Plant Survey for the Endangered Small's Milkpea (*Galactia smallii)* and Candidate Sand Flax *(Linum arenicola)* Dade County Florida, Adjacent to SOCSOUTH Headquarters Homestead, Florida

PO 952722

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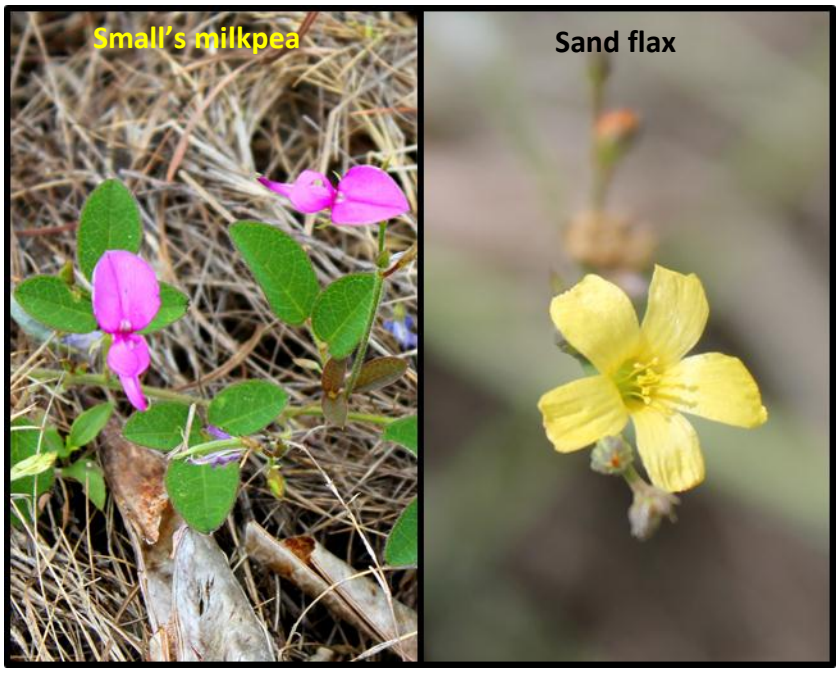

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Introduction

The Institute for Regional Conservation (IRC) conducted plant surveys adjacent to the Special Operations Command South (SOCSOUTH) Headquarters in Miami-Dade County, Florida. The areas surrounding the survey area to the south, east, west are the Homestead Air Reserve Base, Florida Army National Guard, and SOCSOUTH respectively, and to the north are agricultural lands.

Pine rockland's once dominated south Florida's coastal ridge. Pine rocklands are dominated by a single canopy tree, slash pine (*Pinus elliottii*), with a diverse hardwood and palm subcanopy. A rich herbaceous layer contains many endemic species. The pine rockland habitat is considered a fire climax community. Fire helps maintain pine rockland plant communities by controlling the amount of vertical structure, invasion and growth of hardwoods, species composition, and allows light to reach the understory and herbaceous plants. Anthropogenic habitat destruction has resulted in the loss of much of this habitat leaving only remnant patches of pine rocklands.

In Miami-Dade County, the pine rocklands are associated with the Miami Rock Ridge, a formation of oolitic limestone. Pine rocklands occur on relatively flat limestone rock that is at or near the surface. Soils often accumulate in depressions and rock cavities and consist of sand, marl, and organic material. It is here that many rare and endemic plant species thrive.

The survey area is situated on parts of the Miami Rock Ridge and contain several areas of pine rockland fragments. A preliminary survey, revealed the presence of two rare plant species, *Galactia smallii* (Small's milkpea), which is listed as endangered under the Endangered Species Act (ESA), and *Linum arenicola* (sand flax), which is a candidate for listing under the ESA. These species were found in many parts of the survey area, at varying densities. The two species were growing in relictual pine rockland habitats and areas that had formerly been cleared for construction of buildings and parking lots in order to create the Homestead Air Force Base (HAFB). The infrastructure was abandoned in the 1990's and substantial overgrowth of native and invasive species has occurred.

It was determined that a survey should be conducted to determine the distribution and density of both *Galactia smallii* and *Linum arenicola.*

Methods

The objective of this project was to obtain baseline location data and densities for the federally endangered *Galactia smallii* and federal candidate *Linum arenicola* at the time of the survey. The boundaries and polygons (approximately 113 acres) for the project were obtained as ESRI ArcMap shape files from the Department of Defense (Figure 1). Rare species surveys were conducted in areas that contained potential habitat for *Galactia smallii* and *Linum arenicola*.

Following the initial surveys, to determine the locations of *Galactia smallii* and *Linum arenicola*, IRC returned to quantify the densities in the different populations. In areas where the populations were small (less than 10 meters (m) x10 m), randomly placed 1 m x 1 m plots were utilized within the population of plants to determine population size. In larger areas, each species (*Galactia smallii* and *Linum arenicola*) was quantified using randomly placed belt transects (1 m x 50 m).

Areas adjacent to SOCSOUTH were divided into larger Polygons (Figure 2) to aid in locating smaller sub-polygons of populations of *Galactia smallii* and *Linum arenicola*. Sub-Polygons of populations of *Galactia smallii* and *Linum arenicola* were created in ArcMap from data generated during the initial surveys and when we quantified their densities. While we searched for *Galactia smallii* and *Linum arenicola* we also documented exotic invasive species (Table 1), common native plants (Table 2) and state listed plant species (Table 3).

Results

All areas outlined (Figure 1) were surveyed for *Galactia smallii* and *Linum arenicola;* however, most populations were confined to the area adjacent to the air field (Figure 2). These results are confined to the time of the survey. During the surveys no other species considered as Endangered, Threatened, or Candidates by the U.S. Fish and Wildlife Service were found other than *Galactia smallii* and *Linum arenicola*. Additionally, a total of 19 species listed by the State of Florida Department of Agriculture and Consumer Services as Endangered or Threatened were found during the surveys (Table 3). These species are typical components of pine rocklands.

A total of 33 populations of *Galactia smallii* were mapped and 32 populations quantified (Figure 3). One sub-polygon (32) was destroyed by heavy equipment and was therefore not quantified. *Galactia smallii* was found in varying quantities throughout the area with the lowest average density of 0.01/ m^2 and highest density of 5.10/ m^2. The average density is 1.00 ± 0.18 (SE)/m^2. The total population is estimated at 10,974.35 ± 824.00 (SD) plants.

Fewer populations of *Linum arenicola* were found in the survey area (Figure 4). Eighteen populations were found with varying average densities; the lowest density of 0.10/ m^2 and the highest 11.00/ m^2. The average density of *Linum arenicola* is 2.27 ± 0.725 (SE)/m^2. The population estimate for *Linum arenicola* is estimated at 21,274.77 ± 2,224.00 (SD) plants.

Survey area 1

This area is highly impacted by buildings and parking lots, but holds good populations of both *Galactia smallii* and *Linum arenicola*. The populations are in danger of being outcompeted by exotic invasive species such as *Neyraudia reynaudiana* and *Schinus terebinthifolius.* The southern portion contains areas dominated by native vegetation; *Metopium toxiferum, Andropogon* spp., *Schizachyrium* spp., *Passiflora suberosa, Morinda royoc, Zamia integrifolia,* and *Chiococca parvifolia.* While surveying, a population of *Ernodea cokeri,* a Florida State Endangered species, was discovered**. The southern portion of survey area 1 would be a good site for a conservation area due to the high number of pine rockland species including Florida State Endangered species (*Linum arenicola)*, and Federal endangered species (*Galactia smallii)*.**

Figure 5, 6 and 7

Galactia smallii **Sub-polygons**	**Acres**	**Hectares**	**Density per m^2**	**Estimated Density**
0	0.390	0.158	1.98	3,123
1	0.003	0.001	2.00	27
2	0.016	0.007	1.00	66
4	0.032	0.013	0.04	5
5	<0.001	<0.001	2.00	6
6	0.137	0.055	0.30	166
7	0.001	<0.001	1.00	6
8	0.131	0.053	5.10	2,709
30	0.007	0.003	0.25	7
				Total 6,115

Figure 8 and 9

Linum arenicola **Sub-polygons**				
0	0.347	0.141	2.74	3,852
1	0.003	0.001	1.00	10
2	0.018	0.007	10.00	708
3	0.987	0.399	2.00	7,990
4	0.664	0.269	0.10	269
5	0.146	0.059	1.73	1,021
11	0.009	0.004	1.50	55
12	0.018	0.007	1.00	74
15	0.060	0.024	1.67	403
				Total 14,382

Exotic/invasive vegetation
Schinus terebinthifolius, Zoysia tenuifolia, Neyraudia reynaudiana, Stenotaphrum secundatum, Sporobolus indicus, Pennisetum purpureum

Common native vegetation
Chaptalia albicans, Crossopetalum ilicifolium, Chamaecrista nictitans var. aspera, Chamaecrista deeringiana, Chromolaena odorata, Setaria parviflora, Passiflora suberosa, Zamia integrifolia, Bidens alba var. radiata, Andropogon spp., Schizachyrium sanguineum, Schizachyrium gracile, Metopium toxiferum, Desmodium incanum

Florida Threatened species
Chaptalia albicans, Pteris bahamensis, Melanthera parvifolia, Smilax havanensis, Angadenia berteroi, Crossopetalum ilicifolium, Cynanchum blodgettii,

Florida State Endangered species
Linum arenicola, Selaginella armata Baker var. eatonii, Ipomoea microdactyla, Ernodea cokeri

Federal Endangered species
Galactia smallii

Survey area 2

Most of this area has been highly impacted by buildings and parking lots and large areas have been scrapped with a blade (graded). Exotic species dominate this area and are a threat to the populations of *Galactia smallii* and *Linum arenicola*.

Figure 10 and 11

Galactia smallii **Sub-polygons**	**Acres**	**Hectares**	**Density per m^2**	**Estimated Density**
3	0.002	<0.001	1.50	14
10	0.067	0.027	1.00	271
12	0.050	0.020	0.50	101
20	0.003	0.001	1.00	14
25	0.007	0.003	2.75	77
			Total	477

Figure 12
Linum arenicola
Sub-polygons

7	0.068	0.028	1.20	332
			Total	332

Exotic/invasive vegetation

Casuarina spp., Neyraudia reynaudiana, Zoysia tenuifolia, Stenotaphrum secundatum, Schinus terebinthifolius, Acacia auriculiformis, Ricinus communis

Common native vegetation

Andropogon spp., Chamaecrista spp., Chamaesyce spp., Paspalum caespitosum, Bidens alba var. radiata, Schizachyrium sanguineum, Schizachyrium gracile, Setaria parviflora, Sabatia stellaris, Eustachys petraea, Crotalaria pumila, Centrosema virginianum, Galactia volubilis, Metopium toxiferum, Desmodium incanum

Florida State Threatened species
Pteris bahamensis, Spermacoce terminalis

Florida State Endangered species
Linum arenicola

Federally Endangered species
Galactia smallii

Survey area 3

This is a low impacted area with cleared building sites and some parking lots. However, there are large areas dominated by exotic species especially *Schinus terebinthifolius* and *Neyraudia reynaudiana.* **Exotic species should be controlled or they will out-compete native vegetation including *Galactia smallii* and *Linum arenicola*.** Open areas still contain native grass species *Andropogon* spp., *Sorghastrum secundum,* and a single *Pinus elliottii.* A diverse array of additional pine rockland species are present including *Chromolaena odorata Lantana involucrata, Phyla stoechadifolia, Spermacoce terminalis.* **The central area, that still has an open canopy, could be utilized as a conservation area due to the variety of pine rockland species including *Galactia smallii* and *Linum arenicola*.**

Figure 13 and 14

Galactia smallii **Sub-polygons**	**Acres**	**Hectares**	**Density per m^2**	**Estimated Density**
13	0.046	0.019	0.15	28
14	0.591	0.239	1.15	2,750
15	0.492	0.200	0.25	497
16	0.736	0.030	0.01	3
17	0.015	0.006	1.00	62
29	0.003	0.001	1.00	11
			Total	3,351

Figure 15 and 16

Linum arenicola **Sub-polygons**				
8	0.537	0.217	2.43	5,284
10	0.070	0.028	0.67	190
13	0.057	0.023	0.50	115
14	0.004	0.002	1.00	16
16	0.006	0.002	1.00	24
17	0.003	0.001	1.00	11
				Total 5,640

Exotic/invasive vegetation

Schinus terebinthifolius, Acacia auriculiformis, Casuarina spp., *Lantana camara, Neyraudia reynaudiana, Zoysia tenuifolia, Stenotaphrum secundatum, Sporobolus indicus, Albizia lebbeck, Leucaena leucocephala*

Common native vegetation

Phyla nodiflora, Schizachyrium sanguineum, Schizachyrium gracile, Andropogon spp., Sorghastrum secundum, Eustachys petraea, Eragrostis elliottii, Chromolaena odorata, Paspalum caespitosum, Bidens alba var. radiata, Lantana involucrata, Samolus ebracteatus, Metopium toxiferum, Desmodium incanum, Pinus elliottii

Florida Threatened species

Pteris bahamensis, Spermacoce terminalis, Chaptalia albicans

Florida Endangered species
Phyla stoechadifolia, Linum arenicola,

Federally Endangered species
Galactia smallii

Survey area 4

This area is highly impacted by buildings and parking lots. There are several small populations of *Galactia smallii.* Old building sites have been scrapped with a blade (graded). This area is heavily impacted by invasive exotic species (*Schinus terebinthifolius and Neyraudia reynaudiana)* which will out-compete *Galactia smallii* if not controlled. Small areas containing native plants still exist *(Andropogon* spp., *Schizachyrium* spp., *Paspalum caespitosum, Lantana involucrata)* but exotics are encroaching into these areas. A small population of *Galactia smallii* (sub-polygon 32) was lost due to the use of heavy equipment over the area.

Figure 17

Galactia smallii **Sub-polygons**	**Acres**	**Hectares**	**Density per m^2**	**Estimated Density**
18	0.161	0.065	0.01	18
22	0.005	0.002	0.25	5
26	0.035	0.014	2.00	284
27	0.004	0.002	0.50	7
28	0.005	0.002	0.50	10
32	0.008	0.003	1.00	31
			Total	355

Exotic/invasive vegetation
Schinus terebinthifolius, Acacia auriculiformis, Casuarina spp., Neyraudia reynaudiana, Zoysia tenuifolia, Leucaena leucocephala

Common native vegetation
Phyla nodiflora, Schizachyrium sanguineum, Schizachyrium gracile, Andropogon spp., *Eustachys petraea, Eragrostis elliottii, Chromolaena odorata, Paspalum caespitosum, Bidens alba var. radiata, Lantana involucrata, Samolus ebracteatus, Metopium toxiferum, Passiflora suberosa, Desmodium incanum*

Florida Threatened species
Spermacoce terminalis, Chaptalia albicans

Florid Endangered species

Linum arenicola

Federally Endangered species

Galactia smallii

Survey area 5

Several large buildings and parking lots are scattered throughout this area, and large portions have been scraped with heavy equipment. **Exotic species *Schinus terebinthifolius, Neyraudia reynaudiana, Zoysia tenuifolia* dominate this area. Without treatment these populations of *Galactia smallii* will be out competed and lost.**

Figure 18

Galactia smallii **Sub-polygons**	**Acres**	**Hectares**	**Density per m^2**	**Estimated Density**
19	0.076	0.031	0.05	15
21	0.005	0.002	0.25	5
			Total	20

Exotic/invasive species

Schinus terebinthifolius, Neyraudia reynaudiana, Zoysia tenuifolia, Stenotaphrum secundatum, Sporobolus indicus, Albizia lebbeck,

Common native vegetation

Lantana involucrata, Schizachyrium gracile, Schizachyrium rhizomatum, Schizachyrium sanguineum, Andropogon spp., Chromolaena odorata, Bidens alba var. radiata, Passiflora suberosa, Phyla nodiflora, Rhynchospora floridensis, Chiococca alba, Metopium toxiferum, Desmodium incanum

Florida Threatened species

Coccothrinax argentata, Crossopetalum ilicifolium, Jacquemontia curtisii, Pteris bahamensis

Florida Endangered species

Ipomoea microdactyla, Phyla stoechadifolia

Endangered species
Galactia smallii

Survey area 6

No buildings exist on this area but it is highly dominated and impacted by exotic invasive species such as *Schinus terebinthifolius.* Populations of both *Linum arenicola, Galactia smallii* occur near the water tower in a mowed area.

Figure 19

Galactia smallii				
Sub-polygons	**Acres**	**Hectares**	**Density per m^2**	**Estimated Density**
9	0.096	0.039	1.40	541
			Total	541

Figure 20

Linum arenicola				
Sub-polygons	**Acres**	**Hectares**	**Density per m^2**	**Estimated Density**
6	0.053	0.022	0.33	71
			Total	71

Exotic/invasive vegetation
Schinus terebinthifolius, Zoysia tenuifolia, Stenotaphrum secundatum

Common native vegetation
Phyla nodiflora, Schizachyrium spp.*, Andropogon* spp.*, Bidens alba var. radiata, Lantana involucrata, Desmodium incanum*

Endangered species
Linum arenicola,

Endangered species
Galactia smallii

Other occurrences

1) St Lo Blvd

A small population of *Galactia smallii* was found along the northern verge of St. Lo Boulevard to the north of survey area 2. This population is growing in mowed *Zoysia tenuifolia* on the road verge.

Figure 21

Galactia smallii **Sub-polygons**	**Acres**	**Hectares**	**Density per m^2**	**Estimated Density**
11	0.002	<0.001	1.00	6
			Total	6

2) JOBCORE

A single, low density population of *Galactia smallii* was found growing in *Zoysia tenuifolia*. The area surrounding this population is dominated by *Zoysia tenuifolia, Schinus terebinthifolius*, and *Neyraudia reynaudiana.*

Figure 22.

Galactia smallii **Sub-polygons**	**Acres**	**Hectares**	**Density per m^2**	**Estimated Density**
23	0.002	<0.001	1.00	7
			Total	7

3) LAKESIDE

To the west of the lake a small population of *Galactia smallii* exists growing amongst numerous exotic invasive species such as *Wedelia trilobata* and *Zoysia tenuifolia.* Numerous exotic species exist around the lake.

Figure 23.

Galactia smallii **Sub-polygons**	**Acres**	**Hectares**	**Density per m^2**	**Estimated Density**
24	0.012	0.005	0.50	24
			Total	24

Exotic/invasive species

Wedelia trilobata, Casuarina spp., Schinus terebinthifolius, Neyraudia reynaudiana, Zoysia tenuifolia, Stenotaphrum secundatum, Sporobolus indicus, Panicum repens, Leucaena leucocephala, Acacia auriculiformis, Araucaria heterophylla, Tradescantia discolor

Common native vegetation

Coccoloba uvifera, Andropogon spp., Paspalum caespitosum, Bidens alba var. radiata, Sabal palmetto, Eustachys petraea, Crotalaria pumila, Chiococca parvifolia, Phyla nodiflora, Metopium toxiferum

Federally Endangered species

Galactia smallii

4) Road side

A high density population of *Linum arenicola* was found on the north side of St. Lo Boulevard opposite survey area 3. This population is growing along the road verge in mowed *Zoysia tenuifolia* with exposed limestone.

Figure 16

Linum arenicola **Sub-polygons**	**Acres**	**Hectares**	**Density per m^2**	**Estimated Density**
9	0.019	0.008	11.0	849
			Total	849

Figures

Figure 1. Map of Survey area showing the boundary outlined in black.

Figure 2. Map of survey areas showing outlined polygons in green which hold several populations of either *Galactia smallii or Linum arenicola.*

Figure 3. Survey areas showing location of *Galactia smallii* population

Figure 4. Survey area showing locations of *Linum arenicola* populations

Figure 5. Survey area 1, showing populations of *Galactia smallii*. Sub-polygons 0,1 ,2, 6, 8, 30

Figure 6. Survey area 1, showing populations of *Galactia smallii*. Sub-polygon 0, 2, 6, 8, 30 and 31.

Figure 7. Survey area 1, showing populations of *Galactia smallii*. Sub-polygons 4, 6, 8 and 31.

Figure 8. Survey area 1, showing *Linum arenicola* populations. Sub-polygons 0, 1, 2, 3 and 5.

Figure 9. Survey area 1, showing *Linum arenicola* populations. Sub-polygons 0, 3, 4, 5, 11, 12, and 15.

Figure 10. Survey area 2, showing populations of *Galactia smallii*. Sub-polygons 3, 10, and 25.

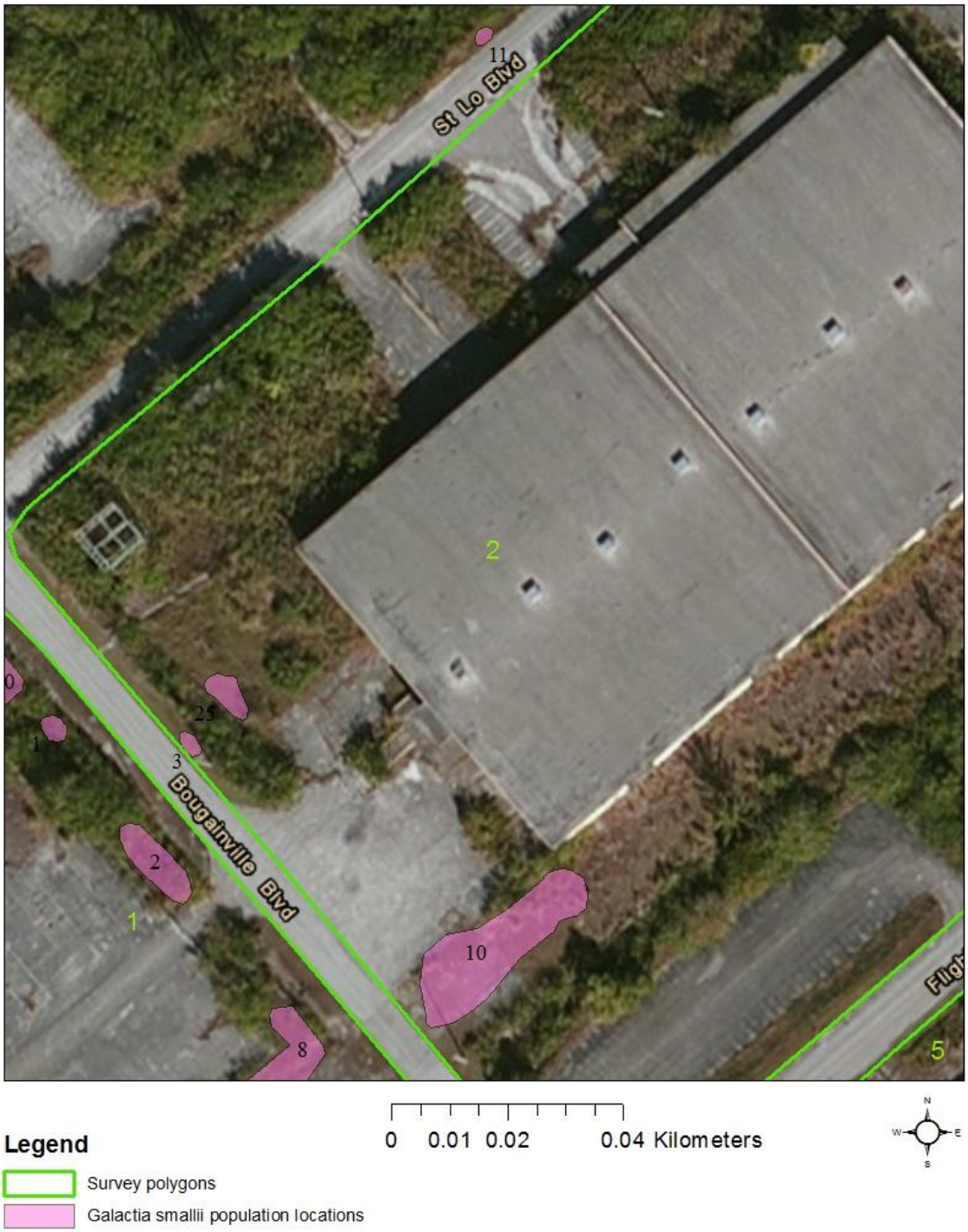


Figure 11. Survey area 2, showing populations of *Galactia smallii*. Sub-polygons 12 and 20.

Figure 12. Survey area 2, showing *Linum arenicola* populations. Sub-polygon 7.

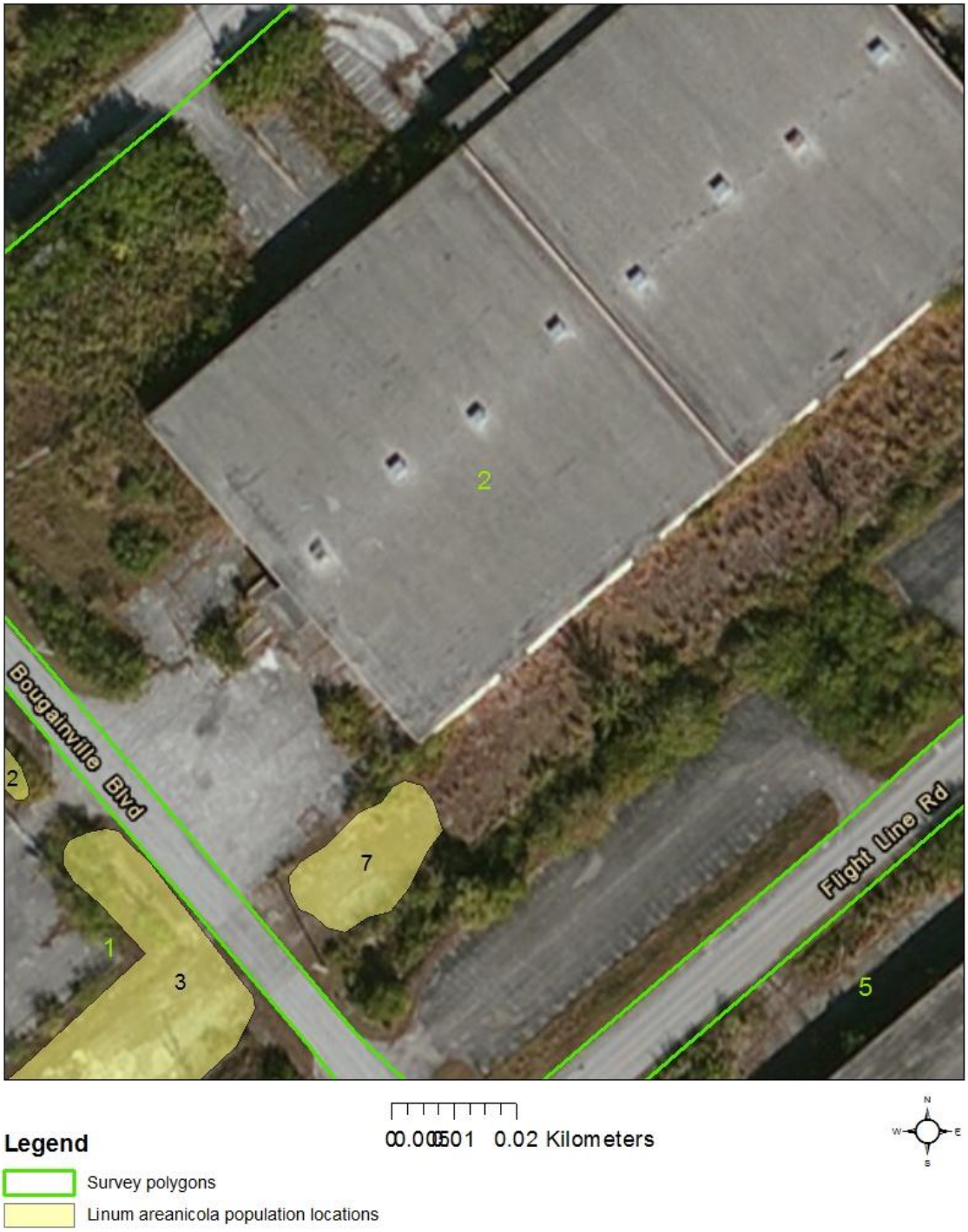


Figure 13. Survey area 3, showing populations of *Galactia smallii*. Sub-polygons 13, 14, 15, 16 and 29.

Figure 14. Survey area 3, showing populations of *Galactia smallii*. Sub-polygons 14 and 17.

Figure 15. Survey area 3, showing *Linum arenicola* populations. Sub-polygons 8, 13, 14, 17.

Figure 16. Survey area 3, showing *Linum arenicola* populations. Sub-polygons 8, 10, 16. North of survey area 3 is sub-polygon 9, that contains a high density population of *Linum arenicola.*

Figure 17. Survey area 4, showing populations of *Galactia smallii*. Sub-polygons 18, 22, 26, 27, 28 and 32. Polygon 32 was later destroyed by heavy equipment.

Figure 18. Survey area 5, showing populations of *Galactia smallii*. Sub-polygons 19 and 21.

Figure 19. Survey area 6, showing populations of *Galactia smallii*. Sub-polygon 9.

Figure 20. Survey area 6, showing *Linum arenicola* populations. Sub-polygons 9.

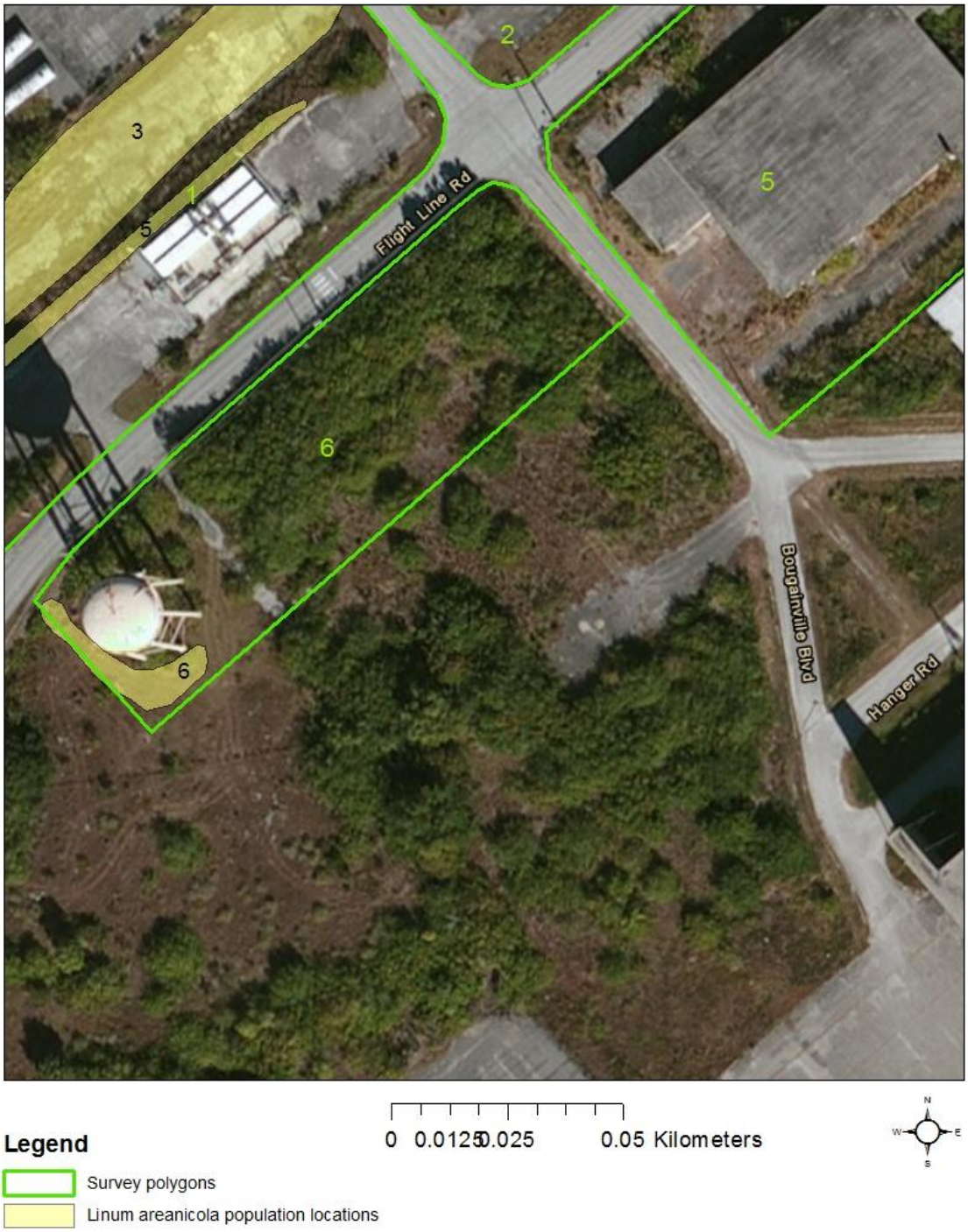


Figure 21. Map showing small population of *Galactia smallii* just north of Survey Area 2. Sub-polygon 11.

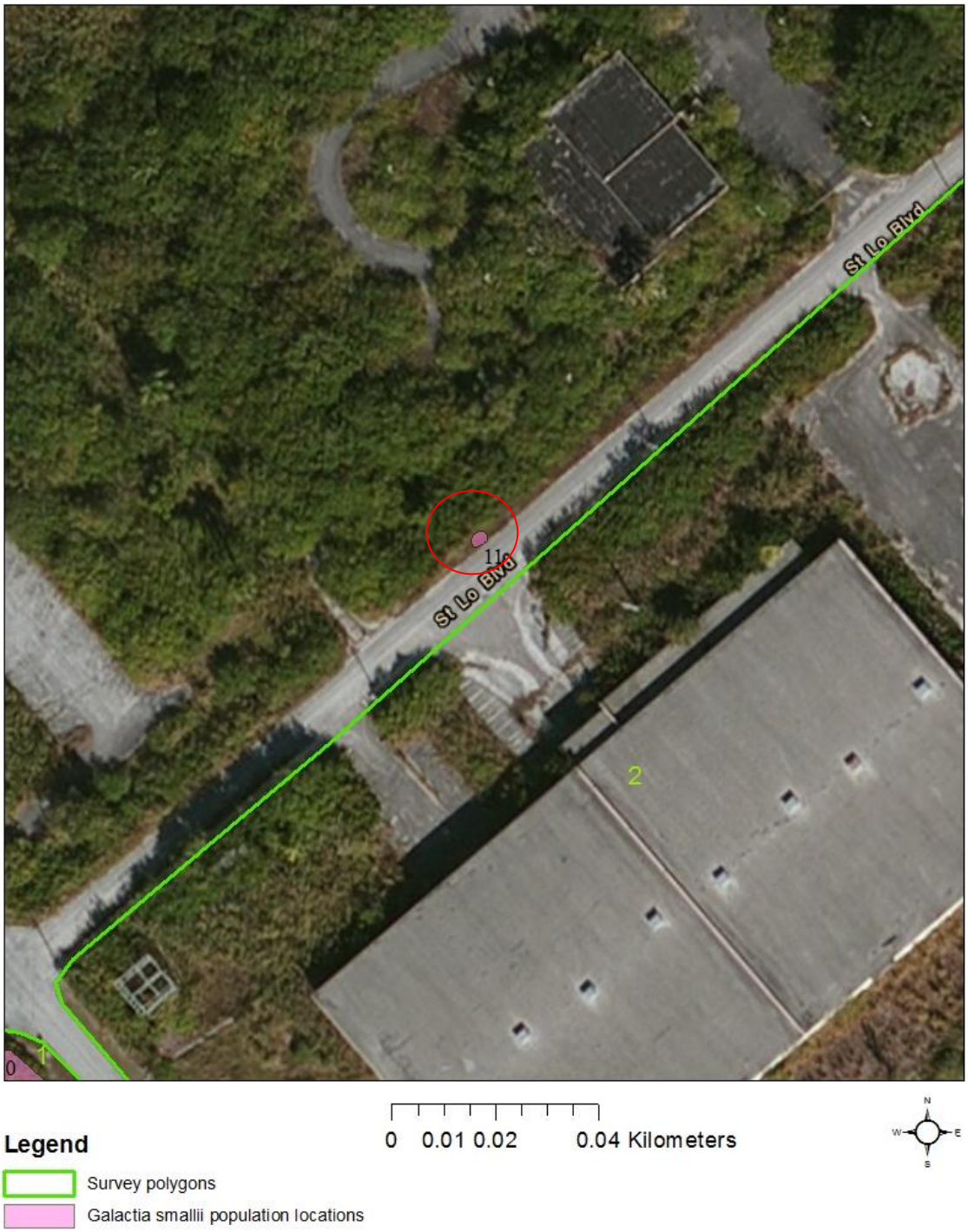
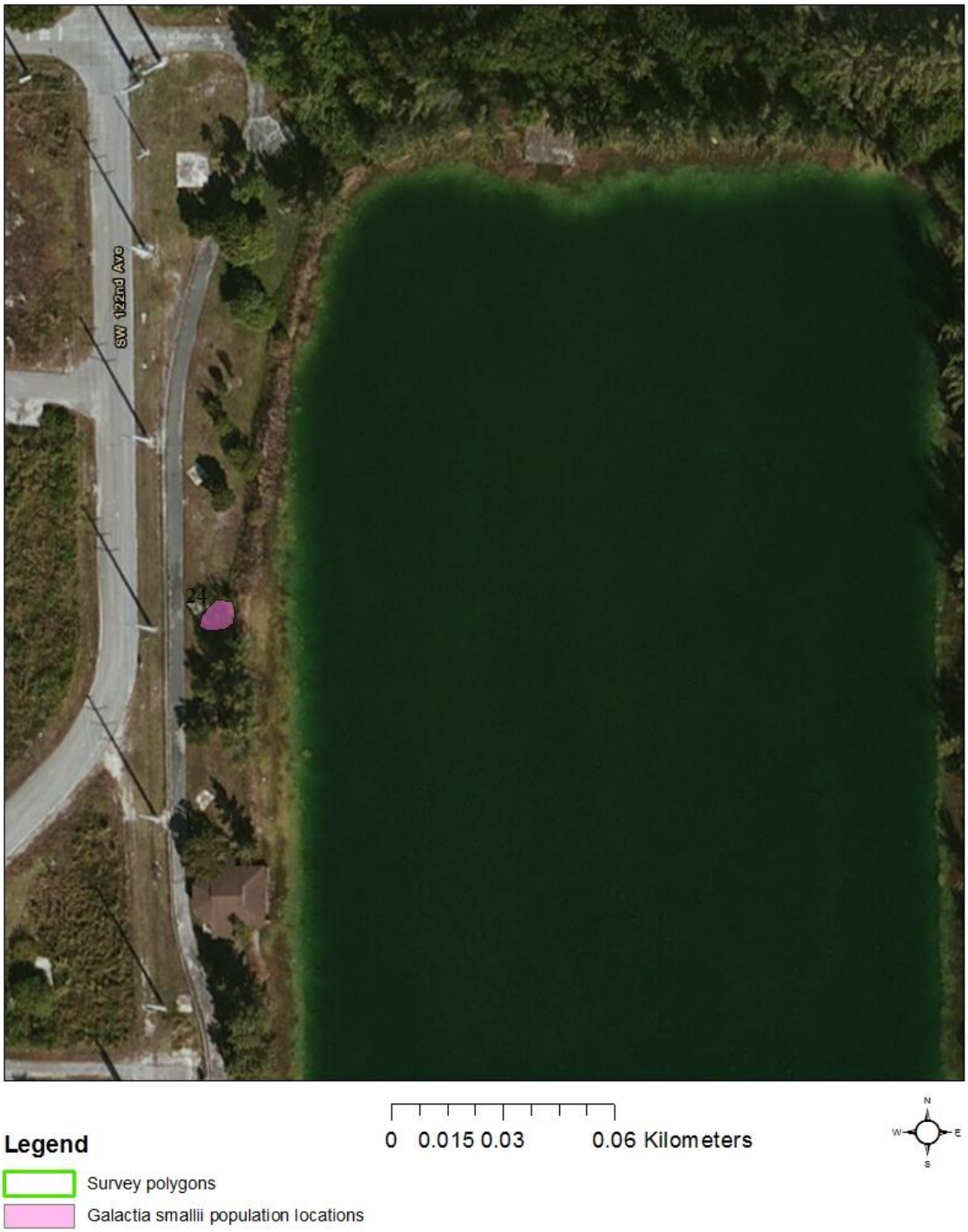


Figure 22. Map showing small population of *Galactia smallii* near the Job Corps residence area. Sub-polygon 23.

Figure 23. Map showing small population of *Galactia smallii* to the north of the survey area adjacent to the lake. Sub-polygon 24.



Tables

Table 1

Exotic vegetation

Scientific name	**Common name**
Acacia auriculiformis	Earleaf acacia
Albezia lebbeck	Woman's tongue
Araucaria heterophylla	Norfolk-island-pine
Casuarina spp.	Australian pine
Lantana camera	Shrubverbena
Leacaena leucocephala	Lead tree
Neyraudia reynaudiana	Berma reed
Panicum repens	Torpedograss
Pennisetum purpureum	Napier grass
Ricinus communis	Castorbean
Schinus terebinthifolius	Brazilian pepper
Sporobolus indicus	Smut grass
Stenotaphrum secundatum	St. Augustine grass
Tradescantia discolor	Oyster plant
Wedelia trilobata	Creeping wedelia
Zoysia tenuifolia	Zoysia grass

Table 2

Common native vegetation

Scientific name	**Common name**
Andropogon spp.	Bluestem grasses
Bidens alba var. radiata	Spanish-needles
Centella asiatica	Coinwort
Centrosema virginianum	Spurred butterfly-pea
Chamaecrista deeringiana	Deering partridge pea
Chamaecrista nictitans var. aspera	Hairy partridge-pea
Chamaesyce spp.	Sandmats
Chiococca alba	Common snowberry
Chiococca parvifolia	Pineland snowberry
Chromolaena odorata	Jack-in-the-bush
Coccoloba uvifera	Seagrape
Crossopetalum ilicifolium	Quailberry
Crotalaria pumila	Low rattlebox
Desmodium incanum	Beggar's-ticks
Eragrostis elliottii	Elliott's love grass
Eustachys petraea	Common fingergrass
Galactia volubilis	Downy milkpea
Lantana involucrata	Wild-sage
Metopium toxiferum	Poisonwood
Morinda royoc	Mouse's pineapple
Paspalum caespitosum	Blue crowngrass
Passiflora suberosa	Corkystem passionflower
Phyla nodiflora	Frogfruit
Pinus elliotii var. densa	Slash pine
Rhynchospora floridensis	Florida whitetop
Sabal palmetto	Cabbage palm
Sabatia stellaris	Rose-of-Plymouth
Samolus ebracteatus	Water pimpernel
Schizachyrium gracile	Wire bluestem
Schizachyrium rhizomatum	Rhizomatous bluestem
Schizachyrium sanguineum	Crimson bluestem
Setaria parviflora	Yellow bristlegrass
Sorghastrum secundum	Lopsided Indian grass
Zamia integrifolia	Coontie

Table 3

Florida State Threatened species

Scientific name	**Common name**
Angadenia berteroi	Pineland-allamanda
Byrsonima lucida	Locustberry
Chaptalia albicans	White sunbonnets
Coccothrinax argentata	Florida silver palm
Crossopetalum ilicifolium	Quailberry
Cynanchum blodgettii	Blodgett's swallowwort
Jacquemontia curtisii	Pineland clustervine
Melanthera parvifolia	Pineland blackanthers
Psidium longipes	Longstalked-stopper
Pteris bahamensis	Bahama ladder brake
Senna mexicana var. chapmanii	Bahama senna
Smilax havanensis	Havana greenbrier
Spermacoce terminalis	Everglades Keys false buttonweed
Swietenia mahagoni	West Indian mahogany

Florida State Endangered species

Scientific name	**Common name**
Ernodea cokeri	Coker's creeper
Ipomea microdactyla	Man-in-the-ground
Linum arenicola	Sand flax
Phyla stoechadifolia	Southern fogfruit
Selaginella armata Baker var. eatonii	Eaton's spike-moss

Federally Endangered Species

Scientific name	**Common name**
Galactia smallii	Small's milkpea