Critique: South Dade Logistics & Technology District Environmental Considerations and Beneficial Impacts

Report of the Technical Advisory Committee of the Hold the Line Coalition

27 April 2022

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What's at Stake?

The decision to approve the South Dade Logistics and Technology District (SDLTD) cannot be made based solely on the immediate costs and benefits of the proposed development. The site proposed for development is approximately 794 acres of agricultural land located southwest of the town of Cutler Bay and south and east of the Florida Turnpike, and immediately west of the Biscayne Wetlands boundary (Figure 1). Accepting this proposal to convert this agricultural site to an urban industrial and commercial development impacts the future evolution of the entire area of the coastal plain between the Urban Development Boundary and the shoreline of Biscayne Bay.

The coastal plain provides a valuable buffer between the urbanized coastal ridge and the critically important ecological resources of Biscayne Bay and its coastal mangrove shoreline. The unique hydrological and ecological characteristics of this low-lying, flood-prone area provide tangible benefits to the County related to natural amenities, water supply, shoreline protection, flood protection, and resilience to sea level rise.

A full accounting of the impacts of the proposed SDLTD development must include its impact on Biscayne Bay and surrounding areas of the County. We must also consider the impacts that the SDLTD will have on 1) the quality of life within the local area, 2) the regional benefits supported by the current agricultural land use, 3) the ongoing ecosystem restoration efforts in the area, which contributes to building resilience to sea level rise, and 4) the health of Biscayne Bay.

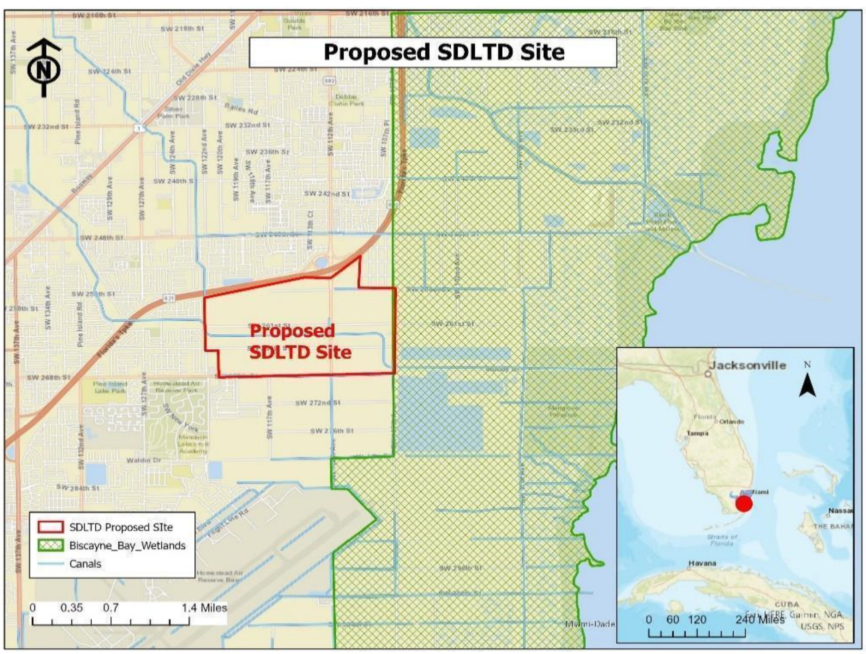

Figure 1: The site proposed for the SDLTD is near the town of Cutler Bay, south of the Florida Turnpike Extension, west of SW 107th Ave, north of SW 268th St and east of SW 122nd Ave. The site lies in the coastal plain, a low-lying area approximately 2.5 miles wide that is the northern extension of the landscape described by Meeder et al. (2017) as the Southeast Saline Everglades. Current land use consists of agriculture, west of the L-31E levee, and the Biscayne Bay Mangrove Preserve, east of the levee.

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Current Land Use – Agriculture in the Coastal Plain Benefits the Region

Current land use activities on the proposed SDLTD site provide tangible economic benefits. The proposed SDLTD site, approximately 794 acres, is currently used almost exclusively for agricultural production. The site is located southwest of the town of Cutler Bay and south and east of the Florida Turnpike, and immediately west of the Biscayne Wetlands boundary (Figure 1). Onsite agricultural activities produce $28.6 million of product annually and support an annual labor income of $18.6 million. In addition, ecosystem services of the current agricultural land use total $844,000 per year from existing tropical tree nurseries.

The current agricultural land use also provides other less tangible benefits to Biscayne Bay and adjacent urbanized areas of the County. These benefits, a result of the location of the site within the coastal plain area of Miami-Dade County and the site's unique hydrological and ecological characteristics include:

- *Stormwater and Flood Management* - The coastal plain is an outlet for the drainage canals that protect local and interior urban areas from flooding by rainfall, and its coastal wetlands dissipate storm surge in Biscayne Bay.
- *Protection from Salt Water Intrusion* - Infiltration of fresh water into the Biscayne aquifer across the coastal plain protects the County's water supply by creating a barrier to salt water intrusion.
- *Critical Habitat* – Current land use supports critical habitat for valued fish and wildlife.
- *Fresh Water for Biscayne Bay* – The coastal plain is a critical link in the delivery of the freshwater required to sustain Biscayne Bay as a vital estuarine ecosystem.
- *Nutrient Reduction* – The coastal plain reduces the amount of nutrients that reach Biscayne Bay in the freshwater runoff from the agricultural and urban areas to the west.

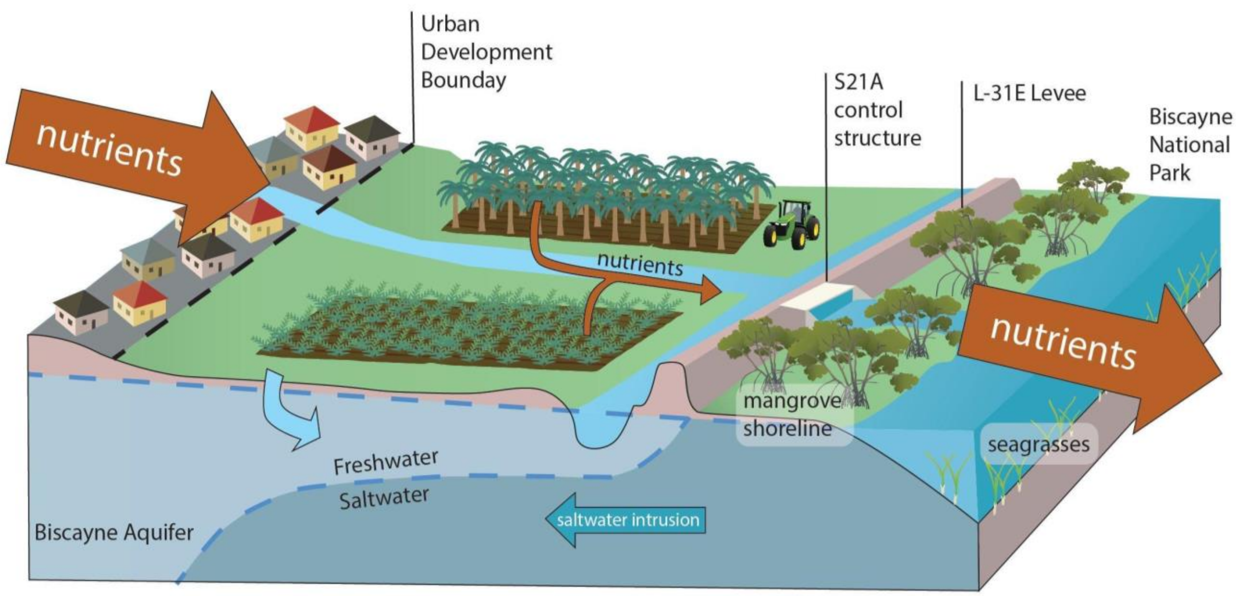

Figure 2: The low-lying coastal plain east of the Urban Development Boundary provides a buffer between urban development and the Biscayne Bay ecosystem. Agricultural activities on the proposed SDLTD site produce $28.6 million of produce, labor income of $18.6 million, and $844,000 per year in ecosystem services. Agriculture in the coastal plain supports regional benefits related to flood control, aquifer recharge, nutrient filtering, and water management.

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Proposed SDLTD – Urban/Industrial Land Use Puts Regional Benefits at Risk

The proposed SDLTD development consists primarily of warehouse/distribution buildings and ancillary support services on 794 acres. The full phase III build-up includes approximately 9.3 million square feet (over 200 acres) of Industrial uses, 120,000 square feet of commercial uses, and a 150-room hotel. The SDLTD will replace agricultural fields with over 200 acres of warehouses and commercial buildings covering more than one quarter of the site, not including roads and parking lots. In some areas, the applicant is planning for 90 percent coverage by impervious surfaces (Langan 2021, 2022).

Construction of the SDLTD will drastically alter the site (Figure 3). All of the new infrastructure must be elevated because the site is currently highly vulnerable to flooding. In 2021, low areas on the east side of the site flooded during the seasonally-high "King Tides" in Biscayne Bay, in spite of the fact that it is nearly 2 miles from the bay shoreline. The land surface within the footprint of the buildings and the surrounding parking lots and roads must be raised 5 to 12 feet above the existing elevation, requiring approximately 250 million cubic feet of fill.

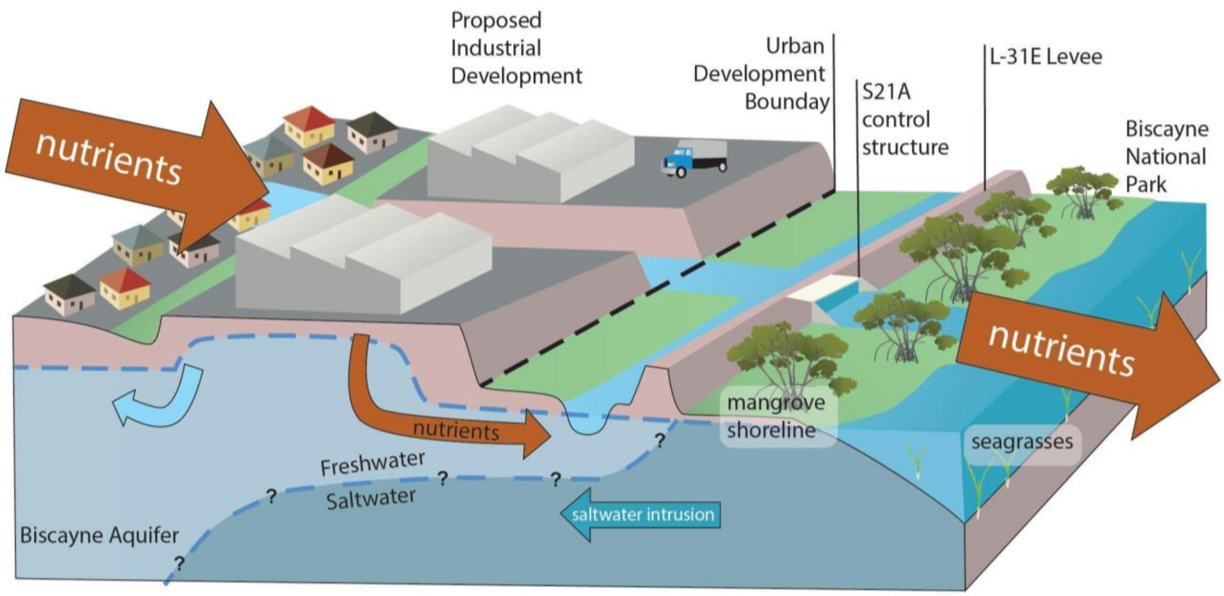

Figure 3: Development of the SDLTD will cover about one quarter of the site with industrial and commercial buildings elevated above flood level by 5 to 12 feet of fill. This will disrupt the hydrological and ecological functioning of the coastal plain. Storm water runoff will be retained on site by a perimeter berm, water detention area, and infiltration trenches. As a result, pollutants will leave the site through a groundwater pathway rather than in surface water.

The area of the site not covered by buildings, parking lots, and roads will be altered to manage stormwater runoff from these surfaces. The applicant plans to construct a perimeter berm at an elevation 8.5 feet NGVD and a "network of exfiltration trenches and surface retention areas to meet the volumetric storage requirements of the "100-year, 3-day storm event." These plans do not account for the lost filtration function provided by the current use. However, the applicant's plans do not specify the exact nature and extent of the alterations that will be required for these purposes have not yet been

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determined, with nearly continuous changes in their plans submitted to the governing entities over the last 6 months.

Over the long term, the proposed development will set back ongoing efforts to restore and protect Biscayne Bay. The expressed intent of the applicant is to remove the SDLTD site from the coastal plain by elevating it above the surrounding landscape. In doing so, development of the SDLTD will not only permanently alter the hydrology and ecology within the bounds of the site, but it will also impact the functioning of the entire coastal plain, diminishing valuable regional benefits that it provides. Subsequent sections of this report provide more detail on these impacts.

Further, the proposed SDTL development compromises on-going efforts to restore Biscayne Bay (Figure 4). The SDLTD site lies in the planned pathway for delivering more natural fresh water flows to Biscayne Bay from areas to the north and from wastewater reuse. Some of this water will be stored and dispersed into the Biscayne Mangrove Preserve, and some will be conveyed further south to feed coastal wetlands in the Model Lands and Southern Glades. The site was first identified for this purpose in 2005 during the initial planning for the Biscayne Bay Coastal Wetlands (BBCW) project (Appendix A).

Ecological restoration of the proposed SDLTD site–converting it into a freshwater wetland instead of an industrial development, will enhance regional benefits already provided in the coastal plain:

- Flood protection – Coastal mangroves provide natural protection from storm surge in Biscayne Bay. Mangroves also mitigate the impact of rising sea level through the natural processes of sediment trapping and accretion in which the elevation of the sediment surface increases over time. Coastal mangroves are capable of accreting sediment at a higher rate than any other type of wetland.
- Saltwater intrusion -Restoration will increase the water available to and held in freshwater wetlands at the site. This will increase freshwater recharge to the aquifer and raise the water table. These measures will strengthen the barrier against saltwater intrusion. Without restoration, rising sea level is expected to drive the intrusion of saltwater farther inland.
- Critical habitat – Improved quantity and timing of freshwater flows to the nearshore area of Biscayne Bay is anticipated to improve habitat for pink shrimp, juvenile sea trout, redfish, and snook that is degraded by the pulsed release of freshwater from the canal system as it is currently operated (Kearns et al, 2008).
- Nutrient reduction -Restoration of freshwater wetlands and coastal mangroves will enhance their natural capacity to filter and reduce the amount of nutrients and other pollutants discharged into Biscayne Bay from the urbanized Atlantic Coastal ridge.

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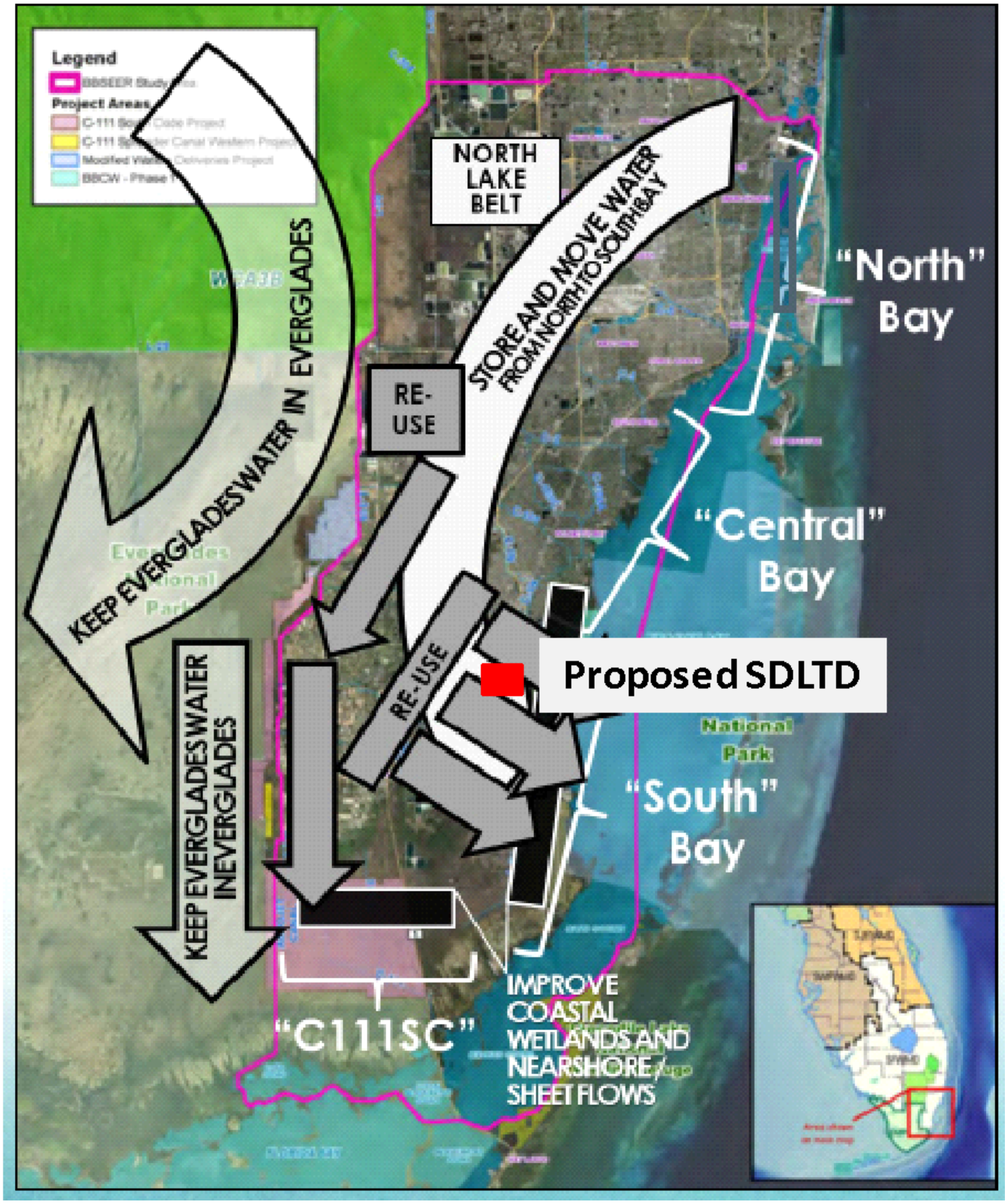

Figure 4: Elements of the BBSEER project under consideration for the vicinity of the SDLTD site (South Bay) would bring additional fresh water from the north and treated sewage effluent (re-use) and distribute it as sheetflow through coastal mangroves into Biscayne Bay. (Source: presentation at BBSEERProject Delivery Team Meeting, 6 October 2021)

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Proposal for South Dade Logistics and Technology District is Flawed

The applicant has failed to provide the information that is needed to adequately assess both the foreseeable risks and the potential benefits of the proposed development. The applicant has recently reiterated their claims that the SDLTD will deliver "more than 11,000 new jobs" while at the same time protecting the environment and Biscayne Bay.[1] Neither claim is supported by materials provided by the applicant, so far. Therefore, they cannot be accepted as credible.

The proposed SDLTD development consists of warehouse/distribution buildings and ancillary support services on 794 acres. The planned development includes approximately 9.3 million square feet (over 200 acres) of Industrial uses, 120,000 square feet of commercial uses, and a 150-room hotel. The applicant's analysis of storm water, water supply, and other critical aspects of their project are inadequate for a project of this scale. This is a fatal flaw in the application (Grosso, 2021).

SDLTD Will Not Deliver All the Jobs Promised

"Bring the Jobs South Dade," has been a primary justification for the entire project.

The applicant's estimate of the number of new jobs, the main benefit claimed for the project, is wildly exaggerated. The applicant estimated a total of 7,340 direct construction jobs and 11,428 direct warehousing jobs, promising 18,768 direct jobs, Table 1. Using the same economic model as the applicant, we calculate that only 408 direct construction jobs per year for a 15-year build-out, and 5,019 recurring warehouse jobs, a total of 5,427 jobs, which is 29% of the applicant's direct employment projections, Table 2.

A similar discrepancy occurs with their estimates of total direct, indirect, and induced jobs, (which we will call "ripple effect" jobs and that could occur anywhere in the County, not necessarily in South Dade). The applicant's estimate of these "ripple-effect" jobs is 30,869, a number once heralded as a "game changer." Our estimate of total "ripple-effect" jobs is 7,975, which is 25.8% – – a quarter – – of the applicant's estimate.

There are two reasons for the discrepancy between our estimates.

First, the applicant exaggerated the construction jobs by "compressing" into a single year the jobs needed in all the years to complete the project; for example, they counted 100 workers, each hired for 15 years, as 1,500 "non-recurring" jobs. Users of the IMPLAN model are instructed to divide total construction jobs by the estimated years to complete the project. The applicant failed to do this.

Second, the applicant uses inappropriate or outdated coefficients for the "space required for each worker" in using the IMPLAN model to figure the employment provided by their warehouse and

[1] Miami Herald, April 7, 2022

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commercial facilities. The IMPLAN model does compute "recurring" warehouse jobs on an annual basis. Our estimate is that 5,019 direct recurring jobs will be created, which is 44% of the applicant's estimated 11,428 jobs. And, we estimate a total of 7,326 "ripple-effect" jobs, which is 42% of the applicant's estimate of 17,445 (Tables 1 and 2). Our job estimates rely on coefficient values based on a sample of 10 logistical facilities recently built in Florida and other states, which more correctly represent the most up-to-date technology likely to be applied in South Florida.

To sum up, we estimate a total of 5,427 direct and 7,975 total ripple effect jobs. This compares to the applicant's estimate of nearly 12,000 direct and 18,341 ripple effect jobs. Our estimates of both direct and ripple effect jobs represent around 44% of the applicant's original estimates when corrected for a 15 year build out.

This report differs from other critiques in that we re-computed the employment forecasts using the very regional economic modeling tool – – IMPLAN (Impact Analysis for Planners) – – used by the applicant! We, however, use the latest model available for Miami Dade County for the year 2020. (The applicant did NOT specify which year or county their model was constructed for.) We re-estimated the crucial assumptions of their model, provided by the applicant regarding space per worker for the industries of warehousing, commerce, and hotels using recent Florida and US data, and then recomputed employment using the IMPLAN model for Miami-Dade County.

However, we estimate only 408 direct construction jobs per year and 5,049 recurring warehouse jobs, a total of 5,427 jobs, which is 29% of their direct employment projections.

Table 1: Economic Benefits, Jobs and Values Originally Estimated by the Applicant, June 30, 2021

		1	2	3	4	5	6
	Non-recurring jobs: construction	Phase 1	Phase 2	Phase 3	Total Work-Years, All Phases	Jobs/yr 10 yr build-out, All phases	Jobs/yr 15 yr build-out, All phases
1	**Direct**	**2,464**	**2,311**	**2,565**	**7,340**	**734**	**489**
2	Indirect	1,026	964	1,070	3,060	**306**	204
3	Induced	1,014	951	1,056	3,021	**302**	201
4	Total (DII)	4,506	4,226	4,691	**13,423**	**1,342**	**895**
5	Labor Income (mill$)	$234.5	$219.9	$244.1	$698.5		
6	Value Added (mill$)	$310.1	$291.7	$323.7	$925.5		
7	Budget Spent (mill$)	$312.6	$293.2	$325.4	$931.2		
	Recurring warehouse & other jobs created				Total Annual Jobs		
8	Direct	3,705	3,572	4,151	**11,428**		
9	Indirect	868	836	972	2,676		
10	Induced	1,083	1,045	1,214	3,342		
11	Total	5,656	5,453	6,337	**17,446**		
12	Labor Income (mill$)	$248.9	$239.9	$278.9	$767.7		
13	Value Added (mill$)	$339.8	$327.6	$380.6	$1,048.0		

Sources and Methods: See notes below.

*Phase 1 & 2 based on square footage of facilities designated by the applicant.

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Table 2: Economic Benefits, Jobs and Values Our Estimates, February 2022

		1	2	3	4		5	6	7	8	9
	Non-recurring jobs: construction	**Phase 1**	**Phase 2**	**Phase 3**	Total Work-Yrs, All Phases	% difference, ours to applicant's	Jobs/yr 10 yr build-out All Phases	Jobs/yr 15 yr build-out All Phases	Total Work-Yrs, Build-out Phases 1 & 2 only*	% difference to 3-phase original application**	Total Jobs/yr., 15-yr Build-out Phases 1 & 2* only
1	Direct	**2,136**	**1,890**	**2,097**	**6,123**	16.6	**612**	**408**	**4,026**	45.1	**268**
2	Indirect	459	406	451	1,316	**57.0**	132	88	865	71.7	58
3	Induced	801	709	787	2,297	**24.0**	230	153	1,510	50.0	101
4	Total (DII)	3,396	3,005	3,334	**9,735**	27.5	**974**	**649**	**6,401**	52.3	**427**
5	Labor Income (mill$)	$221.4	$199.5	$221.2	$642.1	**8.1**			$420.9	39.7	
6	Value Added (mill$)	$284.5	$256.0	$284.1	$824.6	**10.9**			$540.5	41.6	
7	Budget Spent (mill$)	$312.6	$293.2	$325.4	$931.2				$605.8		
	Recurring jobs: warehouse & other				**Total Annual Jobs**		Jobs after 10 yrs more automation				Jobs after 10 yrs more automation
8	Direct	1,421	1,461	2,137	**5,019**	56.1	**1,750**		**2,882**	74.8	**1,005**
9	Indirect	394	380	594	1,368	**48.9**			774	71.1	
10	Induced	268	265	404	937	**72.0**			533	84.1	
11	Total (DII)	2,083	2,107	3,136	**7,326**	58.0	**2,534**		**4,190**	76.0	**1,461**
12	Labor Income (mill$)	$40.6	$89.3	$136.5	$266.4	**65.3**			$129.9	83.1	
13	Value Added (mill$)	$112.0	$112.7	$168.3	$393.0	**62.5**			$224.7	78.6	

Sources and Methods: See notes below.

*Phase 1 & 2 based on square footage of facilities designated by applicant.

**Compared to corresponding lines in Table 1 above.

Sources and methods for Tables 1 & 2:

Table 1: from the applicant's original estimates, July 30, 2021.

Lines 1–6, cols. 1-4 are reproduced from Miami Economic Associates Inc. (MEAI), July 30, 2021, from table on page 14, which cites, "Aligned Real Estate Holdings LLC, Coral Rock Group, Minnesota IMPLAN Input – Output Model, MEAI."

Line 7, cols. 1-4, from text of above document, p. 13, includes "hard costs associated with off–site improvements, site prep, installation of on–site infrastructure, vertical building construction, and tenant improvements."

Table 2, our estimates, this report, February, 2022.

Procedures: for non-recurring construction jobs, we used the applicant's estimated hard costs for each phase, divided among three components: Water, sewer, & utilities (sector #56, 15.4%); Roads & highways (sector #54, 7.7%); new construction (sector #51, 76.9%), as suggested to users by IMPLAN.com. The total number of jobs, (direct, indirect, and induced) were then computed using the IMPLAN model's 2020 economic data for Miami-Dade County.

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However, IMPLAN.com alerted its users that the number of "jobs" estimated by the model refers to the total number of "work-years" corresponding to the **entire construction spending**, as if all the construction is to be completed in a single year! If, however, the construction were to take 10 or 15 years, then the total number of "work-years" should be divided by 10 or 15, to state correctly the number of jobs created for any single year. Only by dividing the IMPLAN-computed number of jobs by the total number of years can the true number of annual construction "jobs" be known. In Table 1, line 1, the applicant **failed** to divide the total number of work-years (col. 4) by the number of years! To correct this omission, we divided the total construction jobs by 10 years in col. 5, line 1 and by 15 years in col. 6, line 1, in view of the two different estimates of completion time for the project.

We have followed the same procedure in our Table 2 to "annualize" the IMPLAN estimates of total work-years (col. 4, line 1) into number of jobs in col. 5 and 6, line 1.

The estimates in Table 1 and Table 2 of true, annual construction jobs (cols. 5 & 6, line 1) are very similar. **Our** estimates are lower due possibly because we disaggregated "construction" into 3 sectors and also due to the year of the IMPLAN model, ours being the most recent available. However, the applicant's widely-publicized number of direct construction jobs of 7,340 and total construction jobs (including indirect and induced) of 13,423 should be reduced to a fraction of that on an annual basis: either 734 (direct jobs) & 1,342 (total jobs) for a 10-year build-out or 489 (direct jobs) and 895 (total jobs) for a 15-year build-out.

The procedure followed for estimating recurring (warehouses, commercial, and hotel) **jobs requires a bit more explanation.**

To compute Table 1, the MEAI, July 2021, document specifies 0.75 workers per 1,000 SF in warehousing (which is 1,333 SF per worker); 1.5 workers per 1,000 SF in last-mile warehousing (i.e., 667 SF per worker); 4 workers per 1,000 SF for office workers (250 SF per worker); and 15 workers per 1,000 SF for general commercial workers (67 SF per worker). These coefficients of "space per worker," (with the exception of hotels which is given as 0.35 worker per key), were then applied to the square footage (SF) given in their application documents for each type of activity, in order to compute the number of "direct workers." This number of direct workers was then entered into the IMPLAN model to estimate the number of "indirect" and "induced" jobs.

Please note this procedure differs from how we derived construction jobs which was computed directly from the dollar spending for each phase of work, whereas the number of recurring jobs is based on the **square footage expected in each activity** and on the **amount of space required for each worker.** Once the direct number of jobs is computed, only then can the IMPLAN model compute the number of indirect and induced jobs throughout the Miami-Dade economy.

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We were able to replicate the applicant's direct job estimates within 6% of his Table 1 jobs using his "space per worker" coefficients and the latest space designations available for each activity in the applicant's December 23, 2021, documents, which were the most recent available at this time.

However, from where did the applicants "space per worker" come from in the first place?

We surveyed the range of classical literature used by urban planning agencies in the decade of the 2000s (see bibliography). Then we researched reports of warehouse construction by Amazon, FedEx, and UPS, for 2020 and 2021, since the technology available for this South Florida project is most likely to reflect the very latest technology available today.

We averaged the space coefficients for five plants built in the past two years in Florida and five in other states (Virginia, Michigan, New York, Georgia, Alabama).

We followed similar procedures for commercial and hotel activity in recent years to compare the applicant's coefficients. We found enormous differences, probably due to the rapid mechanization and advanced logistical systems found in the very latest facilities, and the fact that we undertook our own sampling of recent construction.

However, future technologies are likely to use even less labor! The use of robotics, advanced conveyor systems, and emphasis on speed of delivery, suggest that rather substantial reduction in labor will continue. For example if warehouse automation continues at its current 10 percent per year, a 5,000 worker warehouse would need only 399 workers after 25 years. If the automation trend increases by 1 percent per year above the 10 percent, the same facility would need only 10 workers after 25 years to continue the same or higher levels of productivity.

These corrected "area per worker" ratios lie at the heart of our critique of the applicant's estimated job numbers. We used 3,272 SF per worker for basic warehousing, 1,636 SF for last mile warehousing, 603 SF per worker for office support, 300 SF per worker for all commercial activity, and 0.22 workers per key for the hotel industry.

The results of these coefficients, applied to the applicant's own designated square footage for the different activities, yield our number of direct recurring jobs presented in Table 2, line 8, col. 4, which is **5,019, half the number of the applicant's direct job estimates** of 11,428 (Table 1, line 8, col. 4)!

To estimate the number of indirect and induced jobs, we entered the direct employment estimates (calculated from the area and the square-foot per worker coefficients) into the IMPLAN 2020 model for Miami Dade county for three different

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sectors: warehousing (sector #472), office work (sector #473), and other commercial (sector #393).

Our total (direct +indirect+ induced) jobs (Table 2, line 11, col. 4) is **7,326, less than half the applicant's** widely publicized, total recurring job number of 17,446 (Table 1, line 11, col. 4).

Conclusions:

(1) The applicant's construction jobs are inflated because the applicant mistakenly counted each single "job" or work-year which continues, for example, for the entire 15 year build-out, as **15 separate jobs**. Therefore, their forecast of 7,340 construction "jobs" should be corrected to read "734 annual jobs" for an 10-year build out and "489 annual jobs" for a 15 year build-out. [We correct the applicant's unintentional error in Table 1, cols. 5-6.]

(2) Only the **direct** jobs should be considered as a real benefit for South Miami Dade, as the IMPLAN model relates to the **entire** county. Both the 6,000 indirect and induced construction jobs and the 6,000 indirect and induced warehouse jobs (Table 1, col. 4, lines 2-3, 9-10) could be created anywhere in the County with little effect on South Dade! This means that the applicant's estimate of direct local job creation should be "downsized" to 734 annual construction jobs (for an 10-yr. build-out) plus 11,000 direct warehouse jobs, instead of their widely-publicized 13,000 construction jobs (due to the IMPLAN error) and 17,000 recurring warehouse jobs since both these estimates include indirect and induced jobs anywhere in the county.

(3) The applicant (Table 1) estimated 11,428 direct jobs, and 17,446 Total (D +indirect +induced) for recurring warehouse employment. We found 5,019 direct jobs in warehousing and 7,326 total, including direct, indirect, and induced. The discrepancy between their Table 1 and our Table 2, between the applicant's and our methodology, is due to our use of freshly-researched coefficients that reflect the latest and most up-to-date technologies as implemented in Florida and out-of-state logistics plants and which are most likely to be applied in the proposed SDLDT project.

(4) If phase 3 is not fully implemented, then the likely job creation could be less, or 268 direct annual construction jobs for an 15-year build-out and 2,882 direct recurring warehouse jobs once the project is built and operating. (See Table 2, line 1, col. 9.)

(5) There are also other economic costs, benefits, and losses that we have also computed. Namely:
The loss of agricultural output and employment.
The loss of ecological services provided by the 800 acres currently in corn, tree crops, or fallow.
The loss of amenities to the surrounding neighborhoods of the project which will bring air and traffic pollution with the vibrations of thousands of trucks daily loading and unloading. This will result in the loss of value to the neighborhood house owners and a decline in tax revenue to the county and municipalities.

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(6) The loss due to the creation of an 800 acre "disamenity" can be valued in two ways: first, as the cost of constructing a stormwater treatment area (STA), similar to those being built as a part of Everglades Restoration in the Everglades Agricultural Area (EAA) and for the St. Lucie Reservoir, at a cost of approximately $9,500 per acre or $7.6 million for an 800 acre equivalent. This can be considered the "replacement cost" to society for "losing" the natural filtration and storage capacity of those 800 acres.
(7) A second disamenity or market "loss" will be perceived by nearby home owners due to truck traffic, air, and noise pollution associated with logistics centers (see bibliography attached to this chapter). This loss can range from 5 to 20% of property value and depends on many factors, such as distance from, and viewing of, the disamenity. (See R. Mendelsohn and S. Olmstead, **"The Economic Valuation of Environmental Amenities and Disamenities: Methods and Applications**," Amer. Rev. Environ. Resourc. 2009)
(8) The reverse is true if the 800 acres were purchased for recreation and restored as a wildlife preserve/park. Crompton & Nicholls, authors of ***The Impact of Property Values of Parks, Trails, Golf Courses, and Water Amenities***, 2021, p. 197, write, "… the studies' results suggest that a positive impact of 20% on property values abutting or fronting a passive park area is a reasonable starting point. [in the case of a heavily used park] the proximate increment… may reach 10% on properties two or three blocks

Appendix B identifies additional sources of information consulted for this analysis.

Applicant Has Scaled Back the Number of Jobs Claimed for the SDLTD

The applicant has modified their initial jobs estimates as the SDLTD application has come under increasing scrutiny. Their May 2021 proposal proclaimed 40,000 new jobs would come: 13,000 short-term jobs in construction and 25,500 permanent jobs in logistics, warehousing, and commerce: a new era for South Dade; jobs for the locals, reduced travel time to work, just push the development boundary out by 800 acres in a three phase expansion. Create the second largest industrial park in South Florida!

July 30, 2021, the applicant lowered the estimates of permanent jobs by 32% to 17,446 while keeping the original estimate of 13,000 construction jobs. These estimates have been critiqued on technical and professional grounds by the South Florida Regional Planning Council, the South Florida Water Management District, and other public and nonprofit agencies. Further, the applicant currently has proposed to develop only Phases 1 and 2, comprising only 41 percent of the area.

Current Agricultural Activities Have Value

Loss of productive farmland will harm the agricultural economy across the entire County. The Florida Department of Agriculture and Consumer Services (FDACS) describes the current land use as **"an integral part of the vibrant South Dade County agricultural foundation"** (Poucher 2021). This assessment by agricultural experts at FDACS runs counter to claims by the applicant that the site is

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currently useless for agriculture. Current activities on the site proposed for the SDLTD provide tangible economic benefits that cannot be ignored in the jobs calculations.

The Centennial of commercial agriculture in the “Redland” area of Miami Dade County was celebrated in 1998. The use of marl prairies for row crops such as tomatoes, pole beans, has been documented in the “East Glades” marl as early as the early 1900s through today. Marl soils has sustained agricultural production throughout time producing early market potatoes and field grown trees that supplied the expanding housing market over the last 60 years or so. Numerous field nursery operations have flourished providing a wide array of palms, hardwood, and tropical trees to developers, local, county, and state governments to this day.

Throughout the Miami-Dade County’s agricultural production area, including the marl soils of the East Glades, having fallow periods is a normal function of production. Seasonal markets of crops such as sweet corn and other vegetables, as well as wetter periods, as is with agriculture throughout the United States, is a function of growing seasons and marketability. In South Miami Dade, with the exception of bonito, a tropical sweet potato, and okra, the vegetable production season is traditionally over by mid-May each year. Therefore, the fields are left fallow until the fall.

The current agricultural use, according to the IMPLAN economic model, employs 194 direct workers (Table 3) and 356 total DII or “ripple-effect” workers, producing $28.6 million worth of produce and labor income of $18.6 million. The value of ecosystem services for current agricultural products is $844,470 (Table 3). However, if the land is restored as a freshwater wetland, the value of ecosystem services would be $12.62 million per year for the 763 acres of onsite agricultural lands.

Ecosystem services comprehends at least 17 categories (see Weisskoff 2005, Table 10.4 and 10.6). For tropical wetlands, the most important of these are gas regulation, water supply, water regulation, sediment retention, waste treatment, water quality improvement, refugia, food production, raw materials, recreation and cultural benefits.

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Table 3: Value of Current Agricultural Use

Annual Production	**Acres**	**$/acre** (2017 Ag census)	**Value ($)**
Nurseries	534	51,992	27,763,728
Sweet corn	229	3,798	869,742
Total			**28,633,470**

Jobs in Agriculture	
Direct	194
Indirect	97
Induced	65
Total Jobs	356
Labor $million	$18.60
Value Added ($million)	$27.20

Source: IMPLAN

Ecosystem Services	**$/acre****	**(1.83 CPI)**	**Acres**	**Total $ value/yr.**
Nurseries	844	1,545	534	824,774
Sweet corn	47	86	229	19,696
Current agricultural mix				**844,470**
Freshwater wetland	8,622	15,778	763	**12,622,608**

**from Costanza (1997) , quoted in Weisskoff (2005), T. 10.6, original in 1994 $, inflated to 2021 from Minneapolis Fed Reserve CPI series. Values are for the sum of 17 specific ecosystem services.

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SDLTD Will Increase Demand on Municipal Water and Sewer Infrastructure

The proposed development imposes difficult-to-estimate costs on the County related to increased demand on municipal services for water and sewer. We carefully reviewed the applicant's claim that the SDLTD will dramatically reduce water use at the site.

The applicant's claims about water use projected for the SDLTD are in error and misleading on two counts. First, the applicant seriously underestimates the amount of municipal water that will be required at the planned SDLTD. Second, the applicant incorrectly equates municipal water use at an industrial and commercial facility with local onsite agricultural water use for irrigation to bolster their claims that the SDLTD development will result in a huge reduction in consumptive water use at the site.

The applicant estimates that water use by the SDLTD will be approximately 246,085 GPD (Table 4). We estimate that water use by the SDLTD will be 1.3 million GPD (Table 5). This is nearly six times the amount reported by the applicant. This entire amount represents an increase in demand on the County's infrastructure for municipal water supply and wastewater treatment.

The comparison with current water use at the site is not relevant and grossly misleading because the vast majority, if not all water use for agricultural irrigation is pumped onsite from shallow groundwater wells and any excess irrigation water (after evapotranspiration) could be returned to the watertable via infiltration or flow in local ditches and eventually the C-102 canal potentially under wet conditions.

Table 4: Applicants projected total estimated water use for the SDLTD development based on per square foot by land use type—i.e., commercial, industrial, retail, etc. by the applicant).

Phase	Proposed Uses	Unit	Total	Flow Rate (GPD)	Total GPD
I	Warehouse	Sq.Ft.	2,980,000	2 gpd/100 sq.ft.	59,600
	Retail	Sq.Ft.	20,000	10 gpd/100 sq.ft.	2,000
II	Warehouse	Sq.Ft.	2,900,000	2 gpd/100 sq.ft.	58,000
	Retail	Sq.Ft.	38,400	10 gpd/100 sq.ft.	3,840
	Bank	Sq.Ft.	3,000	10 gpd/100 sq.ft.	300
	Full-Service Restaurant	Sq.Ft.	32,000	100 gpd/100 sq.ft.	32,000
	Service Station/Convenience Store	Sq.Ft.	96,600	450 gpd Gas Station/convenience store & 65 gpd/100 sq.ft. (50% sq.ft. Fast Food Rest)	2,595
	Hotel	rooms	150	115 gpd/room	17,250
III	Warehouse	Sq.Ft.	3,425,000	2 gpd/100 sq.ft.	68,500
	Retail	Sq.Ft.	20,000	10 gpd/100 sq.ft.	2,000
Total Water Use Likely under SDLTD Development in GPD					**246,085**

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Estimated Water Use for the SDLTD

Our estimate for water use by the SDLTD is based on data and analysis and model provided by Morales et al (2011) (Table 6). The proposed SDLTD development if fully implemented through phase III would consist of up to 9.3 million square feet of logistics centers, warehouses, offices, and other related uses. The development would also include supportive commercial development, and a 150 Room Hotel onsite.

The development is envisioned to occur in 3 phases. Below is a list of the proposed development by phases with reference to relative location within the 794 acre property:

i. Southeastern Corner -- 3,000,000 sq. ft. of logistics centers, warehouses, etc. and supportive commercial uses (up to 20,000 sq. ft. of maximum commercial development).
ii. Western and Northern edges: 2,900,000 sq. ft. of logistics centers, warehouses, etc. and up to 80,000 sq. ft. of supportive commercial uses, and a 150 Room Hotel.
iii. Center of Property: 3,425,000 sq. ft. of logistics centers, warehouses, etc. and up to 20,000 sq. ft. of supportive commercial uses.

Morales et al (2011) used “effective” or heated area in square feet to estimate commercial, industrial, and institutional (CII) water use in urban settings of Florida. They broke down urban land use types by 23 FDOR land use type codes and produced coefficients for each category. Coefficients were fitted by simple linear least-squares regression to produce water use estimates and statistics regarding the fits.

Using the Morales method, we estimate that if SDLTD development is allowed to proceed, it will require 1,290,516 GPD of “blue” consumptive use. This is approximately 5.2 times the amount the applicant claims would be needed for the SDLTD development.

Table 5: Total estimated consumptive water use using Morales et al, 2011 CII average water use coefficients and effective (heated) area to produce water use estimates.

Phase	Proposed Uses	Unit	Total Area (sq. ft.)	Effective Area coefficient	Effective heated Area (sq. ft.)	Water Use Coefficient (Gal/Sq.Ft.)	Estimated Water Use (GPD)
I	Warehouse	Sq.Ft.	2,980,000	0.9460	2,819,080	0.1400	394,671
	Retail	Sq.Ft.	20,000	0.9290	18,580	0.2620	4,868
II	Warehouse	Sq.Ft.	2,900,000	0.9460	2,743,400	0.1400	384,076
	Retail	Sq.Ft.	38,400	0.9290	35,674	0.2620	9,346
	Bank	Sq.Ft.	3,000	0.8970	2,691	0.4610	1,241
	Full-Service Restaurant	Sq.Ft.	32,000	0.9620	30,784	0.6770	20,841
	Service Station/Convenien ce Store	Sq.Ft.	96,600	0.8650	83,559	0.2030	16,962
	Hotel	rooms	150	0.9450	142	0.2490	35
III	Warehouse	Sq.Ft.	3,425,000	0.9460	3,240,050	0.1400	453,607
	Retail	Sq.Ft.	20,000	0.9290	18,580	0.2620	4,868
	Total Area	Sq.Ft.	**9,515,150**			**Total GPD**	**1,290,516**

Current Water Use by Agriculture

We estimate current water use to be approximately 2,032,454 GPD. This is based on the best management practice (BMP) recommended by the Florida Department of Agriculture and Consumer Services (FDACS). Current agricultural land use over the proposed SDLTD site is comprised of mostly palm tree (534 acres) and row crop (sweet corn) production (229 Acres). Our estimate is based on the recommended BMP irrigation amounts, on average 1.65 in/week, applied during the dry season for half of the year (November through May). This amount is 1,827,546 GPD lower than the water use estimated by the SDLTD applicant.

Water currently used for irrigation at the site is pumped from wells located on the property and not taken from the Municipal Miami-Dade Supplied potable water supply. The applicant claims that the current water use is approximately 3,860,000 GPD based on the total maximum permitted groundwater withdrawal for all wells registered at the site. Our estimate of actual current water use is about half this amount, 1,827,546 GPD, based on the crops currently grown at the site.

The vast majority of land use (96 percent) in the proposed SDLTD area is agricultural and the soils have medium to low permeability. Of current agricultural land uses, 70 percent is field grown palm trees; the other 30 percent is used for sweet corn production. Agriculture over the site is seasonal, limited and comprises approximately 96 percent of the total land use (Table 6).

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Soils in proposed SDLTD area of south Miami-Dade County area are comprised of the Krome, Chekika and Perrine marls. These soils are known to have low water holding capacity and mostly medium permeability (Savabi, M.R., 2001). Lower Permeability soils occur in areas that are obviously wetlands on the north and eastern side of the property (Miami-Dade County, accessed 2022).

According to the Florida Department of Agriculture and Consumer Services (FDACS) best management practices (BMP) manuals, recommended amounts of irrigation water to grow sweet corn and palm trees in South Miami-Dade County, Florida are approximately 2 inches per week for corn and about 1 to 1.5 inches per week for palms between April through October as needed; the dry season (Putnam 2008; Putnam, 2014). Current reported irrigation estimates concur, based on Crane (2022) for Pejibaye palm tree production, the recommended irrigation rate is about 4 to 6 inches (10.2–15.2 cm) of water per month---or about 1 to 1.5 inches (2.5–4 cm) of water per week, applied from April through October as needed during dry periods that often occur during late fall and early winter months.

Table 6: Total agricultural area in acres at proposed SDLTD site and estimated annual irrigation amounts based on recommended BMPs for row crop and palm tree production (Putnam, 2008, 2014) assuming that irrigation is used roughly over half the a year during the dry season at recommended (BMP) amounts (Crane, 2022).

Land Use	Acres	Recommended Irrigation during dry season in/wk	Estimated Water Use for Irrigation in GPD
Row Crop (acres)	229	2.0	1,293,087
Palm Tree (acres)	534	1.5	739,368
Total	763	1.7	2,032,454

*note independently verified estimates of irrigation water use at the proposed site.

Comparing future water use by the SDLTD industrial facility with current water use by agriculture is misleading. All of the water currently used by agriculture for irrigation is supplied from private, onsite shallow groundwater wells. Water used by the SDLTD industrial facility will be piped in as municipal, treated potable “Blue” water that will then need to removed (piped out) from the site for treatment.

Currently, water in excess of evapotranspiration infiltrates to recharge the Biscayne aquifer or drains as runoff into nearby drainage ditches and the C-102 canal. More freshwater in the groundwater and the canal may help dilute pollutants such as nutrients, potentially improving water quality. Due to the relatively medium permeability of the soils (up to 0.5-0.8 inches hour (Studstill et. al., 2006)), most of the excess water likely runs off to ditches or infiltrates slowly.

SDLTD Stormwater and Flood Management Plans Lack Detail

In the short term, the proposed development risks increased flooding on adjacent properties due to the extent of modifications that will be required to surface elevation at the site. The applicant says that they will remove the site from the 100-year flood plain. Therefore, we looked carefully at the plans the applicant has submitted for review.

The applicant's plan for stormwater management is to retain onsite the entire volume of runoff from a 3-day, 100-year storm. In support of this proposal, the applicant offers only the results of an analysis of runoff from hypothetical 40-acre developed site. The results, they claim, proves the feasibility of proposed elements of their "conceptual design" to achieved the stated stormwater management goals. However, the mismatch in scale between their 40-acre proof-of-concept analysis and the proposed 800-acre site proposed for development raises significant concerns about the adequacy and credibility of the proposed plan for managing floodwaters once the project is built.

A recently published UF study found that stormwater ponds do little to prevent pollution in nearby lakes and ponds (Hess et al. 2022). One could extrapolate to general water bodies such as canals. Stormwater ponds, designed mostly to prevent erosion and flooding, often remove only about 50% and sometimes less (Hess et al., 2022). These ponds, with claims to be the Best Management Practices for water quality improvement, are purported to remove 80% of phosphorus, nitrogen and suspended solids from stormwater and considered a Best Management Practice, or BMP, to reduce pollutants from flowing into natural water bodies. Although the UF research scientists studied stormwater detention facilities in the Gainesville area, they concluded that their findings can be applied to urban areas throughout Florida.

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Agency Comments:

"A review by our Office of Agricultural Water Policy finds that the proposed amendments will alter the flood control of the surrounding area and require significant changes to water management to ensure the viability of the remaining adjacent agricultural parcels." (Poucher FL/DACS, 2021)

"The land elevation is proposed to be raised significantly (5-12 feet) above the existing elevation. It is possible that drainage from the expanded Urban Development Boundary (UDB) area may cause water levels in the C-102 Canal to increase and thereby negatively impact drainage for areas further to the west." (Glenn SFWMD 2021)

"Filling and converting the property from agriculture to development would reduce area available for transition of uplands to coastal wetlands, which is already very limited because of the density of development in Miami Dade County. Coastal wetlands are important storm buffers for the human landscape and are important for support of fish and wildlife in Biscayne Bay. Based on the USACE high sea level rise scenario, in 50 years this property at its current elevation could support coastal wetlands along the future shoreline." (Glenn SFWMD 2012)

"The Environmental Considerations and Beneficial Impacts document provides public infrastructure drainage information that cannot be assessed by DERM at this time without a complete environmental assessment of the agricultural lands for soil and possible groundwater contamination. In order for DERM to evaluate and determine the proposed drainage systems that can be installed in the CDMP application area, the applicant shall first obtain DERM Pollution Remediation Section review and approval of a complete environmental assessment of the entire CDMP application area. Based on the recommendations of the environmental assessment, a stormwater management master plan, signed and sealed by a Florida licensed professional engineer, shall be submitted for DERM review and approval to evaluate stormwater management needs and flooding issues […]" (Istambouli DERM 2021)

Of further concern is the fact that the SDLTD site straddles the C-102/Princeton Canal. This canal serves as the outlet for the network of drainage canals that serves the developed area of the entire the C-102 basin, (Figure 5). The C-102 canal discharges to Biscayne Bay via the coastal structure S-21A, operated by SFWMD. The site currently includes drainage ditches and swales that collect runoff from the site and adjacent properties for discharge into the C-102 canal. The continued, unimpeded operation of the C-102 canal is critical to protecting areas in the C-102 basin from flooding by rainfall.

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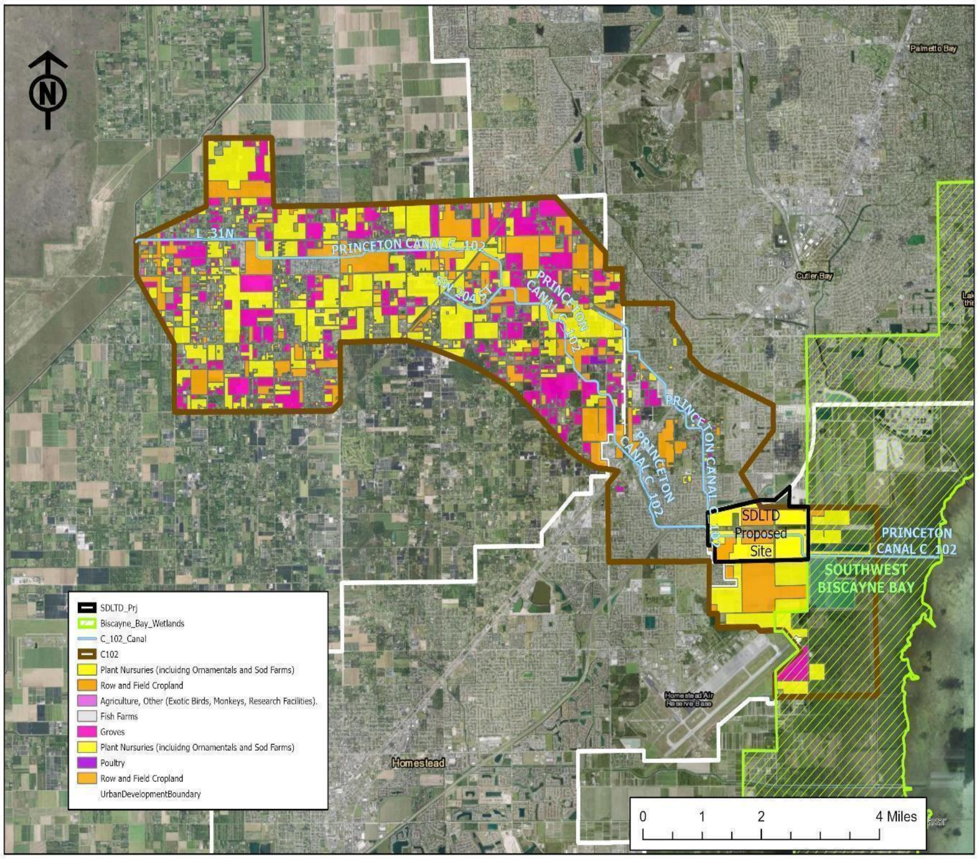

Figure 5: The C-102 bisects the site and is the only outlet for the network of drainage canals that serves the developed area of the entire the C-102 basin. The C-102 canal discharges to Biscayne Bay via the coastal structure S-21A, operated by SFWMD.

Currently**,** the site proposed for the SDLTD is an agricultural area with no stormwater management facilities. According to the “Conceptual Stormwater Management Master Plan” for the SDLTD project produced by Langan (Project #330078601), the existing site discharges about 760 acre-fee of stormwater annually to the C-102 East Canal Basin. The site currently includes drainage ditches and swales that currently discharge into the C-102 canal and eventually to Biscayne Bay via the coastal structure S-21A operated by SFWMD.

The proposed Master Plan drainage plan for the SDLTD includes a perimeter berm at 8.5 NGVD to retain onsite runoff from a 100 year, 3-day storm event, assumed to be about 16 inches. The plan includes exfiltration trenches and dry retention areas, primarily designed for water quality treatment according to the Miami-Dade County requirements. The peak stage from the 100 year, 3-day storm has been estimated by the applicant to be 8.5 ft NGVD which was presumably used for establishing the perimeter berm elevation. The plan calls for retaining or improving some of the existing ditches to provide drainage during the development of Phase I. As shown in Figure 6 (Langan Fig-04), the C-102 canal and its levees (estimated to be about 4 feet above the natural ground on either side) will remain as it exists today. It is not clear how the proposed perimeter berm, the C-102 canal and its levees on either side will be configured for the project.

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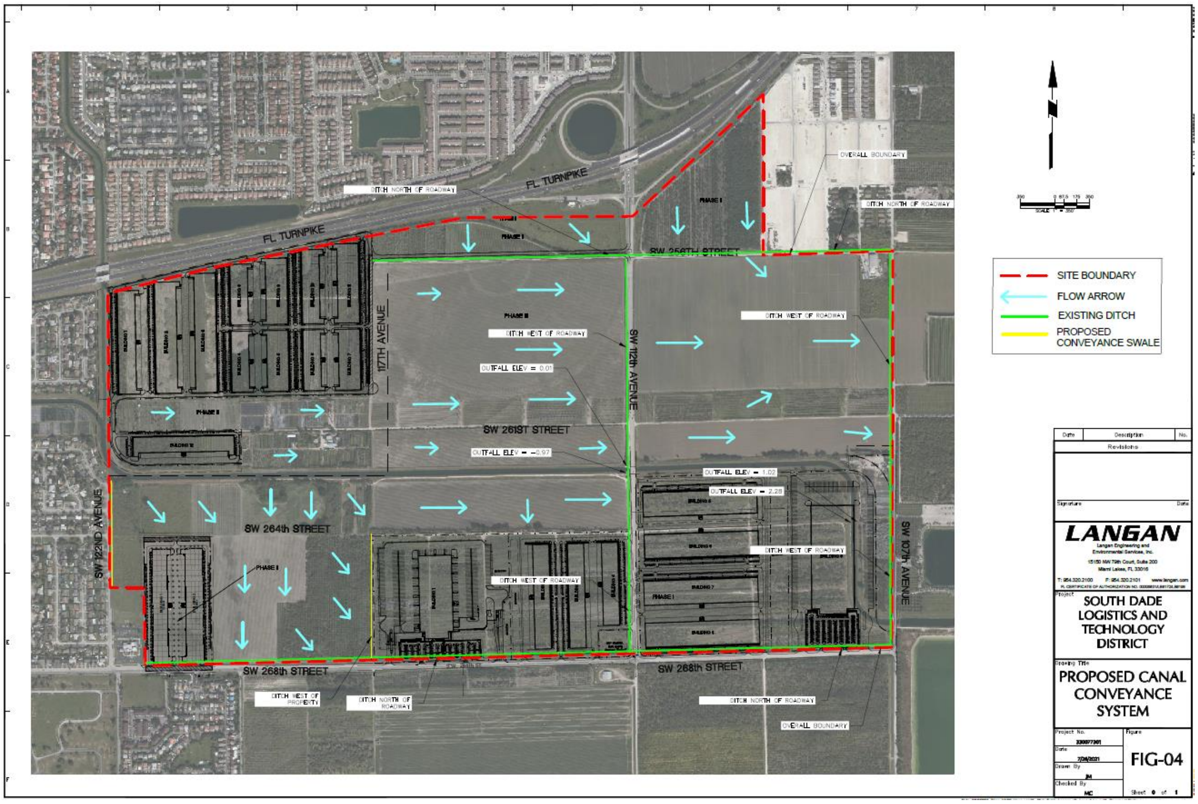

Figure6: Proposed Canal Conveyance systems (Langan report, Fig-04).

It is extremely concerning that these plans are based solely on an analysis of a "conceptual 40-acre parcel" for the development of the plan for the entire site. It is not clear why the applicant has not provided or used the ultimate SMP for the entire project site and its all three phases (I, II, and III) with sufficient details to ensure the flood protection is maintained not only for the site that is proposed for being developed, but also in areas surrounding the site, particularly the residential areas to the north, northwest, and the southwest. While the applicant provides a cursory assessment of potential impacts in these areas using simply the land elevation data, such claims without a thorough analysis are not credible.

The use of calculations based on a conceptual, 40-acre site to determine the height of the perimeter berm required for the larger SDLTD project site (20 times larger) is questionable and unacceptable. Such an attempt to scale-up a stormwater management plan is deemed useless. Further, the extrapolation of the site-specific stormwater calculations from the conceptual site to the entire site is inaccurate as the stormwater features of a fully-developed site are not clearly articulated. It should be noted that the proposed project is not a typical, 40-acre, residential site but rather a large industrial site that will ultimately expand to 800-acres. Another concern is the feasibility of the perimeter berm to contain onsite runoff from a storm larger than the 100-year return period and 3-day duration.

Another major concern is the offsite impacts of the proposed project. Because the C-102 East basin is largely undeveloped and agricultural, the part of the basin where the project is located likely provided flood storage during storms. That storage is extremely important to ensure flood protection for the

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residential areas in the C-102 West basin as their stormwater will have to be discharged by the C-102 east basin via the S21A coastal structure outlet to Biscayne Bay. The natural storage of floodwaters that exist today but are lost due to future development of the eastern basin may be detrimental to the flood protection operation of the entire C-102 basin.

With future sea level rise the flood protection challenge will be further exacerbated unless additional capacity at S21A is provided to ensure the level of service for flood protection in the western part of the basin. The operation of S21A is already challenging because of the historical sea level rise during the last 50-years or more as the original design did not account for rising sea level when it was planned and designed. Many of the coastal structures in Miami-Dade County have to close during higher high tides (King Tides) because of potential saltwater intrusion inland via canals due to higher water levels in the Bay.

Elevating the project site will likely have unintended consequences. According to the plan, the project site's topographic elevation will be increased by as much as 5 feet. Because of the rainfall recharge, particularly during the wet season, there is a high likelihood of groundwater mounding in this large elevated site of 800-acres compared to surrounding neighborhoods. Such a mound may change the groundwater flow patterns resulting in increased flooding risk to residential areas to the north, west, and southwest.

Only comprehensive groundwater modeling in the region can address this concern. As with any area in Miami-Dade County, elevated, shallow groundwater levels will affect flood protection negatively and that may exacerbate any flooding currently occurring in the neighboring areas. In such a situation, the frequency of repetitive flooding that may already be occurring in certain areas is likely to increase.

Additional issues:

- 100 year, 3-day rainfall is 16 inches but the calculation uses a credit of 3.28 inches. There is no clear explanation for this in the SMP. Is this allowed by the County?
- The Stage-Storage value provided by the Exfiltration Trenches is 25 acre-feet. There is no clear explanation as to how this was computed. Does this account for rising groundwater levels due to sea level rise?
- It is likely that future rainfall extremes will be more intense? Similar to accounting for sea level rise, why wouldn’t the applicant allow for the potential increase in extreme rainfall intensity?
- AECOM storm surge simulation results show that, with the project, surge elevation actually decreases in the north and northeastern areas of the project (see Figures 13 and 14). The reduction in surge elevation is not intuitive and that needs to be explained.

Review of additional document:

The following additional documents were reviewed for additional information that may have addressed the above concerns and comments mentioned in the previous paragraphs:

1. Langan report dated January 11, 2022 provide to DERM

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2. South Dade Logistics & Technology District Development Agreement Data December 27, 2021

Neither of the above reports included additional details that would provide details to address local and regional surface water and groundwater concerns mentioned above. Both of the above documents indicate vague commitments (underlined in text below) without any details necessary for a thorough review. Some examples are:

Langan Report (1/11/2022)

"The proposed public infrastructure will be designed in accordance with the proposed design considerations described in this document to alleviate the sea level rise impacts associated with the predictions described in the Unified Sea Level Rise Projection Report (2019), Southeast Florida Regional Climate Change Compact."

"All phases of development (Phases I, II, and III) shall meet the retention requirements for the 100-year, 3-day storm event peak stage as described in this document."

"All public collector and arterial roads within the District will provide drainage facilities designed to accommodate the 10-year design storm, except where higher regulatory standards apply."

"The proposed development will include by-pass swales or other means of conveyance, if required to maintain existing drainage flow patterns from the neighboring properties so there are no negative impactspost-development compared to the existing pre-development conditions"

SDLTD Will Affect Saltwater Intrusion

Agency Comments:

"Additionally, the construction of significant acreages of impervious surface will rob the surrounding area of vital water management and recharge benefits, […] both on the subject parcel as well as for the surrounding natural resource environments." (Poucher FL/DACS, 2021)

"Due to the conversion of pervious surface (agricultural lands) to impervious surface (industrial and commercial uses), there would need to be considerations made with respect to additional volume of runoff anticipated. This is in relation to water quality and quantity, as the current stormwater infiltration functions as a part of the system to protect the drinking water source from saltwater intrusion." (Weaver FL/DEP 2021)

In the short term, the proposed development risks increased saltwater intrusion in the Biscaye aquifer by disrupting recharge to the Biscayne aquifer that occurs under current conditions and provides a hydraulic barrier to saltwater intrusion. Nowhere in the applicant's plans for stormwater management is this issue addressed.

The SDLTD will cover the site with large expanses of impervious surfaces (roofs, roads, and parking lots), which increase surface runoff at the expense of infiltration and recharge to the aquifer. It could be

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argued that the stormwater management system proposed by the applicant will increase recharge, because of all of the runoff will be captured and retained on the site. However, the information about the "conceptual design" of the stormwater management system is not sufficient to allow an evaluation of the potential for recharge to the aquifer. Absent this information, the impact of the SDLTD on aquifer recharge and saltwater intrusion must be counted as a major concern.

The coastal plain serves as a buffer against the intrusion of saltwater into the Biscayne aquifer farther inland. The Biscayne aquifer is the primary source of drinking water supply in Miami-Dade County. The intrusion of salt water from Biscayne Bay poses a constant threat to the County's water supply wells. Currently salt water extends inland along the bottom of the aquifer beneath the entire extent of the coastal plain (Figure 7).

The Biscayne aquifer, the main source of water supplies in Miami-Dade County (99.3% of drinking water supplies, (Marella, 2005)) has been designated as a sole source aquifer by the US Environmental Protection Agency. The aquifer is located just a few feet below land surface making it highly vulnerable and susceptible to contamination and pollution. It is imperative that this important resource is protected and conserved.

In 2009, Miami-Dade County produced an average of 312.5 million gallons of freshwater for drinking water supply per day (MGD) and served a population of more than 2.2 million customers (Miami-Dade County Water and Sewer Water use and future planning document, 2009). The Miami-Dade Water and Sewer Department (WASD) is the main public water supplier in Miami-Dade County and all water supply sources in the County are managed and regulated by the South Florida Water Management District (SFWMD) through Water Use Permits (WUPs) that furnish water service to Miami-Dade County's 35 municipalities.[2]

Protection of the County's water supply depends on maintaining hydrologic conditions favorable to recharge into the aquifer across the coastal plain. Currently, the intrusion of salt water in the vicinity of the proposed SDLTD has been halted. Fresh water from rainfall over the coastal plain and leakage out of canals recharges the underlying Biscayne aquifer. This maintains a layer of fresh water at the surface of the aquifer that creates a hydraulic barrier against further movement of saltwater from Biscayne Bay inland through the aquifer. The inland extent of saltwater at the base of the aquifer has not changed since 2008.[3]

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[2] Miami-Dade County Water and Sewer Water use and future planning document, 2009; https://www.miamidade.gov/greenprint/planning/library/milestone_one/water.pdf). [accessed 10/30/2021]
[3] https://southeastfloridaclimatecompact.org/indicator-saltwater-intrusion/ [accessed 31 Jan 22]

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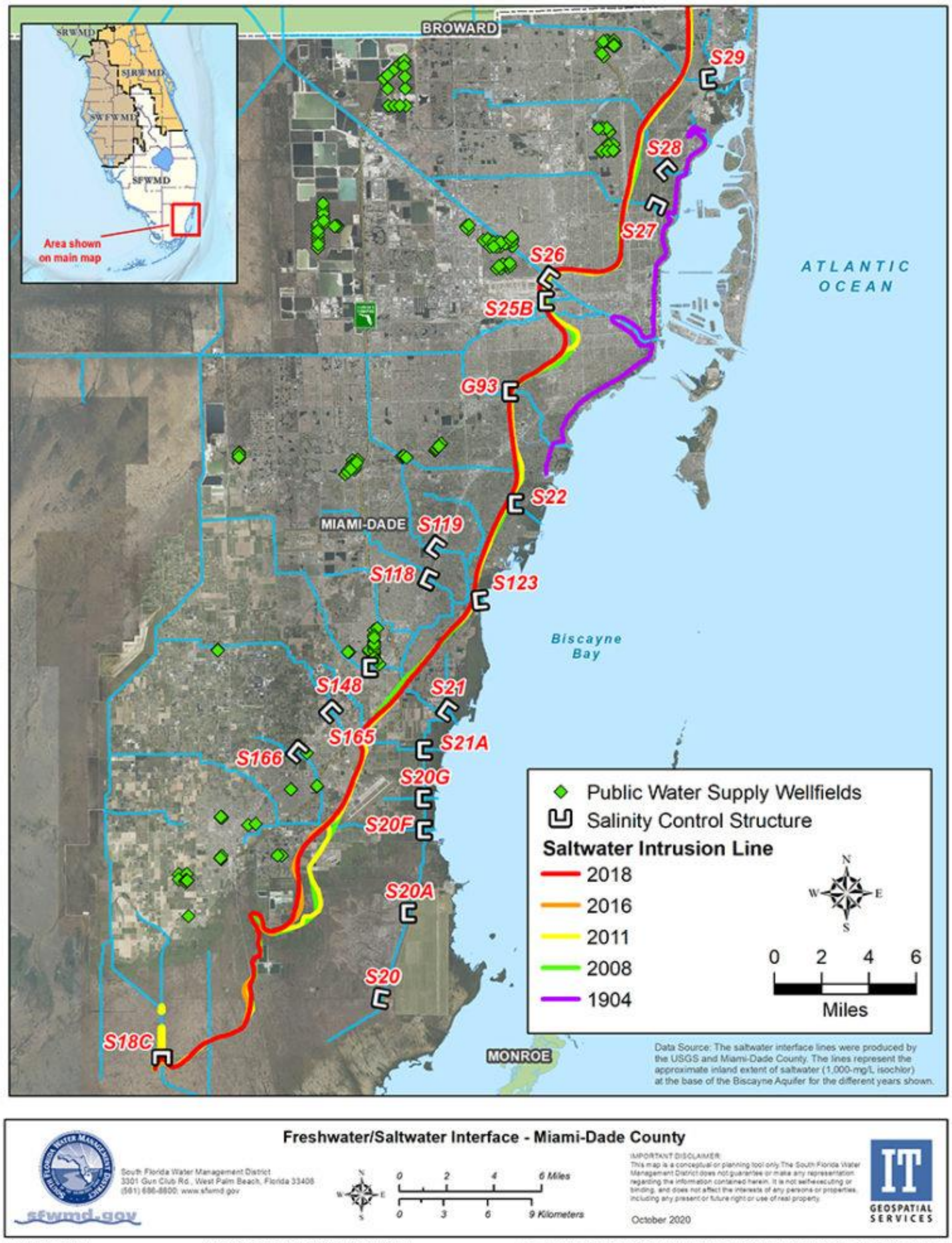

Figure 7: Extent of salt water intrusion (source: https://southeastfloridaclimatecompact.org/indicator-saltwater-intrusion/ [accessed 31 Jan 22])

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SDLTD Impacts on Critical Habitat

Agency Comments:

"Filling and converting the property from agriculture to development would reduce area available for transition of uplands to coastal wetlands, which is already very limited because of the density of development in Miami Dade County. Coastal wetlands are important storm buffers for the human landscape and are important for support of fish and wildlife in Biscayne Bay." (Glenn SFWMD 2012)

"The CDMP application (CDMP20210003) area referenced in the document is located within the consultation areas for the federally endangered Everglades snail kite and the Florida bonneted bat and provides a combination of open land and water that is similar to other sites in Miami-Dade County where foraging or roosting by the Florida bonneted bat has been documented. The subject area is also within the core foraging areas for the federally threatened wood stork." (Istambouli MDC/DERM)

In the short term, the proposed development risks harm to wildlife. Endangered and other flying species ((butterfly, bat, bird, bees, and winged insects) rely on the ability to fly safely to locate and access food and feeding areas. Flying species will be much more likely to be killed by the increase in high-speed truck and automobile traffic while hunting for food or prey on the proposed SDLTD site. The increased traffic will cause significant increases in noise, water, and air pollution from the increased truck and automobile traffic and parking lots, disrupting potential feeding areas at the site. If the proposed development is allowed to proceed, it will create and produce an increased risk of injury and death for endangered and other species in the area from the loss and disruption of feeding areas on the proposed site.

The proposed SDLTD development is located in the lower C-102 canal basin and the updated proposed BBSEER mitigation area for restoration of the Biscayne National Park, wetlands, and Estuary. Species that rely on the health and restoration of Biscayne Bay include the federally listed Manatee and Swallow-tail Kite and the Florida bonneted bat. Critical habitat and food for Manatees includes healthy sea-grasses (Thalassia) beds. In addition to Manatee, another critically endangered species, Swallow-Tail Kite, are adependent on healthy wetlands to support populations of their main food source—Apple Snail. Any increase in wetlands to filter surface waters and improve water quality to the Bay to reverse Thalassia sea-grass cover decline in Biscayne Bay and provide more habitat for Apple Snails and therefore, Swallow-Tail Kites will benefit these endangered species.

The SDLTD site report lists 7 endangered species found on or near the proposed development site. They are: 2 butterflies, 1 bird, 1 bat species, 2 species of vegetation, and the American Crocodile. The distance of the proposed development to nearby critical habitat boundaries is: east 0.77 miles, north 1.37 miles, 1.52 miles south. These are relatively short distances for the 4 flying endangered species that fly in

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search of food and/or prey from areas from where species make their homes. The proposed development site report minimizes the potential harm and risk for endangered and other species currently residing or using the proposed development site.

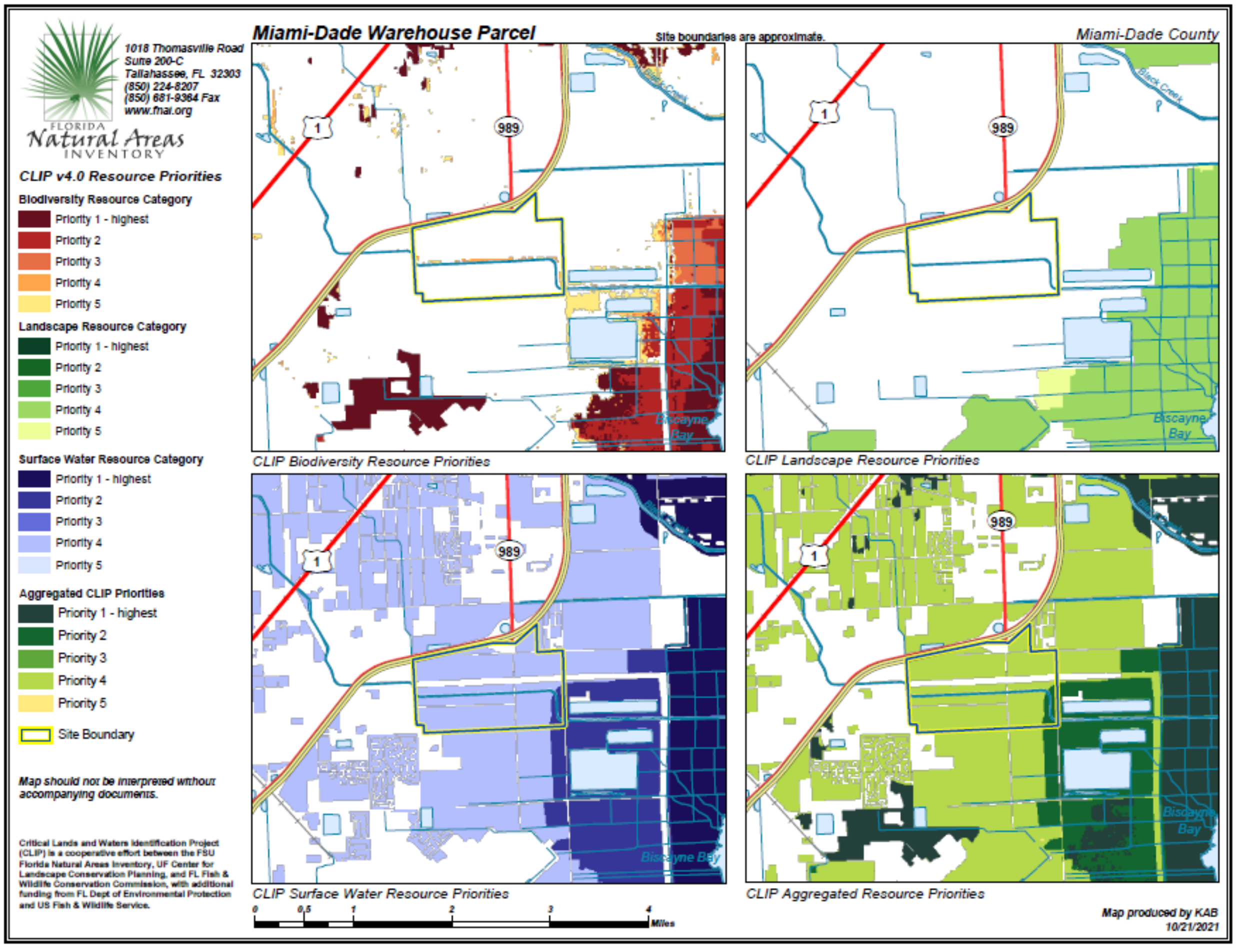

Figure 8: Habitat Index provided for the proposed SDLTD site by Florida Natural Areas Inventory (FNAI) (from Florida Natural Areas Inventory, Schwartz, 2021).

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Table 7: Inventory of Federal or State Endangered or listed species that have inhabited or potentially inhabited the proposed SDLTD site[4]

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Listing
Ataenius wenzelii	Ataenius Beetle	G3G5	S2S3	N	N
Basiphyllaea corallicola	Rockland orchid	G2G3	S1	N	E
Chamaesyce porteriana	Porter's broad-leaved spurge	G2	S2	N	E
Crossopetalum ilicifolium	Christmas berry	G3	S3	N	T
Jacquemontia curtissii	Pineland jacquemontia	G2	S2	N	T
Linum arenicola	Sand Flax	G1G2	S1S2	E	E
Mosiera longipes	mangroveberry	G3G4	S2	N	T
Pine Rockland	Pine rockland	G1G2	S1	N	N
Pituophis melanoleucus	Pine Snake	G4	S3	N	ST
Pteris bahamensis	Bahama brake	G4	S3	N	T
Rivulus marmoratus	Mangrove Rivulus	G4G5	S3	SC	N
Sachsia polycephala	Bahama sachsia	G2	S2	N	T
Stylosanthes calcicola	pineland pencil flower	G4	S2	N	E
Tantilla oolitica	Rim Rock Crowned Snake	G1G2	S1S2	N	ST
Tragia saxicola	pineland noseburn	G2	S2	N	T
Other Potential Species if Habitat Restored					
Anemia wrightii	Wright's anemia	G2?	S1	N	E
Asplenium verecundum	modest spleenwort	G1	S1	N	E
Ataenius wenzelii	An Ataenius Beetle	G3G5	S2S3	N	N
Athene cunicularia floridana	Florida Burrowing Owl	G4T3	S3	N	ST
Basiphyllaea corallicola	rockland orchid	G2G3	S1	N	E
Bourreria cassinifolia	smooth strongbark	G3?	S1	N	E
Chamaesyce deltoidea ssp. deltoidea	deltoid spurge	G2T1	S1	E	E
Chamaesyce porteriana	Porter's broad-leaved spurge	G2	S2	N	E
Colubrina cubensis var. floridana	Cuban snake-bark	G2G3T1	S1	N	E
Dalea carthagenensis var. floridana	Florida prairie clover	G5T1	S1	E	E
Digitaria pauciflora	few-flowered fingergrass	G1	S1	T	E
Drymarchon couperi	Eastern Indigo Snake	G3	S2?	T	FT
Elytraria caroliniensis	narrow-leaved Carolina scalystem angustifolia	G4T2	S2	N	N
Eumops floridanus	Florida bonneted bat	G1	S1	E	FE
Galactia pinetorum	pineland milkpea	G2Q	S2	N	N
Glandularia maritima	coastal vervain	G3	S3	N	E
Gopherus polyphemus	Gopher Tortoise	G3	S3	C	ST
Jacquemontia curtissii	pineland jacquemontia	G2	S2	N	T
Linum carteri var. smallii	Small's flax	G2T2	S2	N	E

[4] (from Florida Natural Areas Inventory, Schwartz, 2021).

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Promises That SDLTD Will Protect Biscayne Bay are Unfounded

In the short term, the proposed development risks decreased health of Biscayne Bay. The "state-of-the-art" stormwater management at the SDLTD could end up harming Biscayne Bay. Construction of the SDLTD will begin by adding 8 to 12 feet of fill to the site to raise the ground surface above the level of the 100-year flood. The applicant touts this as removing the SDLTD from the flood plain. However, removing the SDLTD site from the low-lying flood plain will also disrupt the essential hydrologic and ecologic functioning of the surrounding coastal plain.

The applicant claims that the SDLTD will improve water quality in discharges to Biscayne Bay. The basis for this claim is that development of the SDLTD will eliminate surface runoff from the site from reaching the Bay via the C-102 canal. Stormwater management at the SDTLD will retain runoff from all storms up to the 3-day, 100-year rainfall event; and this in turn will eliminate 901.28 kg/year of nitrogen and 156.75 kg/year of phosphorus loads that currently occurs in runoff water from the site. According to the applicant, their development would significantly reduce nutrient pollution discharging to Biscayne Bay (unsigned, 2021).

The proposed SDLTD site is approximately 1-2 miles east of the outlet of surface water drainage from the Princeton/C-102 basin to Biscayne Bay. Proposed changes to this site would disrupt the hydrological and ecological functioning of the coastal plain that protects Biscayne Bay from the impacts of existing urban development in the Princeton/C-102 basin west of the site. The applicant's "comprehensive" review of the impacts of the project on Biscayne Bay" fails to account for the loss of replacement of low impact agricultural activities by industrial and commercial urban development so near Biscayne Bay with respect to sea-level rise and salt-water intrusion, freshwater recharge, flood control, urban water-quality buffering effects, and wildlife habitat.

Agency Comments:

"Impacts to Agricultural Water Management: Development in the proposed area not only threatens agricultural production, but also threatens to disrupt the delicate balance of flood control, recharge, nutrient filtering, and water management that takes place throughout the agricultural community and provides significant benefits to Biscayne Bay and the environment of South Dade." (Poucher FL/DACS, 2021)

Applicant Plays Down the Scope of the Problems Facing Biscayne Bay

The applicant's claim that the SDLTD will have a significant effect on pollution to Biscayne Bay trivializes the magnitude of the problem of nutrient pollution in the bay, and they advance an overly simplistic view of how activities on the site link to conditions in the bay. The applicant supports their claim with an analysis that focused solely on the 800-acre site as a source of nutrients to the bay under current conditions and how this might change with implementation of their stormwater management plan.

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In contrast, we have reviewed all available water quality data from areas that contribute to the nutrient load entering the bay through the C-102 canal, e.g. the Princeton/C-102 basin and adjacent areas of the coastal plain, Figure 9. The results of our analysis of these data lead us to draw markedly different conclusions about the likely impact of the SDLTD development on water quality affecting Biscayne Bay.

We collected and analyzed water quality data from the C-102 basin and other nearby canal basins for the period of record from the Miami-Dade County Environmental Monitoring Program (DERM). Water quality stations in the C-102 canal are from upstream to downstream order: PR08, PR04, PR03, and PR01 (Figure 9). For purposes of characterizing mean monthly and mean annual nutrient loads, nutrient concentrations from PR08, representative of agricultural land use were multiplied by flows from station S165-S (Figure 9). Concentrations from PR04 and flows from S195-C were used to compute loads for PR04. Land use near PR04 is predominantly urban, however upstream loads from a limited area in agriculture contributes slightly to loads at this station. Loads at PR03 were calculated using the combined flows from both stations S165-S and S195-C. Land use influences above this station include all upstream urban and agriculture and the relatively small amount of agriculture at the proposed site (less than 3 percent in the basin) downstream (east) of the urban area (Figure 9). Nutrient loads for station PR01, which apparently receives flows from station S21A-S (which is the combined flows from the Goulds/L-31 and Princeton canals). Land use upstream and upgradient from PR01 includes effluent the South Dade Landfill. This landfill has a dramatic negative impact on water quality at this site, dramatically increasing nutrient loads compared to those of at PR03–fully within the Princeton/C-102 canal basin.

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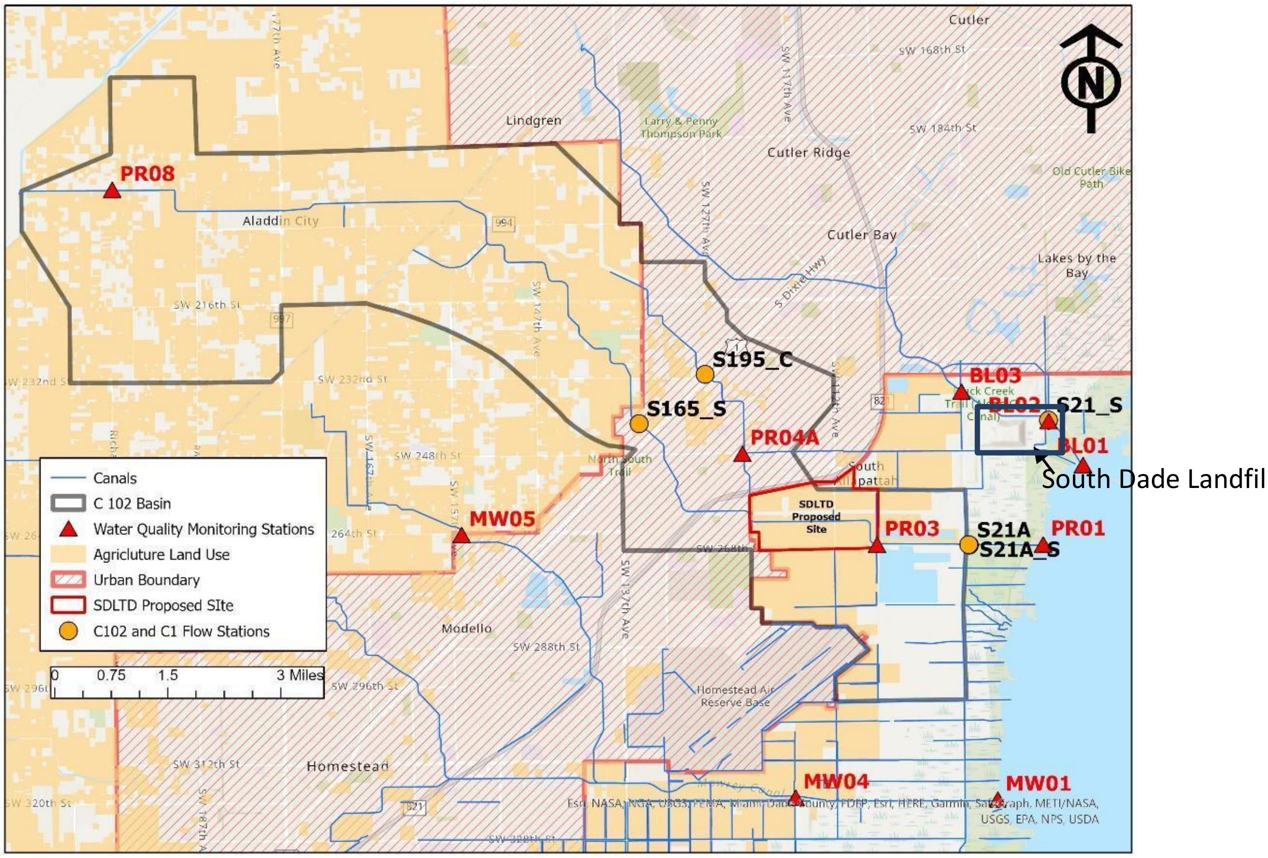

Figure 9: The proposed SDLTD site, water quality sampling sites, canal stage and discharge stations, agricultural areas, the Miami-Dade designated urban area, canals, and the entire Princeton (C-102 canal) basin.

Biscayne Bay Is Impacted by Multiple Sources of Pollution

The first conclusion from this analysis is that construction of the SDLTD may effect nutrient loads flowing into Biscayne Bay only negligibly from the C-102 canal because it comprises less than 2.5 percent of the total C-102 basin. Any effects are likely to be slightly negative with respect to nitrogen and slightly positive with respect to phosphorus loads. The applicant claims that construction of stormwater retention facilities planned for the SDLTD will improve water quality and "significantly" reduce nutrient loads to Biscayne Bay. However, nutrients from the site constitute only a fraction of the total nutrient load carried by the C-102 canal. As previously stated in the stormwater section of this document, stormwater retention facilities (their plan for retaining pollutants) remove 50 percent or less of nutrients from stormwater (Hess et al. 2022).

Within the C-102 basin, agriculture is the dominant land use in the upper Princeton/C-102 basin, (Figure 5, Table 8. Agriculture makes up a total of 16,882 acres of the entire basin with more than 97 percent occurring west and north of the urban area. Urban land use occurs in the middle of the basin and comprises roughly 35.78 percent of the basin. Finally, current land use within the proposed SDLTD site

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(fully within the C-102 basin) located to the east of the urban boundary (Figure 5), is agricultural. The proposed site makes up less than 5 percent of the total agricultural area in the basin and less than 2.5 percent of the entire basin area.

Total nutrient loads carried by the C-102 canal into Biscayne Bay is augmented by the addition of nutrients and other pollutants from the South Dade Landfill. The South Dade Landfill is located South of the Black Creek Canal, North of the Goulds Canal and immediately west of Black Point Park and Marina (Figure 10). Water from the landfill reaches the C-102 canal through the Goulds Canal and the L-31-E canal, joining the C-102 canal near the S21A structure, Figure 11. Water from the landfill increases concentrations of ammonia, COD, chloride and other constituents measured at PR01. Conversations with Dade County staff indicate that the South Dade Landfill is considered to be a major source of nutrients entering the bay from the C-102 canal, further diluting the degree to which a reduction in nutrients from the SDLTD can affect nutrient pollution problems entering Biscayne Bay.

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Table 8: Comparison of agricultural land-use categories by percent within the C-102 Basin and at the proposed site.

LU CODE	C-102 Basin AG Area in Acres	SDLTD Site Ag Area in Acres	
710	3,627		
720	3,787	229	Row Crop
732	32		
760	6,281	534	Plant Nurseries (including Ornamentals and Sod Farms)
770	11		Fish Farms
790	16		Agriculture, Other (Exotic Birds, Monkeys, Research Facilities).
All Others	3,129		
Total AG ACRES	16,882	763	All Agriculture
TOTAL NON AG ACRES	13,753	31	Non-Agricultural
TOTAL PERCENTAGE AGRICULTURAL ACRES AT PROPOSED SDLTD SITE			96%
TOTAL PERCENTAGE NON-AGRICUTLURAL ACRES AT PROPOSED SITE			4%
TOTAL PERCENT OF AG ACRES AT SDLTD SITE AS A PERCENT OF TOTAL AGRICULTURE IN C-102 BASIN			5%
TOTAL PERCENT OF PROPOSED SDLTD AREA AS A PERCENT OF BASIN			2.5%

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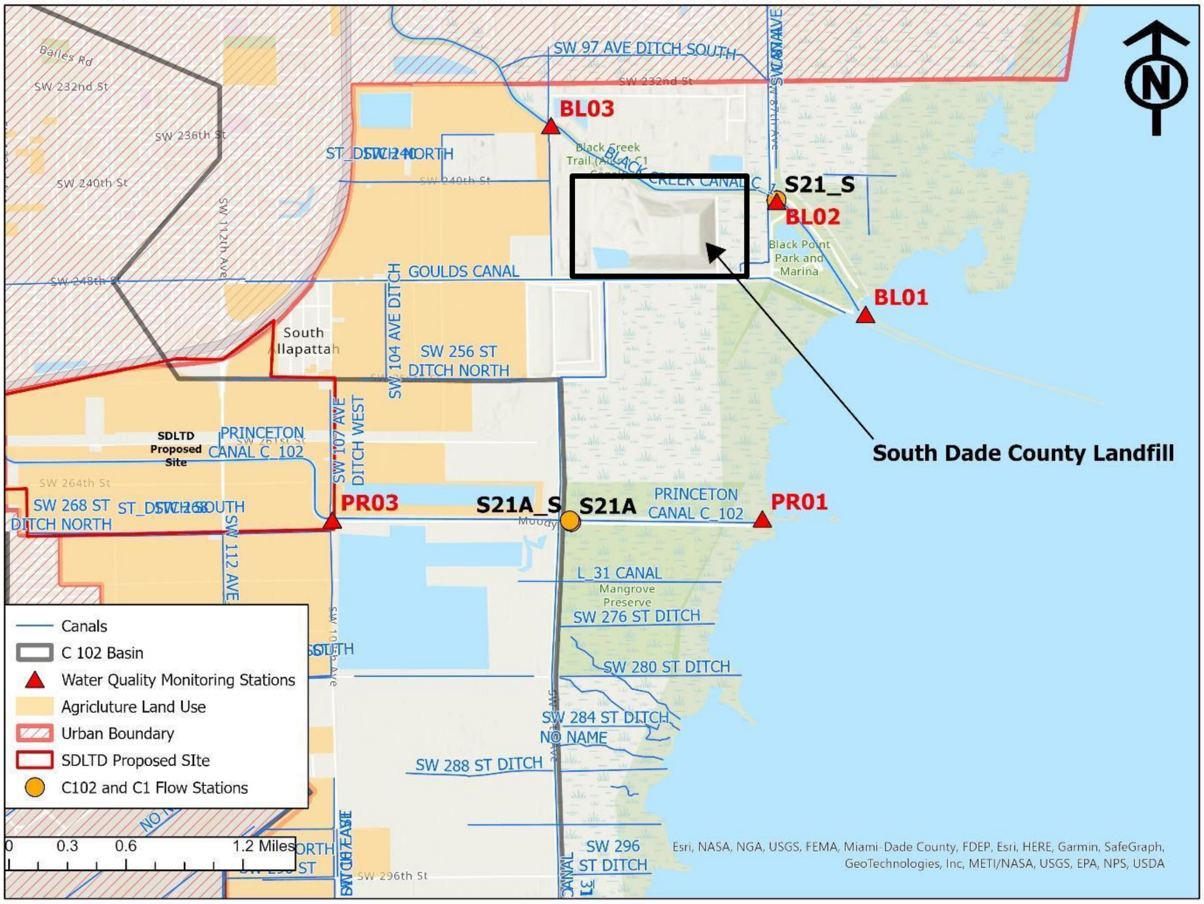

Figure 10: The proposed SDLTD site, water quality sampling sites, canal stage and discharge stations, agricultural areas, the Miami-Dade designated urban area, canals, the Princeton (C-102 canal) basin, and the South Dade Landfill location.

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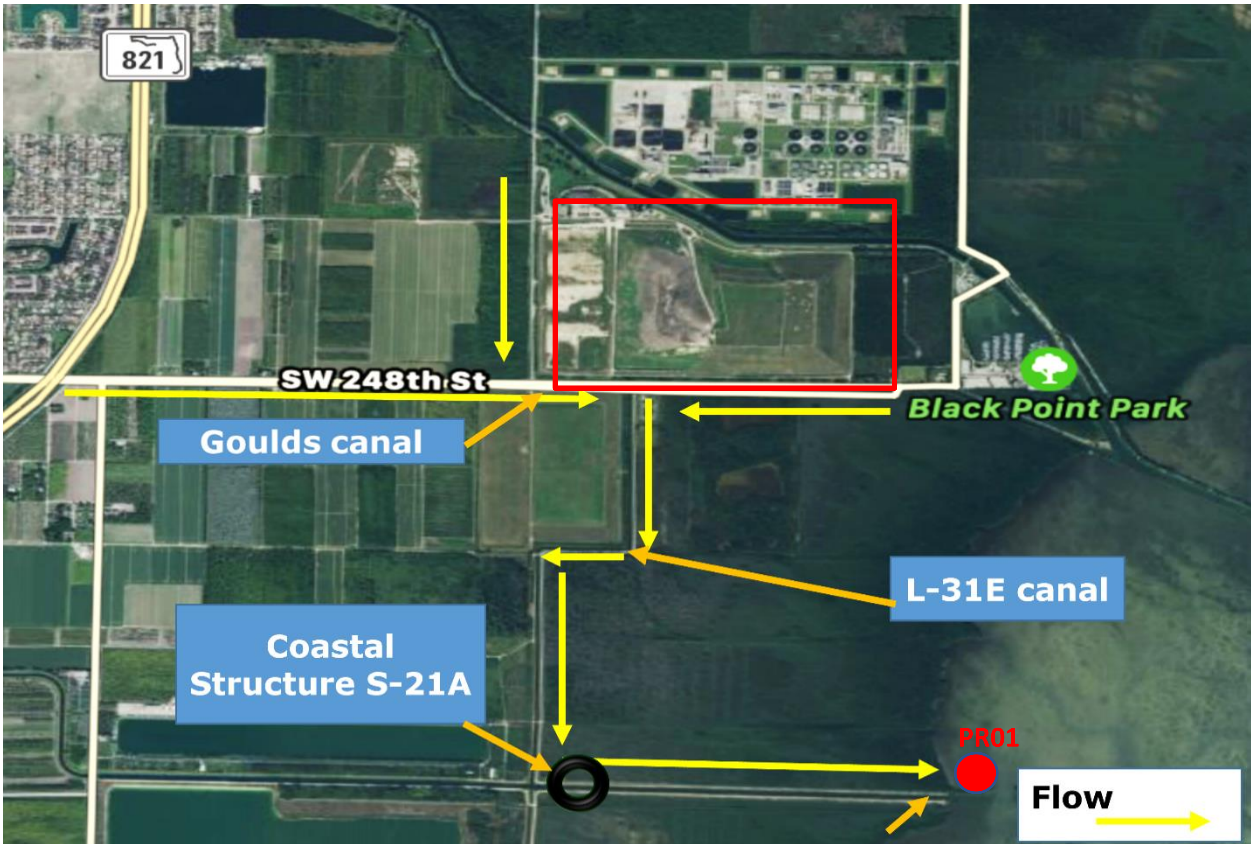

Figure 11: The South Dade Landfill and the Goulds canal, flow structure S21-A on Princeton canal and water quality station PR01 all downgradient. (Source: Miami Dade DERM)

Groundwater Pathway Cannot Be Ignored

The contribution from the South Dade Landfill to the nutrient load carried by the C-102 canal is important because it demonstrates the influence that groundwater can have as a source of pollution to Biscayne Bay. Groundwater flow to the Goulds Canal is the main source of pollution reaching the C-102 canal from the landfill.

Groundwater carries leachate generated by the infiltration of rainfall through the soil cap on the landfill. Leachate leaves the bottom of the landfill through the bottom of an unlined cell and flows south into the Goulds Canal. Groundwater flows mainly to the south and somewhat to the east in the shallow, intermediate, and deep aquifer draining cell 1 on the southeastern boundary of the South Dade Landfill (Figures 12, 13, 14) into the aquifer and wetlands below the landfill (Miami-Dade County Department of Solid Waste Management, 2020).

The applicant ignores the role of groundwater as a pathway for pollution leaving the SDLTD, entering surface water and ultimately reaching Biscayne Bay. In their assessment of future impacts of the SDLTD on the bay, the applicant claims credit for eliminating the SDLTD as a source of pollution to the bay because the stormwater management system will be designed to eliminate runoff from developed areas of the site. All rainfall falling on the site will be captured and held while it infiltrates into the ground,

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carrying with it any pollutants washed off the site. As with leachate from the landfill, enhanced infiltration from the SDLTD stormwater management system will feed a flow of groundwater that must ultimately find its way into either the C-102 canal or the L-31E canal adjacent to the site.

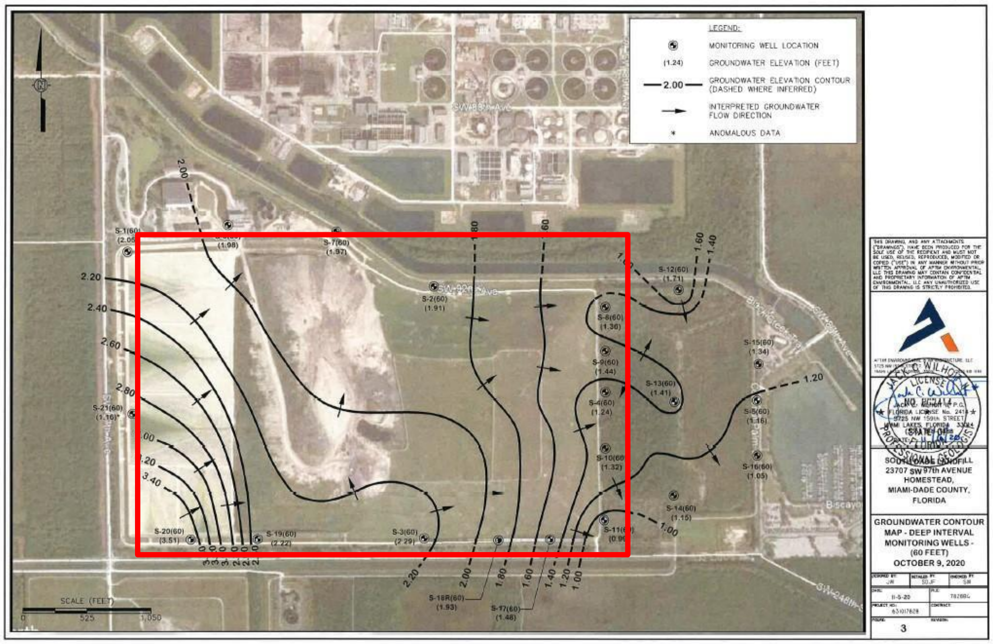

Figure 12: Potentiometric surface October 2020 shallow wells.

FIGURE 3 - GROUNDWATER CONTOUR MAP (INTERMEDIATE WELLS)

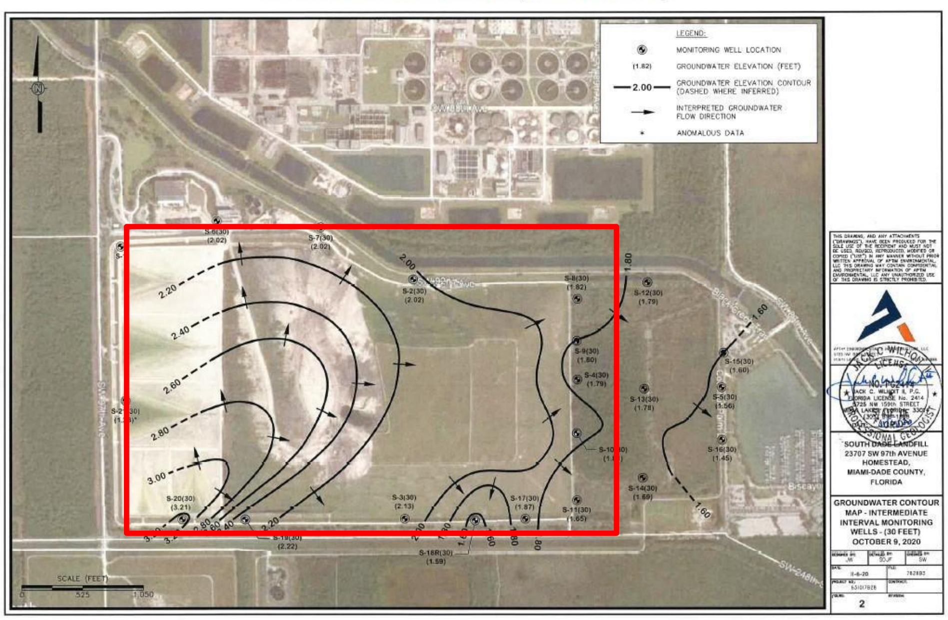

Figure 13: Potentiometric surface October 2020 Intermediate Wells.

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FIGURE 2 - GROUNDWATER CONTOUR MAP (SHALLOW WELLS)

Figure 13: Potentiometric surface October 2020 Deep wells.

Stormwater Management Will Not Stop Pollution from the SDLTD

A state-of-the-art stormwater management system will not prevent runoff from the SDLTD from reaching Biscayne Bay, nor will it totally clean up the pollutants in it. Our analysis of water quality data from the Princeton/C-102 basin (Appendix C) provides insight into the difference between agriculture and urban areas as sources of pollution. And, it allows us to assess the efficacy of stormwater management in urban areas for pollution control. In general, the data show that agricultural areas are a greater source of pollution by phosphorus, and urbanized areas contribute more to pollution by nitrogen compounds.

From this, we conclude that stormwater management likely will not eliminate nutrient discharges from the SDLTD site. In general, urbanization of agricultural lands can be expected to lead to increased ammonia, nitrate plus nitrate concentrations and nutrient loads in the adjacent canals. Construction of the SDLTD may decrease phosphorus loads by a small amount, but it will not significantly decrease total nitrogen loads entering Biscayne Bay and it will curtail any future restoration abilities for this very critically located land area.

Table 9 summarizes calculated mean monthly and mean annual nutrient loads by constituents and station. These loads were calculated to assess the effects of various land uses, the agricultural drawdown, and potential effects of dry and wet and season effects if any on total loads. Note that total nitrogen is the sum of TKN + NO_2 + NO_3, where TKN is the sum of all inorganic (NH_3) and organic (NH_4) nitrogen. The table also mostly shows increases in all nutrients constituents, especially nitrogen species, from the upstream stations (PR08) to PR01 the terminal discharge point at Biscayne Bay. However, there are several subtleties within this data that lead to some truths about land use and ability to reduce nutrient loads discharging to Biscayne Bay from the in the entirety of the C-102 canal and basin.

Summary statements about mean nutrient constituent loads traveling downstream through the C-102 basin:

- Nutrient loads for station PR01, apparently receives flows from station S21A_S which is the combined flow from the Goulds/L-31 and Princeton canals. Land use upstream from PR01 includes the South Dade Landfill, negatively impacting water quality when combined with water from the Princeton canal and basin upstream of the S21A sturcture.
- Monthly loads for nutrient constituents were significantly higher during the wet season (June through October) than in the dry season (November through May), approximately 1 to 2 orders of magnitude higher. This is a result of more significant recharge events and increased discharge during this period and generally higher concentrations in groundwater and surface water from recharge moving water through the system more efficiently.
- The South Dade landfill contributes significant nutrient loads of all species to loads at station PR01 throughout the year without regard to season.
- If the proposed development occurs ammonia loads may fall slightly however total nitrogen loads may be increased from increases in nitrate plus nitrite.
- Total phosphate and orthophosphate loads from the C-102 basin above the S21-A structure may decrease slightly if the SDLTD development goes forward however the amount of total phosphorus loads discharging to Biscayne Bay is doubled by the contribution from the South Dade Landfill leachate.
- The proposed SDLTD development if implemented may have only negligible positive effects with respect to phosphorus and minor negative effects with respect to total nitrogen loads to Biscayne Bay due to the relatively insignificant percent of basin area (2.5 percent).

Ammonia

Total ammonia loads were highest in samples from PR01 (annual total of 417.68 kg/yr) (table below). This is the result of contaminants leaching from the South Dade Landfill and being diverted into surface waters south and west of the landfill (L-31 and Goulds canals) and groundwater transporting contaminants from the landfill into wetlands south of the site (from Miami-Dade Solid Waste management 2020 report discussed above). These contaminants eventually discharge into the C-102 canal upstream from PR01 negatively influencing water quality there. Agricultural sites PR08 and PR03, with annual loads of 145.72 and 66.49 kg/yr, respectively have the highest concentrations in sites fully within the C-102 basin. These sites are mostly influenced by agricultural activity. Annual ammonia loads at PR04 (20.09 Kg/yr) were generally lower than in agricultural areas. Ammonia concentrations increased slightly between upstream stations and PR03 (2.31 kg/yr). Generally ammonia loads were highest during the wet season (notably in July through September) than during the dry season (Table 9); Ammonia concentrations are high in fertilizers, used in agricultural production and lawn care in urban areas. Ammonia in fertilizers generally volatilizes or is adsorbed in soil and plants in areas where application rates are lower.

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Nitrate plus Nitrite

Nitrate plus nitrite loads increased significantly from upstream agricultural areas to downstream stations. Between the agricultural and urban stations (PR08 (133.15 kg/yr) to PR04 (3610.21 kg/yr); Nitrate loads again increased PR04 (urban) and PR03 (urban and agricultural land uses). Nitrate concentrations at PR03, (5,155.62 kg/yr), a site influenced by upstream urban as well agricultural land uses increased also. Generally, nitrate plus nitrite increased more in sites influenced by urban areas compared to agricultural areas. Nitrate plus nitrite at station PR01 (9351.76 kg/yr) shows a significant increased downstream from the S21-A structure. Once again a result of contaminants from the South Dade Landfill. Nitrate plus nitrite loads were high at most stations most of the year but greatest during the wet season except at PR01 where they were high all year long (Table 9).

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Table 9: Analysis of simple monthly and annual nutrient loads kg/yr by station in upstream to downstream order.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
	NH4												
PR08	2.33	3.99	2.79	2.6	0.67	4.4	20.08	18.48	41.87	42.74	1.94	3.83	145.72
PR04	0.19	0.13	0	0.22	0	1	6.09	2.06	4.7	5.17	0.33	0.2	20.09
PR03	2.61	1.14	2.93	4.31	0.52	2	8.65	9.1	12.16	20.69	0.51	1.87	66.49
PR01	39.79	21.96	13.24	9.09	9.24	26.3	36.73	29.05	60.46	66.35	70.73	34.74	417.68
	NOX												
PR08	0.34	1.07	0.35	0.52	0.13	27.5	6.56	8.43	4.52	75.5	1.17	7.06	133.15
PR04	74.95	60.91	0	82.19	0	269.17	594.34	516.28	680.75	1203.64	50.83	77.15	3610.21
PR03	45.3	117.68	37.16	42.04	3.51	446.45	930.34	532.88	912.86	1674	82.09	331.31	5155.62
PR01	324.91	341.06	234.35	90.02	161.7	622.44	1046.05	1127.15	2466.95	1661.8	805.28	470.05	9351.76
	TKN												
PR08	14.95	0	20.93	0	7.64	82.59	140.09	104.91	157.73	551.83	15.71	36.66	1133.04
PR04	3.08	0	2.93	0	6.31	31.71	64.74	13.53	51.58	204.83	7.22	12.03	397.96
PR03	23.01	0	32.08	0	15.74	93.47	219.49	111.52	157.32	1218.51	15.69	40.57	1927.4
PR01	94.69	215.07	77.11	54.09	55.67	694.2	467.4	544.54	276.83	3131.38	197.02	649.88	6457.88
	TN												
PR08	338.7	0	0	0	0	142.44	141.05	171.56	116.9	196.39	168.91	152.15	1428.1
PR04	1821.46	0	0	0	0	611.64	679.28	1027.74	791.81	1684.58	285.32	940.19	7842.02
PR03	1821.46	0	0	0	0	1427.09	1737.06	2383.91	1729.18	3543.73	875.89	2190.18	15708.5
PR01	550.71	715.1	513.07	644.24	470.77	831.88	425.11	1410.21	922.43	1452.11	224.84	1326.63	9487.1
	OPO4												
PR08	0.16	0.03	0.04	0.05	0.02	0.7	0.76	0.59	0.83	13.29	0.14	0.31	16.92
PR04	0.18	0.04	0	0.05	0	0.32	0.82	0.49	0.7	5.12	0.11	0.11	7.94
PR03	0.29	0.06	0.08	0.1	0.03	0.72	1.67	2.22	1.01	13.46	0.25	0.74	20.63
PR01	0.45	1.05	0.4	0.14	1.13	2.49	2.22	1.01	1.57	1.29	1.09	0.98	13.82
	TP												
PR08	0.11	0.18	0.11	0.03	0.03	0.64	1.03	0.73	0.97	16.29	0.13	0.26	20.51
PR04	0.09	0.19	0	0.04	0	0.26	0.9	0.83	1.12	7.46	0.32	0.1	11.31
PR03	0.23	0.53	0.2	0.14	0.08	0.57	2.49	2.53	2.66	15.37	0.17	0.68	25.65
PR01	1.4	1.38	1.22	1.14	1.04	1.94	7.75	2.9	4.97	12.59	2.75	1.96	41.04

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Total Nitrogen

Mean Total annual nitrogen loads increased significantly between PR08 (1,428.1 kg/yr) throughout C-102 basin to PR03 (15,708.5 kg/yr), areas unaffected by the South Dade Landfill (Table above). Annual loads were also high in station PR04 (7,842.02 kg/yr). Total nitrogen loads somewhat were lower at PR01 (9,487.1 Kg/yr) than at PR03 for reasons unknown? Total nitrogen loads were significantly greater during the wet season compared to the dry season but were higher than other stations during the dry season at PR01, probably due to the landfill leachate transport.

OrthoPhosphate

Orthophosphate loads were much lower than nitrogen species loads by 2 to 4 orders of magnitude. Mean annual orthophosphate loads were greatest at site PR03 (20.63 kg/yr). Followed by loads at PR08 (16.92 kg/yr), then PR01 (13.82 kg/yr) and finally PR04 (7.94 kg/yr). Generally, sites with dominant urban influence had lower Orthophosphate loads than sites with more dominant agricultural land uses. Station PR03 has influence from agriculture and urban areas. Station PR08 is almost entirely agricultural in land use. Orthophosphate loads generally increased one to two orders of magnitude during the wet season compared to the dry season.

Total Phosphorus

Total phosphorus loads were similar at stations unaffected by the landfill indicating that orthophosphate makes up the majority of total phosphorus loads at these sites. However, loads were highest at station PR01 (41.04 kg/yr) indicating influence from the South Dade Landfill. Mean total annual phosphorus loads were next greatest at station PR03 (25.65 kg/yr), followed by station PR08 (20.51 kg/yr), and station PR04 (11.31 kg/yr). Once again the most dominant urban site had the lowest total phosphorus loads. Recall PR03 is influenced by a mixture of urban and agricultural land use. Total phosphorus loads were relatively high throughout the year at station PR01; at other stations transport was very low or none during the dry season and picked up by one to two orders of magnitude during the wet season (Table 9).

Nutrient Impacts on Seagrass Ecosystems of Biscayne Bay

The seagrass beds of Biscayne Bay and the rest of south Florida require very low nutrient loads to survive. In essence, seagrasses are killed and replaced by fast-growing, noxious seaweed or planktonic algae when nutrient delivery is increased, even at very low nutrient concentrations that would pass drinking water quality standards. Plants, including seagrasses, require light, water, and mineral nutrients, such as phosphorus and nitrogen, to grow. The required supply of nutrients for any plant population is a function of the plant's relative growth rate. Plants that grow quickly require high rates of nutrient supply, while plants that grow more slowly require a lower rate of supply. As a consequence, rapidly growing plants are found where nutrient supplies are high, and slow-growing plants where nutrient supplies are low. High nutrient supplies are not necessarily bad for slow-growing plants, but at high nutrient supply rates allows fast growing plants to overgrow and shade out slow growers.

In general, the size of a plant is a good indicator of its relative growth rate, with smaller plants having higher growth rates. In seagrass beds in Biscayne Bay, the fastest growing plants are the single-celled

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algae that live either in the water, in the sediments, or attached to surfaces, such as seagrass leaves. Filamentous algae that grow on surfaces grow slightly slower, followed by more complex macroalgaes, like the fleshy and calcareous seaweeds. Seagrasses grow even slower. Different species of seagrass have different growth rates and nutrient requirements. The narrow-bladed species widgeon grass (*Ruppia maritima*) and shoal weed (*Halodule wrightii*) grow faster than the spaghetti-like manatee grass (*Syringodium filiforme*) which in turn has a faster growth rate, and therefore higher nutrient requirements, than turtle grass (*Thalassia testudinum*). It quite common in south Florida, that nutrient supplies can be so low as to constrain the growth of even the slowest growing species (Fourqurean and Rutten 2003).

Fertilization experiments have confirmed that a change in nutrient supply first leads to a change in the density, and then the species composition, of seagrass beds in south Florida (Fourqurean et. al., 1995). In Florida Bay, fertilizing sparse turtle grass beds with phosphorus first results in an increase in the density of turtle grass; however, once shoal grass becomes established in the fertilized patches, it rapidly displaces the turtle grass. A model has been developed to illustrate how normally low-nutrient seagrass beds of south Florida will change as nutrient availability changes (Fourqurean and Rutten 2003, Figure 14). The model shows that seagrass beds composed of abundant turtle grass, the slowest-growing species, become lush with increased nutrient conditions. But, as nutrient supply continues to increase, the species composition gradually changes as faster-growing species replace the slower-growing ones. At the highest nutrient levels, seagrasses are replaced by seaweeds and microalgae, Loss of the seagrass community will result in a dramatic change in community structure and function. Animal species dependent on seagrass for food and shelter (e.g., speckled trout, redfish, bonefish and tarpon) are replaced by less desirable species (e.g., jellyfish). The model predicts that the relative abundance of benthic plants at a site is an indicator of the current rate of nutrient supply. Changes in the relative abundance, from slow-growing to fast-growing species, at any site indicates an increase in nutrient supply.

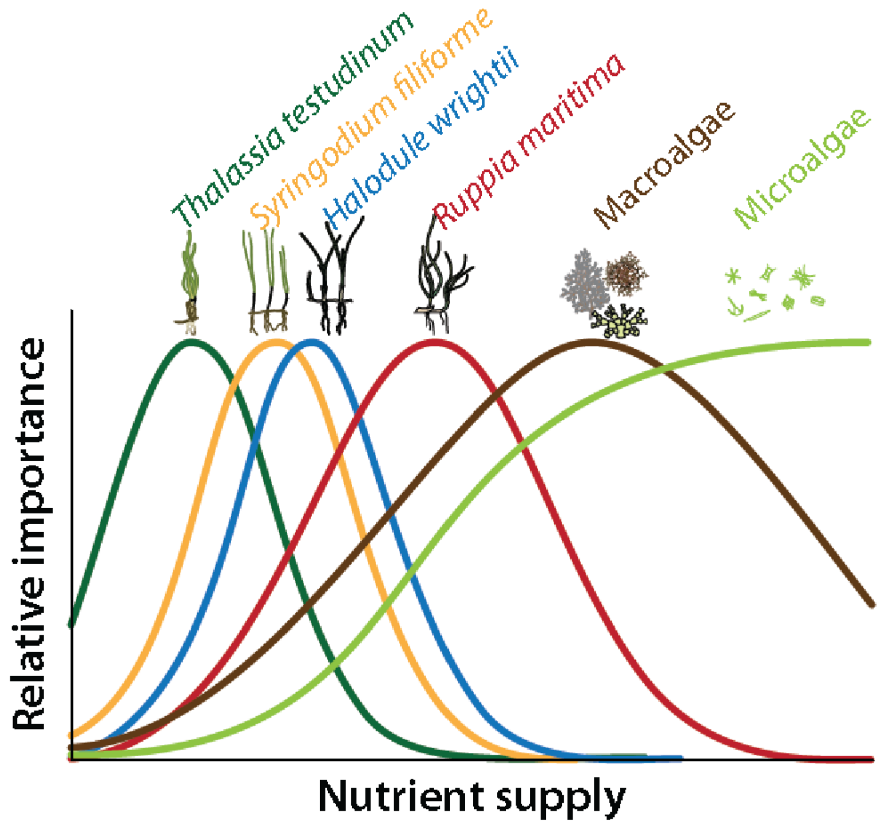

Figure 14: This model describes how the dominant organisms from shallow Biscayne Bay change with addition of nutrients. Nutrient supply can increase either with an increase in concentration OR and increase in volume of nutrient sources. This figure is based on Fourqurean and Rutten (2003) and is reproduced from Kryczynski and Fletcher 2012, page 276.

The seagrasses along the coastline of Biscayne Bay in proximity to the Princeton Canal C-102 have existed for thousands of years in a nutrient-limited state, which means any addition of new nutrients changes the balance of these ecosystems. Increased nutrients harm the ecosystem by increasing the rates of primary production by marine plants. Increase in growth rates means that faster-growing, noxious marine plants, like macroalgae (seaweeds) and microscopic algae and photosynthetic bacteria, overgrow and outcompete seagrasses and corals for light, leading to the losses of corals and seagrasses.

The density and species composition of the seagrasses of southern Biscayne Bay are controlled by the availability of phosphorus. The water column in southern Biscayne Bay has very low concentrations of dissolved phosphorus, and the grand mean TN:TP ratios (ie, the ratio of moles of nitrogen to the moles of phosphorus) of the water in southern Biscayne Bay average 177.9 (Caccia and Boyer 2005). When TN:TP of oceanic water is above 16 it indicates that the availability of phosphorus limits the growth of plankton (Redfield 1958). Seagrasses are more complex than phytoplankton, so that the critical ratio determining whether N or P limits plant growth for seagrasses is 30 (Fourqurean and Rutten 2003). The N:P of Turtle Grass (Thalassia testudinum) collected in the vicinity of Turkey Point was 88.6 in 2013, a clear indication of phosphorus limitation (Dewsbury, 2014). Fertilization experiments (Armitage et al 2011, Ferdie and Fourqurean 2004) clearly show that phosphorus fertilization of turtle grass with N:P >

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80 first leads to an increase in density of turtle grass, then a replacement of turtle grass by faster-growing seagrasses, followed by a loss of seagrasses as P loading continues. The Princeton Canal already is having a nutrient impact on seagrasses of coastal Biscayne Bay (Figure 15). In 2014, N:P of seagrasses in the vicinity of the Princeton Canal was ca, 40:1, the lowest measured in along the south Biscyane Bay shoreline (Lirman et al. 2014), a sign of higher P availability near the mouth of the canal (Figure 15). If, as predicted, the proposed development decreases the ability of the parcel to reduce nutrient concentrations in the Princeton Canal, the development will cause accelerated degradation of the seagrasses of Biscayne Bay through increased nutrient pollution.

Seagrass communities in the vicinity of the mouth of the Princeton Canal have been changing in ways consistent with our understanding of how these systems respond to phosphorus fertilization. Long-term monitoring data from DERM and recent surveys document the loss of Turtle Grass (Figure 16).

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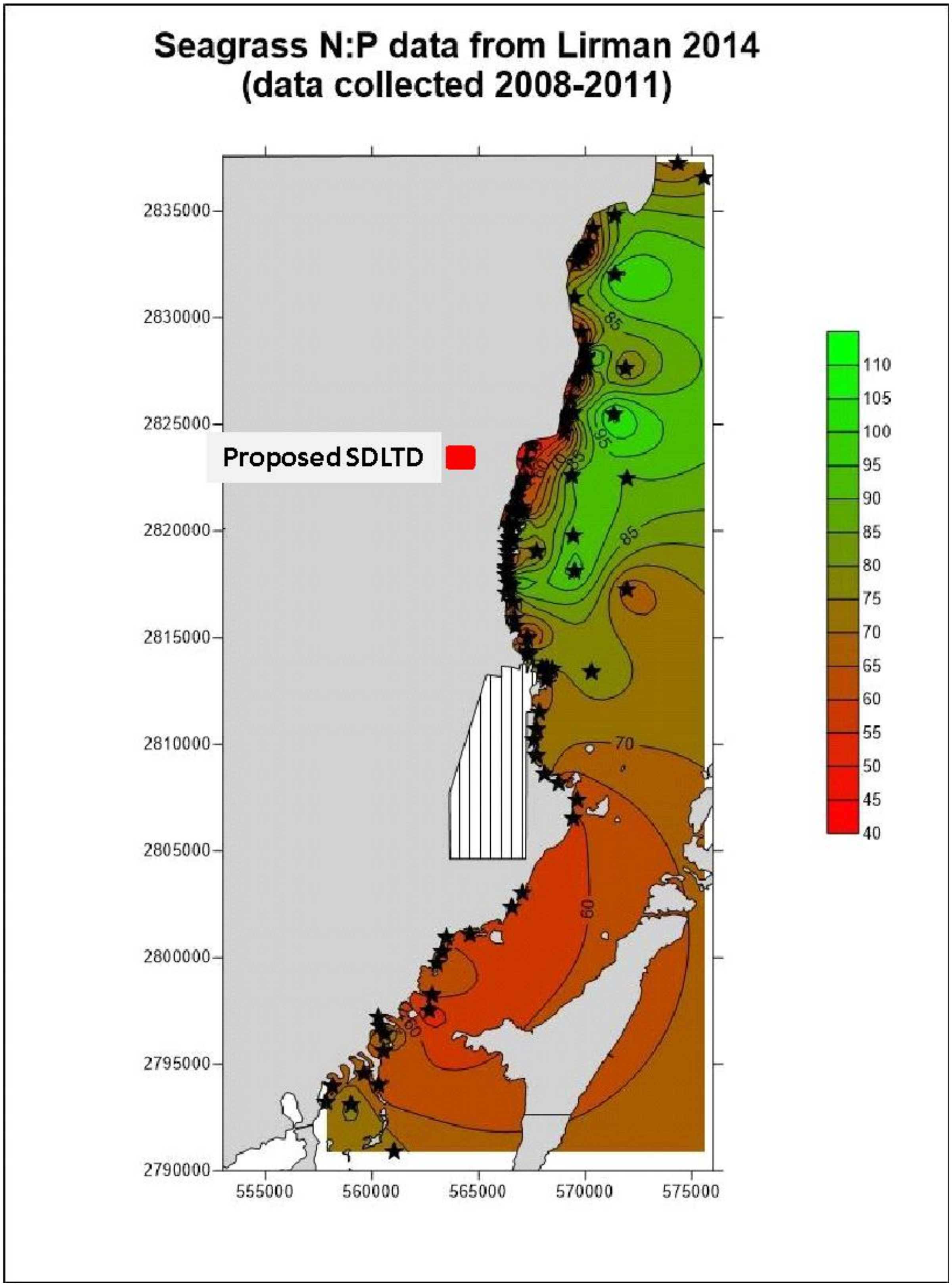

Figure 15: N:P of seagrass leaves, as collected by Lirman et al in 2008-2011 and reported in Lirman et al 2014. Black stars represent their sampling sites

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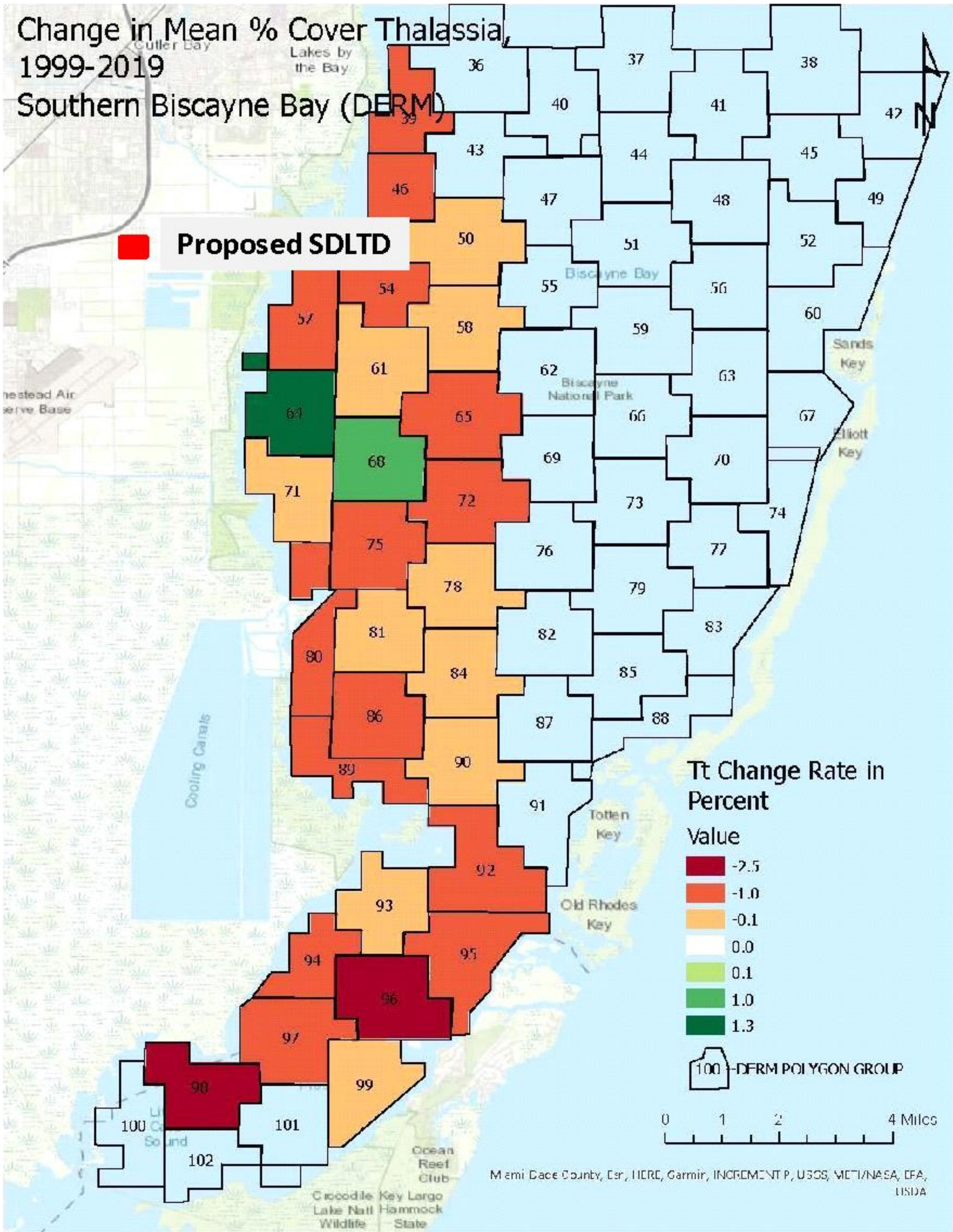

Figure 16: Linear rates of change in Turtle Grass cover (in percent cover change per year) from the DERM data shown in Figure 7 for the coastal DERM subregions (polygons). Note polygon 57, which has experienced rapid seagrass loss over the period 1999-2019, is direclty offshore of the Princeton canal C-102. Data from DERM's long-term seagrass monitoring database.

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The nearshore seagrass beds are incredibly efficient at removing P from the water column and storing P at vanishingly small concentrations. In fact, even 30 feet from large point-sources of P in Florida Bay, it is not possible to measure increases in P concentrations in the water column because it has all been captured by the algal and seagrass communities. This P capture causes increased plant growth and ecosystem imbalances. This imbalance first leads to an actual increase in the abundance of seagrass, but rapidly it causes a change in species composition, first to faster-growing seagrasses, then to seaweeds, then to microscopic algae. Continued discharges of P from the canals of south Florida will in the future cause seagrass losses further offshore in Biscayne National Park. The reduction of nutrient removal that will result from the project will accelerate these impacts.

Phosphorus delivered to Biscayne Bay will cause irreversible changes to the Bay's ecosystems. The geology underlying the offshore seagrass meadows is based on limestone, which is made of calcium carbonate minerals. Calcium carbonate minerals strongly absorb orthophosphate onto their surfaces. But, respiration by plants, animals and bacteria dissolve calcium carbonate minerals, releasing the orthophosphate absorbed to the surfaces. During normal conditions, south Florida ecosystems are incredibly efficient at holding on to captured phosphorus– so much so that the impacts caused by adding P to seagrass beds in south Florida for even short periods can still be measured 30 years after the P additions. On the other hand, bacteria cause added N captured by south Florida ecosystems to be rapidly removed from those ecosystems. These facts result in P additions causing permanent and cumulative imbalances in nearshore marine waters of the Keys while N additions cause imbalances that can be corrected by the cessation of N addition.

Wetlands Offer a Solution

Creation of a functioning wetland at this site could be used to remove nutrients and other pollution that currently discharges from the Princeton Basin through the C-102 canal and into Biscayne Bay. In a comprehensive review of wetland capacity for nutrient removal, Martinez—Guerra et. al. (2018) conclude that constructed wetlands (CWs) serve as sinks for nutrient compounds in their extensive review of studies evaluating "Wetlands for Wastewater Treatment" (2018). They repeatedly found that wetlands effectively remove nutrients from the water column, protecting downstream discharging water bodies from eutrophication due to excess nutrients. In one study, total nitrogen (TN) removal by wetlands ranged from 88.5% to 89.4% of the total loads.

The C-102 canal basin is already highly enriched with nutrients (especially nitrogen species) from the upgradient urban and agricultural land use activities before ever reaching the site. In some cases nitrogen concentrations were lower in the canal after passing the proposed site. The 794 acre site has a very limited if any capacity to improve water quality in the canal water under current land uses, overall producing a slight nutrient negative impact with regards to phosphorus concentrations to Biscayne Bay. However if the site is allowed to be developed as a 9 million square foot industrial park, nitrogen concentrations will most likely experience a dramatic increase, further degrading sea grass cover in Biscayne Bay.

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Establishment of a restored wetland at the proposed site could potentially help remediate by slowing flows of freshwater allowing more filtration of upstream waters before entering Biscayne Bay. While agriculture runoff water from the proposed site is also likely to be somewhat enriched with nutrients from current onsite agricultural activities, the use of 70 percent of the agricultural land onsite for Nursery--Palm Tree and sod, likely lowers potential total nutrient concentrations somewhat, certainly more than if the site was used for 100 percent row crop production.

Current conditions at the site are amenable to wetland creation. The site was formerly a wetland before agricultural activity and hydraulically regulated groundwater levels reduced wetland extent on the site to minimal incidental areas. The underlaying soils are hydric wetland Marls—high in calcium. In addition, the map below shows that approximately 50 percent of the site is less than 2.40 ft. NGVD and most of the eastern half is or was natural wetlands (figure below). Reported (by the applicant) average groundwater level for the site (1.75 ft NGVD) could currently support wetlands over approximately half of the proposed development area.

According to the LiDAR data (MIAMI-DADE GIS---SDLTD report), land-surface elevations range from 1.0 to 3.5 MSL over the proposed SDLTD site; approximately 106 acres out of the total approximately 794 acres (13%) is less than 1.75 feet MSL (NGVD) in elevation (Miami-Dade 2018 LiDAR GIS Data, accessed 10/01/2021) (Figure 17). Therefore, this site has great to once again become the wetland that it is and perform significant ecosystem services for Biscayne Bay removing and reducing nutrients and other water pollutant loads from surface and groundwater before it is discharged to Biscayne Bay.

Experience with the creation of wetlands to improve water quality in Florida provides confidence that this will work. Juston and DeBusk (2011) found that total phosphorus (TP) removal from a constructed stormwater treatment wetlands in the Everglades Conservation Areas were able to remediate 13 –17 ug/L, up to 90% of the incoming P and that larger wetlands likely would provide protection against higher pulses of incoming P. TP remediation depended largely on amount of calcium mineral concentrations in sediments and the density of submerged aquatic vegetation.

In general, wetlands underlain by calcium-rich clays or Marls may remove up to 95% of total phosphorus (TP); containing sorption capacities ranging from 4.5-6 mg P/g (Martinez-Guerra, et. al.; 2018).Calcium—rich, Marl soils and sediments were more effective at P sequestration than muck soils underlying most conventional emergent vegetation wetlands.

A review study of 13 hydrologically altered freshwater forested or freshwater emergent wetlands with levees, spoil banks, roads, and/or freshwater input from sources such as surface runoff or overbank flooding in coastal Louisiana, finds that discharge from freshwater effluent sources containing nutrients and suspended sediments through wetlands, leads to increasing vegetation productivity and soil accretion while concurrently lowering nutrient loads and suspended solids concentrations . For these wetlands, typical TP removal of effluent discharged into Louisiana assimilation wetlands ranged from 82 to 93% and TN removal ranged from 85 to 95% (Altamira-Algara et. al., 2022).

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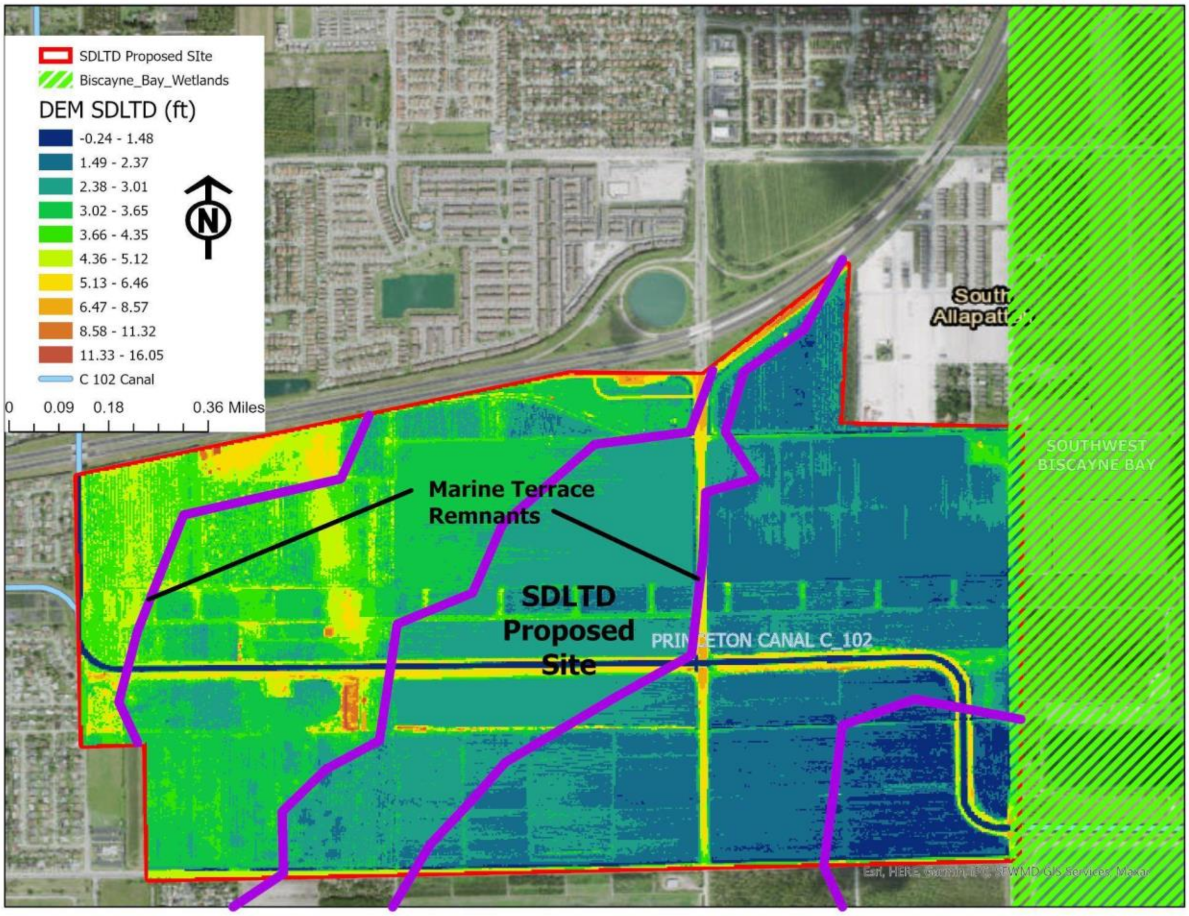

Figure 17: Land surface elevation (DEM 2018 for Miami-Dade County LiDAR elevation) in feet over the proposed SDLTD site, the remnant coastal terraces as part of the Biscayne Bay Wetlands system.

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SDLTD Has Consequences Now and for the Future

Change is inevitable. Accelerating sea level rise will make agricultural activities on the site unsustainable within decades. Rising sea level will reduce drainage and increase the frequency of inundation by salt water from storm surge and during extreme high tides. The land surface slopes gently from a high elevation of about 5 feet (NGVD), at the northwest corner of the site, to a low elevation of only 1.5 feet at the southeast corner. In 2021, low areas on the site flooded as a result of the seasonally-high "King Tides" in Biscayne Bay.

Converting the site to urban industrial and commercial use is not the answer. In the short term, the proposed SDLTD development increases risks to Biscayne Bay and adjacent areas of the County, risks that the applicant is unable to guarantee will not result in irreparable harm. In the long-term, the SDLTD only places more expensive infrastructure at risk to the impacts of rising sea level. In doing so, the SDLTD development will increase the inevitable future cost to the public of adapting to rising sea level.

There is another way. We argue that restoration of the site to its former status as a freshwater wetland provides immediate economic benefits, at no risk to Biscayne Bay and adjacent areas of the County, while also minimizing the eventual costs of adapting to rising sea level in the long-term.

Planning for the Future Coast with Sea Level Rise

Sea level rise is a factor that now must be accounted for in planning decisions. The landscape of the coastal plain is changing now as a result of rising sea level, and the pace of change is expected to accelerate. The amount of sea level rise projected to occur within the next decade or two (Figure 18) will completely transform the landscape of the coastal plain. How to respond to sea level rise presents a new challenge to the County and one that promises to grow in importance over time.

The undeveloped coastal plain serves as a buffer between the urbanized coastal ridge and rising sea level in Biscayne Bay. The coastal plain is a low-lying area approximately 2.5 miles wide at the proposed SDLTD site. This area is the northern extension of the landscape described by Meeder et al. (2017) as the Southeast Saline Everglades. Current land use consists of agriculture, west of the L-31E levee, and mangroves east of the levee. The area east of the levee is managed by Miami-Dade County as a mangrove preserve.

Restoring and enhancing the natural ecosystems of the coastal plain offers a viable response to the challenge of sea level rise. The Corps of Engineers Back Bay Study[5] addresses the threat of increased coastal flooding and identifies natural and nature-based features as a feasible response to the impact of rising sea level in this area. Actions planned as part of the Biscayne Bay and Southern Everglades Ecosystem Restoration (BBSEER) project will defend against the threats that sea level rise poses to the County. Therefore, it is imperative that land use allowed on the coastal plain must not obstruct restoration of Biscayne Bay and its coastal wetlands.

[5] https://www.saj.usace.army.mil/MiamiDadeBackBayCSRMFeasibilityStudy/ [accessed 9 Feb 2022]

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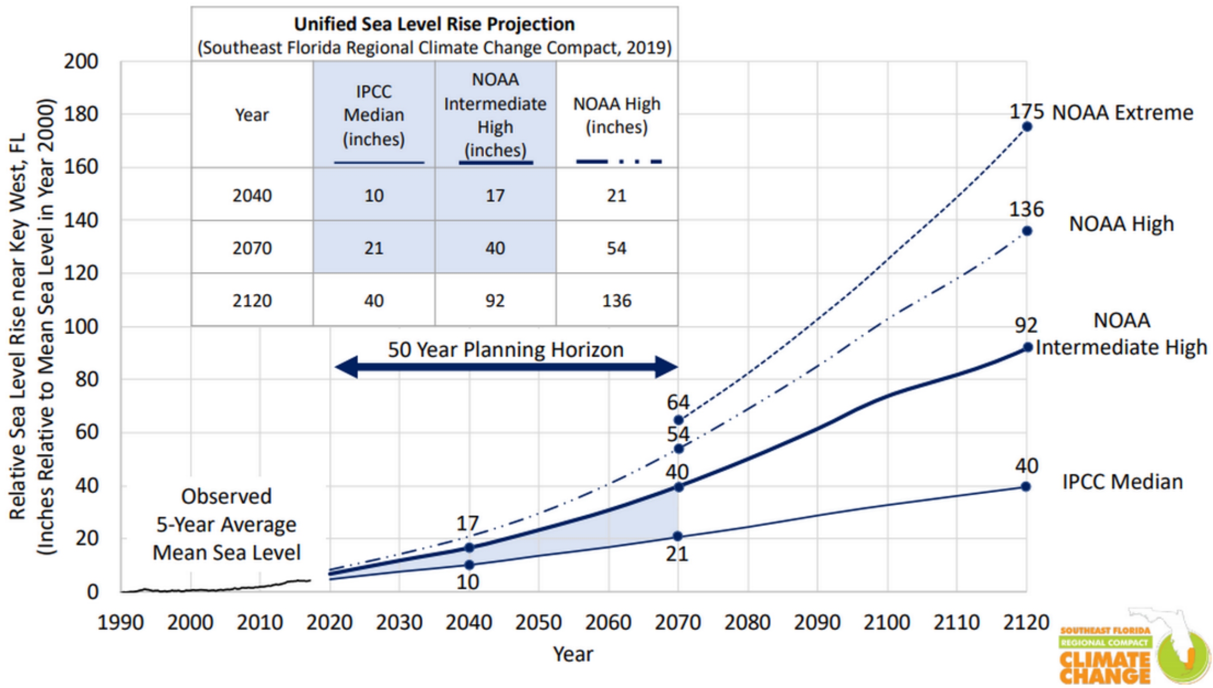

Figure 18: Sea level is projected to increase by as much as 1 foot within the timeframe for development of the SDLTD. A 1-foot increase would put the site on the new shoreline of Biscayne Bay.(source: https://southeastfloridaclimatecompact.org/announcements/the-compact-releases-its-3rd-regionally-unified-sea-level-rise-projection/; accessed 4 Apr2022)

Ecosystem Restoration Addresses the Challenge of Sea Level Rise

Ecosystem restoration offers a path to building resilience to rising sea level. Ecological restoration will also enhance the region's ability to protect built-up areas inside the UDB from hurricanes, storm surge and rainy-day "King Tide" flooding. Natural and nature-based features, such as mangroves and oyster reefs, are a preferred approach for protection from coastal flooding where it is feasible to implement these measures, since these habitats can actually keep elevational pace with sea level rise through accretion.

The Mangrove Preserve located on the shoreline of the bay adjacent to the SDLTD site already offers protection from storm surge. In addition, mangrove swamps are able to offset the effect of sea level rise because of their unmatched ability to trap sediment and build land, actually increasing the elevation of the coastline (Sklar et al 2021). Ecosystem restoration of coastal mangroves enhances these functions in a manner that will adapt to sea-level rise.

The County already is committed to the long-term goal of restoring Biscayne Bay and its coastal wetlands. The Biscayne Bay Coastal Wetland Restoration Project was one of the projects included at the start of the Comprehensive Everglades Restoration Plan (CERP) over 20 years ago. Currently, these efforts are collected under the Biscayne Bay and Southern Everglades Ecosystem Restoration (BBSEER) project.[6] Planning and evaluation of alternatives for the BBSEER are now underway. When completed,

[6] https://www.saj.usace.army.mil/BBSEER/ [accessed 11 Feb 2022]

the BBSEER project will significantly improve the health of the Biscayne Bay ecosystem while also providing protection for the developed areas of Miami-Dade County from future, higher sea level

The scope of the BBSEER project includes the entire coastal plain in southeastern Miami-Dade County and adjacent portions of Biscayne Bay and Florida Bay. In the vicinity of the SDLTD site, the BBSEER aims to increase the resiliency of coastal mangroves, improve ecological and hydrological connectivity north and south along the coast, and improve the quantity, timing and distribution of freshwater inflow to estuarine and nearshore subtidal areas of Biscayne National Park, and reduce the damaging pulsed releases of water to the bay from drainage canals.

SDLTD conflicts with plans to restore Biscayne Bay

Agency Comments:

"Due to the location of the proposed expansion area adjacent to the C-102 canal and within 1.7 miles to the Biscayne Bay Aquatic Preserve, the Department views this proposed change as a potential challenge to achieving the goals of the Comprehensive Everglades Restoration Plan, specifically implementation of the Biscayne Bay Coastal Wetlands (BBCW) project." (Weaver FDEP 2021)

"This property [the SDLTD] sits in a unique landscape position that would readily allow for storing, retaining, or detaining flows from the C-102 Canal Basin and potentially additional restoration flows through the C-102 from other Basins, in an effort to more evenly disperse flows throughout the year to Biscayne Bay. The ability to store or detain wet season canal flows for delivery during drier times is a key component to meeting BBSEER objectives. Management measures currently proposed at this location include a flow equalization basin or a water preserve area." (Glenn SFWMD 2021)

Further, the development of the SDLTD directly impedes ongoing restoration efforts that aim to improve and protect the health of the Biscayne Bay ecosystem. Almost 50 percent of the SDLTD site is located within the boundaries of the land designated by the Comprehensive Everglades Restoration Plan (CERP) to be a Miami-Dade County Water Preservation Area (Miami-WPA), Figure 19. The WPA designation identifies areas that, due to location and low lying land-surface elevation, could function as a natural part of the once and future extensive wetland system and filter water flowing to the Biscayne Bay (Miami-Dade County DERM (EAS, Inc. Report, Figure 3)). The CERP plan Phase II plan includes more than 2/3's of the total land area within the boundaries of the proposed SDLTD Site. The site also overlaps conservation areas designated for the Agricultural Drawdown Dewatering Wells. We need to realize that there are too few opportunities to provide real benefits to Biscayne Bay. This is one of the most important ones.

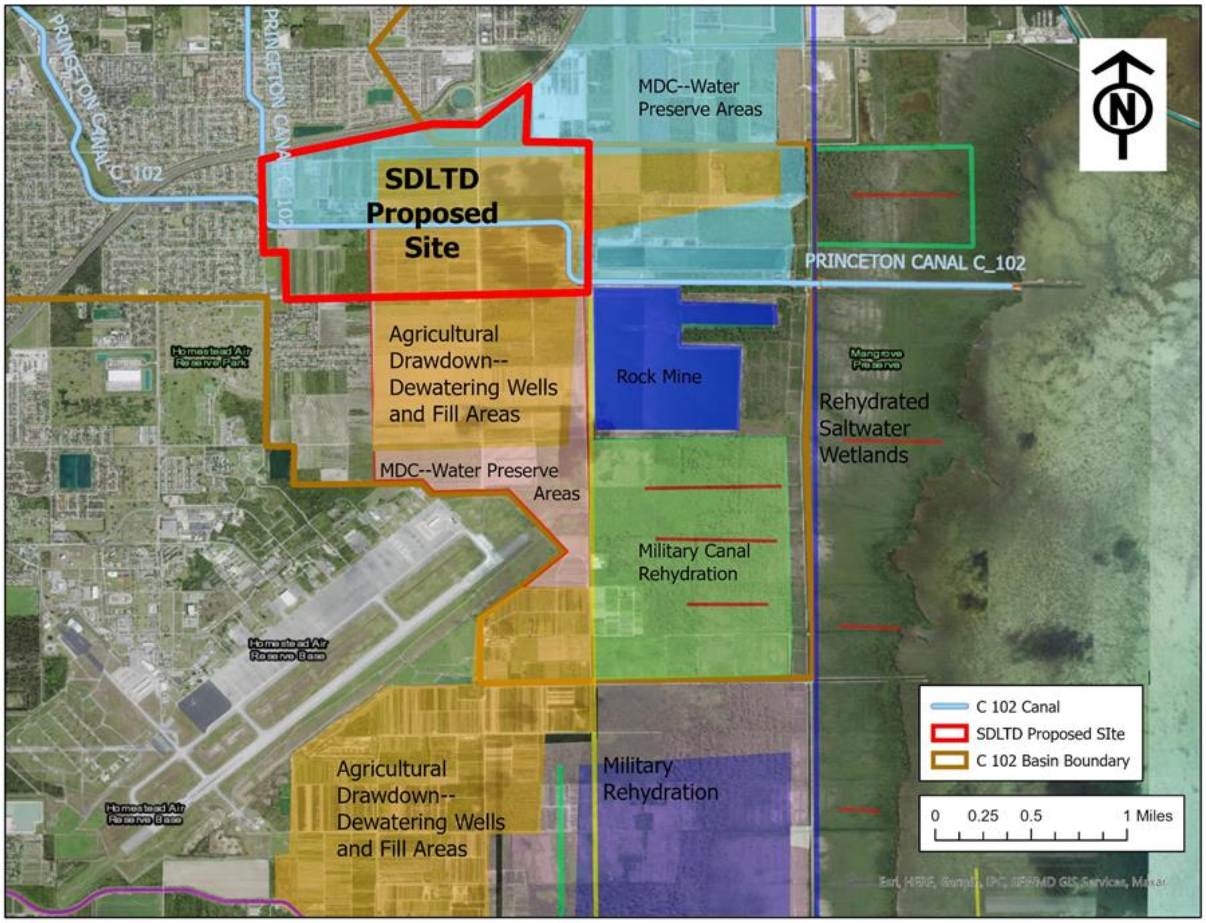

Figure 19: Almost 50 percent of the SDLTD site is located within the boundaries of the land designated by the Comprehensive Everglades Restoration Plan (CERP) to be a Miami-Dade County Water Preservation Area (Miami-WPA). The site also overlaps conservation areas designated for the Agricultural Drawdown Dewatering Well.

The coastal plain conveys freshwater from the Everglades and the Atlantic coastal ridge to Biscayne Bay. The inflow of freshwater is essential for maintaining the estuarine character of nearshore waters and the ecological health of Biscayne Bay. Historically, prior to the area's development for agriculture, water flowed through freshwater sloughs that extended westward to the Everglades through the coastal ridge, known as transverse glades, and across the coastal plain into Biscayne Bay.

Currently, the C-102/Princeton canal follows the path of one of these transverse glades. The C-102 canal provides the same hydrological function as the transverse glades, serving as a source of freshwater essential to the health of Biscayne Bay. Future plans for ecological restoration of Biscayne Bay rely on project elements located in the coastal plain to convey and store additional freshwater for the bay and disperse it evenly across the shoreline as sheetflow.

The proposed SDLTD site was once a part of the great transverse glades freshwater conveyance system and formed much of the upper coastal plain terraces in the wetlands for this area. It is a natural wetlands and should be returned to its proper function and reclaim its former status as a freshwater conveying wetland to continue to improve ecosystem function and services, habitat, and water quality

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in the coastal wetlands and Biscayne Bay. Increased flow through the SDLTD site could facilitate freshwater sheet flow and improve water quality as it flows through the wetlands to Biscayne Bay.

The DEM for the proposed site provides significant topographic evidence that the proposed SDLTD site was a discharge-wetlands area for a Transverse Glade. Historic Transverse Glades (TGs) were/are historic stream features that once fed freshwater from the northeastern Everglades across the Cutler Ridge toward the eastern coastal plains to Southeastern Biscayne Bay. As the freshwater flowed across the glades, the head dropped between 3 -5 feet in elevation from Everglades to Biscayne Bay (Meeder and Harlem, 2010). TGs discharge and coastal plain areas were too wet to farm until after mid-1930s when canal and drainage projects effectively lowered water levels below land surface in many areas for much of the year. Transverse Glades were not readily visible until highly accurate Lidar elevational became available. Most TGs are no longer functional at present under “normal water-level conditions” but become active during periods of extreme flood events (Meeder and Halem, 2010).

Historic Freshwater discharge from Everglades transversed through glades down terraced coastal plain highlands toward to discharge areas then down again through wetlands on ts way to Biscayne Bay. Historic Flows, significantly greater than today, were great enough to maintain coastal freshwater marshes to the shoreline and maintain estuarine zones. Groundwater discharge was enough to maintain offshore and coastal springs and seep fed creeks (Meeder and Harlem, 2010). Currently, groundwater discharge to Biscayne Bay is estimated to be approximately 1 $L/m^2/hr$ from the shoreline to about 300 m offshore if ground-water stage is maintained between 1.7 to 2.1 ft (Meeder et al 1999, Muir-Gonzalas et al 2004). Historic groundwater discharge was significantly greater because stages were estimated to range between 2 to 6 ft higher than present levels (Parker et al 1955). At stage levels 2 ft higher than today, karst cave systems in the Biscayne aquifer are activated, greatly increasing groundwater transmissivities and flow capacities therefore greatly increasing discharge (Figures 20, 21).

The LiDAR DEM data shows the Terraced Coastal Plain wetlands that cover the proposed SDLTD Site (Figure 21). A slope measurement from the NW to SE corner (approximately the direction of water flow presumably) avoiding roads, the turnpike, or ditches and the canal has an elevation approximately slightly less than 6 feet in the NW corner. The SE corner of the property has an elevation of approximately less than 0.5 ft. This represents a slope of approximately 5.5 ft over 8,886.84 ft from the NW to SE corners or approximately 3.25 ft/mile.

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Figure 20: The terraced coastal Plain "Prairie" in the Princeton area before development along were evident (From Meeder and Harlem, 2010).

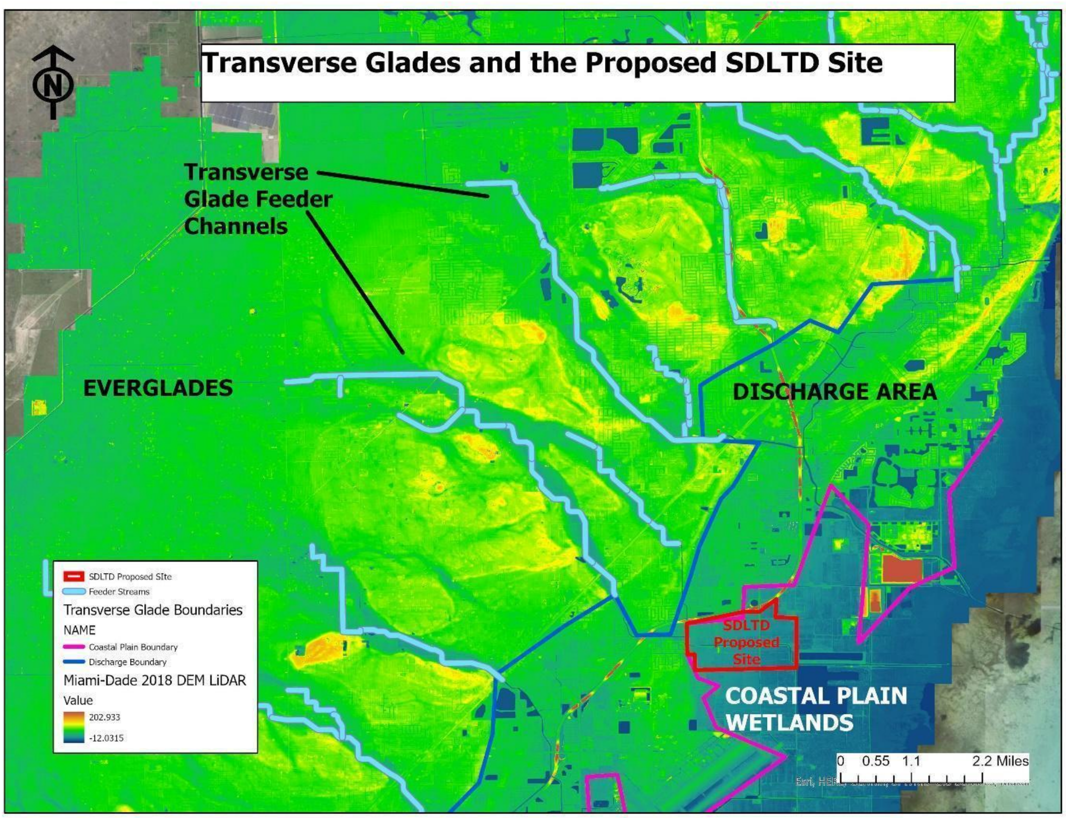

Figure 21: Remnant Regional Transverse Glades in the area of the proposed site showing discharge areas, and the coastal plain wetlands that once were part of the transverse glades system that transmitted freshwater to Biscayne Bay

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What future do we want for Miami-Dade County and Biscayne Bay?

What future do we want for the coastal area of Miami-Dade County and Biscayne Bay? This is the question that should be at the forefront in the discussion of the proposed South Dade Logistics and Technology District, the SDLTD. The proposed development imposes difficult-to-estimate costs on the County by increasing the footprint of infrastructure at risk to sea level rise.

As described throughout this paper, the applicant's proposal to redevelop this site for industrial use is seriously flawed. The proposal seeks an exemption from County policies to allow vague and incomplete information on the scope and impact of the work. Notwithstanding this, the information that the applicant has provided presents an erroneous accounting of the costs and benefits immediately associated with the proposed redevelopment. Most surprisingly, the proposal overstates the project benefits, while seriously understating the negative impacts to the region.

Importantly, the applicant neglects to account for the impact of development on the regional benefits supported by the current agricultural use of the site. Neither do they account for the impacts in the future of allowing industrial development directly in the path of rising sea level.

Alternative Land Use – Restored Freshwater Wetland

A viable alternative use of the site would be to promote its transition first to freshwater wetland and eventually to an estuarine wetland. Ecological restoration as a wetland will preserve or enhance the hydrologic and ecological characteristics supported by the site's current agricultural use and the regional benefits they provide. For example, ecological restoration as a wetland will increase the land area available to store freshwater at the surface, allowing increased filtration, increased recharge to the Biscayne aquifer, and uptake and removal of nutrients that now reach Biscayne Bay (Figure 22).

Restored wetlands provide significant improvements in water quality. Wetlands are capable of reducing nutrients, trace elements, and organic chemicals, and they provide increased critical habitat areas for endangered and other wildlife, including aquatic vegetation, and avian and other species, and increased freshwater availability for storage in the Biscayne aquifer. Restored wetlands also provide protection from storm damage that can keep up elevational pace with sea level rise through soil accretion.

While it is true that restored wetlands can't provide the full range of ecosystem services and the same environmental quality of an undisturbed wetland, a restored wetland can be designed to reduce the most critical threats to the bay and would provide more ecosystem services than development for industrial and commercial land use (Ballantine, Anderson, Pierce, and Groffman, 2017). It is critical that this site be preserved for its present land use or is allowed to revert to more natural wetland conditions that benefit Biscayne Bay preservation and restoration process if this area is allowed to remain as an undeveloped agricultural area or is restored to previous wetland conditions.

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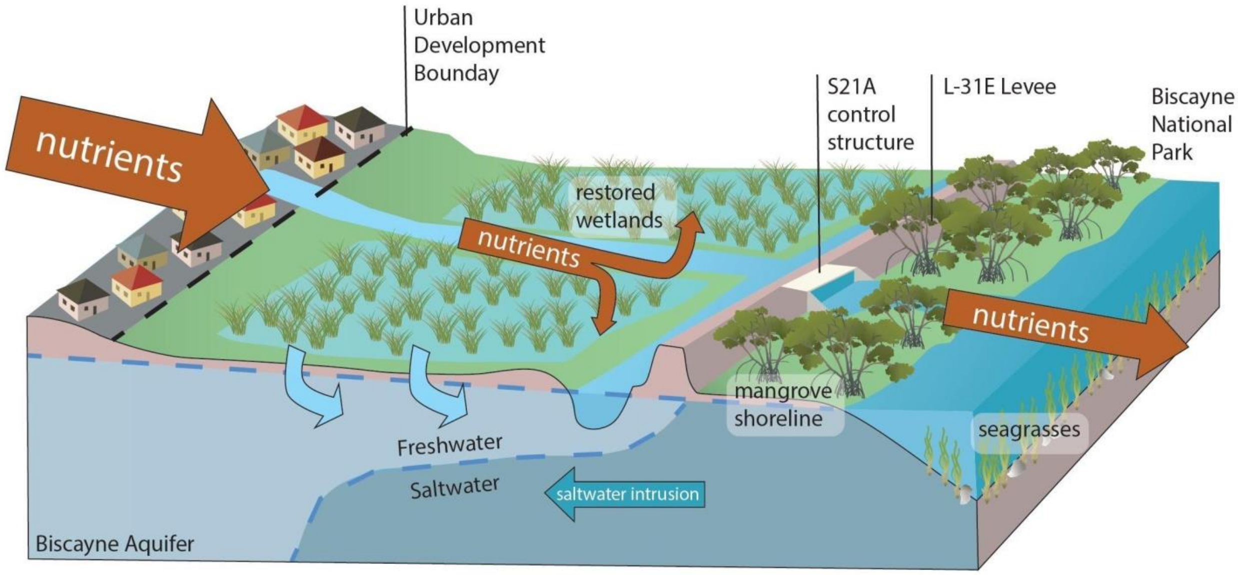

Figure 22: Construction of freshwater wetlands on the site will enhance regional benefits provided by the coastal plain and build resilience to the impacts of sea level rise that are expected within the next decades. In addition, constructed wetlands can be used to remove nutrients carried by drainage from the Princeton Basin through the C102 canal into Biscayne Bay, thus helping to restore and protect the bay's ecosystems.

Economic Value of Restored Wetland

The value of ecosystem services for current agriculture is $844,470 (Table 3). However, if the land is restored as a freshwater wetland, the value of ecosystem services would be $12.62 million per year for the 763 acres. Ecosystem services comprehends at least 17 categories (see Weisskoff 2005, Table 10.4 and 10.6). For tropical wetlands, the most important of these are gas regulation, water supply, water regulation, sediment retention, waste treatment, erosion control and storm protection, refugia, food production, raw materials, recreation and cultural benefits.

But how does society "cash in" or "monetize" these "services" i.e. recurring, perpetual gifts, that the restored wetland can bring to the people and to the region?

As an example, birdwatching is but one of several benefits that a restored wetland would deliver. Others include storm protection, support for economically valuable recreational fisheries in Biscayne Bay, and the aesthetic value of a natural area, which adds economic value to homes in nearby neighborhoods. Also called wildlife – watching; the U.S, Fish and Wildlife Service 2011 National Survey counted 4.3 million people in Florida watching birds and animals, and 658,000 people visiting parks and natural areas within the state (see Table 10), spending over $3 billion on trip related (food lodging, travel) and equipment (cameras, binoculars, camping equipment).

Here is the basis for a true local industry to be built around the miles of wetland boardwalks, an accessible Visitor and Research Center just off the main road, a free, open, and non-intrusive park, a refuge for humans, fish, and birds from the fast pace of urban life, all at Miami's doorstep, bringing a cleaner Biscayne Bay, natural flood protection, and jobs to the existing neighborhoods.

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Table 10: Value of Wildlife-watching in Florida: 2011 National Survey

Participants (millions):			
Total	4.3		
Participants away from home	1.9		
Visitors to parks and natural areas	0.66		
Expenditure ($millions)	2001	2011	% chge
All in-state expenditures	2,001	3,041	52
Expenditure by Fl. Residents	1,834	2,614	42.5
Average expenditure by participant (2011)	All participants	Aver. Per Spender	
Total, all items	$668	$816	
Trip-related (food, lodging, transport)	887	939	
Equipment	276	474	
Number of participants (million)	4.3	3.7	
Total spent ($million)	$2,872	$3,019	

Source: 2011 National Survey of Fishing, Hunting, & Wildlife Associated Recreation – Florida, Table 31

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Appendix A: Elements Identified for the Biscayne Bay Coastal Wetlands Project

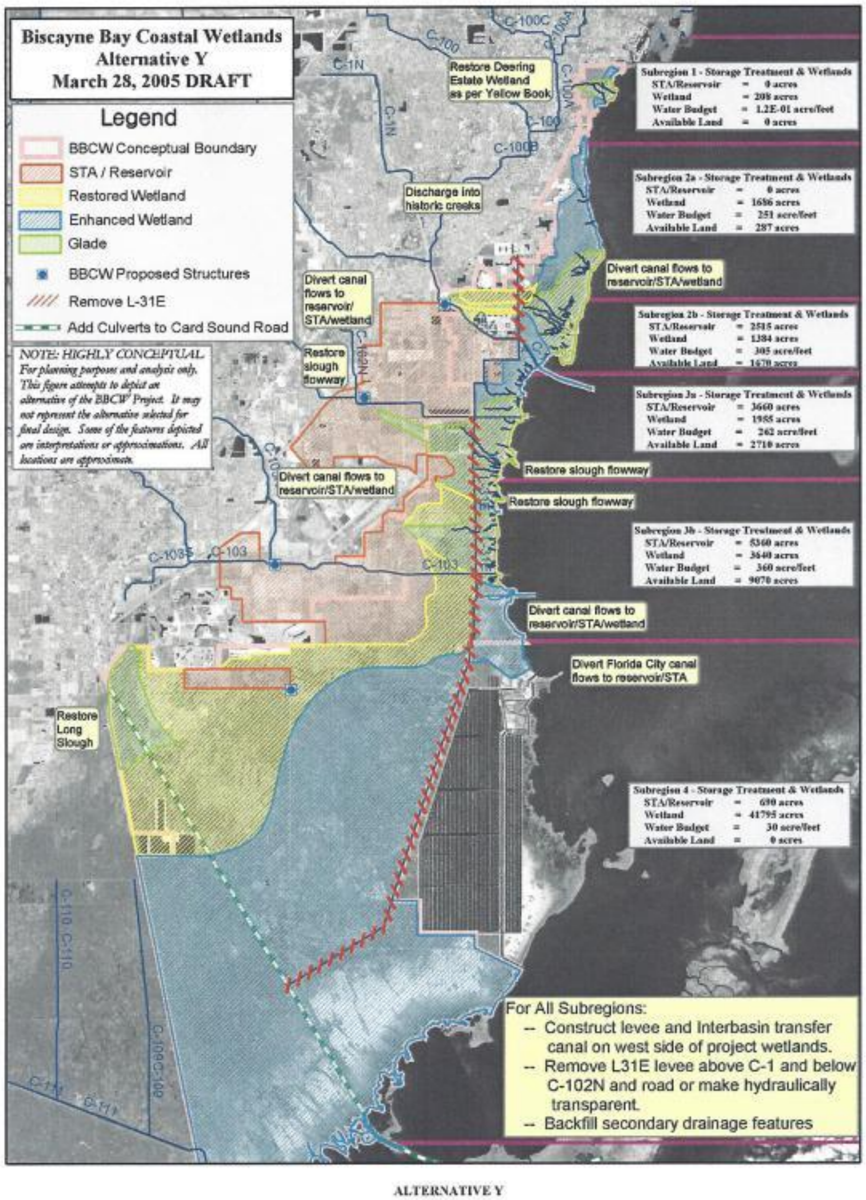

Figure 8– Alternative Y

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Appendix C: Summary of Water Quality Data Reviewed

Nutrient water-quality data was analyzed from the following stations (Figure B1):

Black Creek Canal (C-1):

1. BL12 (agriculture)
2. BL06 (mixed agriculture and urban)
3. BL03 (mixed urban and agriculture)
4. BL01 (mixed wetland and urban);

Princeton Canal (C-102)

1. PR08 (agriculture)
2. PR04 (Urban)
3. PR03 (mixed agriculture and urban)
4. PR01 (urban, landfill, agricultural, and wetland);

Mowry Canal (C-103):

1. MW13 (agriculture)
2. MW05 (agriculture)
3. MW04 (mixed urban and agriculture)
4. MW01 (wetland)

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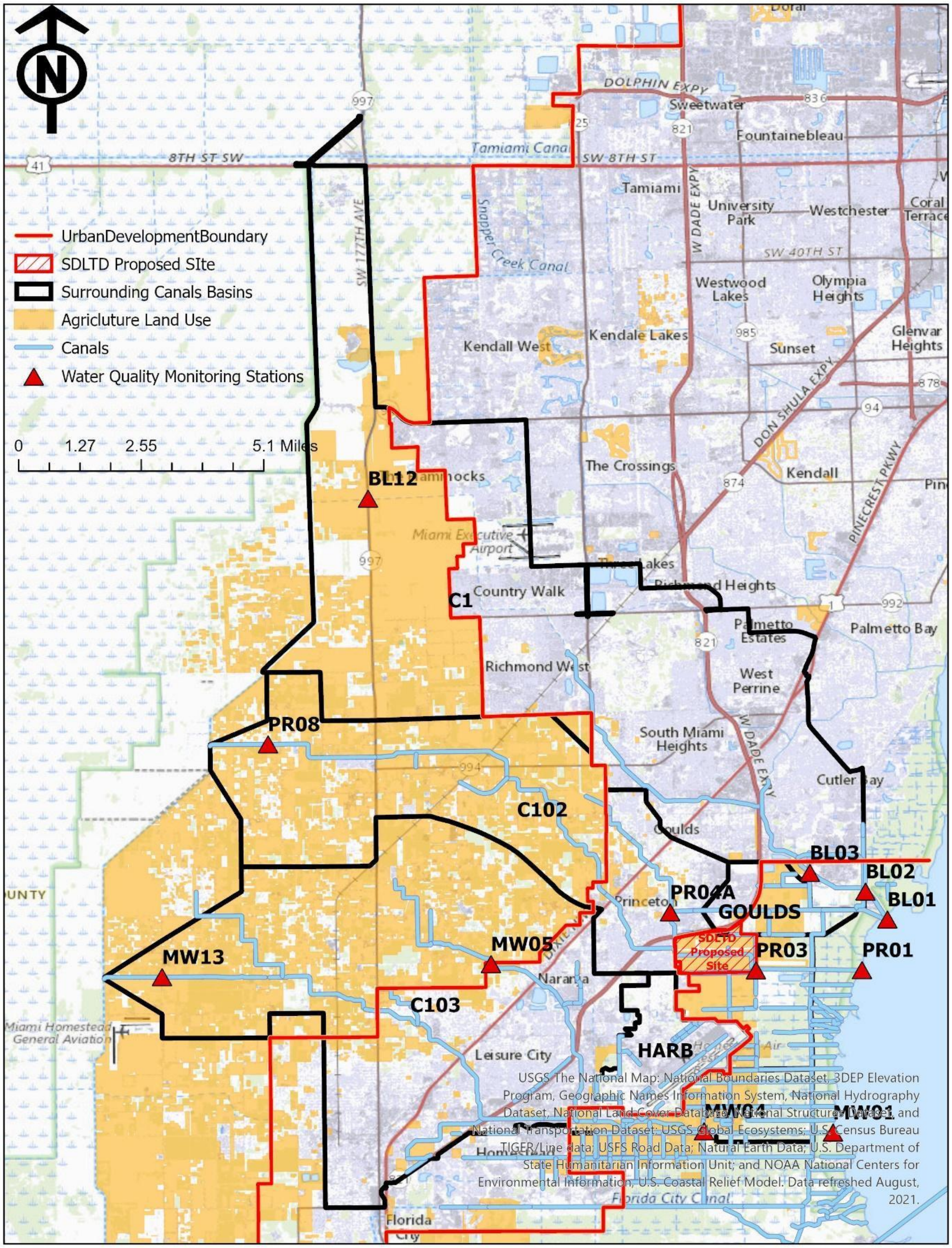

Figure B1: Surface Water Quality Monitoring Stations in the C-102 (Princeton), C103 (Mowry), and C-1 (Black Creek) canal basins, contributing areas, urban designation boundary, and agricultural land use in the contributing areas.

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Phosphorus

The analysis of orthophosphate in water quality samples within the C-1, C-102 and C-103 basins show concentrations (in mg/L as P) greatest for sites BL12 (0.23), MW05 (0.158), PR08 (0.154 and MW13 (0.109)—all stations that drain agricultural areas (Table B1 and Figures B1, B2). Minimum concentrations (the detection level (<0.001) were similar at all sites. The sites with the greatest mean or median as well as the greatest Q3 concentrations, indicating that 50 or more percent of samples had concentrations greater than 0.005 in from stations PR08 (0.007 and 0.005, respectively) and MW13 (0.005). These sites are dominated by waters draining from agricultural lands. Generally, concentrations became lower as water flowed downstream toward the bay, potentially indicating adsorption or dilution or both lowering concentrations as it flows downstream through urban, low intensity agriculture, and wetlands areas before discharging to Biscayne Bay. Overall, orthophosphate concentrations were highest in samples from agricultural areas and lowest at the bay discharge points for each canal than elsewhere. If the proposed site is restored to a functioning wetland directly upstream from Biscayne Bay, diluting potential orthophosphate loads from upstream urban and agricultural land-use areas upstream (Figures B1 and B2, Table B1).

Table B1: Summary Statistics of Orthophosphate concentrations in mg/L as P by land use and station in approximately upstream to downstream order in the C-1, C-102, and C-103 basins.

LANDUSE >	AGRICULTURE				URBAN					WETLAND		
STATION>	BL12	MW05	MW13	PR08	BL03	BL06	MW04	PR04	PR03	BL01	MW01	PR01
N	270	272	272	273	273	39	273	271	273	63	64	61
MIN	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.002
Q1	<0.001	0.002	0.002	0.002	<0.001	<0.001	0.002	0.002	0.002	<0.001	0.002	0.002
MEAN	0.01	0.004	0.005	0.005	0.00	0.01	0.004	0.004	0.004	<0.001	0.003	0.003
MED	<0.001	0.002	0.002	0.003	0.00	0.01	0.002	0.003	0.002	<0.001	0.002	0.003
Q3	0.01	0.003	0.006	0.007	0.01	0.01	0.004	0.005	0.004	<0.001	0.004	0.004
MAX	0.23	0.158	0.109	0.154	0.03	0.01	0.067	0.057	0.079	0.01	0.016	0.009
STD	0.01	0.010	0.007	0.010	0.00	0.00	0.005	0.004	0.006	0.00	0.002	0.001

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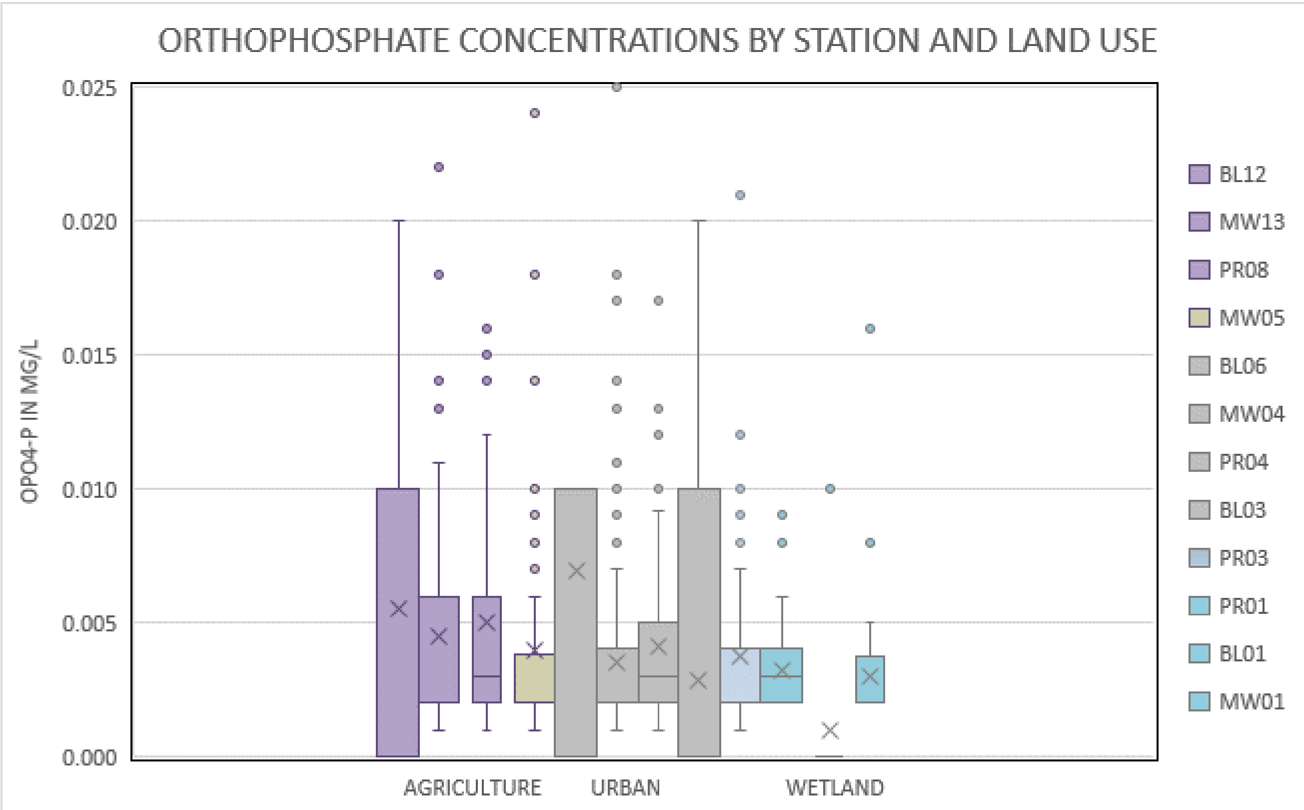

Figure B2: Total Orthophosphate concentrations in mg/L as P by land use and station in approximately upstream to downstream order in the C-1, C-102, and C-103 basins.

The highest total phosphorus concentration (all reported in mg/L as P) were found for samples from stations BL12 (0.32), MW04 (0.280), PR08 (0.256). These sites drain mostly agricultural lands although MW04 drains mostly urban areas most directly (Table B2 and Figures B1, B3). Minimums concentrations remain at or below the detection level of <0.001 mg/L as P) for all stations. The greatest means or medians occurred in samples from stations PR01 and station MW01 (0.009), located the mouth of Biscayne Bay for the C-102 and C-103 canals. Total phosphorus concentrations were somewhat variable but concentrations generally decreased as the water flowed from the upper basin agricultural areas through urban areas and wetlands before reaching the mouth of Biscayne Bay. Both C-102 and C-103 basins have a small area used for agricultural production east of the designated urban boundary and upgradient of the wetlands. Agricultural production in these areas may be increasing total phosphorus concentrations before flowing through wetlands and then out to the Bay. If the proposed site is restored to a functioning wetland as under the CERP and BBSEER plans, the proposed site wetland is to be used to filter C-1 and C-102 canal water before discharging to Biscayne Bay, total phosphorus concentrations may be reduced in water discharging to Biscayne Bay, improving Bay water quality.

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Table B2: Summary Statistics of Total Phosphate concentrations in mg/L as P by land use and station in approximately upstream to downstream order in the C-1, C-102, and C-103 basins.

LANDUSE-->	AGRICULTURE				URBAN						WETLAND		
STATION-->	BL12	MW05	MW13	PR08	BL02	BL03	BL06	MW04	PR04	PR03	BL01	MW01	PR01
N	345	281	347	348	299	382	39	348	281	349	401	434	318
MIN	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Q1	0.01	0.002	0.004	0.004	0.01	<0.001	0.01	0.003	0.003	0.003	0.01	0.005	0.005
MEAN	0.01	0.006	0.007	0.009	0.01	0.01	0.01	0.007	0.006	0.006	0.01	0.009	0.009
MED	0.01	0.004	0.005	0.005	0.01	0.01	0.01	0.004	0.004	0.004	0.01	0.007	0.007
Q3	0.01	0.006	0.007	0.008	0.01	0.01	0.01	0.007	0.005	0.006	0.01	0.010	0.010
MAX	0.32	0.207	0.190	0.256	0.17	0.17	0.02	0.280	0.170	0.180	0.17	0.170	0.170
STD	0.02	0.016	0.015	0.019	0.01	0.01	0.00	0.017	0.012	0.013	0.01	0.011	0.012

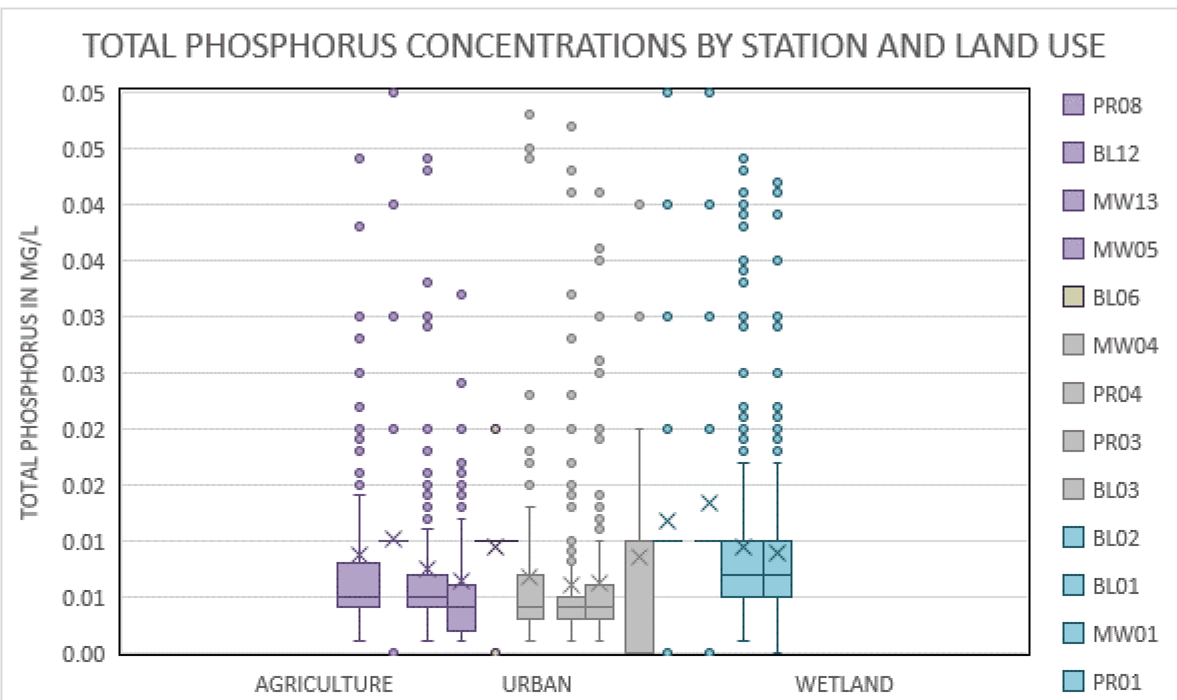

Figure B3: Total phosphorus concentrations in mg/L as P by land use and station in approximately upstream to downstream order in the C-1, C-102, and C-103 basins.

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Nitrogen

The greatest maximum ammonia concentrations (all in mg/L as N) were found in samples from stations BL02 (3.72), draining an urban area and BL01 (1.78), PR01 (1.00), the discharge points for the C-102 canals. The minimum concentration of ammonia (<0.01 mg/L as N--the detection level, all concentrations reported in mg/L as N) at all sites (Table B3 and Figures B1, B4). Concentrations in sample from station MW13 (0.60) and PR08 (0.68), both agricultural areas, and MW04 (0.86), an urban area, were also relatively high. Other sites with generally high ammonia concentrations (Q3 concentrations and greater percentiles) were found for sites in all land use types (Table B3 and Figure B4). The most likely explanation is fertilizer applications are just as likely to occur in urban and agricultural areas, Ammonia is a stable nitrogen species under reduced conditions and so likely to be present in low-oxygenated waters.

Ammonia concentrations in samples from stations located in the wetlands may be high because of a small amount of upgradient agriculture above the wetlands. Agricultural (fertilizer ammonia sources) are close and upgradient to the wetlands and discharge points for the C-102 and C-103 canal basins (Figure B1). Ammonia concentrations were not insignificant in samples from urban areas too. If the proposed site is restored to a functioning wetland as the BBSEER II plan calls for the ammonia concentrations could be lowered by plant uptake in the wetlands.

Table B3: Summary Statistics of ammonia concentrations in mg/L as N by land use and station in approximately upstream to downstream order in the C-1, C-102, and C-103 basins.

LANDUSE	AGRICULTURE				URBAN						WETLAND		
STATION	BL12	MW05	MW13	PR08	BL02	BL03	BL06	MW04	PR04	PR03	BL01	MW01	PR01
N	346	281	348	349	299	382	39	349	281	349	367	375	320
MIN	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Q1	0.18	<0.01	0.11	0.11	0.11	<0.01	<0.01	<0.01	<0.01	<0.01	0.11	0.040	0.068
MEAN	0.29	0.027	0.191	0.223	0.22	0.07	0.08	0.027	0.018	0.029	0.21	0.071	0.125
MED	0.28	0.020	0.170	0.217	0.16	0.03	0.04	0.020	0.010	0.020	0.17	0.060	0.104
Q3	0.40	0.030	0.255	0.320	0.26	0.10	0.13	0.030	0.020	0.030	0.26	0.090	0.160
MAX	0.82	0.310	0.600	0.680	3.71	0.44	0.30	0.860	0.300	0.320	1.78	0.330	1.000
STD	0.14	0.035	0.110	0.131	0.25	0.08	0.08	0.049	0.022	0.033	0.16	0.046	0.096

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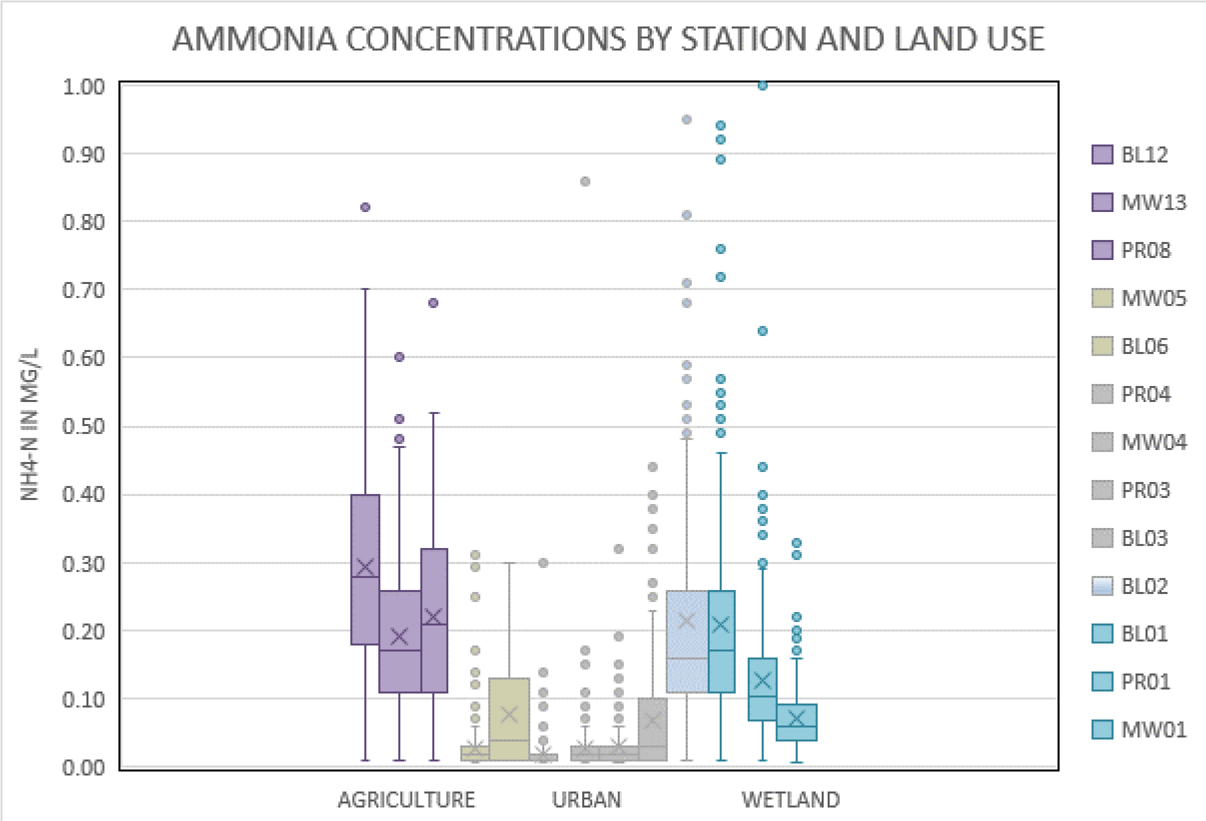

Figure B4: Boxplots of ammonia concentrations as N in mg/L at all water quality monitoring stations in the C-102 and C-103 basins.

Concentrations of Nitrate plus nitrate, in mg/L as N was greatest in one sample from site PR01 (34.00), this stations nitrate plus nitrite data in anomalously high compared to concentrations from the other sites. Otherwise, Nitrate plus nitrite concentrations from sites PR04 (9.48), MW05 (7.41), and PR03 (6.15), all urban land use sites, were much higher than the rest of site data including agriculture. The detection Level (<0.01) was the minimum at all sites. Means, medians, and greater percentiles for samples from sites MW05 (4.47), PR03 (4.39), PR04 (4.10), MW04 (2.02), all urban sites, were consistently higher than other wetlands and the agricultural areas. Discharge from the Princeton canal is loaded with nitrate. This is most likely from urban lawn care practices and agriculture that is between the urban area and the wetlands.

If the proposed SDLTD site becomes a restored wetland as proposed in the updated BBSEER and CERP documents, the water from C-102 and C-1 canals can be filtered through the wetland before entering Biscayne Bay. Rather than continuing to use the site for marginal row crop and palm tree production or building out 6 million square feet of industrial and commercial development, the site should be used to improve water quality in water discharging to South Biscayne Bay.

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Table B4: Summary Statistics of Nitrate plus Nitrite concentrations in mg/L as N by land use and station in approximately upstream to downstream order in the C-1, C-102, and C-103 basins.

LANDUSE	AGRICULTURE				URBAN						WETLAND		
STATION	BL12	MW05	MW13	PR08	BL02	BL03	BL06	MW04	PR04	PR03	BL01	MW01	PR01
N	346	280	348	349	299	383	39	346	281	348	393	430	321
MIN	<0.01	<0.010	<0.01	<0.01	<0.01	<0.01	0.06	0.05	<0.01	<0.01	<0.01	<0.01	<0.01
Q1	<0.01	3.810	<0.01	<0.01	0.04	0.15	0.54	1.564	3.740	3.875	0.03	0.038	0.340
MEAN	0.05	4.469	0.061	0.082	0.21	0.36	1.10	2.023	4.009	4.189	0.17	0.441	1.605
MED	<0.01	4.455	0.030	0.030	0.12	0.27	1.06	2.005	4.100	4.385	0.08	0.210	0.900
Q3	0.03	5.310	0.060	0.060	0.28	0.46	1.59	2.450	4.440	4.810	0.22	0.730	2.620
MAX	3.25	7.140	2.410	2.810	1.21	1.66	2.39	4.640	9.480	6.153	1.07	2.720	34.000
STD	0.21	1.092	0.167	0.250	0.25	0.32	0.68	0.693	0.876	0.996	0.21	0.525	2.363

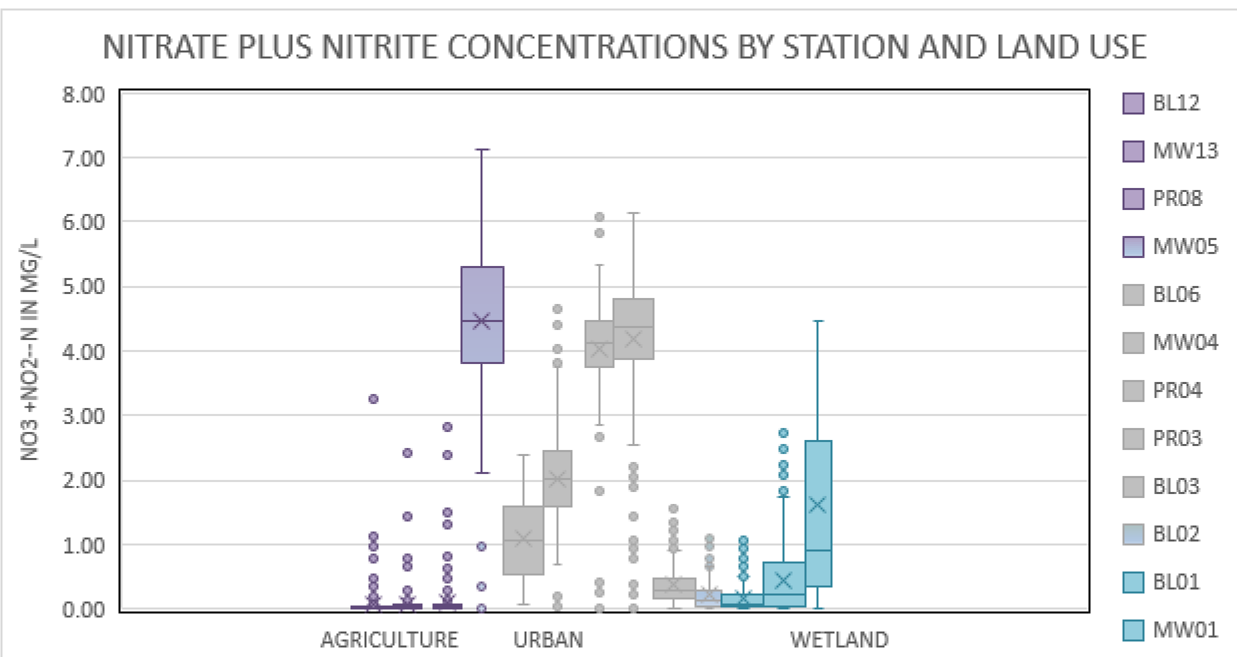

Figure B5: Boxplots of Nitrate plus Nitrite concentrations as N in mg/L at all water quality monitoring stations by land use and stations in approximately upstream to downstream order in the C-1, C-102, and C-103 basins.

Total Nitrogen concentrations, reported in mg/L as N, also had the highest concentrations in samples from urban sites--PR04 (4.20), PR03 (6.54), MW05 (4.76), MW04 (3.96). The lowest concentrations were found in samples from sites PR08 (0.42), MW13 (0.54)--all agricultural areas; and BL03 (0.39), PR04 (0.70), urban areas, and at station MW01 (0.55) (the discharge point to the Bay for C-103). The greatest

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means or medians were found for samples from MW05 (4.03), PR03 (4.52), PR04 (3.86) (all urban areas) as well as the greatest Q3 and higher percentile concentrations at stations MW05 (4.66), PR03 (5.27), PR04 (3.98), MW04 (2.91) (all urban areas). Once again a mixed urban agricultural drainage area produced the highest total nitrogen concentrations with the exception of the Princeton canal discharge point—(PR01—3.74). This could be a result of the row crop and palm tree production occurring immediately upgradient to station PR03.

The nitrate data supports the premise that if the proposed SDLTD site area is restored as a functioning wetland to filter C-1 and C-102 canal water, nutrient and other pollution could be lowered or eliminated from the canals. The restored wetland could potentially remove nitrogen, phosphorus, and other toxins from the water before it discharges to Biscayne Bay.

Table B5: Summary Statistics of Total Nitrogen concentrations in mg/L as N by land use and station in approximately upstream to downstream order in the C-1, C-102, and C-103 basins.

LANDUSE	AGRICULTURE				URBAN					WETLAND	
STATION	BL12	MW05	MW13	PR08	BL03	BL06	MW04	PR04	PR03	MW01	PR01
N	12	12	12	12	12	12	12	12	12	26	30
MIN	0.73	0.716	0.539	0.415	0.39	0.83	0.912	0.701	1.076	0.553	0.801
Q1	0.91	3.229	0.610	0.581	0.89	1.04	1.470	3.613	3.990	0.748	1.100
MEAN	1.02	3.749	0.683	0.682	1.01	1.14	2.132	3.598	4.312	0.942	1.893
MED	1.00	4.035	0.681	0.706	1.00	1.15	1.797	3.855	4.517	0.852	1.970
Q3	1.13	4.658	0.750	0.773	1.20	1.24	2.908	3.979	5.267	1.050	2.340
MAX	1.33	4.757	0.886	0.970	1.58	1.40	3.960	4.200	6.543	1.730	3.740
STD	0.17	1.147	0.099	0.161	0.34	0.16	0.976	0.933	1.484	0.341	0.791

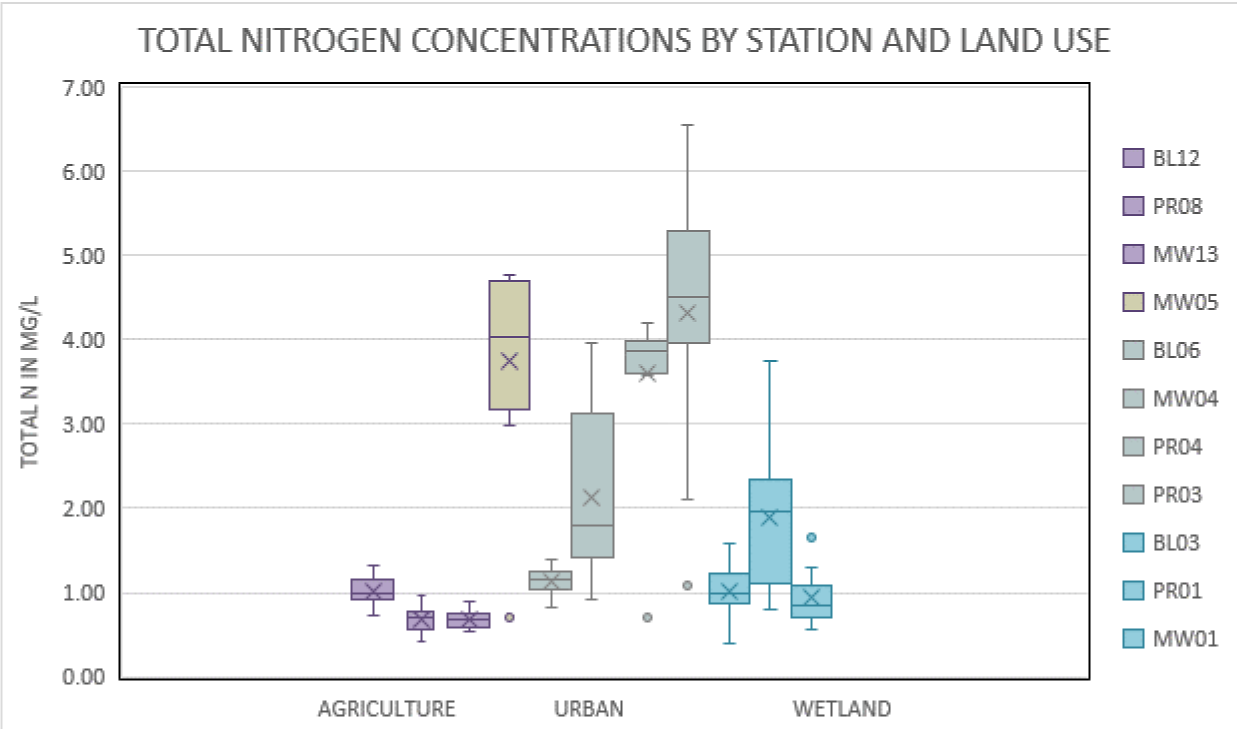

Figure B6: Boxplots of Total Nitrogen concentrations in mg/L as N by land use and station in approximately upstream to downstream order in the C-1, C-102, and C-103 basins.

Water Quality Conclusions

Total phosphorus and orthophosphate concentrations were generally greatest from agricultural areas followed by urban areas and lowest at the mouth of the Biscayne Bay indicating that continued current land uses are failing to improve Biscayne Bay water quality. Nitrogen concentrations (nitrate plus nitrite and total nitrogen concentrations) increased as water flowed through urban and industrialized areas. If the proposed site continues to function as a low intensity agricultural production area, discharge water in canals will continue to degrade water quality in Biscayne Bay furthering the decline in sea-grass cover of the Bay near the C-1, C-102 and C-103 canals.

The greatest maximum nitrogen ammonia and nitrate plus nitrite concentrations were found in samples sites draining urban areas and downstream--the mouth of Biscayne Bay. The proposed Industrialization of the SDLTD site by adding 6 million square acres of industrial and commercial area will lead to increased ammonia, nitrate plus nitrate concentrations from fertilizing applied to the lawns and increased nitrogen loads in freshwater delivered from the C-102 canal and therefore, Biscayne Bay. Establishing a restored wetland at the proposed site could potentially remediate nutrients and other toxins by slowing the flow by spreading it throughout the wetland, allowing more filtration of upstream waters before entering Biscayne Bay. The C-102 canal basin is already highly enriched with nutrients (nitrogen and phosphorus species) from the upgradient urban and agricultural land use activities before ever reaching the site. In some cases, nitrogen concentrations for example were lower in the canal after

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passing the site. The 794 acre site has a very limited if any capacity to improve water quality in the canal water and produces a negative or very small amount of contribution if any to the C-102 canal.

Ultimately this SDLTD site should be purchased and added to the Biscayne Bay Wetlands preserve. If the industrial park is allowed to go forward, presumably paving 794 acres of parking lot and buildings of course retention ponds will be installed to remediate storm water runoff the total amount of the amount of “remediated” water available to dilute upstream nutrient loads will be insignificant compared to the nutrient loads coming from upstream agriculture and urban land use areas because the site comprises less than 6 % of the total area of the total basin agricultural area; it’s ability to “improve” water quality is significantly limited in the C-102 basin. Reducing storm runoff of agricultural wastes by restoring the area to its original state as a wetland will likely increase water quality, aquifer recharge and freshwater storage and availability, and improve and increase habitat for various wildlife. Paving 794 acres in this once viable living wetland and allowing an significant increase in industrialization and accompanying automobile traffic and pollution will decrease habitat and increase water pollution and increasing evaporative water loss for the area.

The proposed development if approved, would result in a reduction in aquifer recharge, storage, and availability due to pavement expansion, a reduction in wildlife habitat and hunting grounds, reduced food supply, and a reduction in water quality, increased water pollution, and water loss due to evaporation from the impervious surfaces and storm-water ponds, increased pollution from traffic, parking areas and buildings, grounds and lawn maintenance and irrigation, and increased dirty-water runoff from parking areas during storm events. A functioning restored wetland could provide filtration to C-102 water for treatment and nutrient and toxic remediation for onsite precipitation and C-102 canal water spread over the site and far better than continuation in its current agricultural land uses or a wholesale conversion to an industrial park with storm water retention ponds, traffic and runoff etc.,. Improved water quality could significantly benefit wildlife habitat by providing wetlands filtration to remove harmful toxins, and other pollutants, increasing sea-grass cover in Biscayne Bay so much more than another industrial park in South Dade County.

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