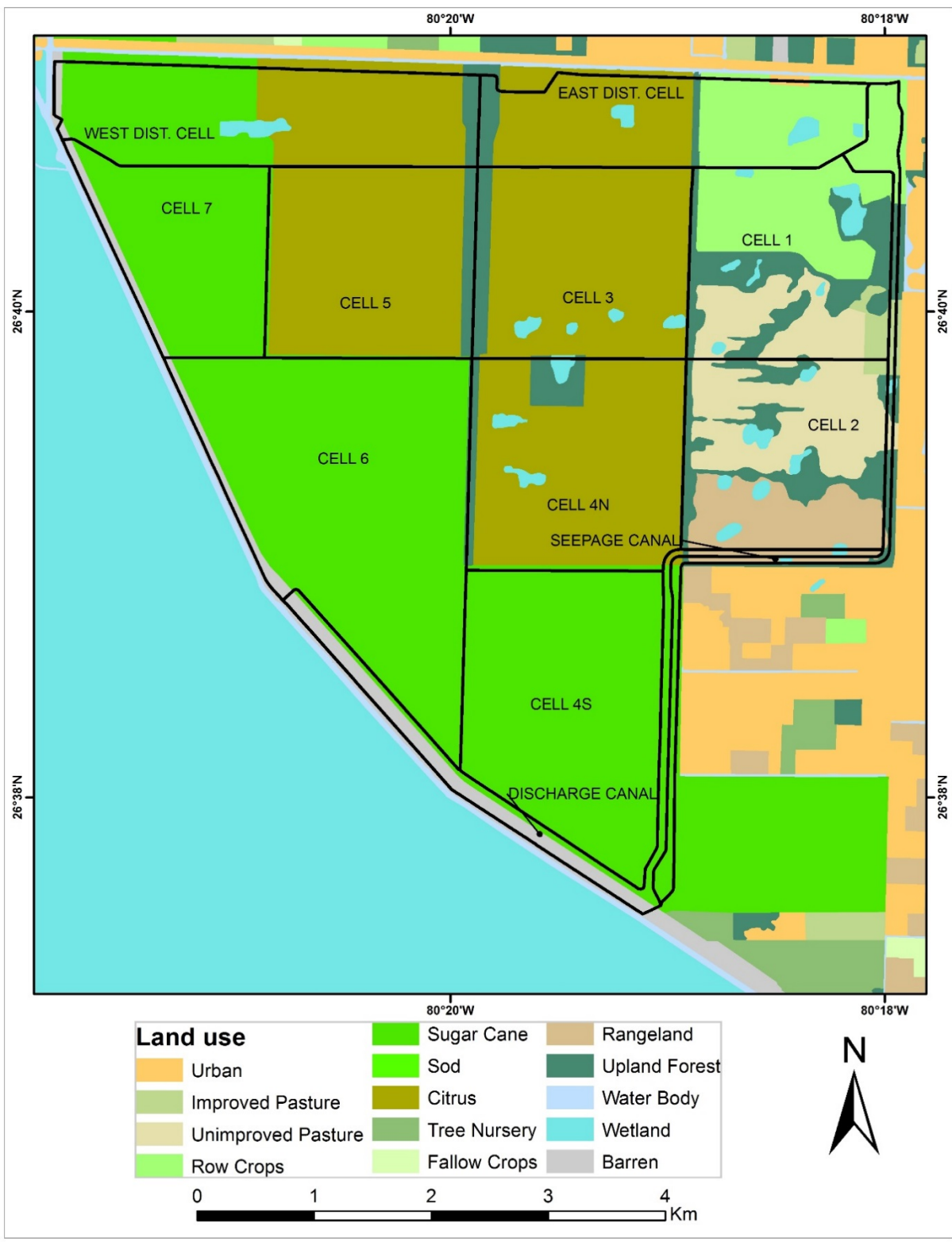


Figure 2. Land use map of STA-1E derived from 1999 aerial imagery that illustrates the general layout of farming practices within STA-1E shortly before farming practices were ended (SFWMD Land Cover/Land Use 1999 Mapping Project).

STA-1W

STA-1W was the first Everglades STA established and was originally named the Everglades Nutrient Removal Project (ENRP). The project began operation in WY1994 and included four treatment cells (Cells 1 through 4) split between two parallel flow-ways (Pietro 2012). The ENRP was expanded to include Cells 5A and 5B (beginning operation in WY2000) at which time the facility was renamed STA-1W. Further compartmentalization occurred in WY2006-WY2007 when Cells 1 and 2 were subdivided into Cells 1A, 1B, 2A, and 2B, respectively. As of WY2018, STA-1W consists of eight treatment cells configured in three flow-ways for a total of 6,544 acres of effective treatment area (**Figure 3**; Piccone et al. 2014, Chimney et al. 2019). A current expansion project has added three cells (Cells 6, 7 and 8) encompassing 4,381 acres; flow-through of these new cells should begin in WY2020-WY2021. Soil samples were taken in the various cells as they were constructed, beginning in WY1996. Soil was characterized by an average bulk density of $2.05 \pm 0.39 \text{ g/cm}^3$, and TP content of $463 \pm 64.3 \text{ mg/kg}$. Soil information for Cells 6, 7, or 8 was not available for this report. STA-1W has treated ~4.39 million ac-ft of water throughout its POR, retaining 676.7 t of TP since beginning operations (73% mass retention; Chimney et al. 2019).

Antecedent land use within STA-1W was almost exclusively sugar cane farms (**Figure 4**). The Eastern Flow-way (Cells 1A, 1B, and 3) and the Western Flow-way (Cells 2A, 2B, and 4) were farmed for sugar cane beginning between 1968 and 1973 until the land was converted into the ENRP in the early 1990s. The Northern Flow-way (Cells 5A and 5B) was also farmed for sugar cane beginning around 1969, however agricultural practices ended in the late 1990s. The north-eastern corner was not used for agriculture until after 1973 and includes some small parcels that were citrus groves or tree nurseries. The cells added as part of the STA-1W expansion (Cells 6, 7, and 8) were primarily sugar cane farms that started in 1973 becoming fallow after that and then converted to STA. Cell 7 also contained row crops and sod (Professional Services Industries, Inc. 2014a), while Cells 6 and 8 contained small rice parcels and occasional row crops (Professional Services Industries, Inc. 2014b), though all parcels were converted back to sugar cane by the time of STA conversion. In addition to sugar cane, some parcels throughout the STA were rice farms (Jammal and Associates 1991) and may have been row crop farms (Goforth 2005). However, the exact location of these parcels was not recorded.

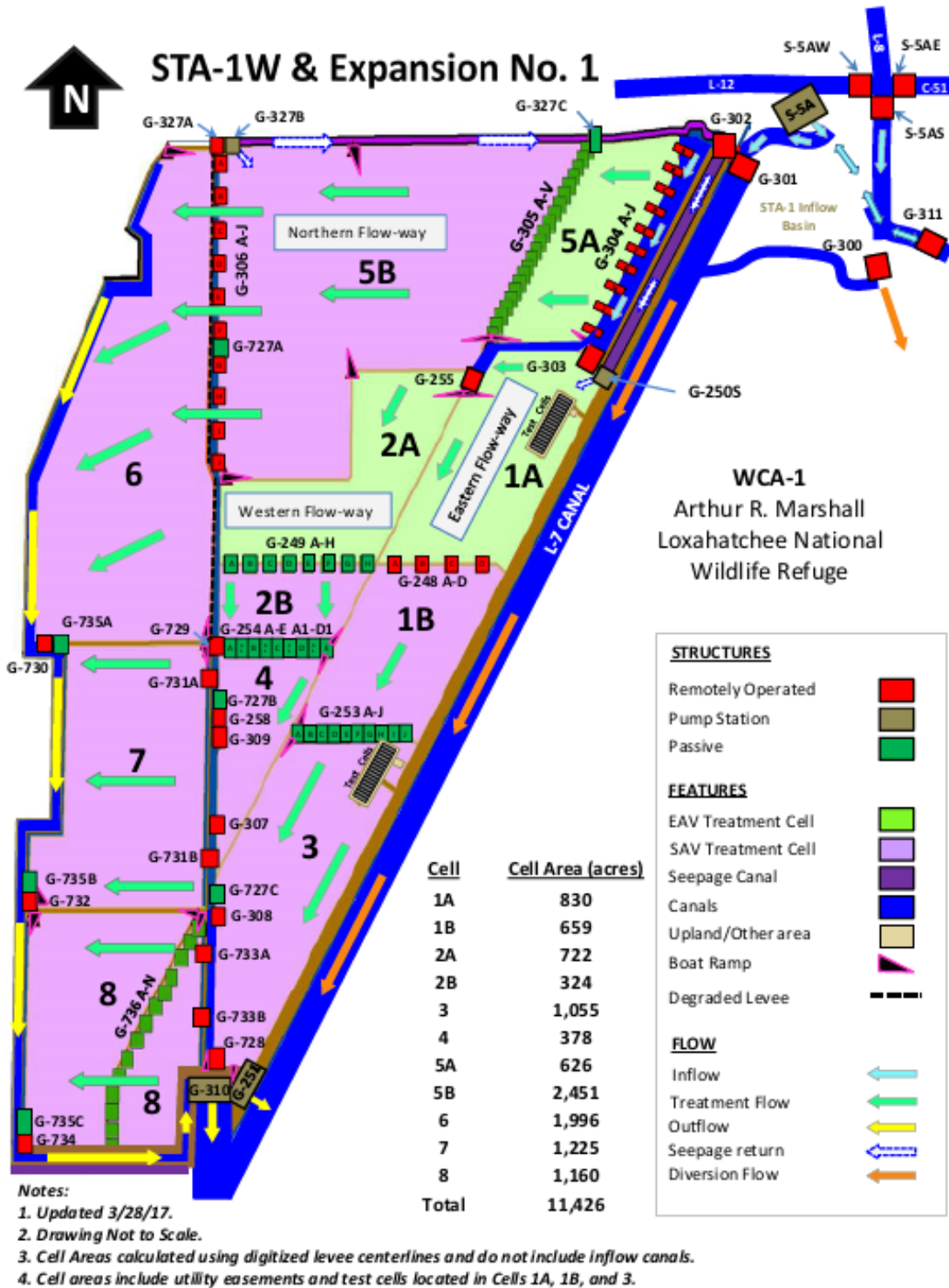


Figure 3. Schematic drawing of STA-1W and its recent expansion area illustrating the layout of the treatment cells and the flow direction in the flow-ways. Note the listed effective treatment areas include the expansion area, which has not begun flow-through operation.

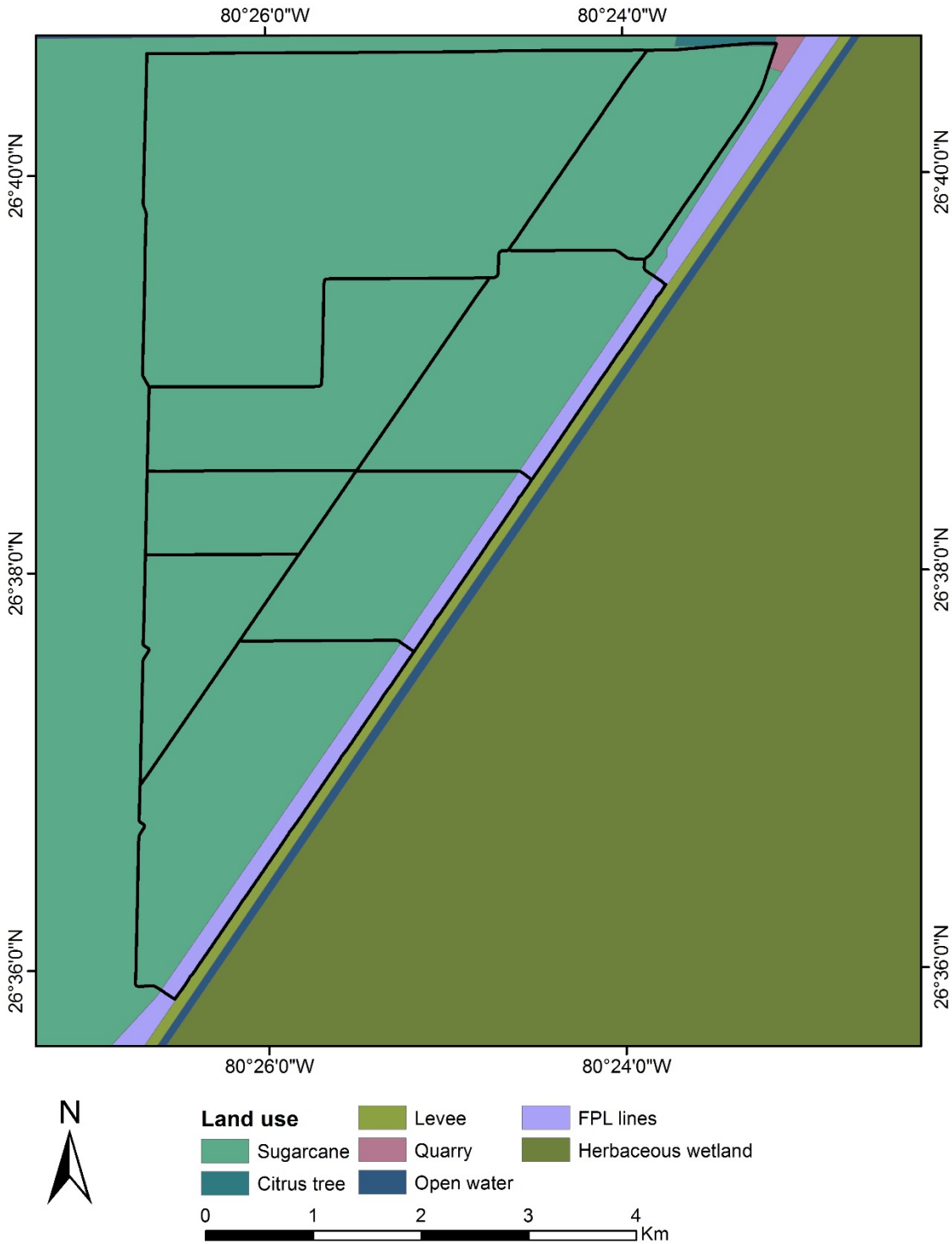


Figure 4. Land use map of STA-1W derived from 1988 aerial imagery that illustrates the general layout of farming practices within STA-1W shortly before becoming an STA (SFWMD Land Cover/Land Use 1988 Mapping Project).

STA-2

STA-2 was designed and constructed in several phases. STA-2 became operational in WY2000 containing three parallel one-cell flow-ways (Cells 1, 2, and 3) with an additional parallel one-cell flow-way (Cell 4) added in WY2007 (Pietro et al. 2007, Pietro 2012). Four more cells (Cells 5, 6, 7 and 8) configured in two flow-ways on land referred to as Compartment B were completed by WY2013 and operational by WY2014. As of WY2018, STA-2 encompassed a total of 15,495 acres of effective treatment area divided into eight cells configured in five flow-ways (**Figure 5**; Piccone et al. 2014, Chimney et al. 2019). Initial soil samples were obtained as cells were constructed, beginning in WY2001. Soil was characterized by an average bulk density of $0.27 \pm 0.08 \text{ g/cm}^3$, and TP content of $601 \pm 142 \text{ mg/kg}$. STA-2 has treated ~ 5.18 million ac-ft of water throughout its POR, retaining 503.4 t of TP since beginning operation (77% mass retention; Chimney et al. 2019).

STA-2 is unlike other STAs in that a large portion of its footprint, referred to as Brown's Farm Wildlife Management Area, contained expansive natural areas at the time of STA conversion. Portions of this management area were historically used for peanut production in the 1920s, though exact locations have not been documented. The land designated as a management area was leased to Florida Game and Freshwater Fish Commission in 1970 for conservation (URS Corporation 2003). Brown's Farm consisted of emergent marshes and dense tree islands, which encompassed all of Flow-way 1, approximately 75% of Flow-way 2, and approximately 25% of Flow-way 3 (**Figure 6**). Land use in the remaining portions of Flow-ways 2 and 3 was dynamic over time (**Figures 7 and 8**). The northern portion of both Flow-ways 2 and 3 were vegetable farms from 1972 to 1984, followed by conversion to sod and sugar cane by 1986, and were eventually completely converted to sod production by 1988 (URS Corporation 2003). The remaining portion of Flow-way 3 was sod and sugar cane, with periodic rotations of rice and corn before STA conversion (URS Corporation 2003). Flow-way 4 (Cells 4, 5, and 6) was primarily sugar cane and sod farms. Cell 4 was split evenly between sugar cane in the southern half and a sod farm operation in the northern half. Aside from sugar cane and sod the northern half of Cell 4 also contained pasture, while Cells 5 and 6 contained vegetables and row crops from 1972 to 1984 shifting to sod and sugar cane by 1986 (**Figures 7 and 8**; URS Corporation 2003). Cell 4 also contained large industrial platforms such as vehicle staging areas, maintenance and fuel storage areas, pump stations, and an aggregate mine which became a fish nursery (URS corporation 2003, Taylor Engineering 2005). Some remnants of these platforms can still be seen today. Flow-way 5 (Cells 7 and 8) was historically vegetable and row crop farms before converting to sugar cane, which became fallow and/or reverted to natural wetlands before being converted to an STA (**Figure 9**). Sugar cane in these cells may have been established as early as 1973. Additionally, the northeast corner of Cell 8 was used for vegetable and/or sod production (URS corporation 2003).

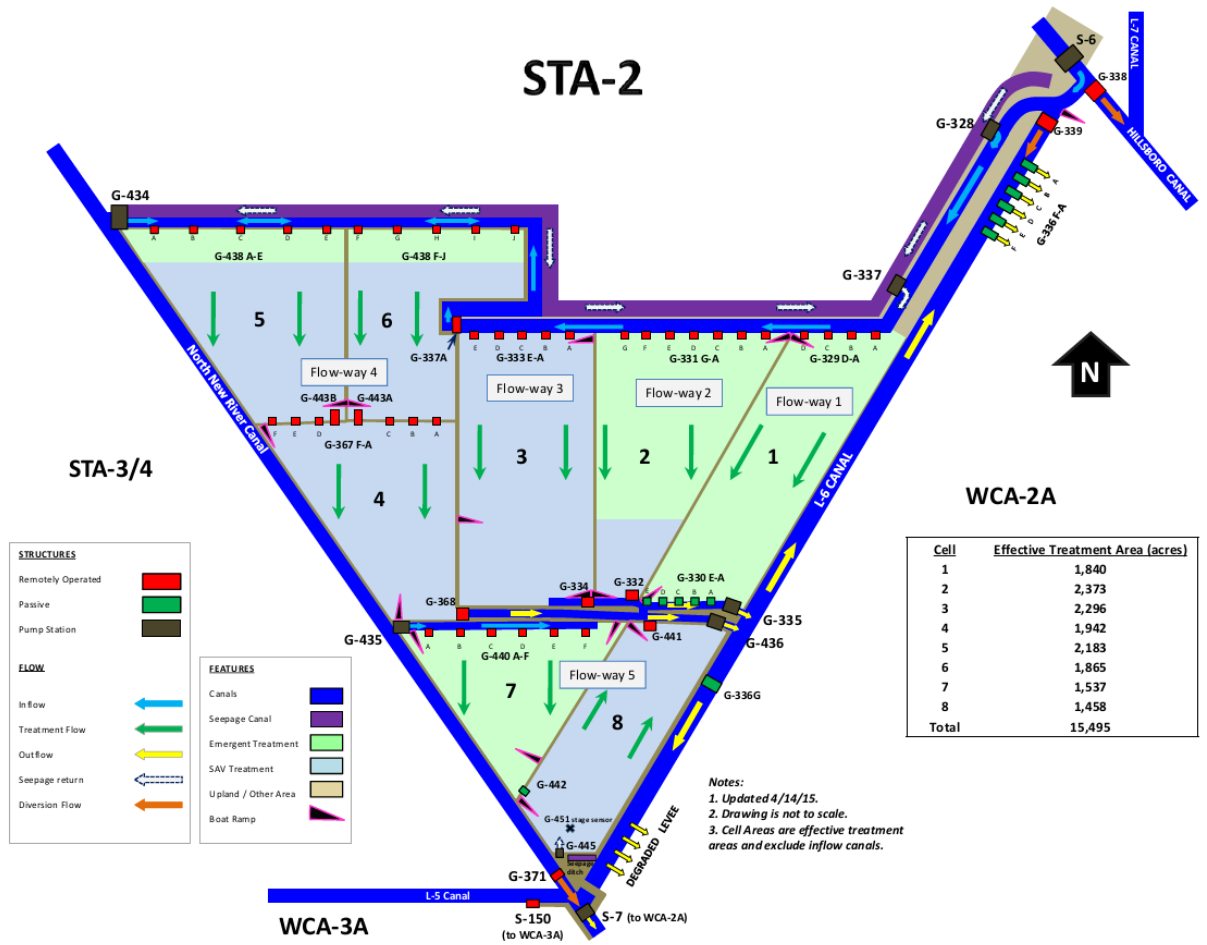


Figure 5. Schematic drawing of STA-2 illustrating the layout of the treatment cells and the flow direction in the flow-ways.

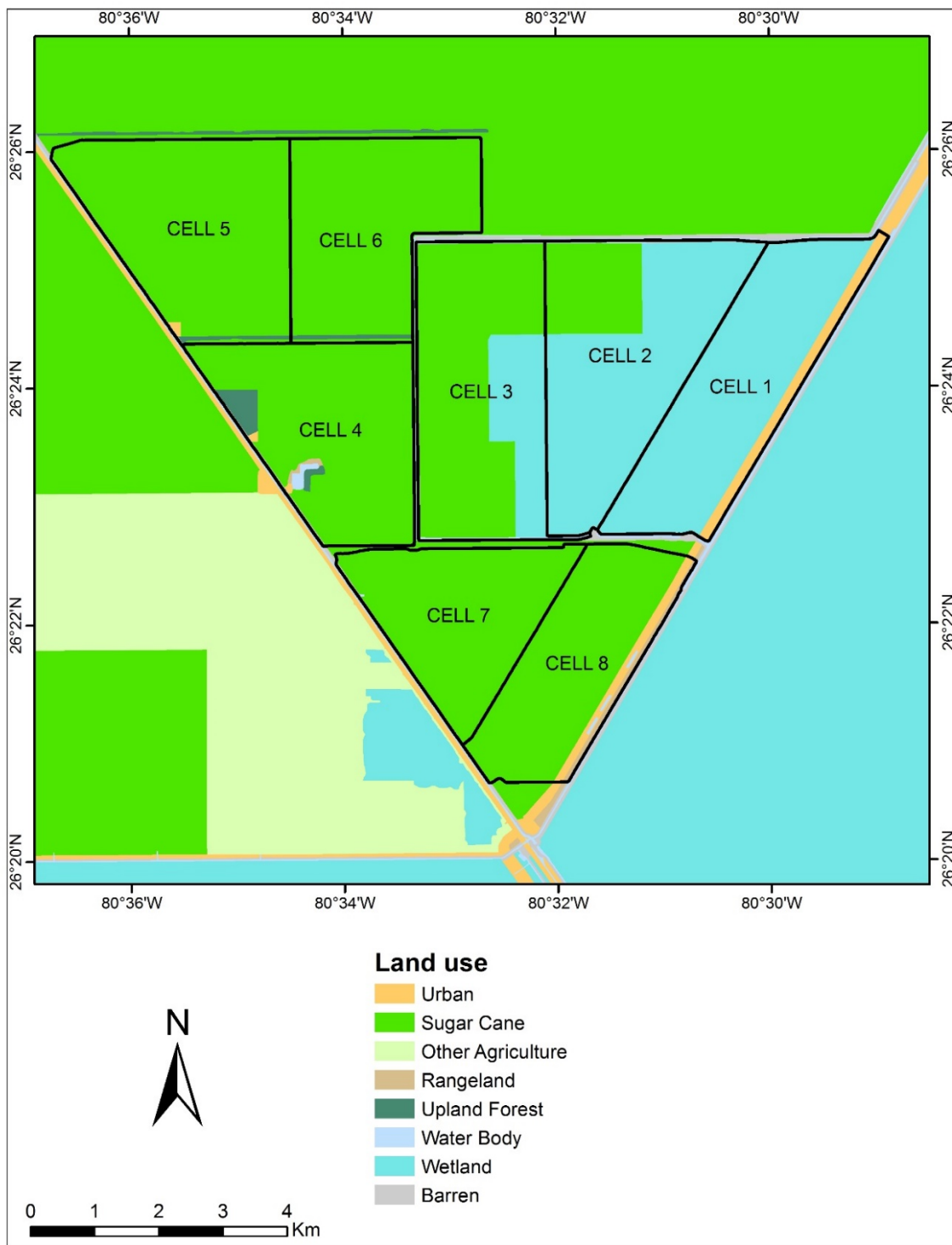


Figure 6. Land use map of STA-2 derived from 1999 aerial imagery that illustrates the general layout of farming practices within STA-2 shortly before becoming an STA (SFWMD Land Cover/Land Use 1999 Mapping Project).

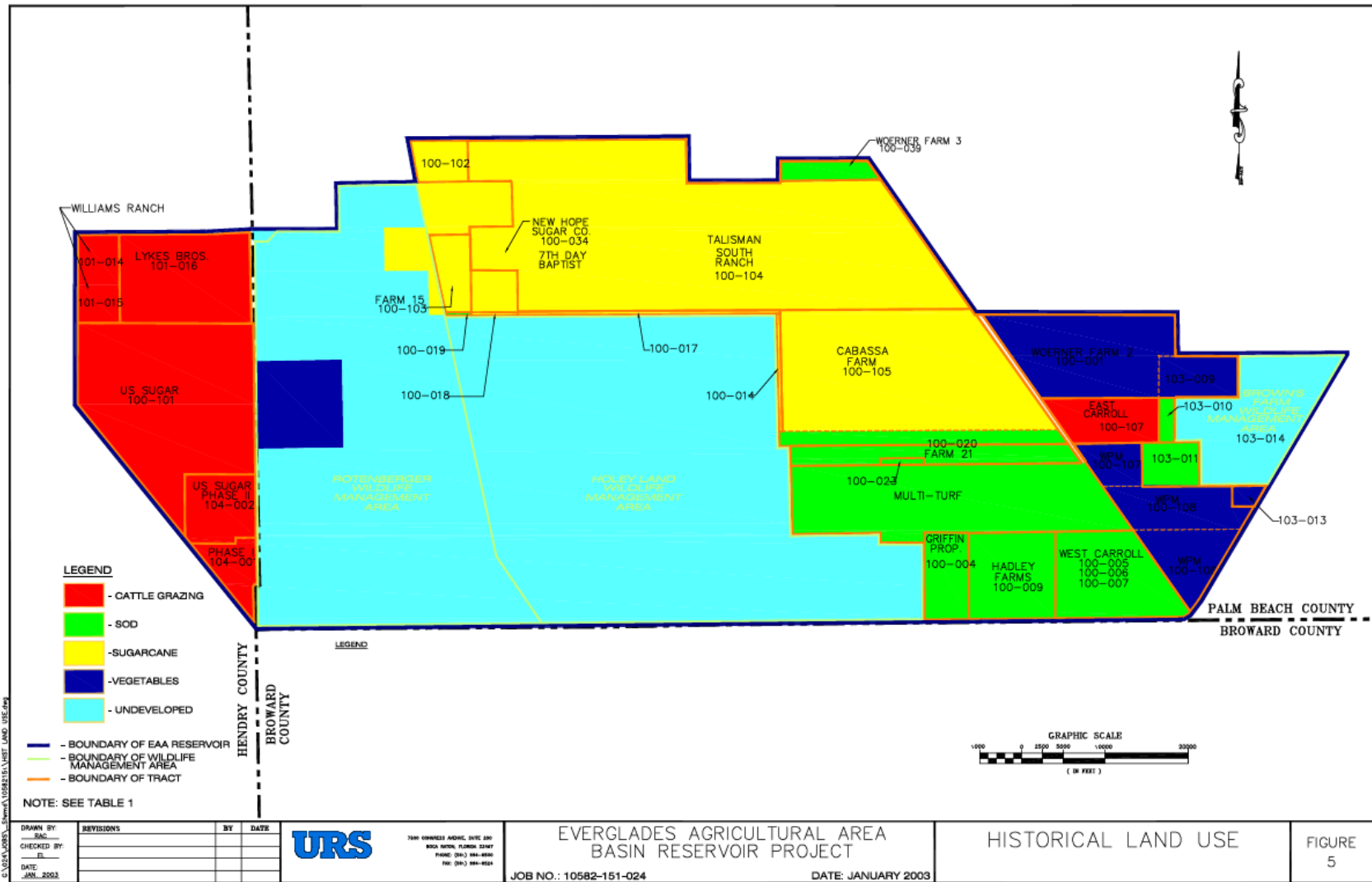


Figure 7. Primary historical land use delineated by land tract for a select portion of the Everglades Agricultural Area that includes the footprint of STA-2, 3/4 and 5/6. Adapted from URS Corporation (2003).

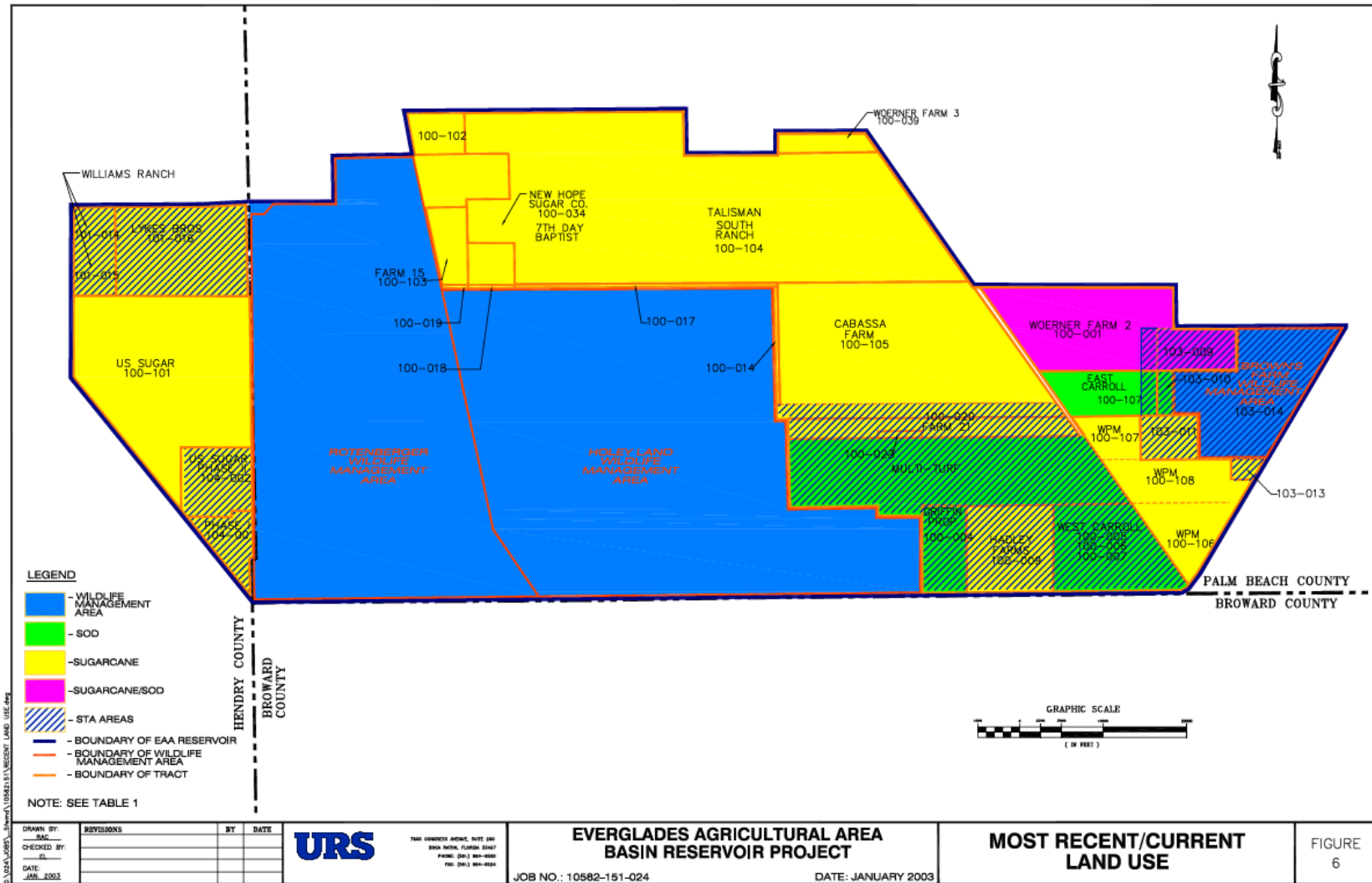


Figure 8. Primary land use shortly before land purchase and conversion into STA-2, 3/4 and 5/6, delineated by land tract, for a select portion of the Everglades Agricultural Area. Adapted from URS Corporation (2003).

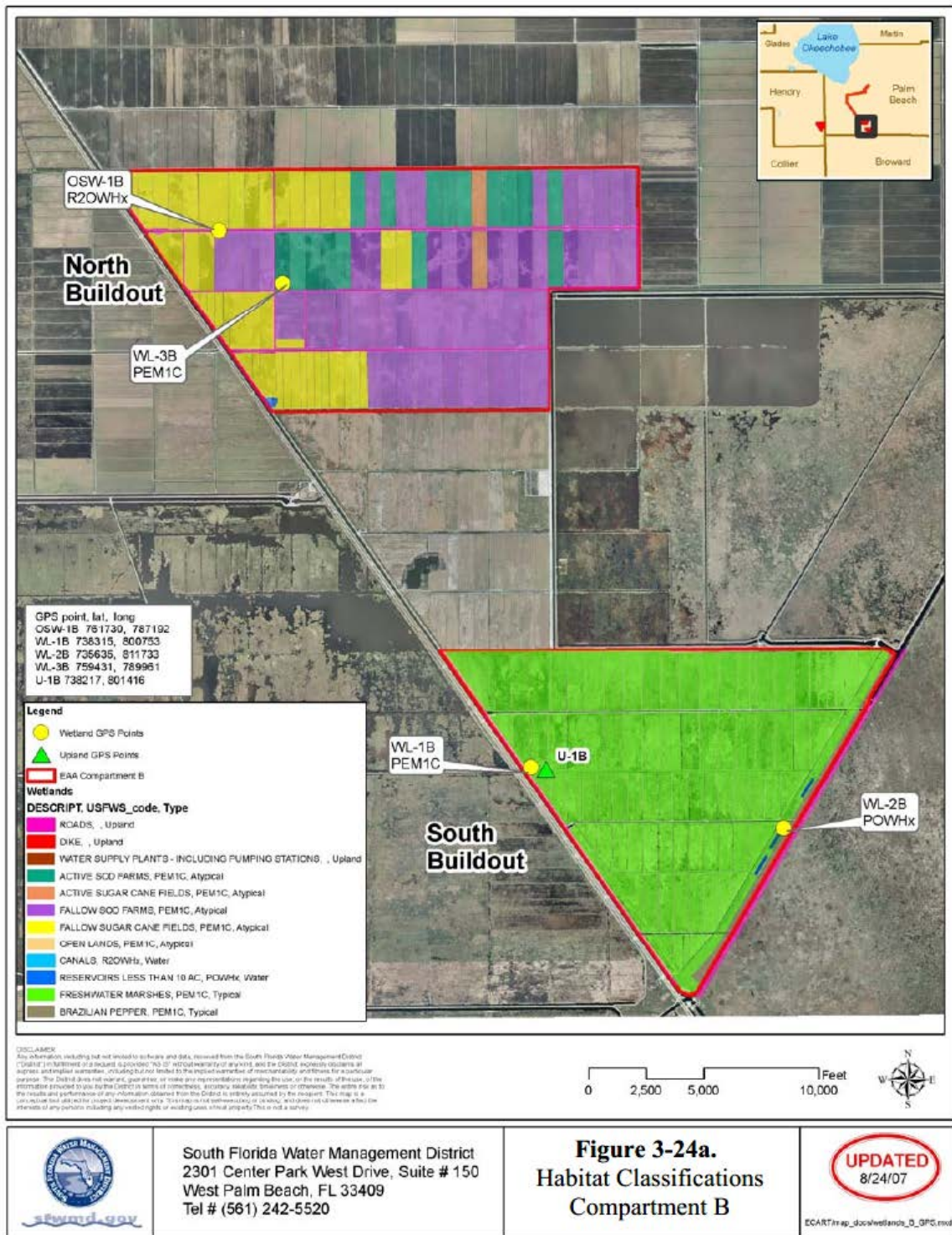


Figure 9. Habitat classification map of Compartment B derived from 2007 field surveys that illustrates the general layout of farming practices within the compartment shortly before its addition to STA-2 (Tetra Tech 2009).

STA-3/4

STA-3/4 construction was substantially completed in late 2003 becoming operational in WY2004. STA-3/4 comprises 16,327 acres of effective treatment area in of six cells divided into three flow-ways with the Central Flow-way also containing the Periphyton-assisted Stormwater Treatment Area (PSTA) Project (**Figure 10**; Piccone et al. 2014, Chimney et al. 2019). Soil sampling was completed in WY2005. Soil was characterized by an average bulk density of $0.34 \pm 0.054 \text{ g/cm}^3$, and TP content of $737 \pm 146 \text{ mg/kg}$. STA-3/4 has treated ~6.65 million ac-ft of water throughout its POR, retaining 728.0 t of TP since beginning operation (85% mass retention; Chimney et al. 2019).

Antecedent land use in STA-3/4 was primarily agriculture beginning sometime in the late 1960s to early 1970s. Generally, the northern third of each flow-way was vegetable and sod farms from 1966 to 1974, and sugar cane from 1974 until STA conversion (**Figures 8 and 11**; URS corporation 2003). The southern two-thirds of each flow-way was generally operated as sod farms, beginning around 1970 (URS Corporation 2003). Many of the sod fields became fallow prior to STA construction. Flow-way 1 (Cells 1A and 1B) followed this pattern, except for the western edge of Cell 1B that was primarily sugar cane. The southeastern portion of Cell 1B was converted to agriculture later than the remainder of the cell (between 1973 and 1980) and restored to wetlands prior to STA construction. Flow-way 2 (Cells 2A and 2B) was sugar cane except for the western edge of Cell 2B where sod was the primary crop with some additional small tree nurseries. The Upper SAV, Lower SAV and PSTA Cells of the PSTA Project were initially used for recreational airboat activities until 1970 when the property was converted to sod production (URS Corporation 2003). Borrow pits were established within and around these cells by 1984 to 1990 (URS Corporation 2003). Flow-way 3 (Cells 3A and 3B) followed the same general trend, though these two cells were mostly converted to agriculture later (between 1973 and 1980) than the remainder of the STA.

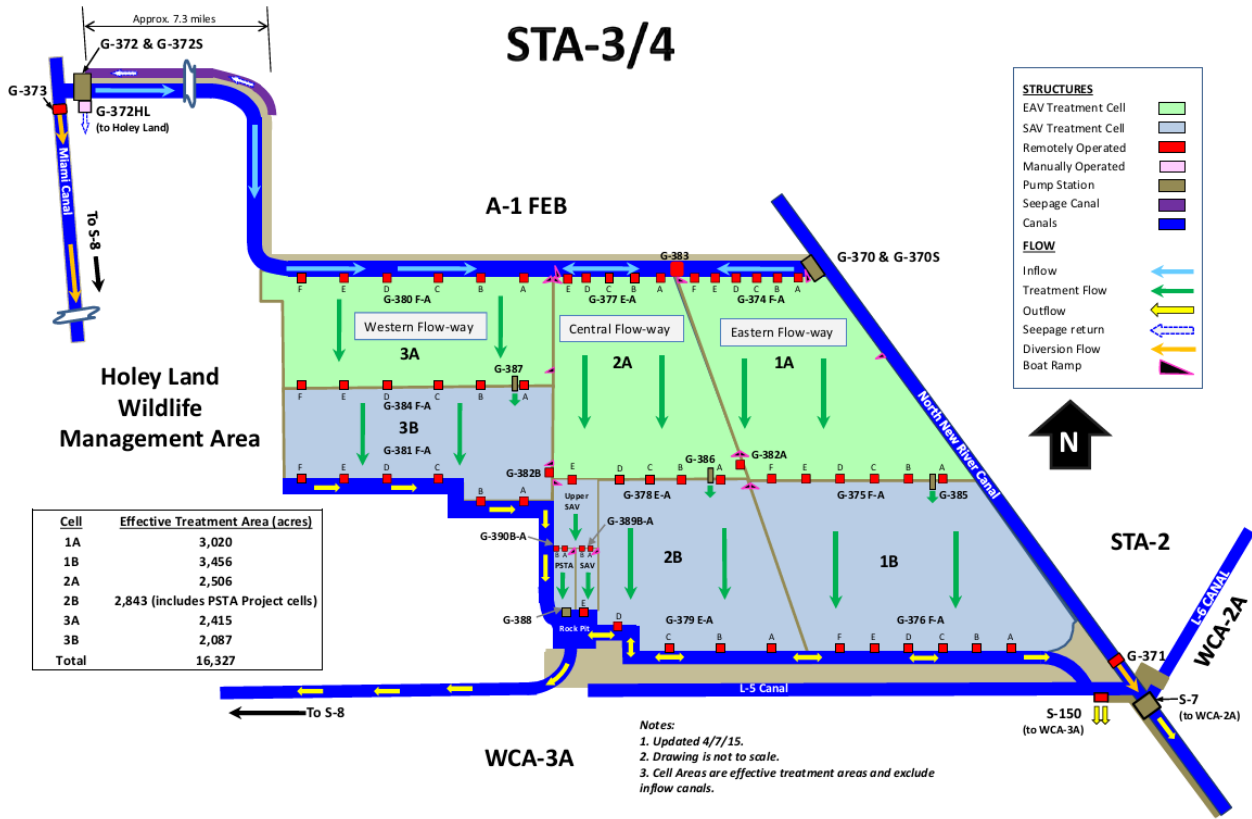


Figure 10. Schematic drawing of STA-3/4 illustrating the layout of the treatment cells and the flow direction in the flow-ways.

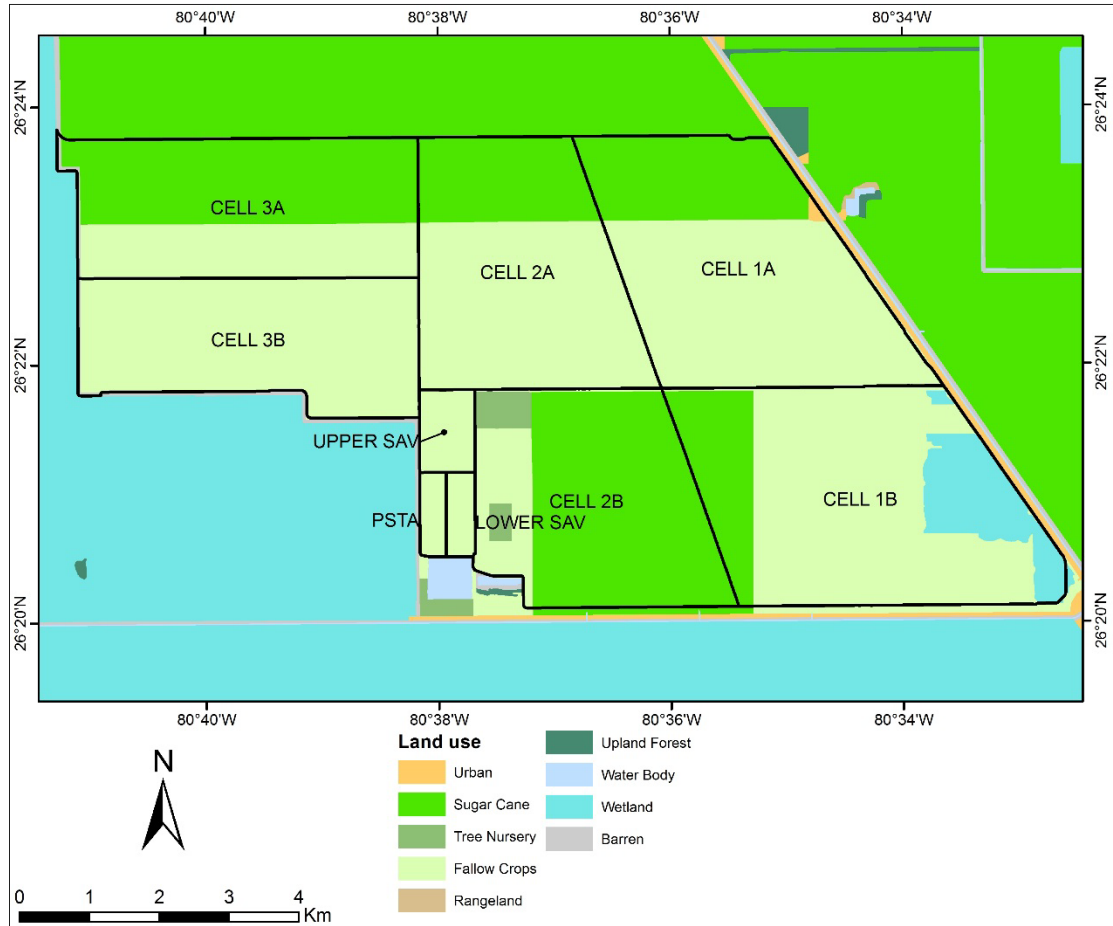


Figure 11. Land use map of STA-3/4 derived from 1999 aerial imagery that illustrates the general layout of farming practices within STA-3/4 shortly before becoming an STA (SFWMD Land Cover/Land Use 1999 Mapping Project).

STA-5/6

STA-5/6 was completed in several phases, originally consisting of two separate STAs: STA-5 and STA-6. STA-5 became operational in WY1999 with two flow-ways containing four cells (Cells 5-1A, 5-1B, 5-2A, and 5-2B) (Pietro 2012). An additional flow-way consisting of two cells (Cells 5-3A and 5-3B) was added in WY2007 (Pietro et al. 2007). STA-6 was operational in WY1998 and consisted of two parallel one-cell flow-ways (Cells 6-3 and 6-5). An additional parallel one-cell flow-way (Cell 6-2) was added in WY2007 (Pietro 2004). The two separate STAs were merged into STA-5/6 with the addition of five treatment cells (Cells 5-4A, 5-4B, 5-5A, 5-5B, and 6-4) constructed on land referred to as Compartment C. The combined STA-5/6 consists of 14 cells configured in eight flow-ways encompassing a total of 13,685 acres of effective treatment area that became fully operational in WY2013 (**Figure 12**; Piccone et al. 2014). Initial soil samples were taken as cells were constructed, beginning in WY2001. Soils in STA-5 and STA-6 were characterized by an average bulk density of 0.62 ± 0.29 and 0.69 ± 0.27 g/cm³, respectively, while TP content was 409 ± 104 and 277 ± 73 mg/kg, respectively. STA-5/6 has treated ~2.45 million ac-ft of water throughout its POR, retaining 433.3 t of TP since beginning operation (69% mass retention; Chimney et al. 2019).

Antecedent land use in STA-5/6 was primarily improved/unimproved pasture and sugar cane farms. Additionally, patches of herbaceous and forested wetland were present throughout (**Figure 13**). The westernmost portions of both Flow-way 1 (Cells 5-1A and 5-1B) and 2 (Cells 5-2A and 5-2B) were maintained as improved/unimproved pasture and cow/calf operations as early as 1968 and became fallow prior to STA conversion (URS Corporation 2003). Remaining portions of Flow-way 1 and 2 were used as unimproved pasture and farmed for sugar cane as early as 1968 until conversion to an STA. The initial agricultural use of Flow-ways 3 (Cells 5-3A and 5-3B), 4 (Cells 5-4A and 5-4B), 5 (Cells 5-5A and 5-5B), and 6 (Cells 6-4 and 6-2) was both improved/unimproved pasture and sugar cane from 1974 to 1989. All pasture operations in these flow-ways ended in 1988, at which time they were converted to sugar cane production that became fallow before STA conversion (**Figure 14**; URS Corporation 2003). Flow-ways 7 (Cell 6-5) and 8 (Cell 6-3) contained herbaceous and forested wetlands until the 1970s, when they were converted for agricultural purposes. Flow-ways 7 and 8 were used as improved pasture and citrus groves, though they were later farmed for sugar cane starting in 1987 (Pietro 2004). Several areas within Flow-ways 7 and 8 were also converted into a water detention area and then to restored wetlands in the 1980s.

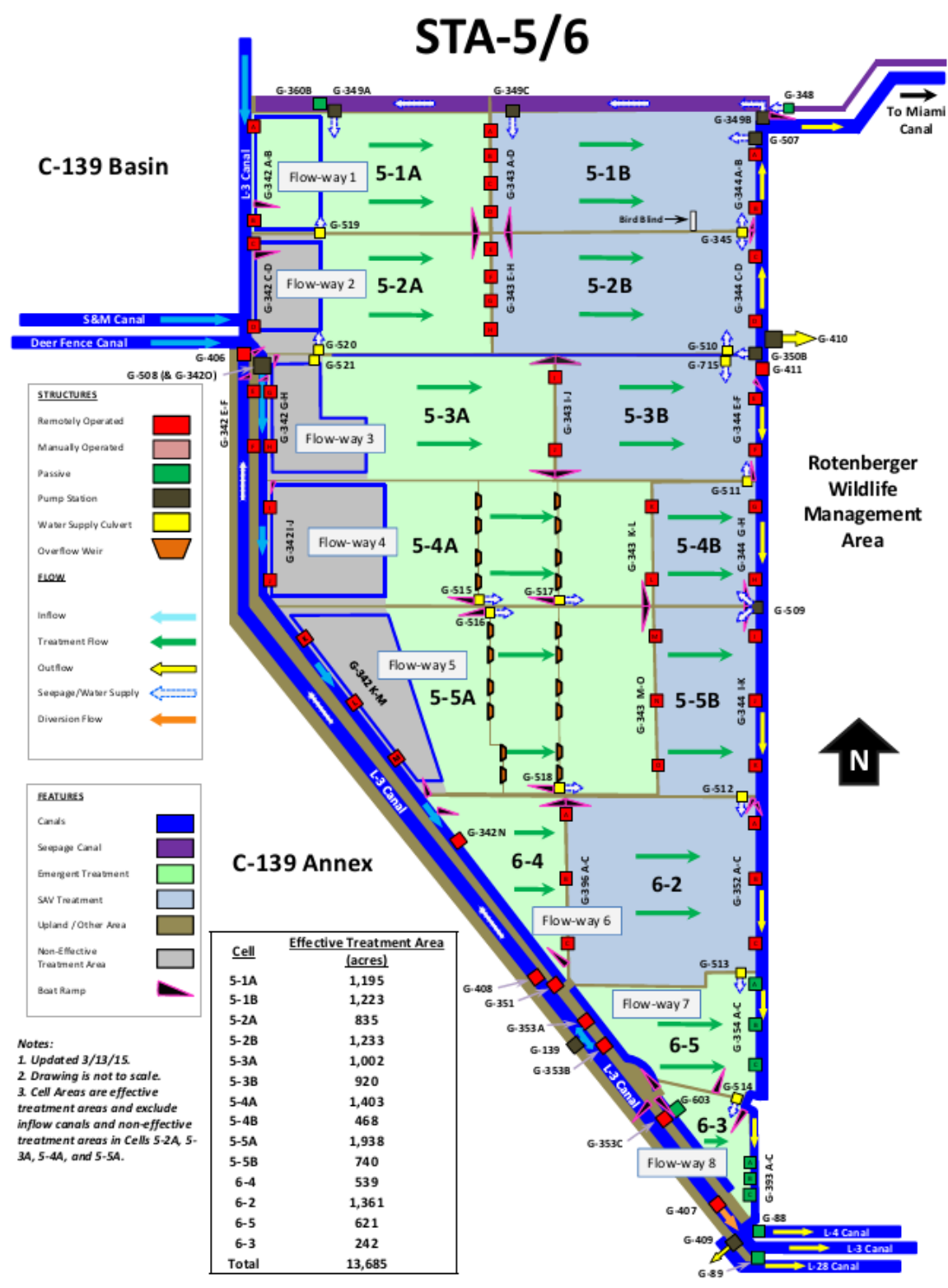


Figure 12. Schematic drawing of STA-5/6 illustrating the layout of the treatment cells and the flow direction in the flow-ways.

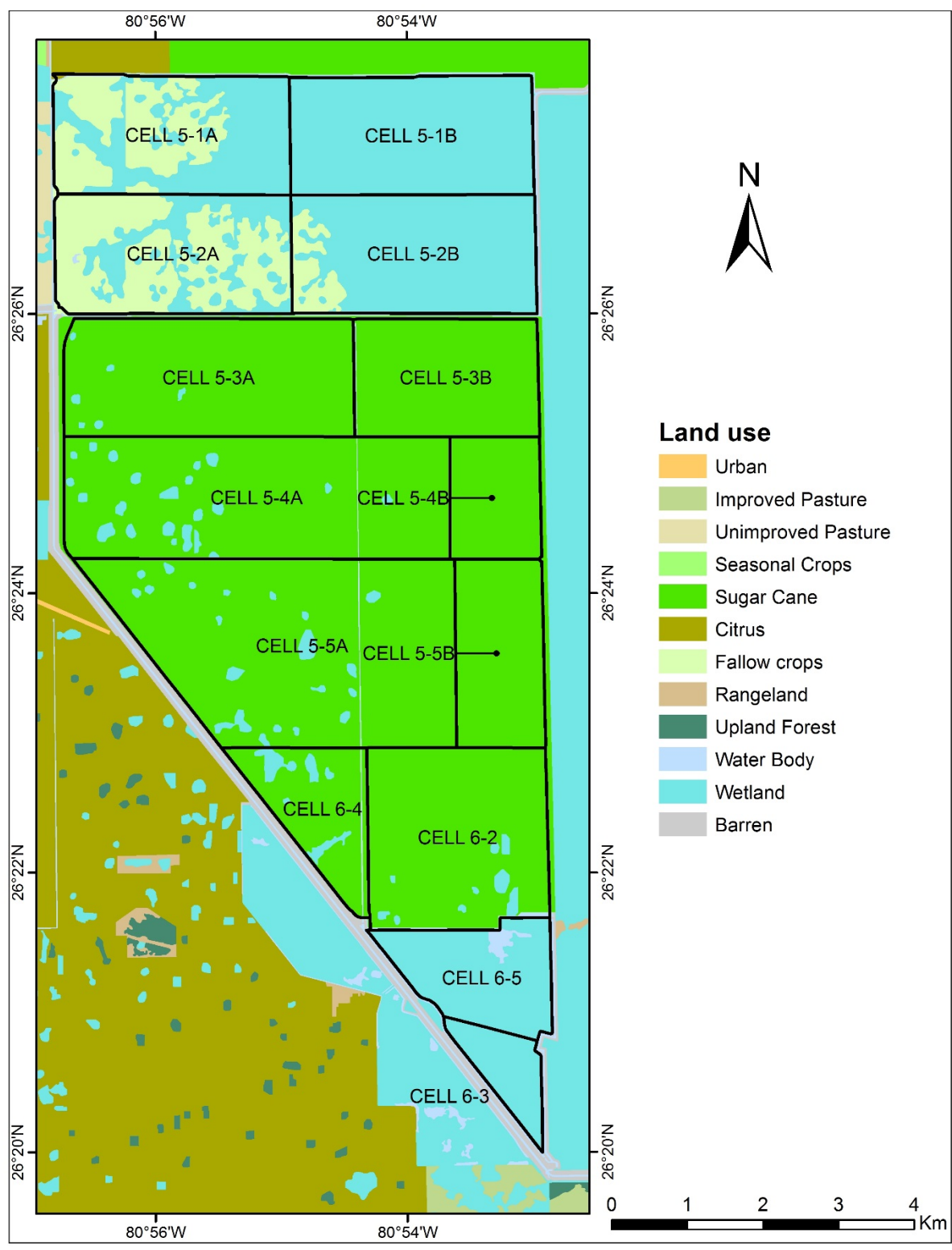


Figure 13. Land use map of STA-5/6 derived from 1999 aerial imagery that illustrates the general layout of farming practices within STA-5/6 shortly before becoming an STA (SFWMD Land Cover/Land Use 1999 Mapping Project).

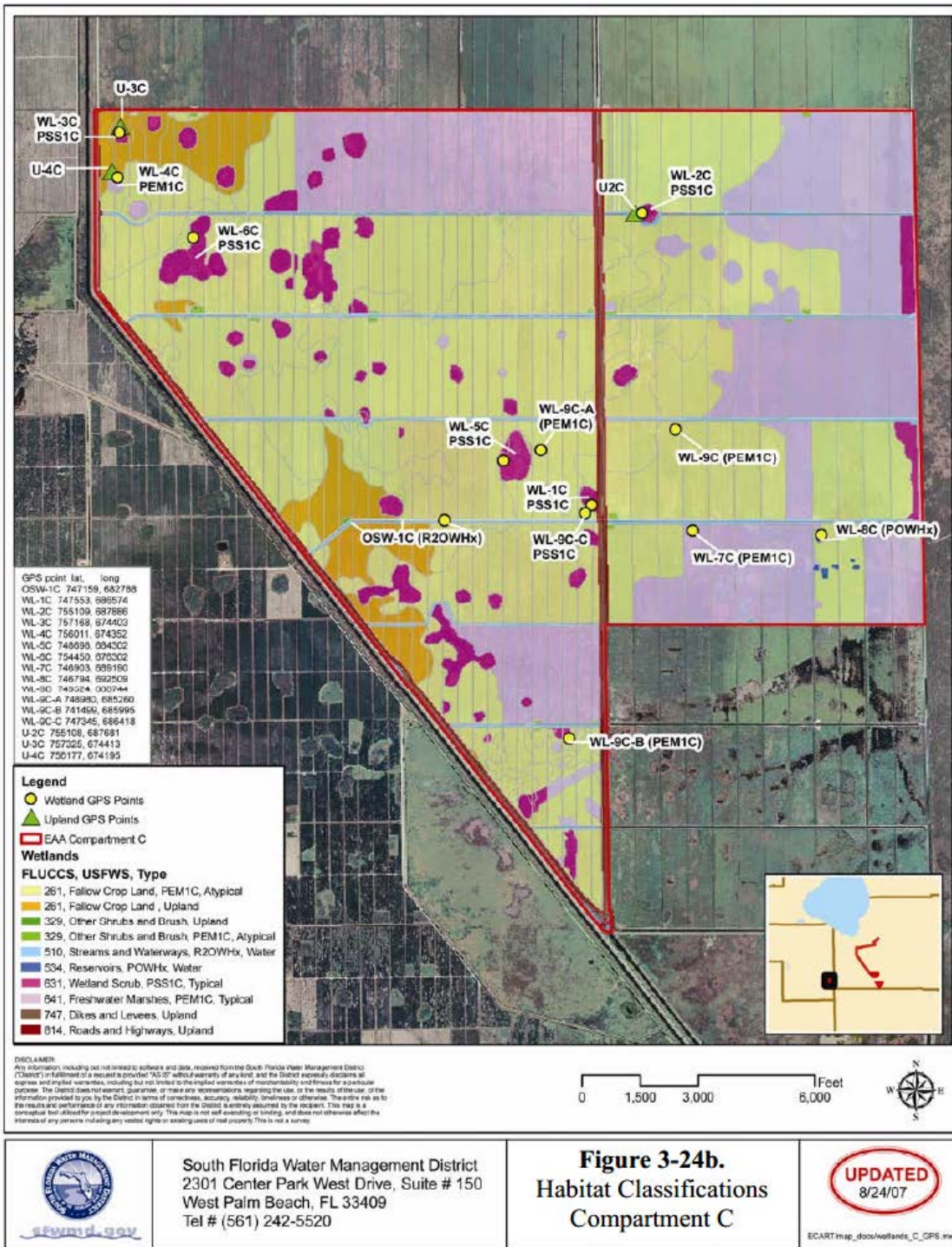


Figure 14. Habitat classification map of Compartment C derived from 2007 field surveys that illustrates the general layout of farming practices within the compartment shortly before its addition to STA-5/6 (Tetra Tech 2009).

Summary

The Everglades STAs antecedent land use varied throughout time primarily including sugar cane, sod, pasture, citrus, row crops, and vegetables. The majority of farming operations started around 1970 and became fallow before STA construction began (**Table 1**). Overall, sugar cane was the most common land use across the Everglades STAs. Both sod and pasture operations were common in many of the Everglades STAs as well. Citrus and row crops were generally farmed in limited spatial and temporal extents. Natural wetlands make up a small fraction of STA antecedent land use (primarily within STA-2), though some wetlands were farmed intermittently and later restored. Initial soil phosphorus storage was generally lower within areas where farming activity was limited or absent and was highly variable across all STAs (5.77 ± 0.8 g P/m² to 44.3 ± 27.8 g P/m²). Documentation of antecedent land use across the Everglades STAs should provide useful insights into current STA challenges and assist with their management and operations.

Table 1. General antecedent land uses for each Cell in the Everglades STAs by decade leading up to STA construction. Land uses that are *italicized* were limited in temporal/spatial extent.

STA	Cell	Pre 1970	1970-1980	1980-1990	1990-2000	Post 2000
1E	1	wetland	pasture	pasture row crops sugar cane	pasture row crops sugar cane	
1E	2	wetland	pasture	pasture	pasture	
1E	3	wetland	citrus	citrus	citrus	
1E	4N	wetland	citrus	citrus	citrus	
1E	4S	wetland	citrus sugar cane	sugar cane	sugar cane	
1E	5	wetland	citrus	citrus	citrus	
1E	6	wetland	sugar cane	sugar cane	sugar cane	
1E	7	wetland	sugar cane	sugar cane	sugar cane	
1W	1	wetland sugar cane	sugar cane	sugar cane	sugar cane	
1W	2	wetland sugar cane	sugar cane	sugar cane	sugar cane	
1W	3	wetland sugar cane	sugar cane	sugar cane	sugar cane	
1W	4	wetland sugar cane	sugar cane	sugar cane	sugar cane	
1W	5A	wetland sugar cane	sugar cane	sugar cane	sugar cane	
1W	5B	wetland sugar cane	sugar cane	sugar cane	sugar cane	
1W	6	wetland sugar cane <i>row crops</i>	sugar cane <i>row crops</i>	sugar cane <i>row crops</i>	sugar cane <i>row crops</i>	sugar cane <i>rice</i>
1W	7	wetland sugar cane <i>row crops</i> <i>sod</i>	sugar cane <i>row crops</i> <i>sod</i>	sugar cane <i>row crops</i> <i>sod</i>	sugar cane <i>row crops</i> <i>sod</i>	sugar cane <i>row crops</i> <i>sod</i>
1W	8	wetland sugar cane <i>row crops</i>	sugar cane <i>row crops</i>	sugar cane <i>row crops</i>	sugar cane <i>row crops</i>	sugar cane <i>rice</i>
2	1	wetland <i>peanut</i>	wetland	wetland	wetland	
2	2	wetland <i>peanut</i>	row crops	row crops <i>sod</i> <i>sugar cane</i>	row crops <i>sod</i> <i>sugar cane</i>	

STA	Cell	Pre 1970	1970-1980	1980-1990	1990-2000	Post 2000
2	3	wetland <i>peanut</i>	row crops <i>sod</i> <i>sugar cane</i>	row crops <i>sod</i> <i>sugar cane</i>	<i>sod</i> <i>sugar cane</i>	
2	4	wetland	<i>sugar cane</i> <i>sod</i> <i>pasture</i>	<i>sugar cane</i> <i>sod</i> <i>pasture</i>	<i>sugar cane</i> <i>sod</i> <i>pasture</i>	<i>sugar cane</i> <i>sod</i> <i>pasture</i>
2	5	wetland	<i>sugar cane</i> <i>row crops</i>	<i>sugar cane</i> <i>sod</i> <i>row crops</i>	<i>sugar cane</i> <i>sod</i> <i>row crops</i>	<i>sugar cane</i> <i>sod</i> <i>row crops</i>
2	6	wetland	<i>sugar cane</i> <i>row crops</i>	<i>sugar cane</i> <i>sod</i> <i>row crops</i>	<i>sugar cane</i> <i>sod</i> <i>row crops</i>	<i>sugar cane</i> <i>sod</i> <i>row crops</i>
2	7	wetland	<i>sugar cane</i> <i>row crops</i>	<i>sugar cane</i> <i>row crops</i>	<i>sugar cane</i> <i>row crops</i>	<i>sugar cane</i> <i>row crops</i>
2	8	wetland	<i>sugar cane</i> <i>row crops</i> <i>sod</i>	<i>sugar cane</i> <i>row crops</i> <i>sod</i>	<i>sugar cane</i> <i>row crops</i> <i>sod</i>	<i>sugar cane</i> <i>row crops</i> <i>sod</i>
3/4	1A	wetland <i>row crops</i> <i>sod</i>	<i>sugar cane</i> <i>row crops</i> <i>sod</i>	<i>sugar cane</i> <i>sod</i>	<i>sugar cane</i> <i>sod</i>	<i>sugar cane</i> <i>sod</i>
3/4	1B	wetland	<i>sugar cane</i> <i>sod</i>	<i>sugar cane</i> <i>sod</i>	<i>sugar cane</i> <i>sod</i>	<i>sugar cane</i> <i>sod</i>
3/4	2A	wetland <i>row crops</i> <i>sod</i>	<i>sugar cane</i> <i>row crops</i> <i>sod</i>	<i>sugar cane</i> <i>sod</i>	<i>sugar cane</i> <i>sod</i>	<i>sugar cane</i> <i>sod</i>
3/4	2B	wetland	<i>sugar cane</i> <i>sod</i> <i>tree nursery</i>	<i>sugar cane</i> <i>sod</i> <i>tree nursery</i>	<i>sugar cane</i> <i>sod</i> <i>tree nursery</i>	<i>sugar cane</i> <i>sod</i> <i>tree nursery</i>
3/4	3A	wetland	<i>sugar cane</i> <i>row crops</i> <i>sod</i>	<i>sugar cane</i> <i>sod</i>	<i>sugar cane</i> <i>sod</i>	<i>sugar cane</i> <i>sod</i>
3/4	3B	wetland	<i>sod</i>	<i>sod</i>	<i>sod</i>	<i>sod</i>
5/6	5-1A	wetland <i>pasture</i> <i>sugar cane</i>	<i>pasture</i> <i>sugar cane</i>	<i>pasture</i> <i>sugar cane</i>	<i>pasture</i> <i>sugar cane</i>	
5/6	5-1B	wetland <i>pasture</i> <i>sugar cane</i>	<i>pasture</i> <i>sugar cane</i>	<i>pasture</i> <i>sugar cane</i>	<i>pasture</i> <i>sugar cane</i>	
5/6	5-2A	wetland	<i>pasture</i> <i>sugar cane</i>	<i>pasture</i> <i>sugar cane</i>	<i>pasture</i> <i>sugar cane</i>	

STA	Cell	Pre 1970	1970-1980	1980-1990	1990-2000	Post 2000
5/6	5-2B	wetland	pasture sugar cane	pasture sugar cane	pasture sugar cane	
5/6	5-3A	wetland	pasture sugar cane	pasture sugar cane	pasture sugar cane	sugar cane
5/6	5-3B	wetland	pasture sugar cane	pasture sugar cane	pasture sugar cane	sugar cane
5/6	5-4A	wetland	pasture sugar cane	pasture sugar cane	pasture sugar cane	sugar cane
5/6	5-4B	wetland	pasture sugar cane	pasture sugar cane	pasture sugar cane	sugar cane
5/6	5-5A	wetland	pasture sugar cane	pasture sugar cane	pasture sugar cane	sugar cane
5/6	5-5B	wetland	pasture sugar cane	pasture sugar cane	pasture sugar cane	sugar cane
5/6	6-2	wetland	pasture sugar cane	pasture sugar cane	pasture sugar cane	sugar cane
5/6	6-3	wetland	pasture citrus	sugar cane pasture citrus	sugar cane	
5/6	6-4	wetland	pasture sugar cane	pasture sugar cane	pasture sugar cane	sugar cane
5/6	6-5	wetland	pasture citrus	sugar cane pasture citrus	sugar cane	

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Appendix A:

Historical aerial imagery of the Everglades Stormwater Treatment Areas



Figure A1. 1984 aerial image of STA-1E from the U.S. Department of Agriculture’s (USDA) National High-Altitude Photography (NHAP) program. STA cell boundaries (black lines) and labels (white text) were added over historical imagery.

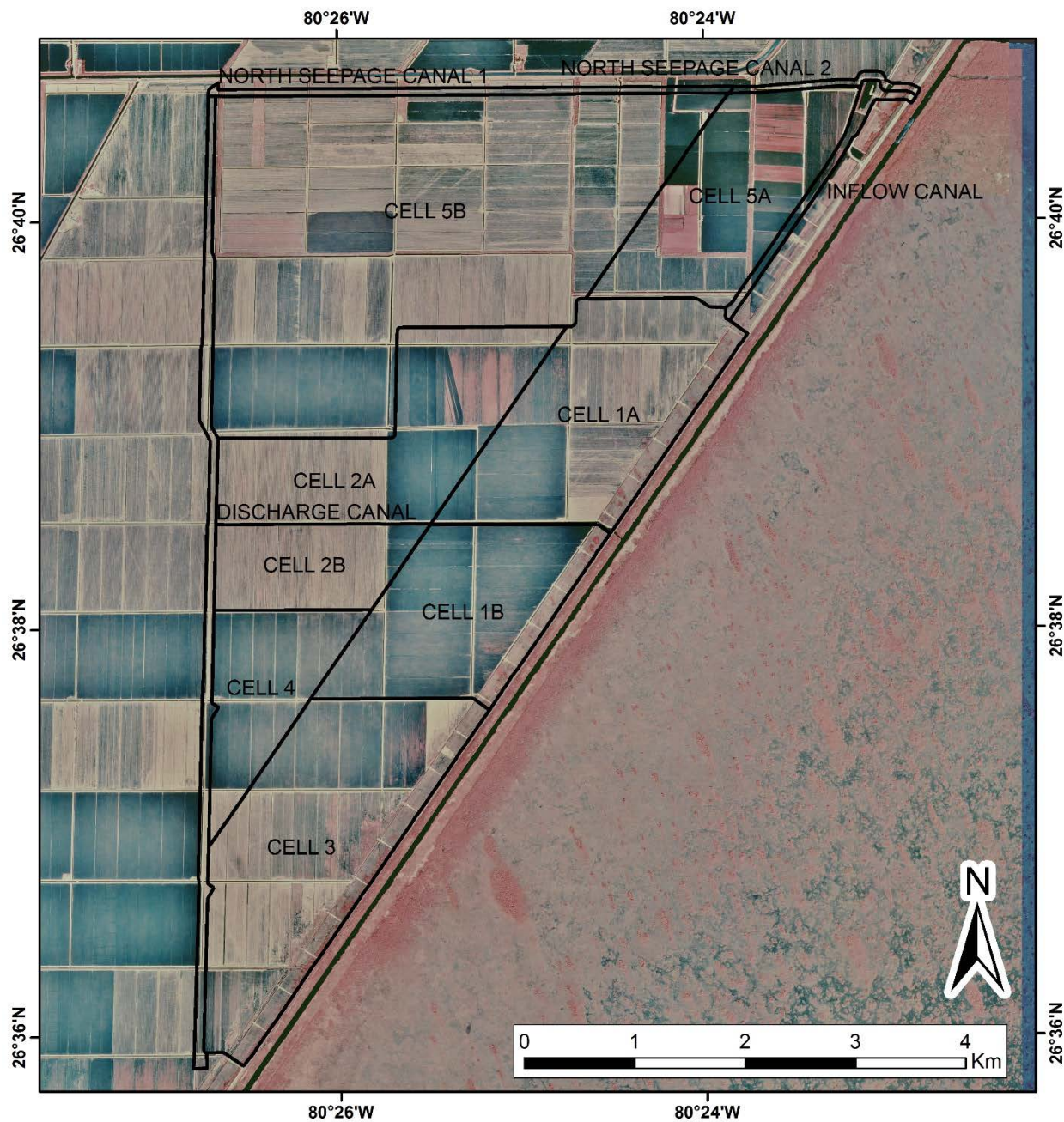


Figure A2. 1984 aerial image of STA-1W from the USDA's NHAP. STA cell boundaries (black lines) and labels (black text) were added over historical imagery.

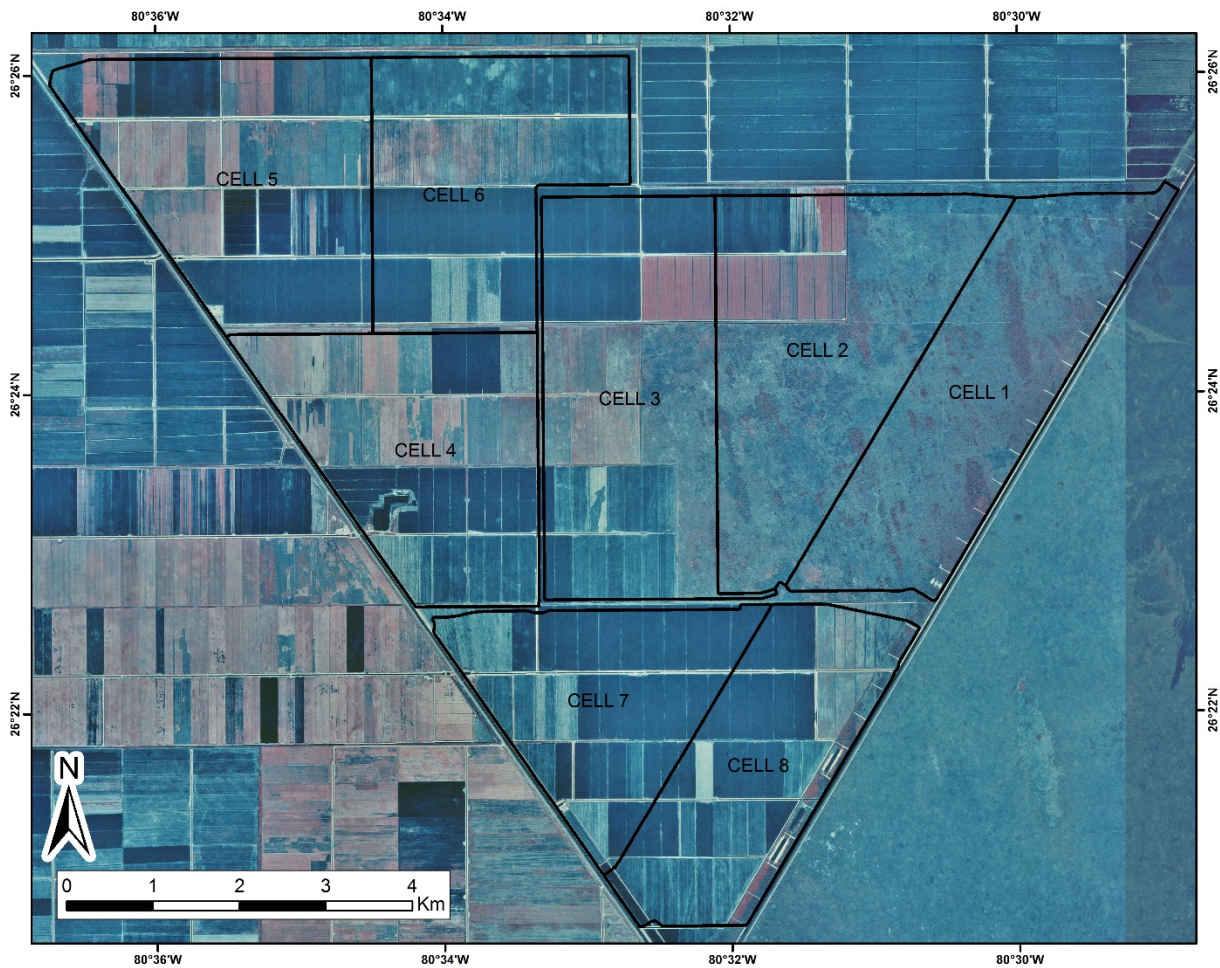


Figure A3. 1984 aerial image of STA-2 from the USDA's NHAP. STA cell boundaries (black lines) and labels (black text) were added over historical imagery.

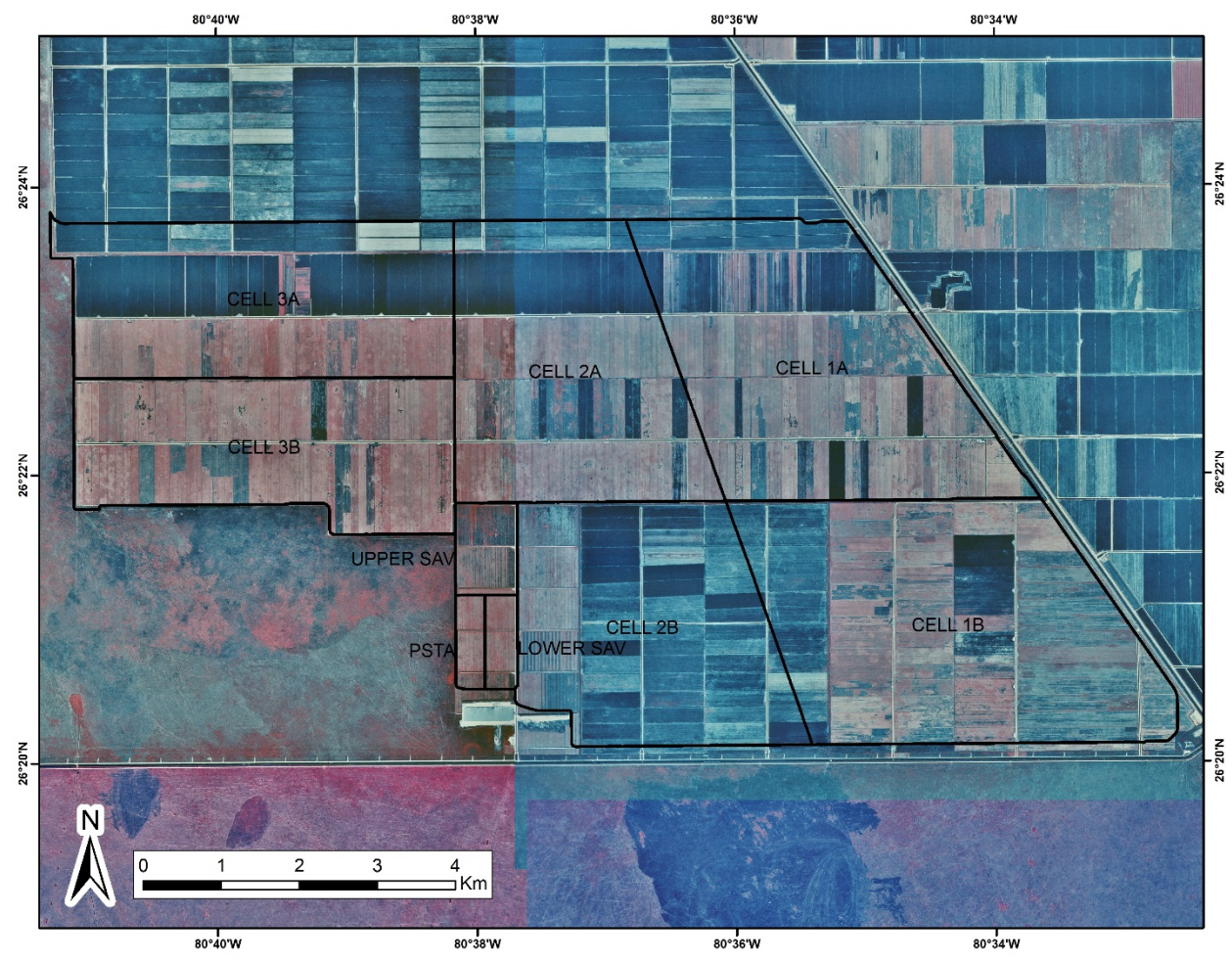


Figure A4. 1984 aerial image of STA-3/4 from the USDA’s NHAP. STA cell boundaries (black lines) and labels (black text) were added over historical imagery.



Figure A5. 1982 aerial image of the northern section of STA-5/6 from the USDA's Flight 182. The north-south canal along the left side of the image is the L-3 canal. Image courtesy of the University of Florida's digital collection of aerial photography (<http://ufdc.ufl.edu/aerials>).



Figure A6. 1982 aerial image of the southern section of STA-5/6 from the USDA's Flight 182. The northwest-southeast canal through the center of the image is the L-3 canal. Image courtesy of the University of Florida's digital collection of aerial photography (<http://ufdc.ufl.edu/aerials>).

Appendix B:

Initial soil characterizations of Everglades Stormwater Treatment Areas

Table B1. Soil characterizations of the Everglades Stormwater Treatment Areas

Bulk density, total phosphorus (TP) content, and TP storage of all Everglades Stormwater Treatment Areas (STA) cells for the 0 – 10 cm soil horizon (\pm standard deviation). Only this soil horizon is included as it was the most consistently sampled depth throughout the period-of-record in all STAs. Data included are from the earliest sampling date following startup. Missing data (--) indicate no sampling efforts were made shortly (< 2 years) following startup. Data were primarily taken from published reports (Reddy et al. 2009, Zamorano et al. 2010), though some data gaps were filled from unpublished sampling events.

STA	Cell	Sample year	Bulk density (g/cm ³)	TP content (mg P/kg)	TP storage (g P/m ²)
1E	1	--	--	--	--
1E	2	--	--	--	--
1E	3	WY2005	1.39 \pm 0.19	108 \pm 70	14.65 \pm 10.12
1E	4N	WY2005	1.38 \pm 0.15	79 \pm 60	10.49 \pm 7.54
1E	4S	WY2005	1.22 \pm 0.34	80 \pm 65	7.94 \pm 5.48
1E	5	WY2005	1.16 \pm 0.3	241 \pm 223	22.82 \pm 15.27
1E	6	WY2005	0.78 \pm 0.42	221 \pm 194	11.17 \pm 5.92
1E	7	WY2005	0.54 \pm 0.3	405 \pm 213	16.23 \pm 4.14
1W	1	WY1996	0.16 \pm 0.06	523 \pm 161	7.44 \pm 1.76
1W	2	WY1996	0.17 \pm 0.04	518 \pm 193	7.92 \pm 0.48
1W	3	WY1996	0.19 \pm 0.06	418 \pm 60	7.8 \pm 2.34
1W	4	WY1996	0.21 \pm 0.01	363 \pm 31	7.68 \pm 0.6
1W	5A	WY2006	0.24 \pm 0.05	452 \pm 188	11.3 \pm 6.13
1W	5B	WY2000	0.26 \pm 0.06	507 \pm 194	6.9 \pm 3
1W	6	--	--	--	--
1W	7	--	--	--	--
1W	8	--	--	--	--
2	1	WY2001	0.14 \pm 0.02	558 \pm 115	7.73 \pm 0.6
2	2	WY2001	0.2 \pm 0.02	293 \pm 63	5.77 \pm 0.8
2	3	WY2001	0.31 \pm 0.07	722 \pm 284	23.67 \pm 14.29
2	4	WY2007	0.23 \pm 0.05	577 \pm 210	18.36 \pm 11.11
2	5	WY2011	0.4 \pm 0.1	714 \pm 206	23.8 \pm 6.8
2	6	WY2011	0.3 \pm 0.05	626 \pm 125	19.2 \pm 5.9
2	7	WY2011	0.3 \pm 0.05	724 \pm 90	20.6 \pm 6.9
2	8	WY2011	0.3 \pm 0.03	595 \pm 96	18.3 \pm 6.1
3/4	1A	WY2005	0.34 \pm 0.12	653 \pm 227	21.53 \pm 8.69
3/4	1B	WY2005	0.29 \pm 0.1	575 \pm 150	17.49 \pm 9.77
3/4	2A	WY2005	0.34 \pm 0.09	934 \pm 132	24.41 \pm 11.68
3/4	2B	WY2005	0.4 \pm 0.1	742 \pm 170	29.14 \pm 8.85
3/4	3A	WY2005	0.39 \pm 0.06	889 \pm 193	34.55 \pm 7.74

3/4	3B	WY2005	0.26 ± 0.07	630 ± 137	15.51 ± 3.35
5/6	5-1A	WY2001	0.39 ± 0.25	519 ± 58	18.76 ± 10.69
5/6	5-1B	WY2001	0.38 ± 0.12	387 ± 147	12.79 ± 0.9
5/6	5-2A	WY2001	0.32 ± 0.01	522 ± 53	16.51 ± 1.42
5/6	5-2B	WY2001	0.31 ± 0.05	425 ± 56	13.12 ± 0.25
5/6	5-3A	WY2008	0.77 ± 0.21	433 ± 209	30.7 ± 14.4
5/6	5-3B	WY2008	0.65 ± 0.2	408 ± 158	24.7 ± 10.2
5/6	5-4A	WY2011	1 ± 0.4	370 ± 288	26.4 ± 20.4
5/6	5-4B	WY2011	0.8 ± 0.4	258 ± 139	44.3 ± 27.8
5/6	5-5A	WY2011	1.1 ± 0.3	230 ± 281	29.6 ± 23.5
5/6	5-5B	WY2011	0.5 ± 0.1	534 ± 129	9.7 ± 2.8
5/6	6-2	--	--	--	--
5/6	6-3	WY2004	0.54 ± 0.29	362 ± 178	16.01 ± 9.41
5/6	6-4	WY2011	1 ± 0.4	235 ± 76	41.6 ± 24.8
5/6	6-5	WY2001	0.52 ± 0.17	236 ± 103	10.81 ± 2.35