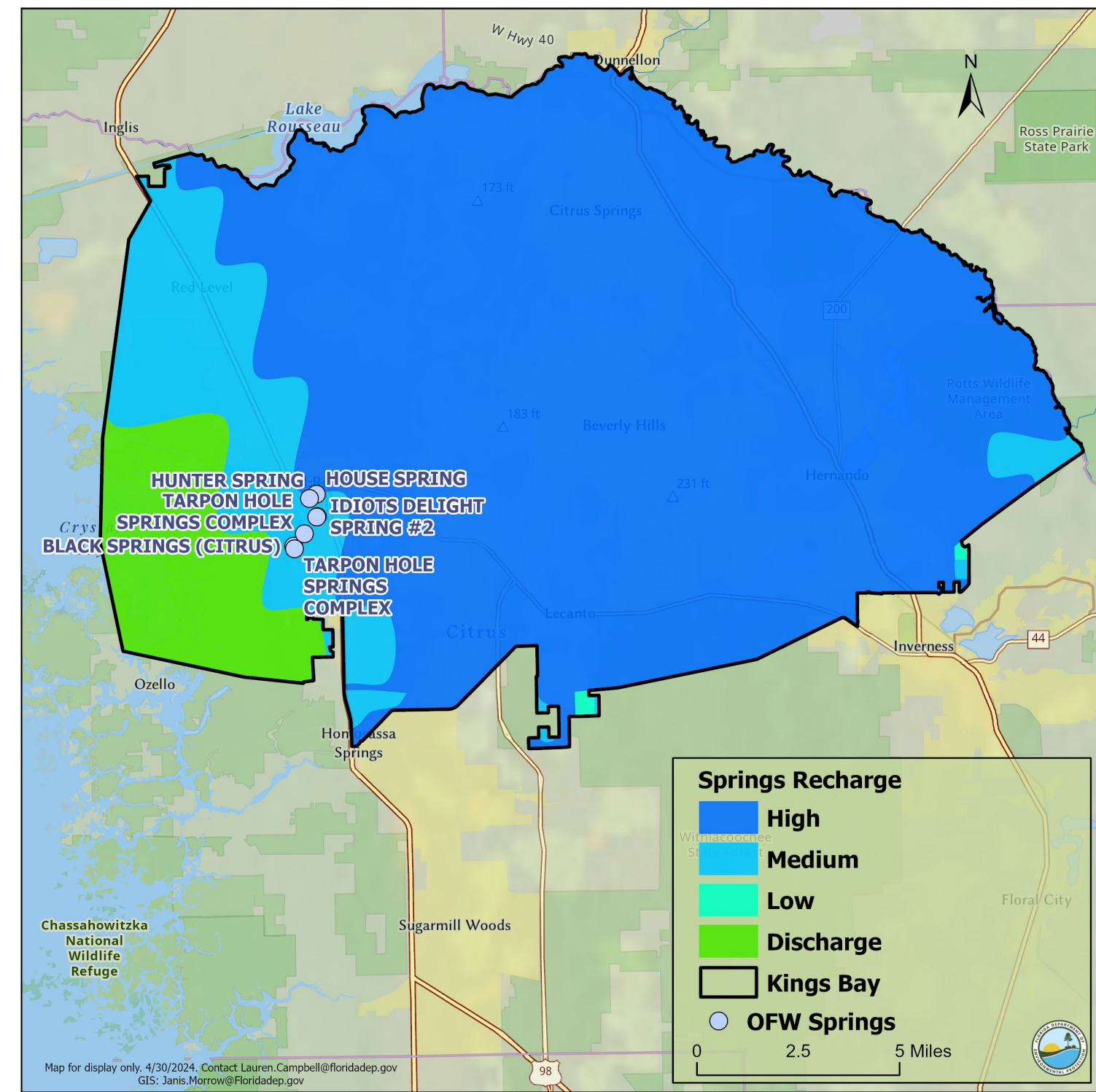




CRYSTAL RIVER/KINGS BAY Springs Basin Analyses

Crystal River-Kings Bay Basin Management Action Plan (BMAP)

The first step to address nitrogen impairments in Crystal River and Kings Bay is to inventory the nitrogen sources in the basin. This was completed through the **Nitrogen Source Inventory Loading Tool (NSILT)**. The NSILT evaluates the loading after attenuation from various sources and considered the groundwater recharge potential based on spatial and geologic factors.



This figure shows the generalized recharge zones in the basin.

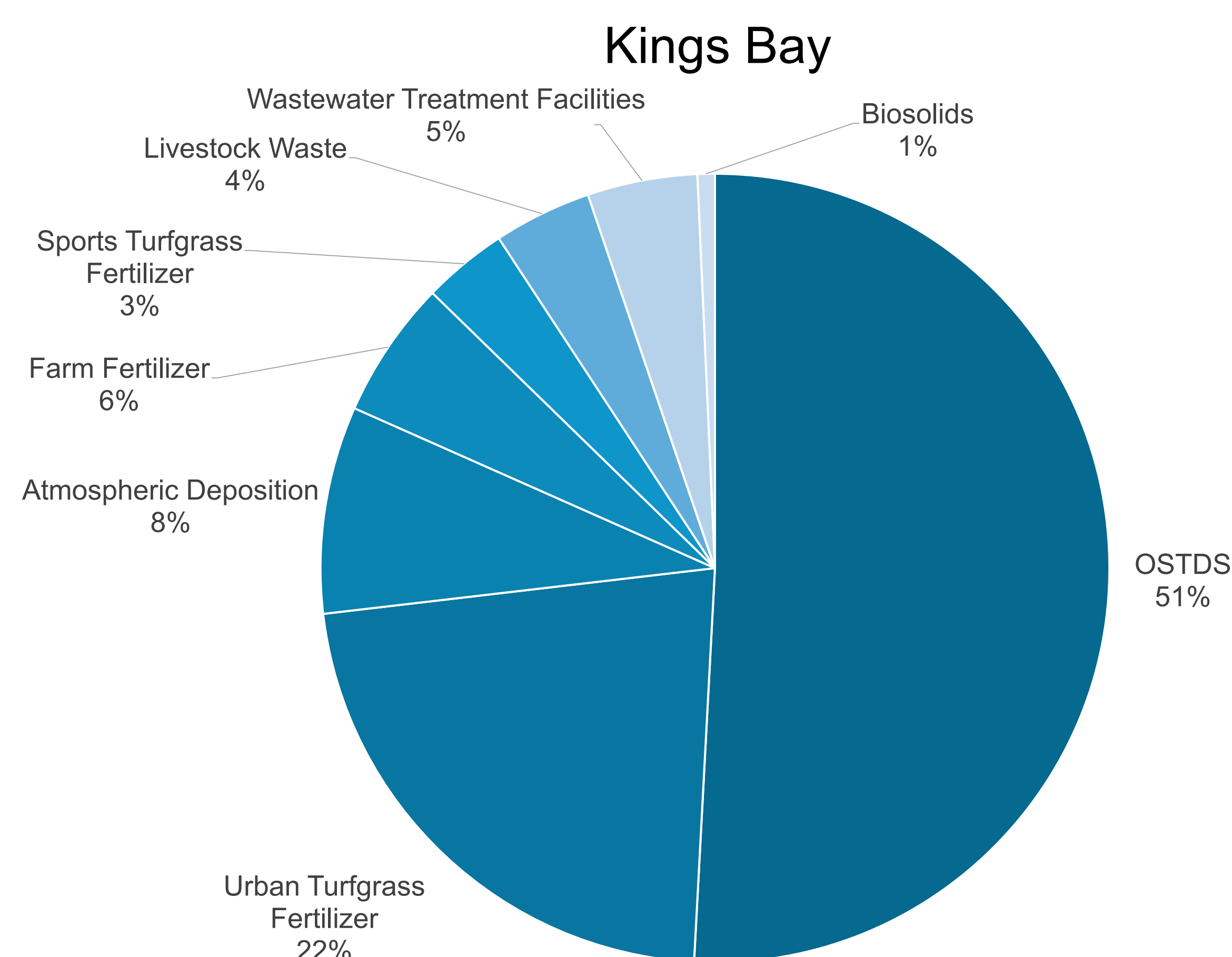
High recharge indicates areas where more water is expected to percolate into the Upper Floridan Aquifer and travel to the spring vent.

Discharge represents areas where water is expected to flow primarily to a surface waterbody and not significantly impact groundwater.

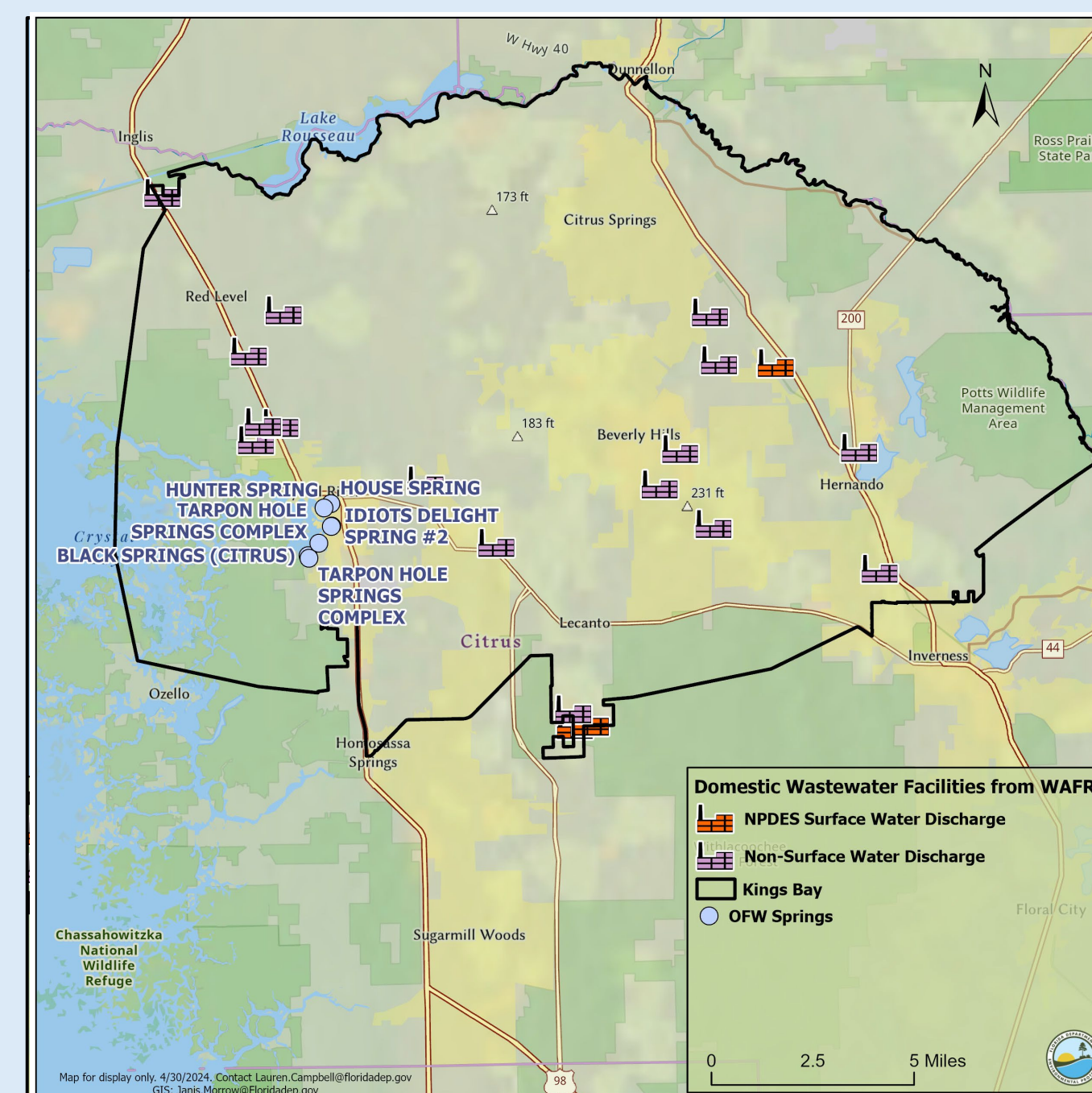
NSILT Summary

Kings Bay Spring Group	
Source	Annual Loading (lbs-N/yr)
Atmospheric Deposition	69,099
Wastewater Treatment Facilities	36,607
OSTDS	413,555
Urban Turfgrass Fertilizer	181,417
Sports Turfgrass Fertilizer	28,283
Farm Fertilizer	45,930
Livestock Waste	32,668
Biosolids	5,782
Total	813,340

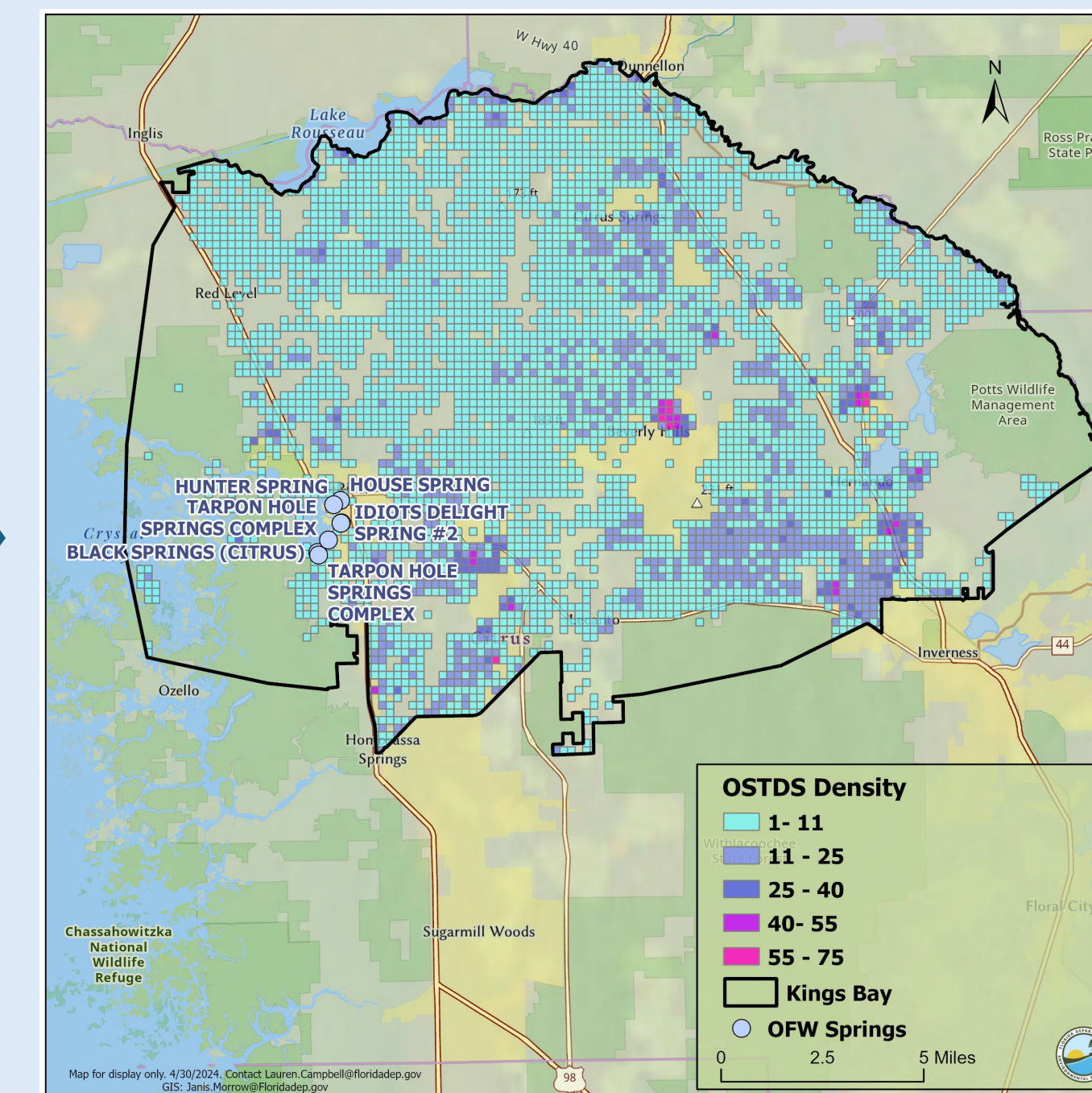
The pie chart below shows the comparative contribution of various nitrogen sources to the Crystal River/Kings Bay Basin.



Urban Source Loading



Twenty-three **domestic wastewater treatment facilities** combine to contribute 5% of the total nitrogen load in the basin. The figure to the left shows the location of domestic wastewater facilities in the basin.



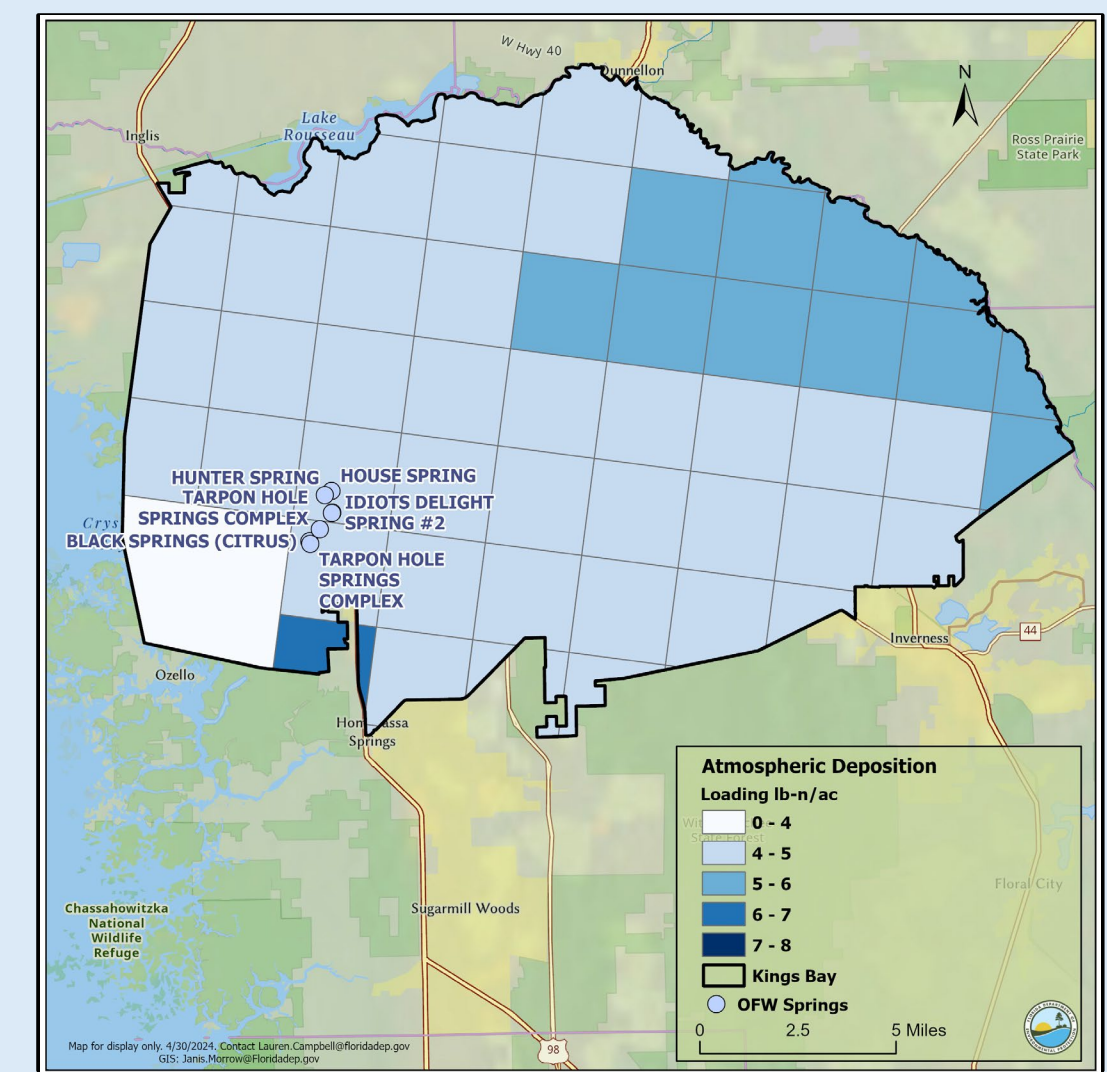
Onsite Sewage Treatment and Disposal Systems (OSTDS), also known as septic systems, contribute 51% of the nitrogen load in the BMAP area. The figure to the right shows OSTDS density per 300-meter by 300-meter grid cell.

Urban turfgrass from single family residential sources and other urban areas combine to total 22% of the total nitrogen load in the basin.

Atmospheric Deposition

Atmospheric deposition was estimated using data from the Total Deposition Science Committee (TDep) model. TDep estimates annual deposition on 4-kilometer by 4-kilometer grid squares.

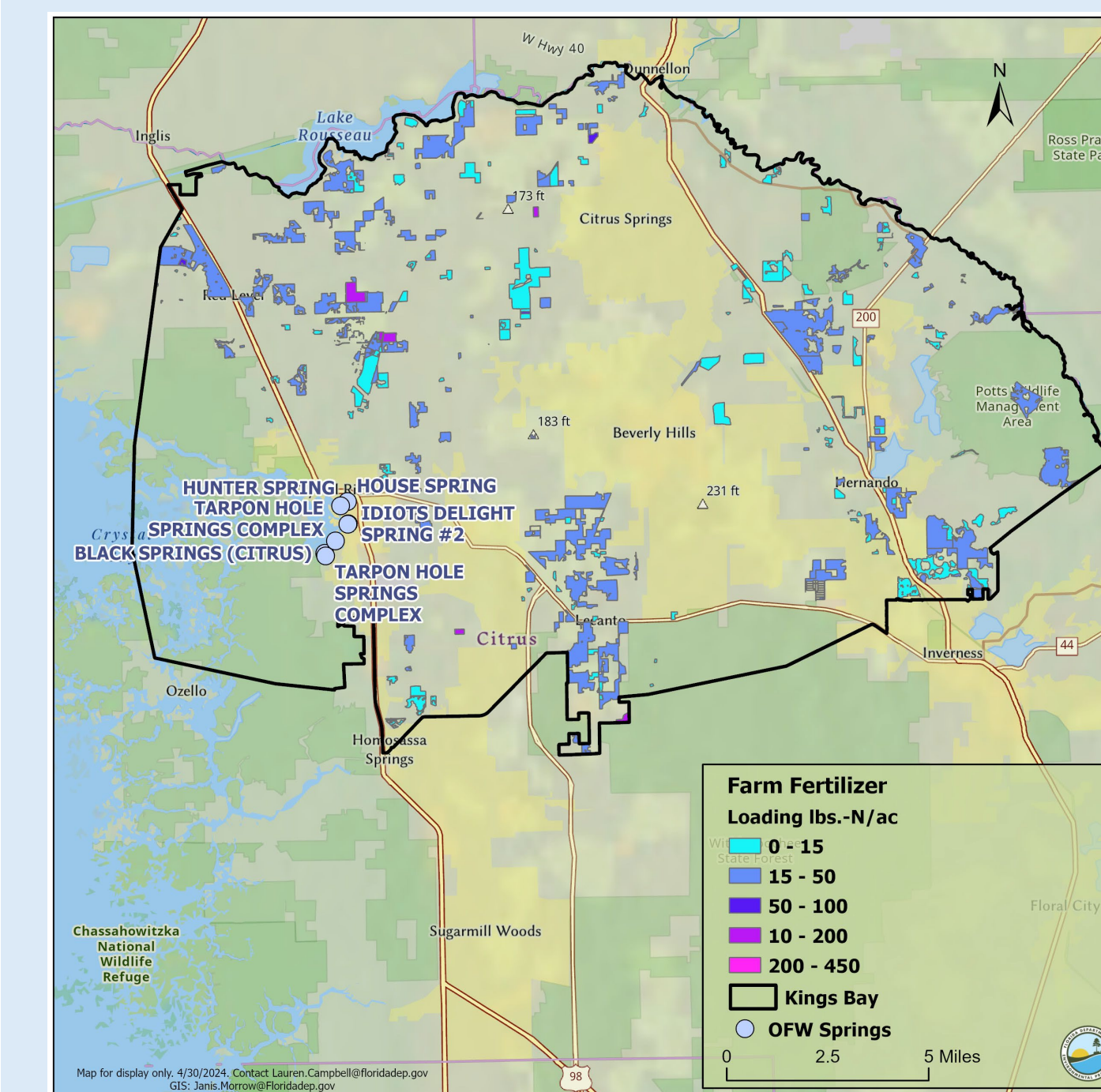
Atmospheric deposition accounts for 8% of total loading within the Crystal River/Kings Bay BMAP area.



Agricultural Source Loading

Agricultural sources include farm fertilizer (6% contribution) and livestock waste (4% contribution).

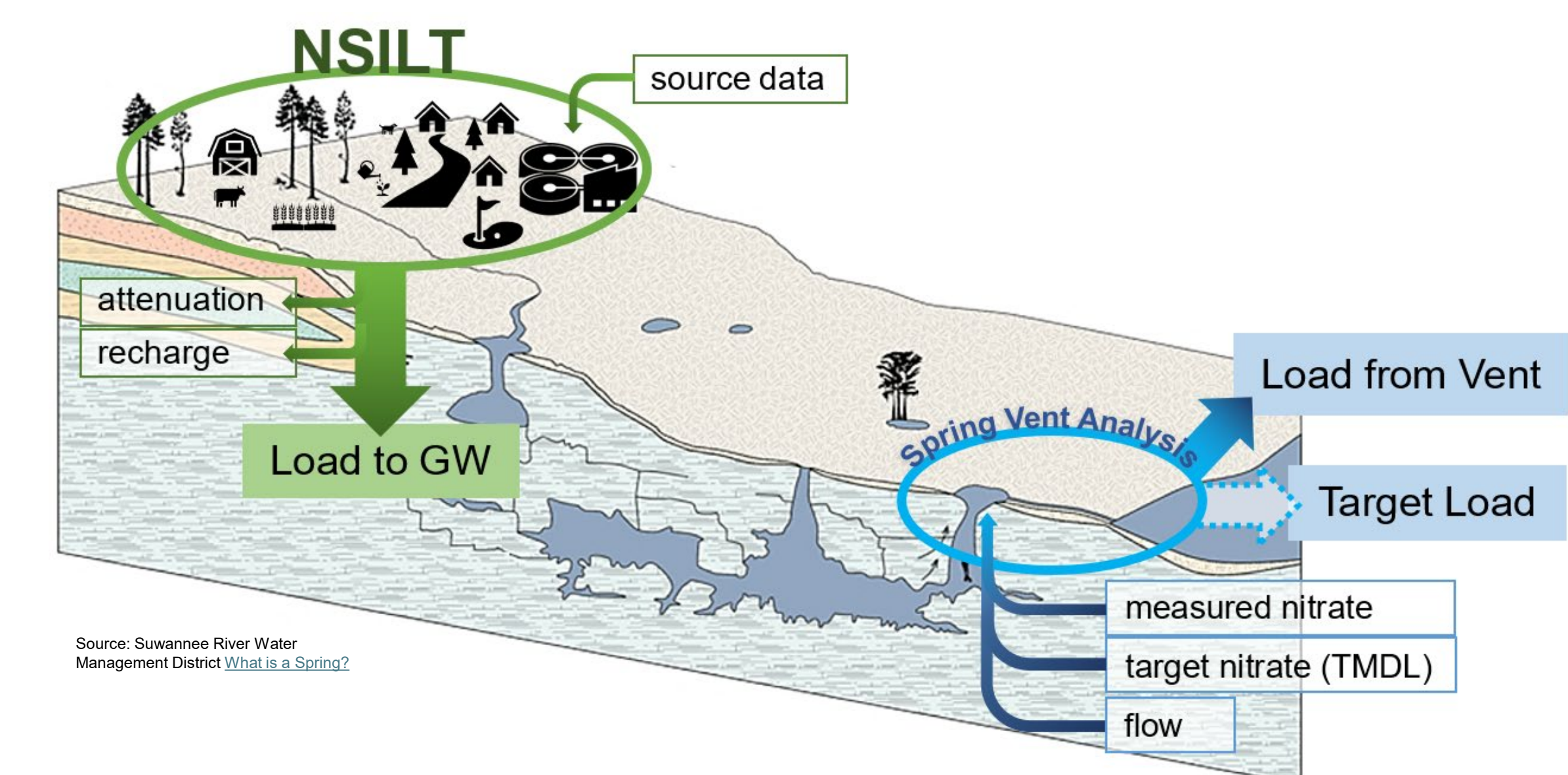
The Florida Department of Agriculture and Consumer Services' (DACS) Florida Statewide Agriculture Irrigation Demand (FSAID) database and U.S. Department of Agriculture's (USDA) Census of Agriculture data were used to estimate agricultural loading.



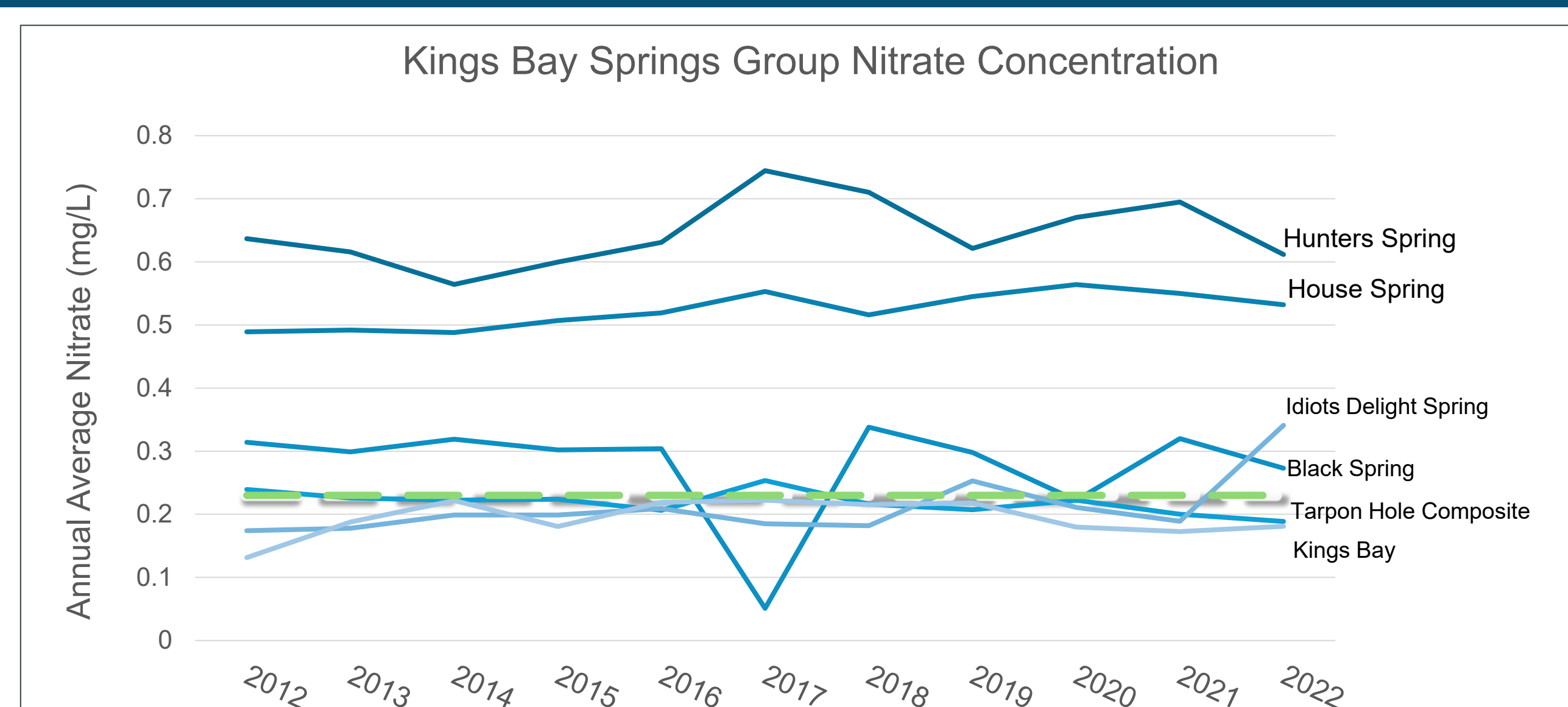
Spring Vent Analysis

Spring vent flows and nitrate concentration data were reviewed to evaluate the total load of nitrate discharging from the spring in pounds of nitrogen per year (lbs-N/yr).

Approximately 43% more nitrate is discharged than the waterbodies can assimilate. This 43% represents the overall reduction needed to achieve the water quality target.



It is estimated that a proportional decrease in loading is needed to resolve the impairment. So, the 43% reduction was applied to the NSILT loading to derive the load reductions needed from the various nitrogen sources.



	Kings Bay Nitrogen Loads (lbs-TN/yr)	Source
Total Load at Spring Vents	453,400	Upper 95% confidence interval - nitrate data from 2012 – 2022.
TMDL Load (October 2023)	259,009	TMDL target is 0.23 mg/L and using the same flow data from 2012-2022.
Reductions Needed at Spring Vent	194,391	
Percent Required Reductions	43%	Based on Spring Vent Load and TMDL Load
Required Reductions	348,712	Based on NSILT Load and Percent Reduction at Spring Vent





CRYSTAL RIVER/KINGS BAY

Allocated Reductions, Milestones and Progress

Basin Required Reductions

Nitrogen Source	Allocations by Source (lb-N/yr)	Percent of Total Reduction
Atmospheric Deposition*	29,626	8.39%
Onsite Sewage Treatment and Disposal System	171,965	48.72%
Wastewater Treatment Facility	25,323	7.17%
Farm Fertilizer (BMP Enrollment)	6,890	1.95%
Livestock Waste-NonCAFO (BMP Enrollment)	3,267	0.93%
Other Agriculture	26,021	7.37%
Urban Turfgrass Fertilizer	77,781	22.03%
Sports Turf-Golf	11,201	3.17%
Sports Turf-Other	925	0.26%
Total	352,998	100.00%

*Not allocated to entities.
CAFO = Confined animal feeding operation.

Management Strategies

General Approach for Entity Allocations and Reductions

While the loading evaluation and entity allocations were determined by source, nutrient reduction credits can be earned through projects addressing any source. Reduction milestones must be met to ensure sufficient progress towards remediation.

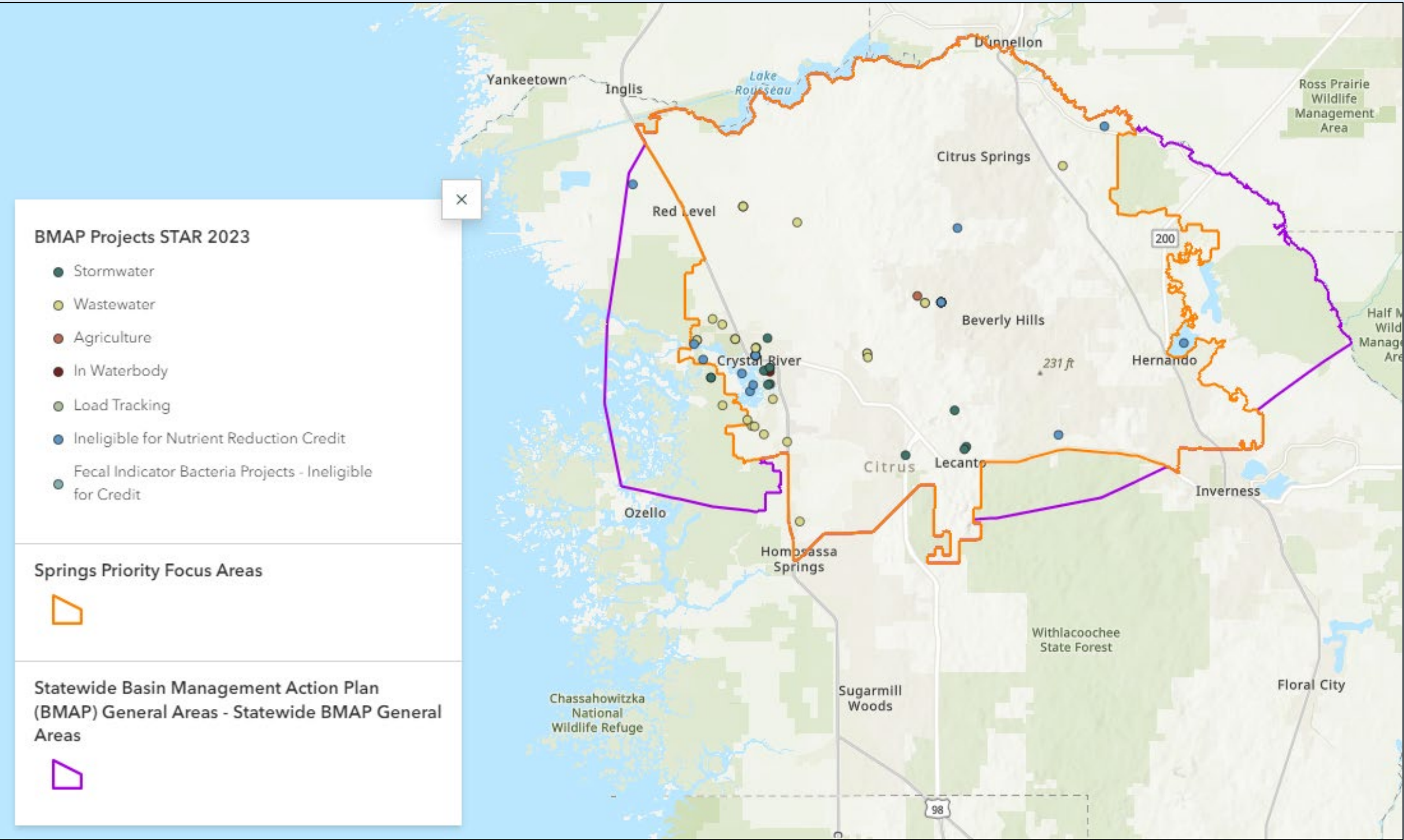
Source-Specific Management Strategies:

- Atmospheric Deposition:** Due to continuing air regulations, atmospheric nitrogen emissions in Florida has been trending downwards since 2005 (Himes & Dawson, 2017).
- Onsite Sewage Treatment and Disposal Systems (OSTDS):** No new installation for conventional septic systems on lots of 1 acre or less. All OSTDS within the priority focus area (PFA) will need to be upgraded or sewerred.
- Wastewater Treatment Facilities:** Surface water discharges from facilities must meet advanced waste treatment (AWT). Other discharge methods must meet AWT standards, if the Florida Department of Environmental Protection (DEP) determines the treatment is needed.
- Farm Fertilizer Best Management Practices (BMP) Enrollment:** An estimated reduction in nitrogen of 15% when a producer enrolls in the Florida Department of Agriculture and Consumer Services (DACS) BMP program and implements BMPs. This program or water quality monitoring is mandatory in BMAP areas.
- Livestock Waste BMP enrollment:** An estimated reduction in nitrogen of 10% when a livestock producer enrolls in the DACS BMP program and implements BMPs. This program or water quality monitoring is mandatory in BMAP areas.
- Other Agricultural Activities:** The remainder of reductions allocated to agricultural sources will need be addressed through a combination of regional agricultural projects, agricultural cooperative regional elements, innovative technologies and cost-share projects.
- Urban Turfgrass Fertilizer:** Ordinances, education, street sweeping and structural stormwater improvements will help to reduce loading from urban turfgrass fertilization.
- Sports Turfgrass Fertilizer – Golf:** Operators will be required to develop a nutrient management plan to ensure fertilizers are being managed responsibly.
- Sports Turfgrass Fertilizer – Other:** Owners/operators must follow the upcoming Sports Turfgrass BMP manual to ensure fertilizers are managed responsibly.

Projects

Project collecting and reporting are crucial to the successful execution and management of basin management action plans (BMAPs). Projects are reported to DEP annually through the Statewide Annual Report (STAR) process. As of Dec. 30, 2023, 34 projects have been completed in the basin.

The benefits of some completed projects were captured in the updated loading estimates. Total reductions achieved by each entity and the basin totals have been updated to reflect these changes.



Stakeholders are required to report projects that are being implemented or planned to achieve the reduction targets, along with an estimate of expected nutrient loading benefits and financial costs.

It is important that all projects necessary to achieve milestone targets are included in the report, even if a funding mechanism is not currently identified. This information provides information about the funding needed to achieve BMAP goals and assists with the prioritization of projects.

Entity Required Reductions

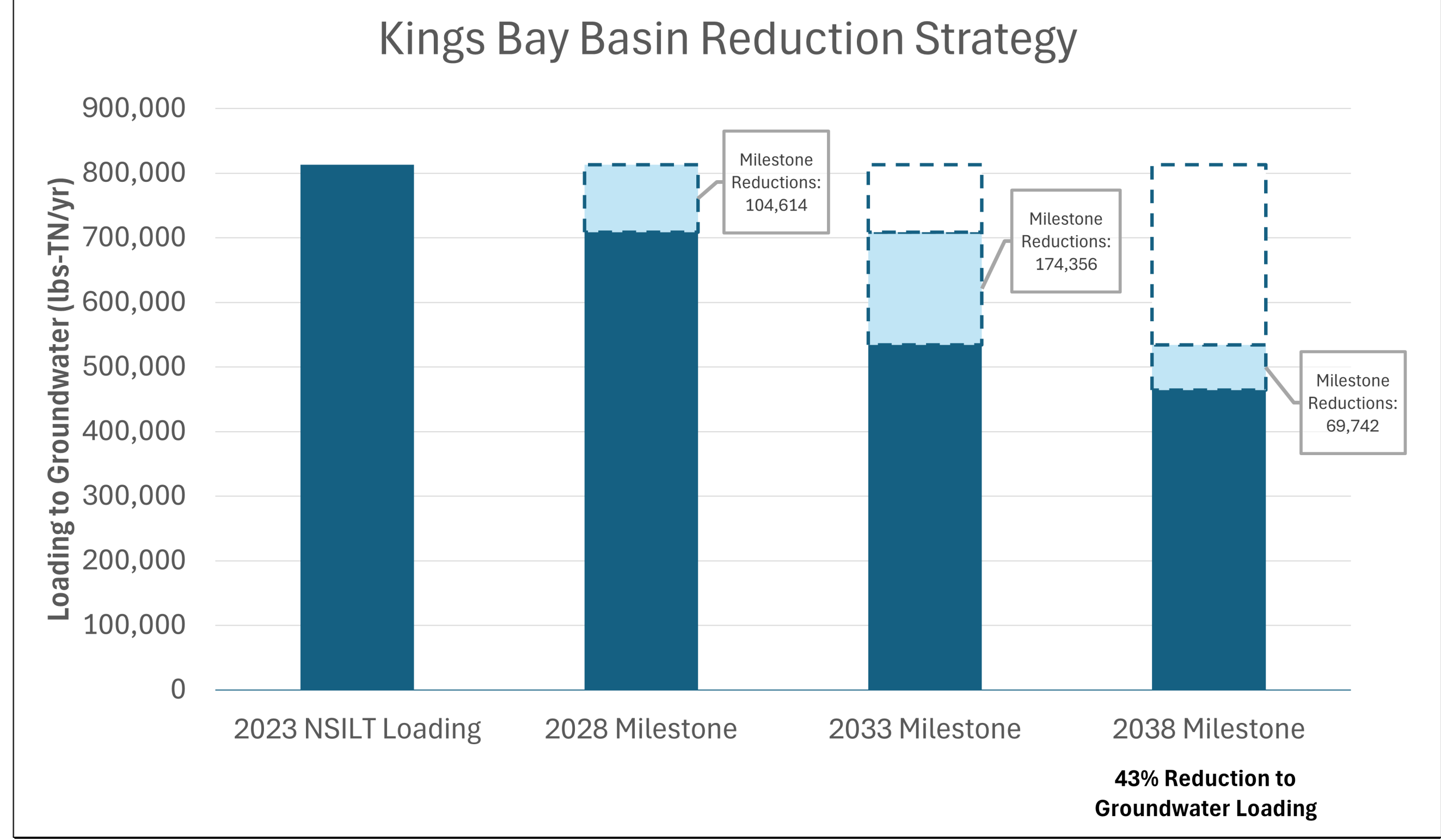
Entity	2028 Milestone (30%)	2033 Milestone (80%)	2038 Milestone (100%)
Citrus County	77,661	207,096	258,870
City of Crystal River	1,456	3,884	4,854
Agriculture	10,853	28,942	36,178
Private Wastewater Facilities	3,680	9,814	12,268
Private Golf Courses*	3,361	8,962	11,202

*Reductions for these entities will be tracked through permits and compliance actions.

Entity 2028 Milestones

The overall reduction strategy for Kings Bay-Crystal River is illustrated by the bar chart below. The results of the NSILT are summarized in the first bar to the left, with different sources contributing to the total estimated load to groundwater.

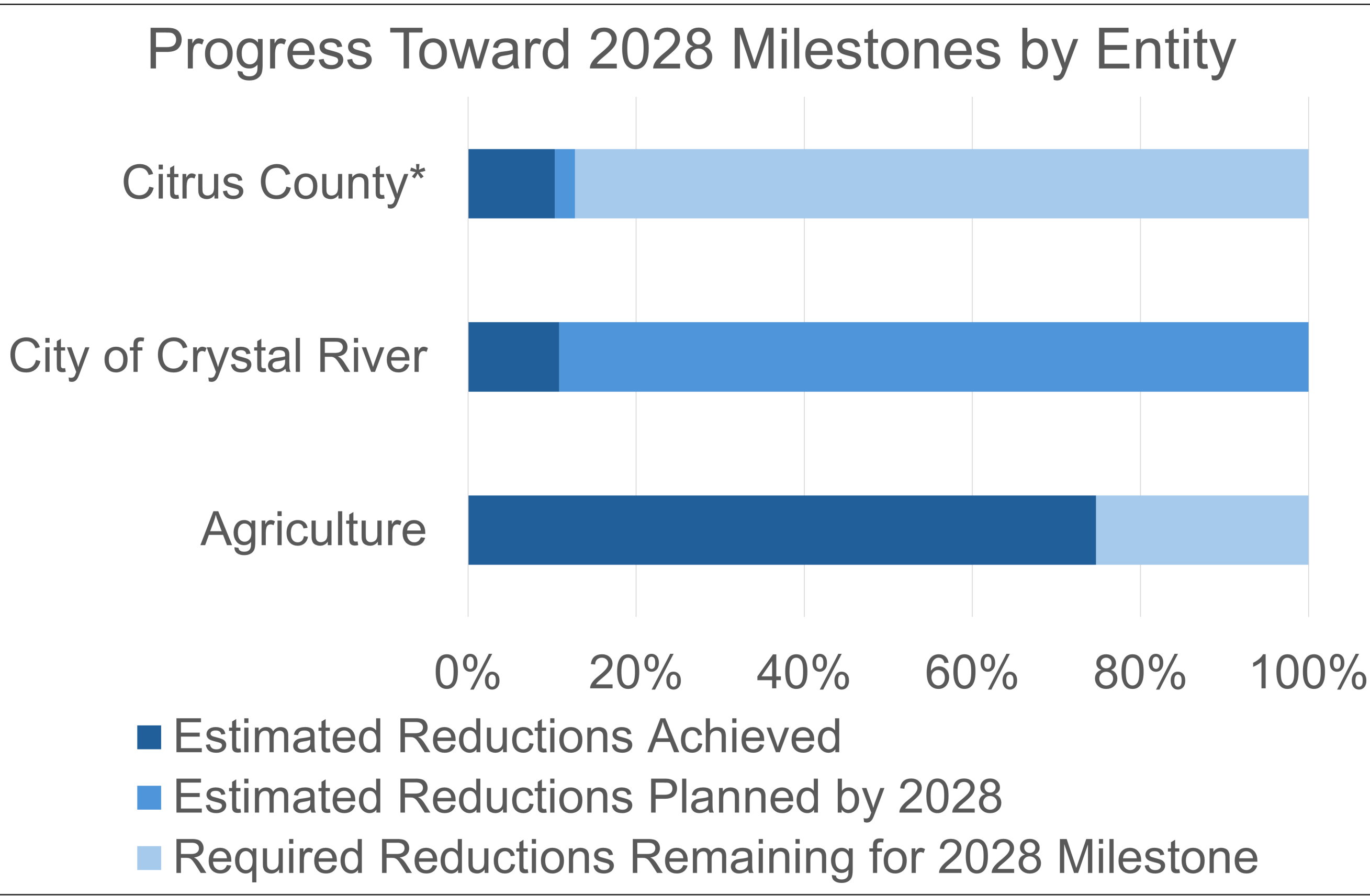
The bars to the right show the basin-wide goals from all entities and all sources in 2028, 2033 and 2038 to achieve an overall 43% reduction in nitrogen loading.



The basin-wide reduction goal for 2028 is 104,614 lbs-TN/yr.

Below is a progress chart for responsible entities in the basin showing achieved reductions and reductions from projects planned through the 2028 milestone.

Estimated reductions reflect projects entered through December 2023.



*Citrus County has identified projects that are estimated to achieve 86% of total allocated reductions by the 2038 milestone.



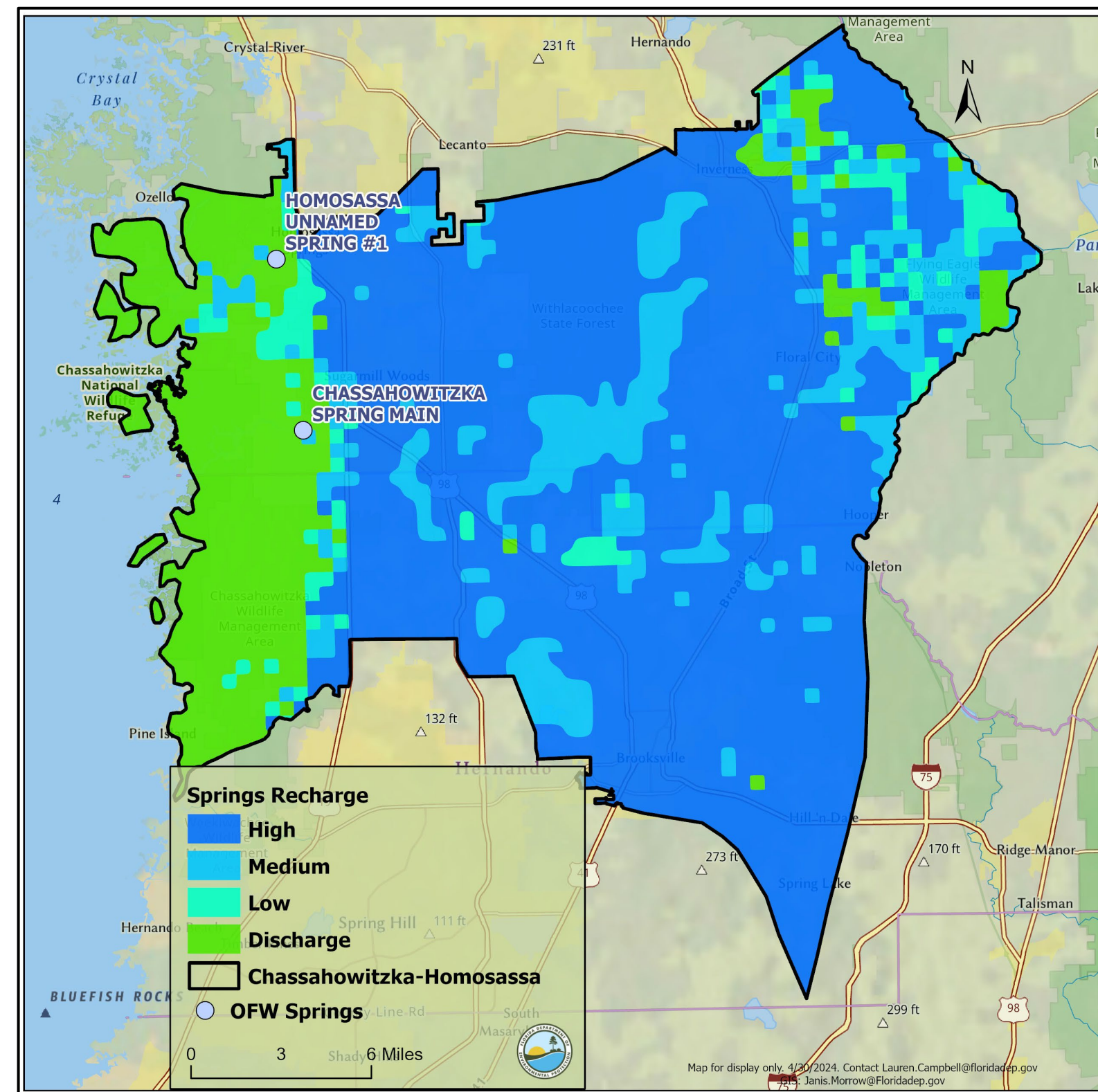


HOMOSSASSA-CHASSAHOWITZKA SPRINGS GROUPS

Springs Basin Analyses

Homosassa-Chassahowitzka Springs Basin Management Action Plan (BMAP)

The first step to address nitrogen impairments in Homosassa and Chassahowitzka springs is to inventory nitrogen sources in the basin. This was completed through the **Nitrogen Source Inventory Loading Tool (NSILT)**. The NSILT evaluates the loading after attenuation from various sources and considered the recharge potential based on spatial and geologic factors.



This figure shows the generalized recharge zones in the basin.

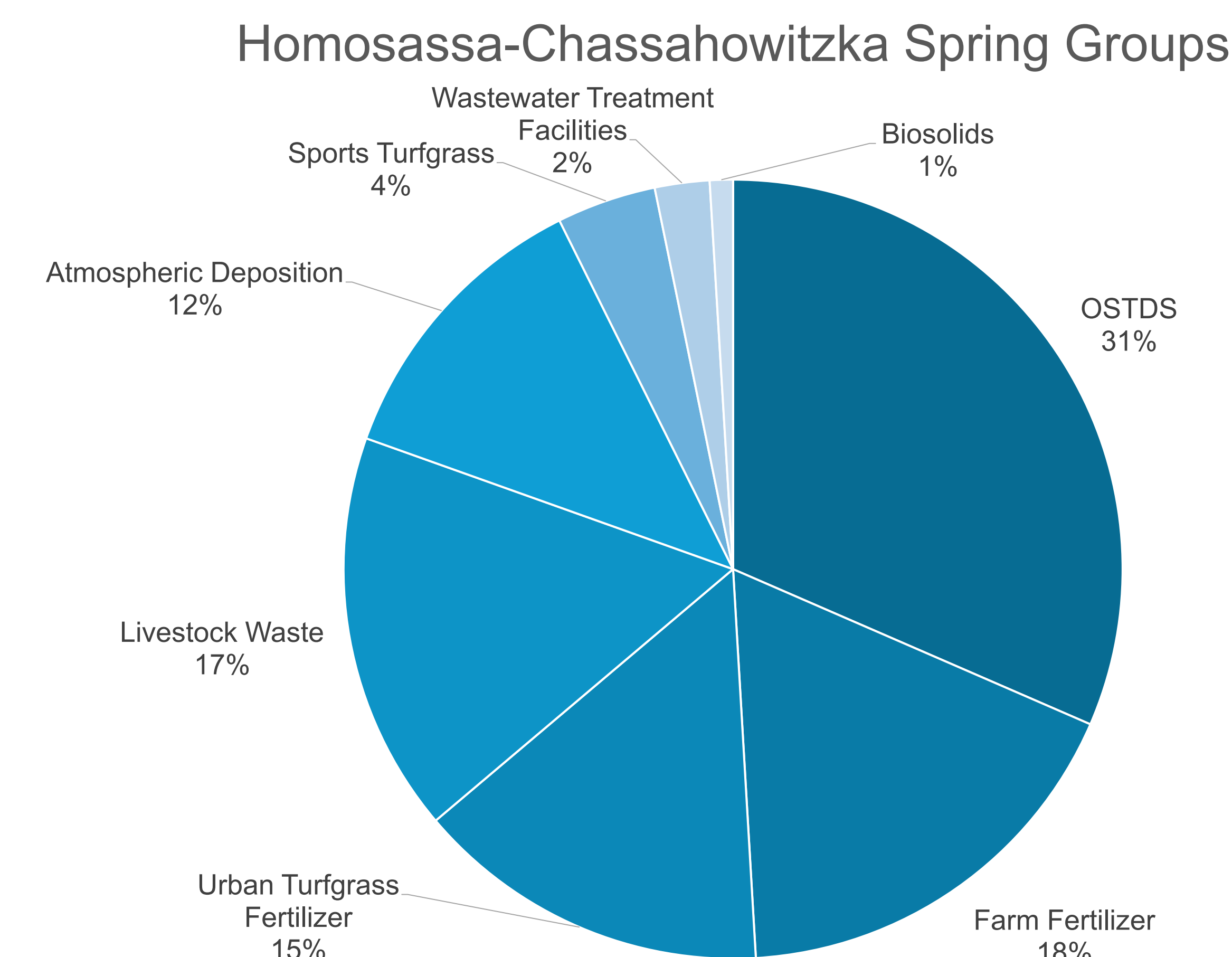
High recharge indicates areas where more water is expected to percolate into the Upper Floridan Aquifer and travel to the spring vent.

Discharge represents areas where water is expected to flow to a surface waterbody and not significantly impact groundwater.

NSILT Summary

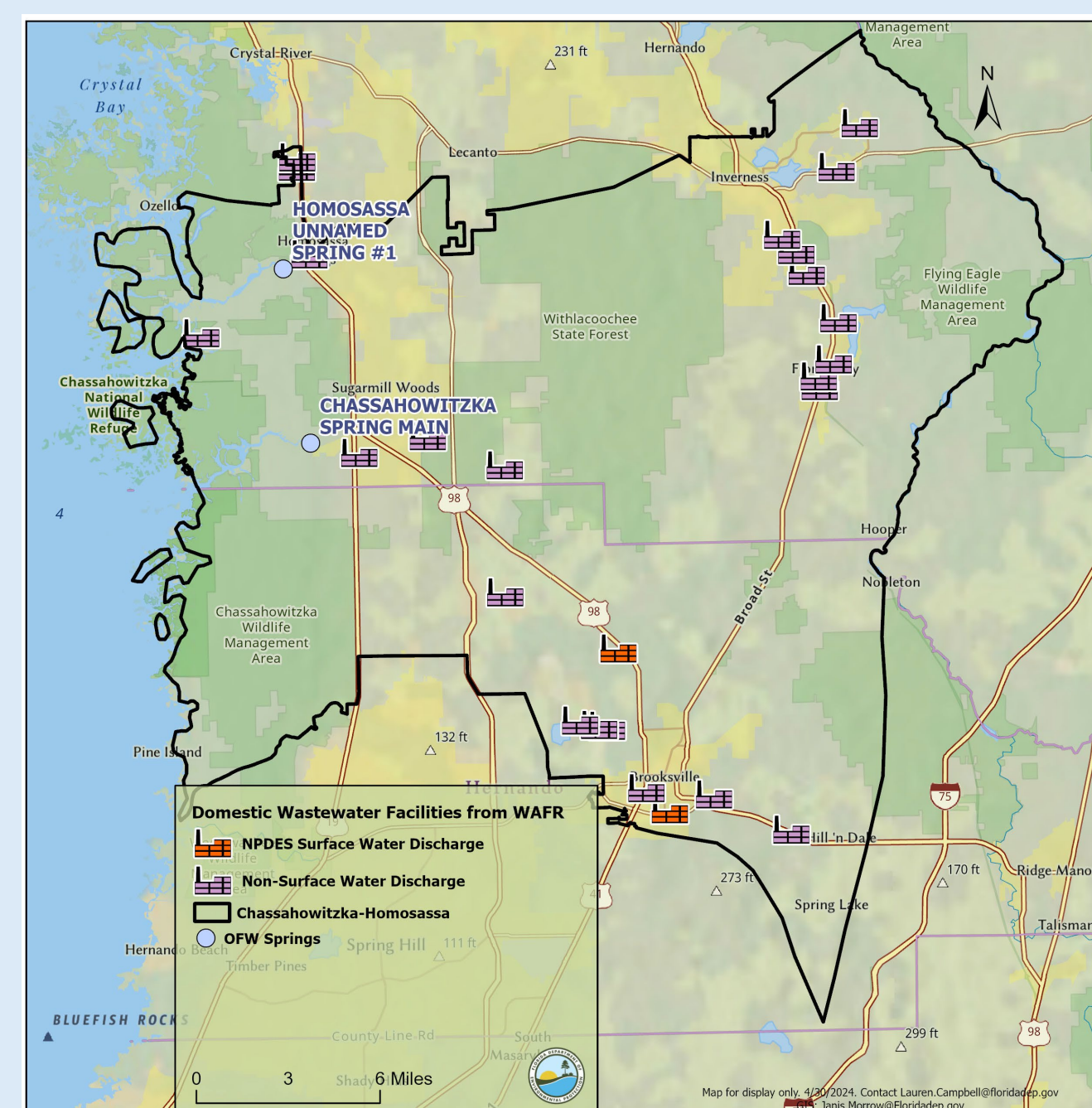
Homosassa Chassahowitzka Spring Groups	
Source	Annual Loading (lbs-N/yr)
Atmospheric Deposition	114,751
Wastewater Treatment Facilities	21,353
OSTDS	296,631
Urban Turfgrass Fertilizer	138,910
Sports Turfgrass Fertilizer	38,827
Farm Fertilizer	165,150
Livestock Waste	156,435
Biosolids	9,043
Total	941,100

The pie chart below shows the comparative contribution of various nitrogen sources to the Homosassa and Chassahowitzka basins.



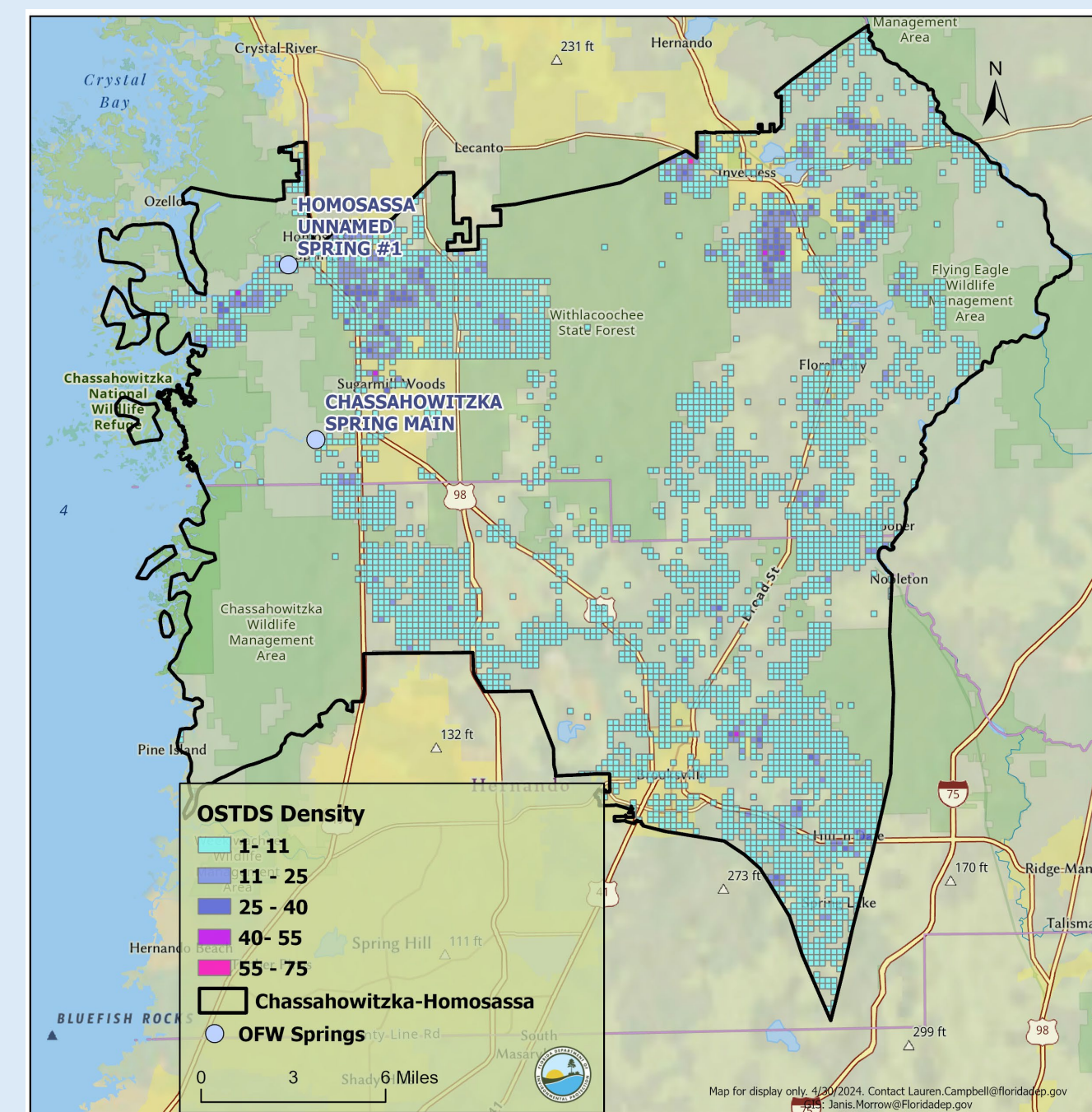
Lbs-N/yr: Pounds of nitrogen per year

Urban Source Loading



Onsite sewage treatment and disposal systems (OSTDS), also known as septic systems, contribute 31% of the nitrogen load in the BMAP area. The figure to the right shows OSTDS density per 300-meter by 300-meter grid cell.

Thirty **wastewater treatment facilities** combine to contribute 2% of the total nitrogen load in the basin. The figure to the left shows the location of domestic wastewater facilities in the basin.

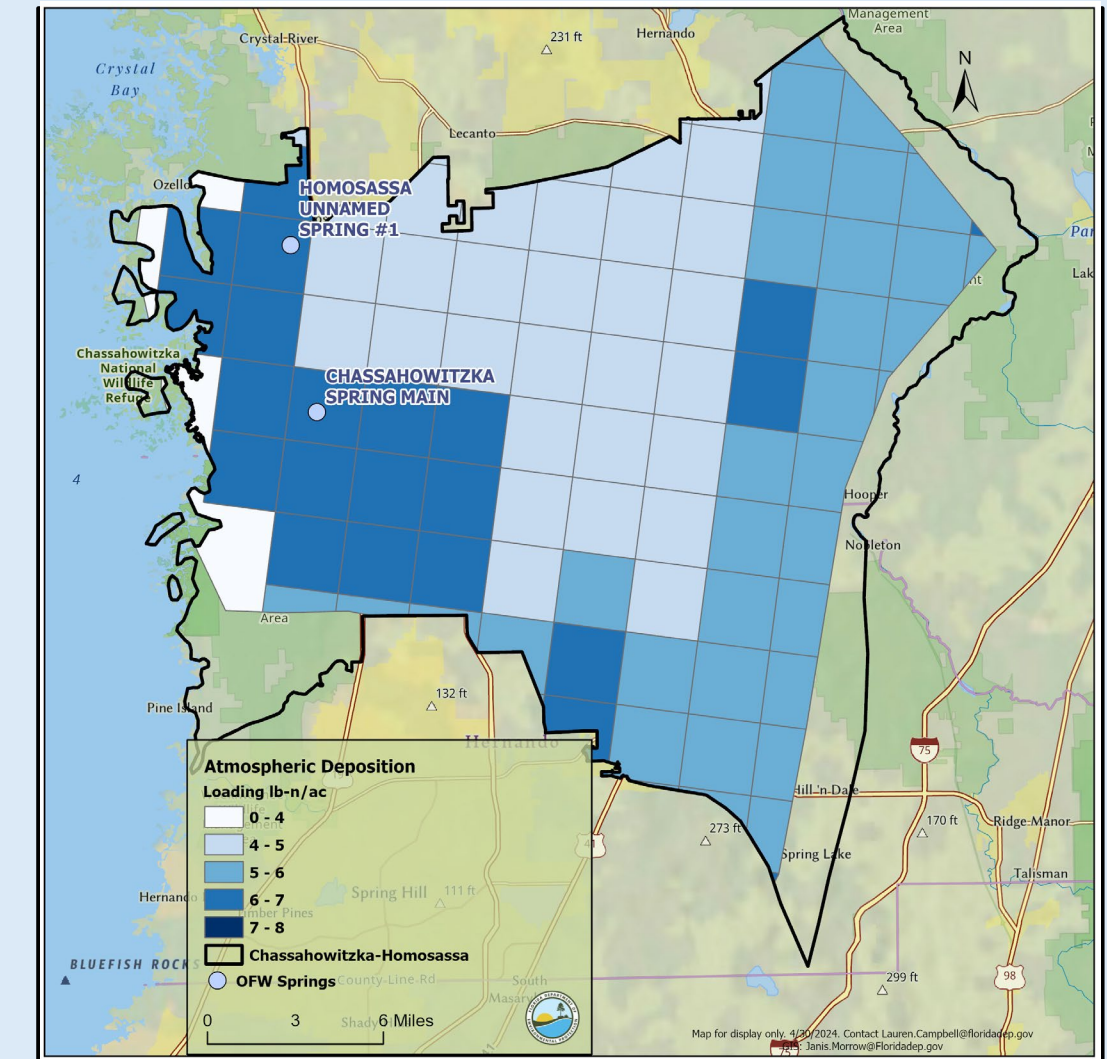


Urban turfgrass from single family residential sources and other urban areas comprise 15% of the total nitrogen load in the basin.

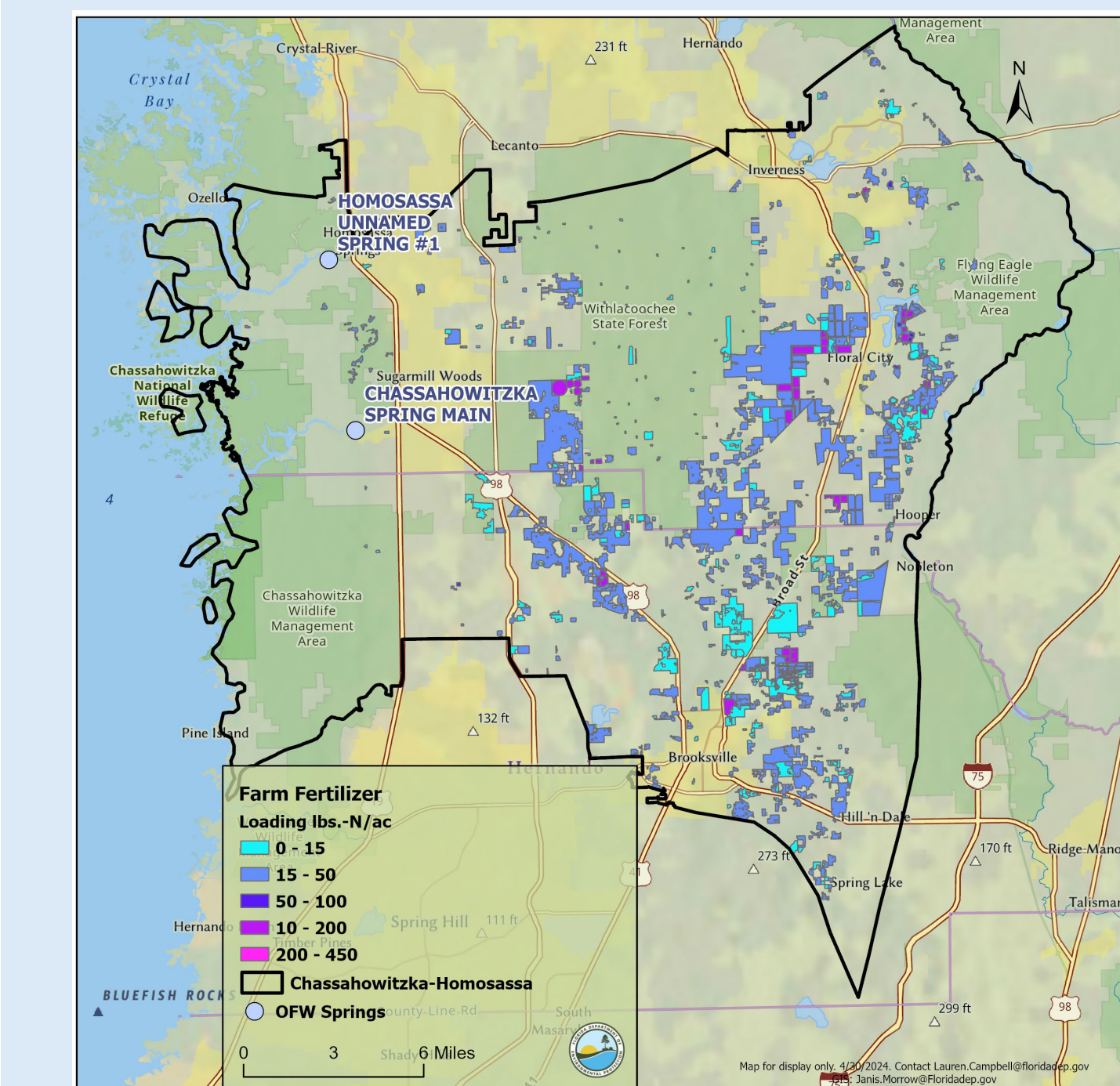
Atmospheric Deposition

Atmospheric deposition was estimated using data from the Total Deposition Science Committee (TDep) Model. TDep estimates annual deposition on 4-kilometer by 4-kilometer grid squares.

Atmospheric deposition accounts for 12% of total loading within the Homosassa-Chassahowitzka BMAP area.



Agricultural Source Loading



Agricultural sources include farm fertilizer (18% contribution) and livestock waste (17% contribution).

The Florida Department of Agriculture and Consumer Services' (DACS) Florida Statewide Agriculture Irrigation Demand (FSAID) database and U.S. Department of Agriculture's (USDA) Census of Agriculture data were used to estimate agricultural loading.

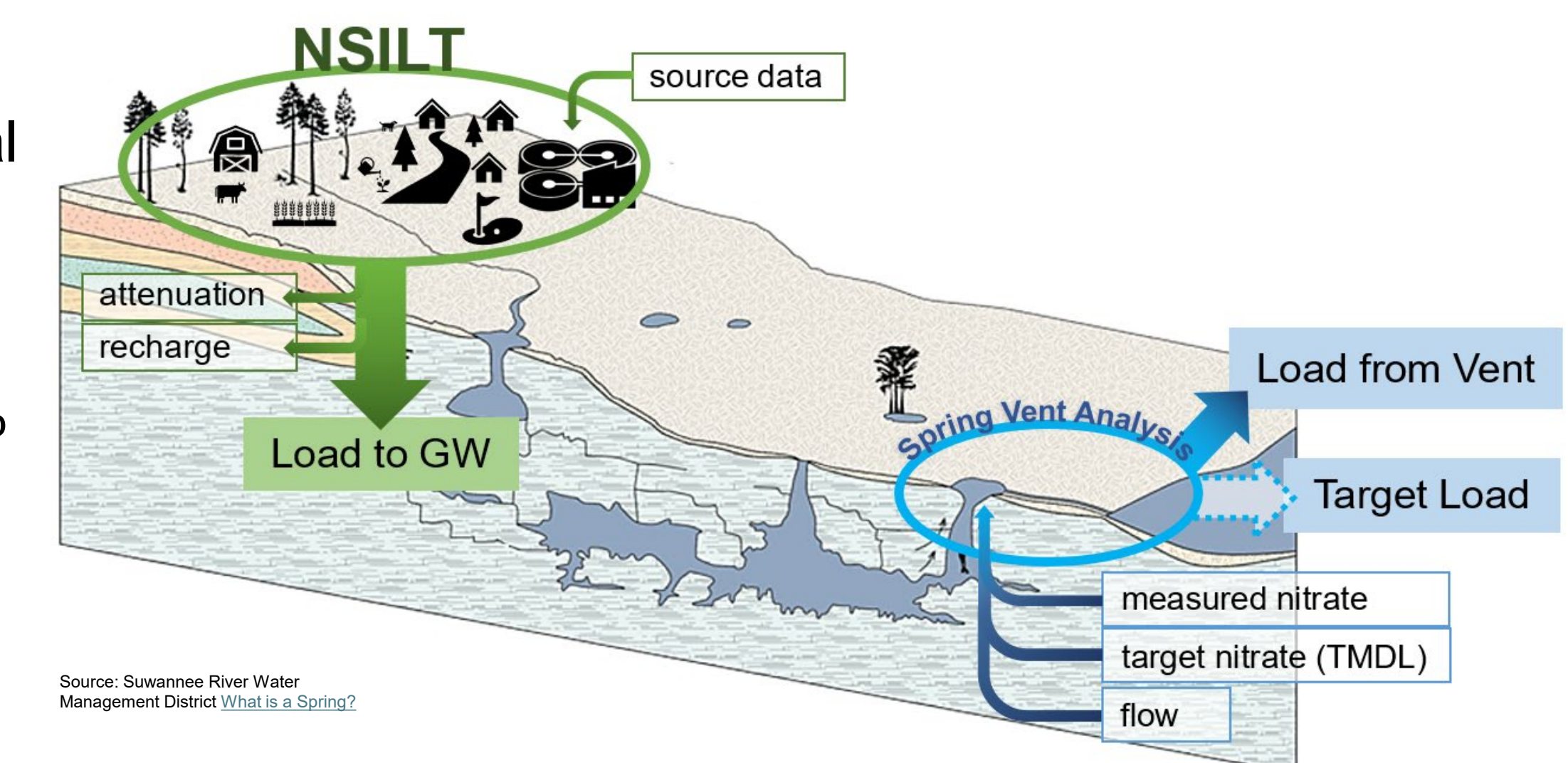
Spring Vent Analysis

	Homosassa Nitrogen Loads (lbs-TN/yr)	Chassahowitzka Nitrogen Loads (lbs-TN/yr)	Source
Total Load at Spring Vents	271,301	207,128	Upper 95% confidence interval - nitrate data from 2012 – 2022.
TMDL Load (October 2023)	94,924	82,543	TMDL target is 0.23 mg/L and using the same flow data from 2012-2022.
Reductions Needed at Spring Vent	176,377	124,585	
Percent Required Reductions	65%	60%	Based on Spring Vent Load and TMDL Load
Required Reductions	382,666	212,017	Based on NSILT Load and Percent Reduction at Spring Vent

Spring flow and nitrate concentration data were reviewed to evaluate the total mass (lbs-TN/yr) of nitrate discharging from the spring.

Approximately 65% and 60% more nitrate is discharged than the waterbodies can assimilate without impairment. This represents the reductions needed to achieve the water quality goals.

It is estimated that a proportional decrease in loading is needed to resolve the impairment, so the same reduction percentage (65% for Homosassa and 60% for Chassahowitzka) is applied to the NSILT loading estimates to derive the load reductions needed from sources within each spring basin.



Chandler Keenan, Basin Coordinator
Chandler.B.Keenan@FloridaDEP.gov
850-245-8555



HOMOSASSA-CHASSAHOWITZKA SPRINGS GROUPS

Allocated Reductions, Milestones and Progress

Basin Required Reductions

Nitrogen Source	Homosassa		Chassahowitzka	
	Allocations by Source (lb-N/yr)	Percent of Total Reduction	Allocations by Source (lb-N/yr)	Percent of Total Reduction
Atmospheric Deposition*	46,033	12.03%	26,432	11.64%
Onsite Sewage Treatment and Disposal System	139,891	36.56%	48,993	21.57%
Wastewater Treatment Facility	1,326	0.35%	11,236	4.95%
Farm Fertilizer (BMP Enrollment)	16,331	4.27%	8,441	3.72%
Livestock Waste-NonCAFO (BMP Enrollment)	8,194	2.14%	6,667	2.94%
Other Agriculture	104,611	27.34%	64,721	28.50%
Urban Turfgrass Fertilizer	56,532	14.77%	31,249	13.76%
Sports Turf-Golf	7,888	2.06%	14,579	6.42%
Sports Turf-Other	984	0.26%	528	0.23%
Regional Projects*	874	0.23%	14,280	6.29%
Total	382,664	100.00%	227,126	100.00%

*Not allocated to entities.
CAFO = Confined animal feeding operation.

Management Strategies

General Approach for Entity Allocations and Reductions

While the loading evaluation and entity allocations were determined by source, nutrient reduction credits can be earned through projects addressing any source. Reduction milestones must be met to ensure sufficient progress towards meeting the total maximum daily load (TMDL) restoration target.

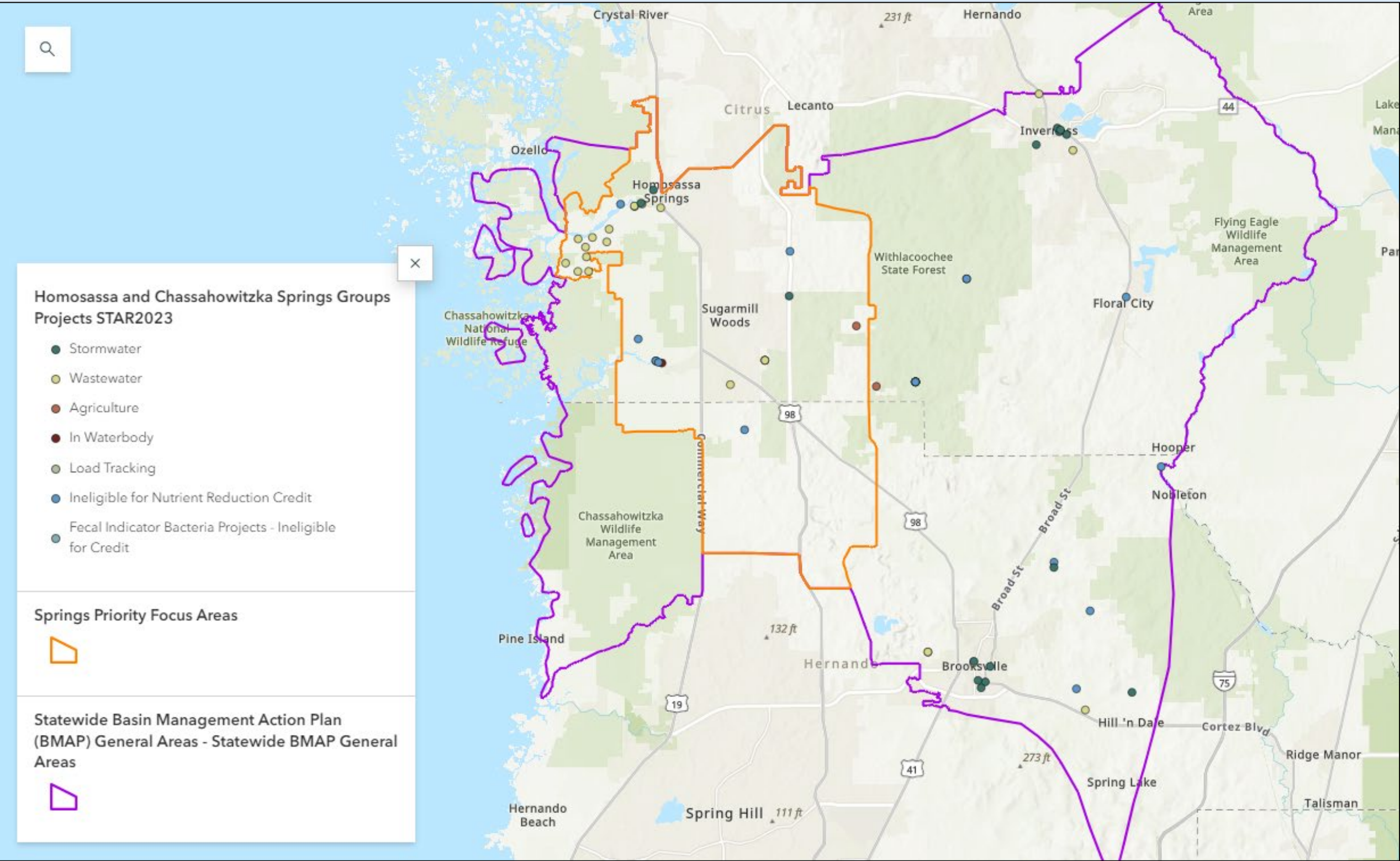
Source-Specific Management Strategies:

- Atmospheric Deposition:** Due to continuing air regulations, atmospheric nitrogen emissions in Florida has been trending downwards since 2005 (Himes & Dawson, 2017).
- Onsite Sewage Treatment and Disposal Systems (OSTDS):** No new installation for conventional septic systems on lots of 1 acre or less. All OSTDS within the priority focus area (PFA) will need to be upgraded or sewerred.
- Wastewater Treatment Facilities:** Surface water discharges from facilities must meet advanced waste treatment (AWT). Other discharge methods must meet AWT standards, if the Florida Department of Environmental Protection (DEP) determines the treatment is needed.
- Farm Fertilizer Best Management Practice (BMP) Implementation:** An assumed 15% reduction in nitrogen leaving the site when a producer enrolls in the Florida Department of Agriculture and Consumer Services (DACS) BMP program and implements BMPs.
- Livestock Waste BMP Implementation:** An assumed 10% reduction in nitrogen leaving the site when a livestock producer enrolls in the DACS BMP program and implements BMPs.
- Other Agricultural Activities:** The remainder of reductions allocated to agricultural sources will need be addressed through a combination of regional agricultural projects, agricultural cooperative regional elements, innovative technologies and cost-share projects.
- Urban Turfgrass Fertilizer:** Ordinances, education, street sweeping and structural stormwater improvements will help to reduce loading from urban turfgrass fertilization.
- Sports Turfgrass Fertilizer – Golf:** Operators will be required to develop a nutrient management plan and perform monitoring to ensure that fertilizers are managed responsibly.
- Sports Turfgrass Fertilizer – Other:** Owners/operators must follow the upcoming Sports Turfgrass BMP manual to ensure fertilizers are managed responsibly.
- Biosolids:** Land application of Class A or Class B domestic wastewater biosolids must be in accordance with a DEP-approved NMP.

Projects

Project collection and reporting are crucial to the successful execution and management of basin management action plans (BMAPs). Projects are reported to DEP annually through the Statewide Annual Report (STAR) process. As of Dec. 30, 2023, 25 projects have been completed in the basin.

The benefits of some completed projects were captured in the updated loading estimates. Total reductions achieved by each entity and the basin totals have been updated to reflect these changes.



Stakeholders are required to report projects that are being implemented or planned that will be necessary to achieve the reduction targets, along with an estimate of expected nutrient loading benefits and financial costs.

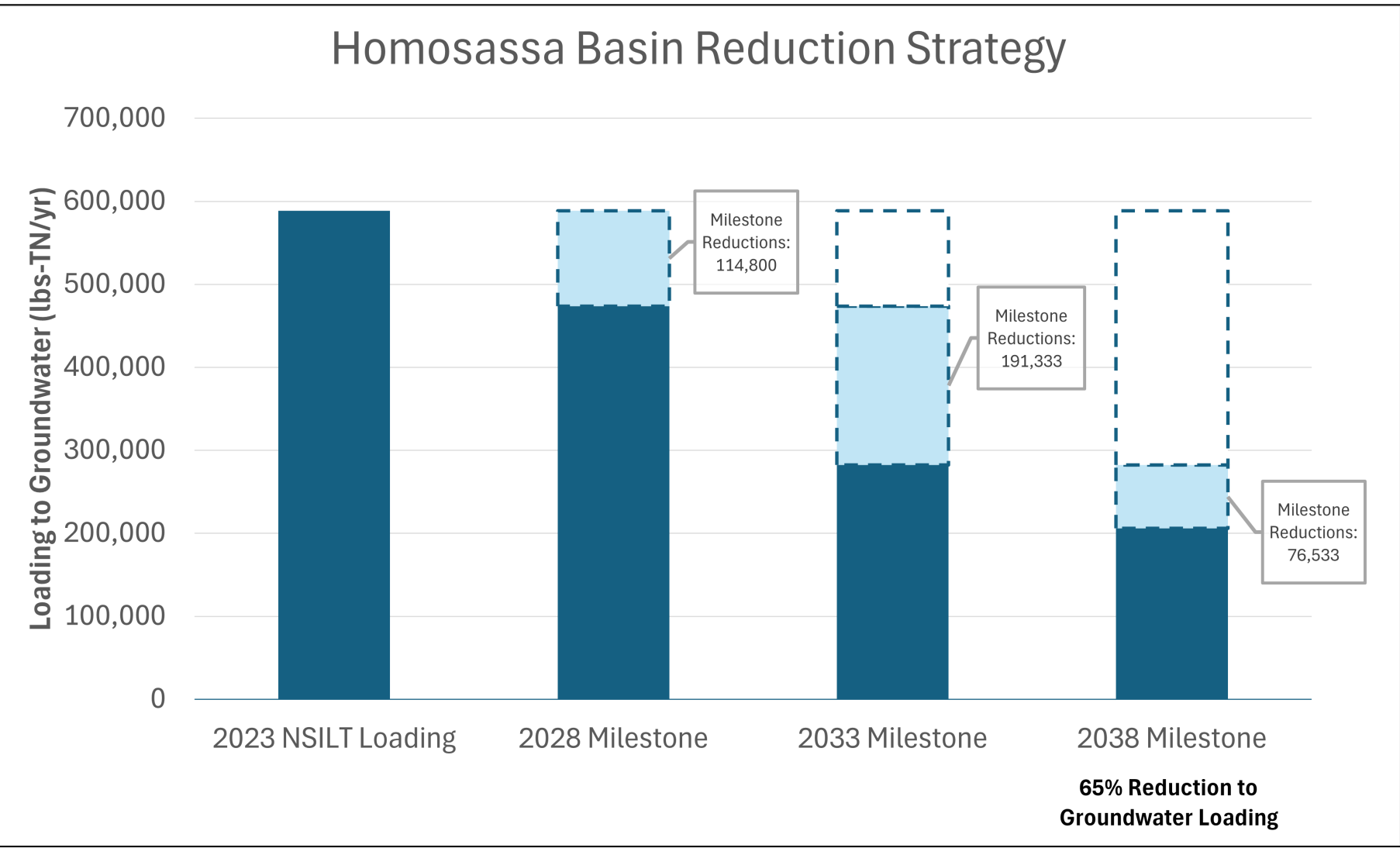
It is important that all projects necessary to achieve milestone targets are included in the report, even if a funding mechanism is not currently identified. It provides information on the funding needed for projects assists with the prioritization of projects.

Entity Required Reductions

Entity	2028 Milestone (30%)	2033 Milestone (80%)	2038 Milestone (100%)
Citrus County	56,836	151,562	189,453
City of Inverness	2,254	6,010	7,512
Hernando County	26,068	69,515	86,894
City of Brooksville	1,483	3,955	4,944
Agriculture	301,405	835,747	208,966
Private Wastewater Facilities*	581	1,550	1,938
Private Golf Courses*	6,740	17,974	22,468

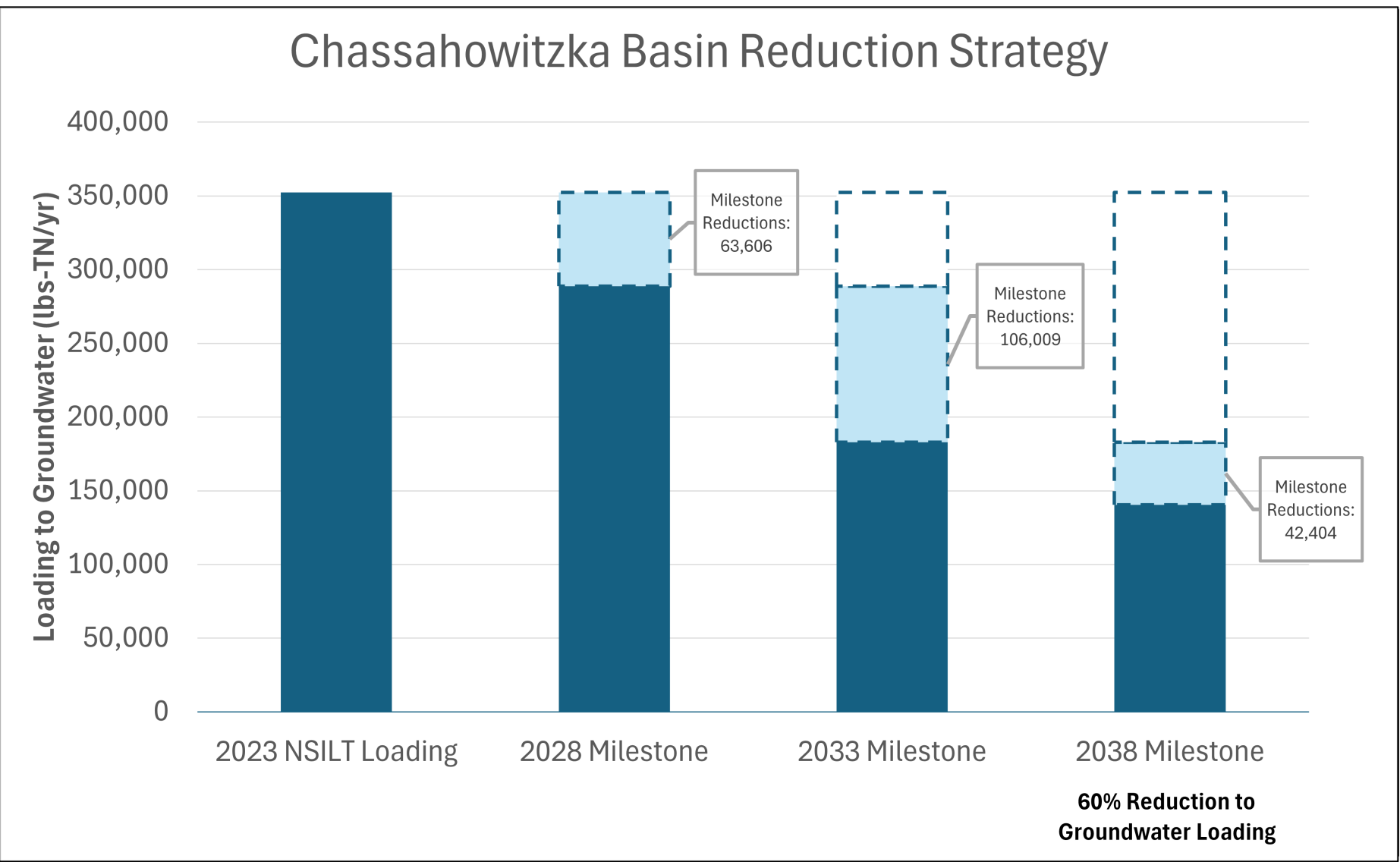
*Reductions for these entities will be tracked through permits and compliance actions.

Entity 2028 Milestones



These charts illustrate the overall reduction strategies for Homosassa and Chassahowitzka springs. The results of the NSILT are summarized in the first bar to the left of each figure, with different sources contributing to the total estimated load to groundwater.

The series of blue bars to the right show the basin-wide goals from all entities and all sources in 2028, 2033 and 2038 to achieve overall reductions of 60 and 65% in nitrogen loading.



The basin-wide reduction goal for 2028 is 178,405 lbs-TN/yr.

Below is a progress chart for responsible entities in the basin showing achieved reductions and reductions from projects planned through the 2028 milestone.

Estimated reductions reflect projects entered through December 2023.

Progress Toward 2028 Milestones by Entity

