Land Use Land Cover Data in Florida:

Dataset Analysis and Findings on Data Use and Data Refinements

Final Report

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Acronyms and Abbreviations

BMAP – Basin Management Action Plan
MMU – Minimum Mapping Unit
DEP – Florida's Department of Environmental Protection
Districts – Florida's water management districts (WMD)
FDACS – Florida Department of Agriculture and Consumer Services
FDOR – Florida Department of Revenue
FDOT – Florida Department of Transportation and
FHD – Florida Hydrography Dataset
FNAI – Florida Natural Areas Inventory
FSAID – Florida Statewide Agricultural Irrigation Demand – a project and datasets of FDACS
LULC – Land Use Land Cover
NHD – National Hydrography Dataset
SME – subject matter expert
NWI – National Wetlands Inventory
NAIP – National Ag Imagery Program
USACE – United States Army Corps of Engineers
NWFWMD – Northwest Florida Water Management District
SFWMD – South Florida Water Management District
SJRWMD – St Johns River Water Management District
SRWMD – Suwannee River Water Management District
SWFWMD – Southwest Florida Water Management District

Executive Summary

Florida Department of Environmental Protection (DEP) retained The Balmoral Group to clearly document how Land Use Land Cover (LULC) data is being developed and refined and to identify all the ways selected agencies in Florida are using LULC data. The purpose of this report is to provide relevant information on LULC data use and data updates in order to inform possible future changes in how LULC are updated or maintained.

This report provides:

- Summarized findings about LULC data refinement and LULC data use in Florida, based on surveys and interviews and focus group meetings with subject matter experts (SMEs)
- Analysis of the LULC data to provide quantified evaluations of the following 6 topics:
  - Feature sizes – how the typical polygon sizes differ by agency and by land use description
  - Classification levels – how the land use descriptions at Levels 2, 3, or 4 vary across the state
  - Land Use (LU) and Land Cover (LC) similarity – quantifies how often LU and LC are the same
  - LU data overlaps – provides descriptions and typical examples of land uses that are by definition overlapping (bridges overlapping roads or waterways and transmission lines overlapping wetlands or agricultural lands, for example)
  - Critical assets identification – documents the statutorily-defined critical asset types that align with existing LULC descriptions
  - Agricultural land use – summarizes how the statewide agricultural LULC data differs from FDACS' coverage of agricultural lands.

An online LULC data viewer or "dashboard" was developed to allow for additional visualization to support the data summaries provided in this report. The **dashboard can be accessed here: https://datavisual.balmoralgroup.us/FL-LULC-dataviewer.**

Recommendations on LULC data update changes

While the design of any potential changes in LULC data update processes are beyond the scope of this project, **several findings of particular relevance are mentioned for consideration**:

- **Critical assets spatial data layers from DEP could be used statewide to improve LULC data consistency (updating LU descriptions based on asset type and location of asset). This serves both to provide better representation of critical assets in the LULC data and allows for areas of critical assets to enable more meaningful flood risk evaluations at locations for which critical assets are represented by points.**

- **Level 3 and 4 LU classifications are often used by LULC data users, but there are numerous distinct LU classifications at those levels – not all of which are required. Providing LULC data users with candidates of simplified LU description schema or collecting data users' existing crosswalk tables would benefit the design and would allow opportunities for particular LU descriptions that need to be retained to be identified. More generally: LULC data users should continue to be engaged during the LULC data changes design phases.**

- **Agricultural lands (level 2000) could potentially be simplified in the LU descriptions used for LULC data updates. Most data users that require detailed crop information relevant to nutrient load or water demand modeling are using FDACS' FSAID; therefore, this could be an opportunity to classify at level 2 or 1 for agricultural lands in the LULC data to improve updates efficiency. Alternatively, the FDACS FSAID data could be integrated into the LULC data directly.** Both options are discussed in more detail in the Agricultural Land Use section.

Information gathering (surveys, interviews, focus groups meetings) was completed with SMEs who are data users and different SMEs involved in LULC data updates. Florida's LULC data is a foundational dataset that is used widely for a multitude of purposes. The LULC data stakeholders included in the information gathering here were from DEP, the water management districts (Districts), and FDACS. The following sections explain the key findings related to data refinements and data use of LULC data.

Data Refinement Key Findings:

- Agencies tend to adjust their classification levels (level 2 to 4) based on their data users' requirements, though most expressed that wetlands and agricultural lands are commonly looked at with the most scrutiny. These land uses take more time in determination of proper codes than other land uses, due to the often-shifting nature of the land. However, there seemed to be opportunities for more direct interaction between LULC data users and data developers to ensure LULC data needs are being met efficiently. Meaning, there did not seem to be established or regular meetings with LULC data users and data developers specifically for the purpose of refining data update/development processes.
- The FDOR/FDOT aerial imagery is the key data source for photointerpretation for LULC data development in Florida for DEP (covering NWFWMD and SRWMD), SJRWMD, and SFWMD. SWFWMD uses another imagery source, contracting directly for imagery to be flown/collected in their District. Key distinctions among the FDOR/FDOT imagery and SWFWMD's imagery collection:

  - Both FDOR/FDOT and SWFWMD imagery is flown about every 3 years
  - However, the FDOR/FDOT has different flight schedules depending on the County; meaning that within a District the imagery collection dates might be months or years apart for different Counties, making photointerpretation a challenge in some situations.
  - SWFWMD collects their own imagery to resolve that challenge of different imagery dates across the District; the imagery data from SWFWMD has very similar flight dates.
  - SWFWMD pays for their imagery, while the FDOT/FDOT imagery is already paid by those agencies and is used freely for LULC data updates by the Districts.
- Most agencies noted the inconsistencies in acquisition timeframes for aerial imagery, which can affect the accuracy of LULC coding. The temporal differences make changes in wetlands, water features, and agricultural lands difficult to accurately document. Also, the variability in the color qualities of imagery (resulting from different contractors for different counties) can make photointerpretation more challenging, especially at the intersection of imagery from different sources. Some agencies utilize false color imagery to improve the consistency of imagery interpretation. Most agreed that more consistent and frequent imagery data would be desirable, albeit not at the cost of accuracy. It was noted that there usually are not major LULC changes in a single year, so every 3 years is likely suitable for LULC applications, but more consistent imagery dates across a District would help with photointerpretation.
- Interviews revealed some commonalities in the supporting datasets used to assist with photo interpretation: these included the Department of Revenue (DOR) parcel data (owner information and use code can be helpful in determining LULC code), the Florida or National Hydrography Dataset (FHD or NHD: to check water or wetland extent), National Wetlands Inventory (NWI), and other imagery sources (Google – including StreetView, National Ag Imagery Program: NAIP).
- There was discussion with SMEs about the potential use of standardized supporting layers that could be used statewide and could possibly streamline LULC updates. For example, the following data layers might be used statewide to reduce editing time – workflows would need adjustment to incorporate these data layers and maintain a continuous coverage LULC dataset without area overlaps:
  - FHD: to represent water and wetlands (polygon datasets)
  - Roadways – from FDOT and USGS to represent state and local road surfaces (line datasets)
  - Agricultural lands from FDACS' FSAID dataset (polygons)

  - Transmission lines for high voltage electricity lines (included as a linear dataset in DEP's critical assets database; maintained/developed by the Department of Homeland Security Homeland Infrastructure Foundation Level Database – DHS HIFLD)

  There was interest in utilizing some standard statewide datasets to reduce LULC revision areas, but there was not consensus on datasets or process.

- Agencies noted some challenges in LULC classification at the boundaries between districts. This sometimes requires LULC updates to expand across District boundaries to avoid the District-to-District differences in LULC classification that might complicate some use cases having boundaries across Districts. SFWMD and SJRWMD both noted some LULC updates outside their boundaries to align their LULC with surface watershed basin boundaries as follows.
  - SFWMD
    - Distance outside District: 4 miles to 15 miles beyond the SFWMD boundary; distance varies along boundary based on watershed boundaries
    - Length of the District boundary for which LULC extend outside the boundary: entire length of District boundary
    - LULC updates outside boundary based on requests or standard procedure: standard procedure
  - SJRWMD
    - Distance outside District: a few miles to 10 miles beyond the SJRWMD boundary to incorporate any watersheds; distance varies along boundary based on watershed boundaries
    - Length of the District boundary for which LULC extend outside the boundary: entire length for which watershed boundaries extend beyond District boundary
    - LULC updates outside boundary based on requests or standard procedure: standard procedure
- Suggestions for potential new LU classifications included:
  - Solar: Utility-scale photovoltaic (PV) installations
  - Abandoned structures
- Suggestions for potential new LC classifications included:
  - Hurricane damaged natural areas and developed areas
  - Swimming pools
  - Residential pervious and impervious surfaces (turf, streets, sidewalks) as separate features rather than being included in residential categories

- Estimated annual costs to update LULC data ranged from about $120,000/yr to $330,000/yr per agency; most of these costs were internal staff time, with the exception of SFWMD and SWFWMD in which most of the costs were for imagery and contractual services.
  The following table summarizes annual costs for LULC data updates:

Table 1. Annual update costs summary by agency

Agency	Total Annual Cost**	Data Costs	Contractor Costs	Internal staff costs
DEP*	$150,000	ŧ		$150,000
SFWMD	$119,000	ŧ	$92,000	$27,000
SJRWMD	$125,000	ŧ		$125,000
SWFWMD	$337,000	$242,000	$88,000	$7,000

*** Note: DEP LULC updates cover both SRWMD and NWFWMD.**
****Note: Annual costs based on agency costs provided as annual amounts or adjusted to annual amounts based on LULC update duration (example: 3-year cycle cost total divided by 3 for annual costs).**
Imagery costs associated with DEP, SFWMD, and SJRWMD are incurred by the FDOR for flights and by FDOT for data storage.

- **Relevant to potential data update process changes:** Manual photo interpretation is used exclusively by all SMEs except one. For that exception, machine learning has been explored, but manual photo interpretation was still used for about 80% of their LULC development. All agencies are exploring or planning to explore how to include some type of automation of LULC data refinement, but none have developed any detailed information based on vendor input or other information sources. However, some data update personnel expressed concerns about how the potential inaccuracies may reduce some benefits of "time saved" via automation. Staffing costs have been noted as an important reason why agencies are exploring data updates automation.
  Major advantages noted of potential process changes: improved consistency in LU classifications across districts, and reduced time between LULC update cycles. It is expected that automation of some parts of LULC data updates could reduce staff time commitments, but there was not a clear indication if there would be a cost increase or decrease overall. It was noted that most automated imagery classification systems have only 10 or 15 categories (based on District staff exploration in recent years of ESRI's and other GIS tool LULC classification tools; not based on vendor solicitation directly). There were no data developers directly using automated classification tools. **It was recommended by some data update experts that automated processes could**

potentially provide the Level 1 land use or provide change detection areas only, and manual interpretation could proceed to categorize to the typical LULC level of detail.

Data Use Key Findings:

- Differences in LULC classifications across district boundaries require dataset adjustments for some applications. For DEP, this is particularly relevant for nutrient load model applications. For the Districts, these cross-district LULC data differences result in some districts updating LULC beyond their boundaries to enable the LULC to be more readily usable by district personnel working on data uses near or across boundaries. See findings above: SFWMD and SJRWMD both routinely extend their LULC data updates beyond District boundaries where needed to align with surface water basin boundaries.
- DEP is using the LULC data statewide and across district boundaries, while the water management districts are typically using LULC just within their district – though there are some exceptions for water supply plan regions that span multiple districts. There are numerous other LULC data stakeholders not included in this scope who are regular users of LULC data.
- Usage frequency of the LULC data for the SME participants in this study was generally about 2 to 3 times per month, with some personnel using LULC daily and others using it just once or twice per year.
- Data use/applications were common for both landscape-scale (basin or planning region) and for site-specific uses (property level assessment). Common applications of LULC data are (**Table 2**):

Table 2. LULC data use cases summary

Data Use Reported	Agency
Water supply modeling: hydrologic models that estimate evapotranspiration and groundwater recharge and other hydrologic processes	All five districts
Water quality modeling: nutrient load estimations	DEP, SJRWMD, SRWMD
Flood risk modeling: watershed management plan models	SWFWMD, SJRWMD
Watershed prioritization for updating watershed models (age of model and % of LU change)	SWFWMD

Data Use Reported	Agency
Permit review processes for WUPs or ERPs	All five districts
Project locations and environmental lands assessments: supports the identification of project locations (for water supply or water quality projects) and the evaluation of environmentally sensitive lands (potential acquisitions or easements)	All five districts
Critical asset area coverage for resilience planning and modeling (for review and exploratory purposes: LULC areas not used statewide for critical assets spatial representation)	DEP

Note: these are LULC data uses by DEP, the water management districts, or FDACS, as those were the subject matter experts convened in this project. There are numerous other LULC data uses in Florida not accounted for in this assessment.

- The majority of data users indicate that level 3 LU classifications are needed for at least some land use assessments. Level 3 and 4 classifications were preferred by data users most commonly in agricultural lands and wetlands and water features classifications. Water and wetlands features were consistently mentioned as features in which the most detailed descriptions and spatial representation are needed, as these features are relevant for permitting and other applications. **It should be noted that while level 3 and 4 LU descriptions were described as sometimes needed by data users, it is evident from review of sample crosswalk tables that in many cases relatively few of the available level 3 descriptions are used.** Meaning, while there are over 130 unique level 3 land use descriptions, only 4 or 5 of those might be used at level 3, while the rest might be used based on level 1 or 2 land use descriptions.
- Between surveys and interviews, the majority of users saw the current frequency of updates (3 years on average) as sufficiently frequent, but general consensus was that if more frequent updates were possible, that would be beneficial. There was a consistent preference for accuracy over frequency; most users would rather not increase update frequency if that resulted in more data uncertainty or classification errors.
- Most users supplemented LULC data with multiple other imagery data sources for verification and supporting information. Some examples included DOR parcel data, soil data, historical LULC data, the NHD/FHD, elevation data, and Google Maps or StreetView for additional imagery review assessment in some cases.
- Several users indicated that the addition of impervious surfaces – possibly as a separate data layer – would benefit their modeling efforts.

- **Relevant to potential data update process changes:** LULC data users indicated a preference to maintain the current classification levels and names, as these are linked to numerical values for various models (runoff, groundwater recharge, nutrient loading, and other models). However, **not all unique LU descriptions are needed for most data uses; it would likely benefit data users to provide them with candidate classification schemes (if these are developed) during any potential design stage of LULC data updates.** Additionally, some users expressed concern about potential misclassifications from an automated or semi-automated data update process. Data users welcomed any automation that might improve data update frequency, but had some reservations about potentially increased classification errors or changes in the LULC classification system. As noted from the data updates SMEs, a major advantage of potential LULC update process changes: improved consistency in LU classifications across districts.

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Feature Size Evaluation

In surveys and interviews with data users, the typical feature sizes or specified minimum mapping units (MMUs) were not noted to be hampering LULC data applications. Most data users indicated that the spatial resolution or size of features were suitable for their applications, with smaller features often needed or preferred for water or wetland features.

The following summary and figures quantify feature sizes around the state. While LU codes in the 2000 to 7000 range are more likely to vary around the state as croplands and natural areas have more variability, specific land uses in the 1000 (Urban and Built-up) and 8000 (Transportation, Communication, and Utilities) ranges could be expected to have more similarities across the state in terms of average feature sizes. The online LULC data dashboard, https://datavisual.balmoralgroup.us/FL-LULC-dataviewer, was prepared to facilitate feature size comparisons for particular land use descriptions or collectively for level 1 or level 2 land use codes.

Shown below is a comparison of average feature size acreage by agency for the 1000 and 8000 level 1 codes (**Figure 1**). There are substantial differences between some districts in average feature size for both 1000 and 8000 levels, with average feature areas around 9 to 21 acres in SRWMD, NWFWMD, and SJRWMD for 8000 level and 62 to 75 acres in SFWMD and SWFWMD for 8000 level (see **Figure 1**). For level 2 LU codes for comparison within 8000 level codes, there is more similarity in feature sizes by district for the 8200 LU code (Communications): average feature size ranges from 1 to 10 acres. For transportation (8200): average feature sizes are similar in SRWMD and NWFWMD (about 40 acres), but in SJRWMD, SWFWMD, and SFWMD, feature sizes are much larger (about 200 acres on average). This is likely representative of expected roadway size differences in those districts (**Figure 2**).

Figure 3 illustrates typical size differences across land uses and districts for 1100 = Residential, Low Density, 1200 = Residential, Medium Density, and 1300 = Residential, High Density land uses. Similar to the findings for 8000 level codes, average feature sizes for 1100, 1200, and 1300 are similar in SRWMD and NWFWMD (about 20 acres), while in SJRWMD, SWFWMD, and SFWMD, residential feature sizes are moderately larger: around 50 acres depending on density group.

It is expected that for level 3 LU codes that would typically be categorizing particular properties, there would be more similarity in feature sizes across districts. This is true in many instances; for example, LU = 8340 (Sewage Treatment or Wastewater Treatment) shows similar average feature sizes (about 20 acres) across the 4 districts using 8340 (see **Figure 4**. Note: SWFWMD does not categorize most LU at level 3). Similarly, for 8120 (Railroads), average feature sizes are nearly the same across districts, with SRWMD showing somewhat larger average feature size (**Figure 5**).

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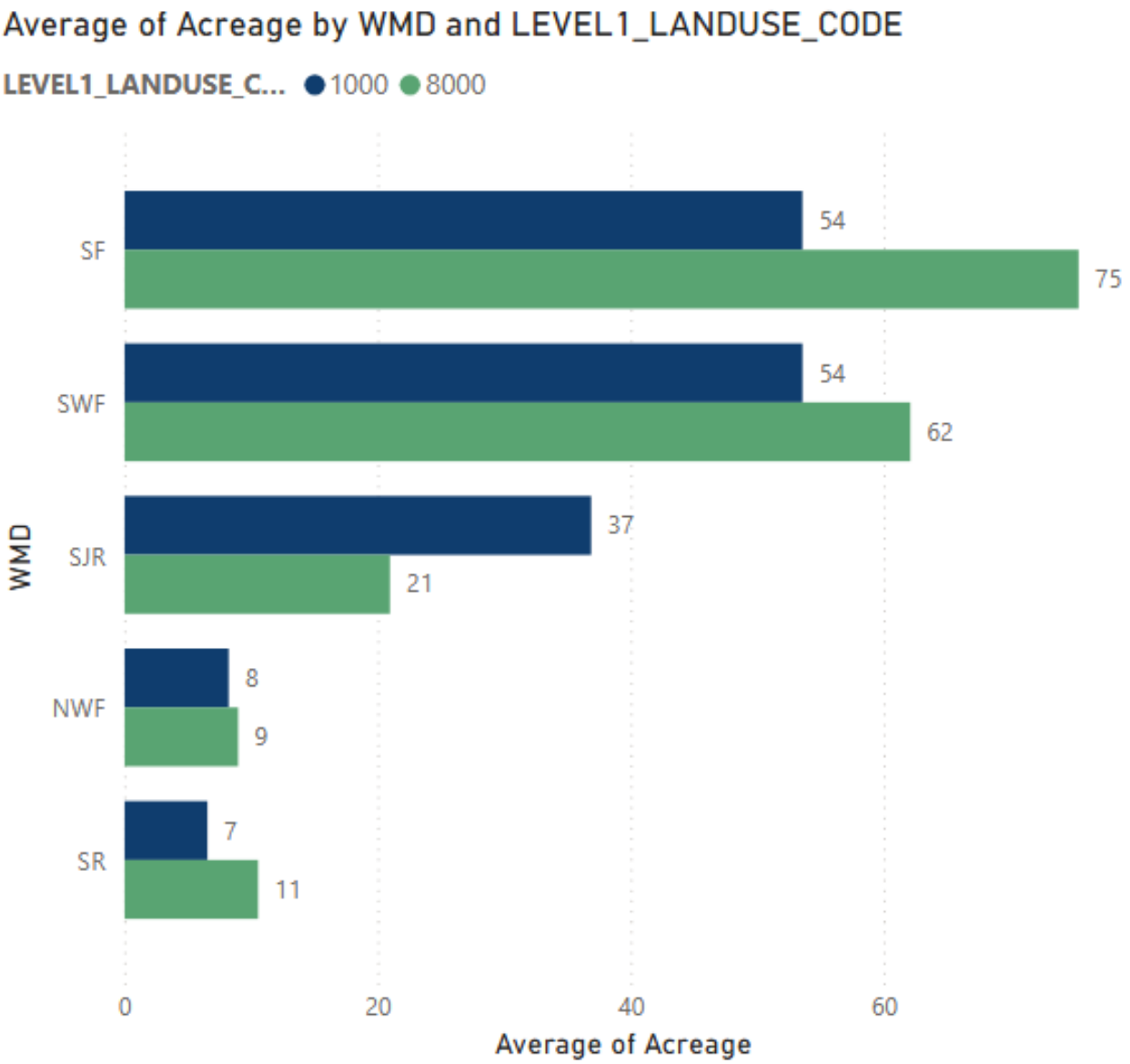


Figure 1. Average feature sizes for 1000 (Urban and Built up) and 8000 (Transportation, Communications, and Utilities)

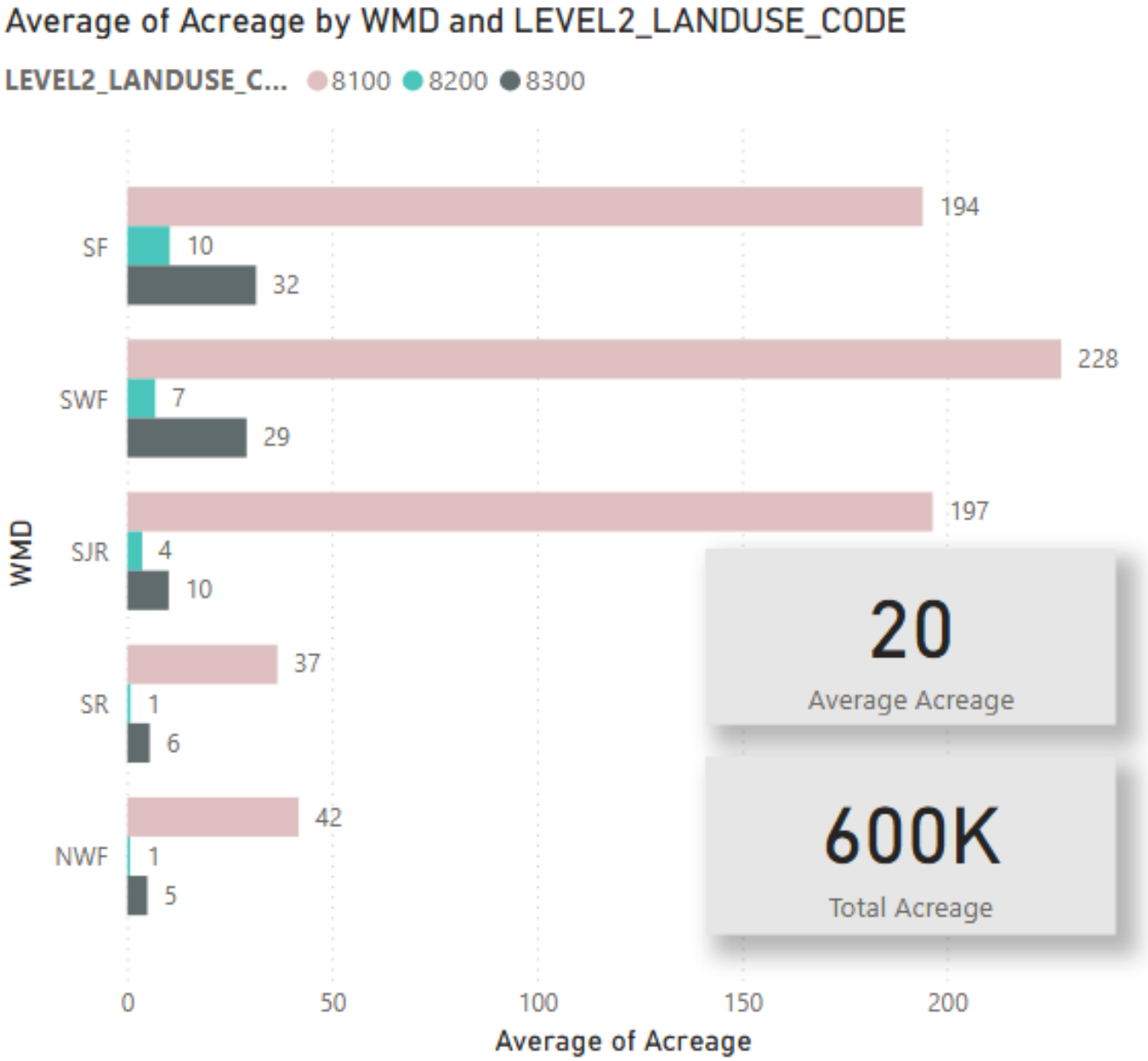


Figure 2. Average feature sizes by district for 8100 = Transportation, 8200 = Communications, and 8300 = Utilities LU codes.

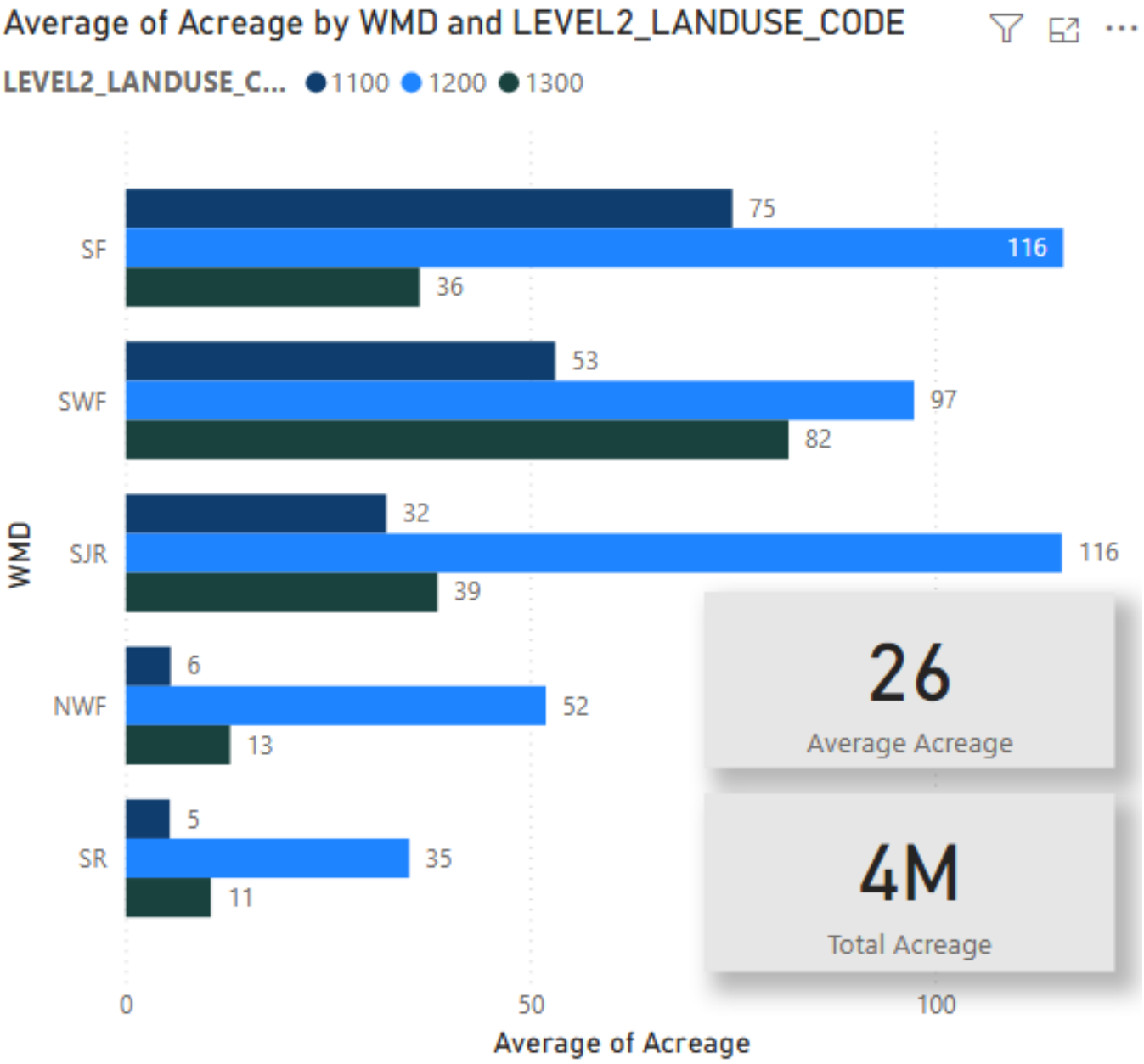
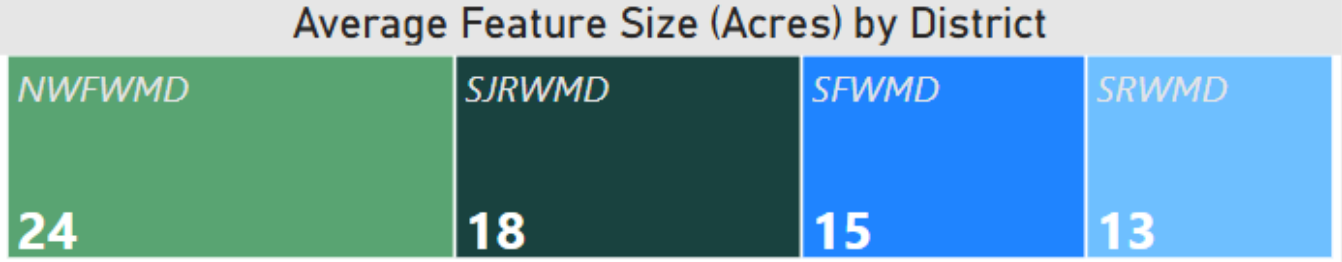


Figure 3. Average feature sizes by district for 1100 = Residential, Low Density, 1200 = Residential, Medium Density, and 1300 = Residential, High Density LU codes

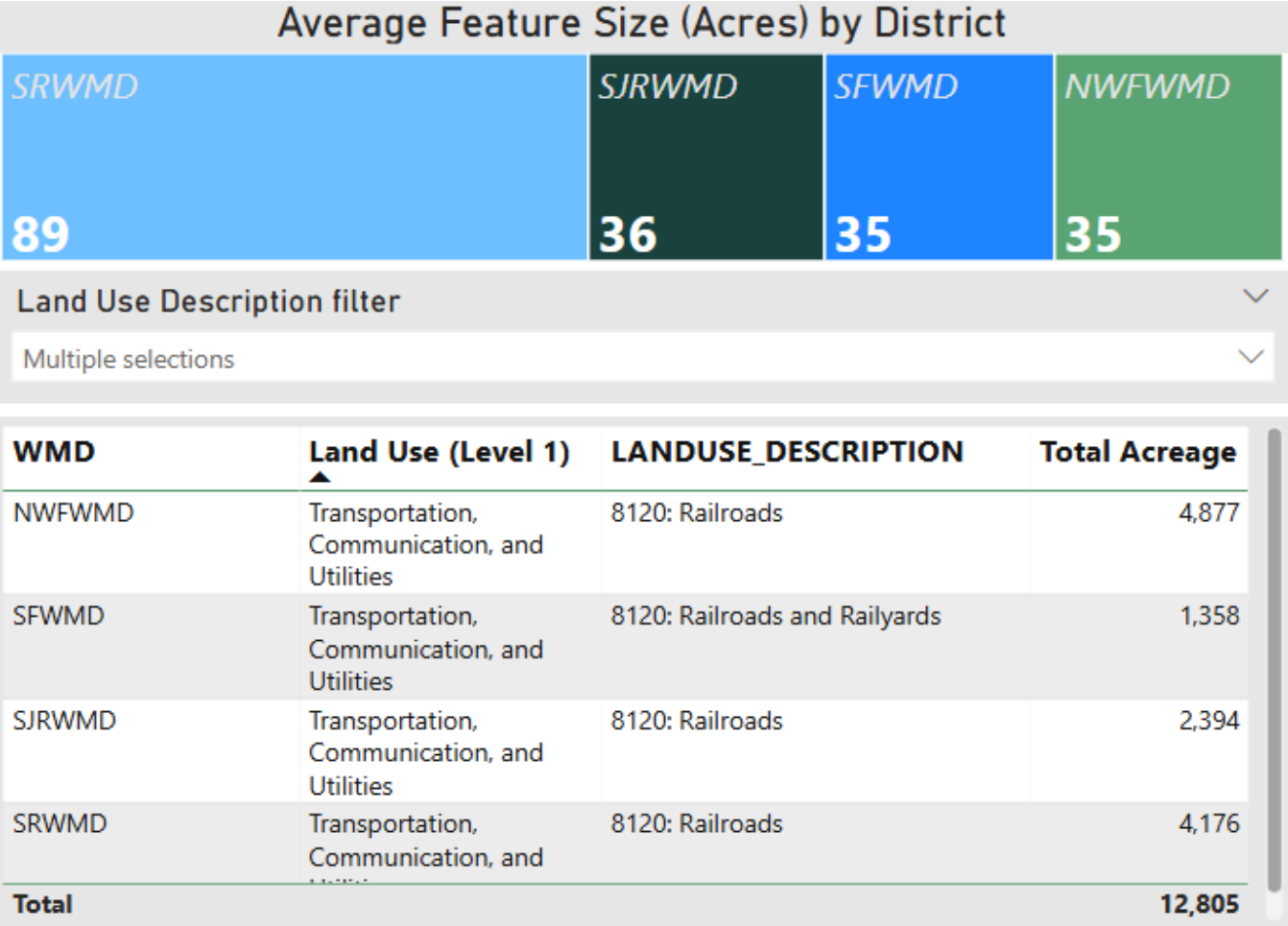


Land Use Description filter

Multiple selections

WMD	Land Use (Level 1)	LANDUSE_DESCRIPTION	Total Acreage
NWFWMD	Transportation, Communication, and Utilities	8340: Sewage Treatment	8,519
SFWMD	Transportation, Communication, and Utilities	8340: Sewage Treatment	4,672
SRWMD	Transportation, Communication, and Utilities	8340: Sewage Treatment	2,183
SJRWMD	Transportation, Communication, and	8340: Wastewater treatment	11,091
Total			**26,465**

Figure 4. Average feature size and total acres for each district for LU = 8340; note SWFWMD does not typically classify LU at level 3



WMD	Land Use (Level 1)	LANDUSE_DESCRIPTION	Total Acreage
NWFWMD	Transportation, Communication, and Utilities	8120: Railroads	4,877
SFWMD	Transportation, Communication, and Utilities	8120: Railroads and Railyards	1,358
SJRWMD	Transportation, Communication, and Utilities	8120: Railroads	2,394
SRWMD	Transportation, Communication, and	8120: Railroads	4,176
Total			**12,805**

Figure 5. Average feature size and total acres for each district for LU = 8120; note SWFWMD does not typically classify LU at level 3

Classification Levels Assessment

There are 218 unique LU codes in the LULC dataset: 42 at level 2, 137 at level 3, and 39 at level 4. Based on data user surveys and interviews, level 3 LU descriptions are commonly needed for LULC data users, but not for applications by SWFWMD data users. LULC data users were surveyed to identify what level of LU descriptions are usually needed for their uses of LULC data. Users were asked if they Sometimes, Always, or Never need Level 2 or Level 3 or Level 4 LU descriptions, and they were provided a link to spreadsheet listing all Level 2, 3, and 4 LU descriptions. A response of "Sometimes" indicates that a user does not need all unique LU descriptions at a particular level, rather they need some of them. For example, for some SJRWMD LULC data uses, the level 2000 (Agriculture) codes needed by SJRWMD require 14 Level 3 land use descriptions, while all the other agriculture codes could be coded as "General

Agriculture" for their purposes. See **Appendix Table 7 (LULC Example Crosswalk)** for the agricultural land cover codes crosswalked to the 3 agriculture groups used by SJRWMD for model parameterization.

About half of data users indicated they need level 3 classifications at least sometimes and half indicated that level 3 uses are always needed (**Table 3 and Figure 6**). The following table (**Table 3**) summarizes user input for Level 2, 3, and 4 classification for each of the 9 Level 1 land uses. It is notable from Figure 6 that users most commonly indicated they always need Level 3 LU descriptions for Agriculture (2000 code LU uses), as many data users are also using FDACs' FSAID data, level 2000 LU might be a sensible opportunity to reduce LULC update efforts. The FDACS FSAID data includes attributes for crop (akin to level 4 LU descriptions) and crop group (akin to level 2 LU descriptions); these crop and crop groups could reasonably be aligned or crosswalked to LU descriptions in the statewide LULC dataset. See Agricultural Land Use section for more information on agricultural land use opportunities.

It is recommended that during the design stage for potential changes in LULC classifications, the candidate classification schemes be shared among data users to allow for additional input on required LU codes. **While there are 218 unique LU codes, and most users indicate they sometimes need level 3 LU descriptions, that does not mean they need level 3 detail for each particular LU.** Collecting data users' crosswalk tables to identify which LU description levels are used for their particular applications could provide additional detail, during the design phase of LULC process change, to identify which Level 3 and 4 codes are actively used. Conversely, DEP's TMDL modelers may primarily utilize a Level 2 to apply an event mean concentration, but utilize the Level 3 or 4 classification to extrapolate or disambiguate land uses from that larger Level 2 land area if such classification does not have an event mean concentration or seems incongruous with attempted ground truthing (primarily satellite image-based).

Table 3. Survey responses from LULC data users aggregating how commonly it was indicated that Level 2, 3, or 4 LU descriptions are needed; % of responses for "Always" and "Sometimes" and total number of responses.

Level 1 Land Use	LU Level	Always	Sometimes	total responses
100 URBAN AND BUILT UP	Level 2	79%	21%	14
	Level 3	36%	64%	14
	Level 4	18%	82%	11
200 AGRICULTURE	Level 2	79%	21%	14
	Level 3	64%	36%	14
	Level 4	33%	67%	12
300 RANGELAND	Level 2	79%	21%	14
	Level 3	58%	42%	12
	Level 4	27%	73%	11
400 UPLAND FORESTS	Level 2	71%	29%	14
	Level 3	46%	54%	13
	Level 4	18%	82%	11
500 WATER	Level 2	79%	21%	14
	Level 3	46%	54%	13
	Level 4	18%	82%	11
600 WETLANDS	Level 2	79%	21%	14
	Level 3	54%	46%	13
	Level 4	31%	69%	13
700 BARREN LAND	Level 2	71%	29%	14
	Level 3	42%	58%	12
	Level 4	18%	82%	11
800 TRANSPORTATION, COMMUNICATION, AND UTILITIES	Level 2	71%	29%	14
	Level 3	58%	42%	12
	Level 4	18%	82%	11
900 SPECIAL CLASSIFICATIONS	Level 2	69%	31%	13
	Level 3	50%	50%	12
	Level 4	8%	92%	12
Average all Level 1 LU	Level 2	75%	25%	14
	Level 3	50%	50%	13
	Level 4	21%	79%	11

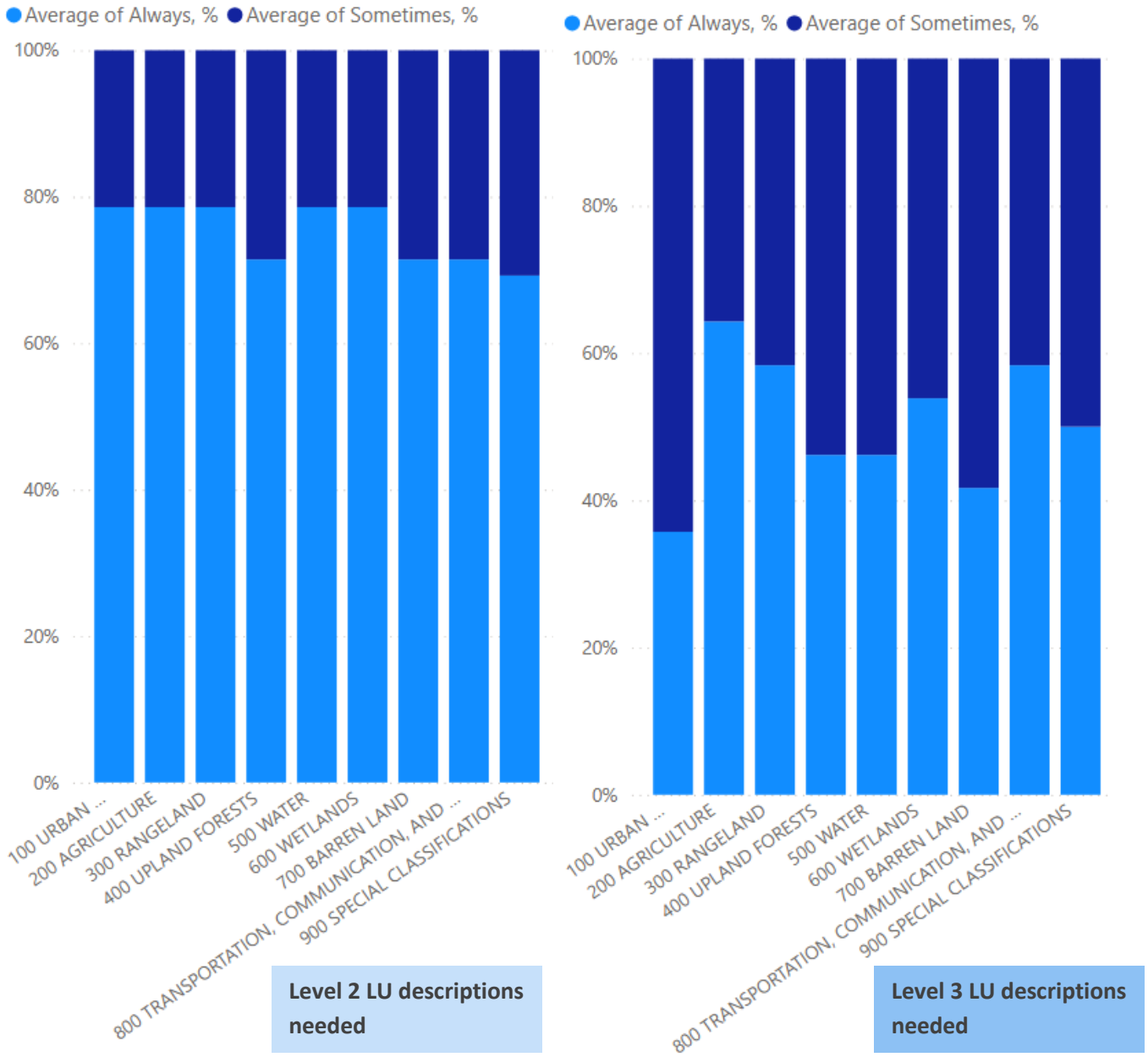


Figure 6. % of LULC data user responses indicating whether they always or sometimes need Level 2 LU descriptions (left) or Level 3 LU descriptions (right)

The remainder of this section summarizes the LULC data in terms of classification level details. The majority of land uses in Florida are categorized at level 3 land use codes. The total acreage statewide for levels 2, 3, and 4 are about 11M acres, 25M acres, and 3M acres, respectively. This aligns with the observation that most data users indicated their preference for level 3 LU descriptions for many of their applications, hence that is likely why most data are developed/maintained at level 3.

The figure below (**Figure 7**) summarizes the acreage categorized at level 2, 3, and 4 for each district. As SWFWMD typically utilizes mostly level 2 LU classifications, there are fewer unique land uses across the 9 level 1 LU codes in SWFWMD compared to other parts of the state. The number of unique land use descriptions and the total acreage for each level and district are shown for each level 1 LU code in **Figures 8 to 16**.

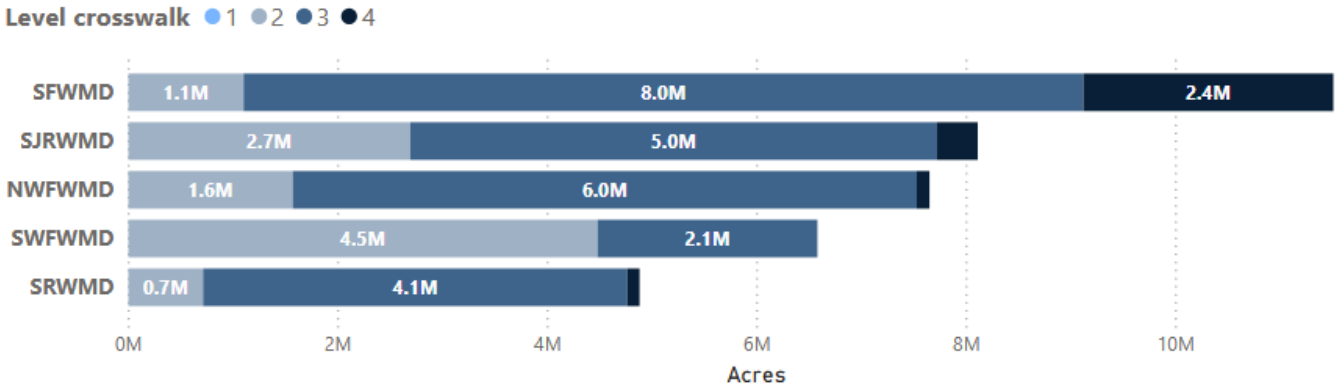
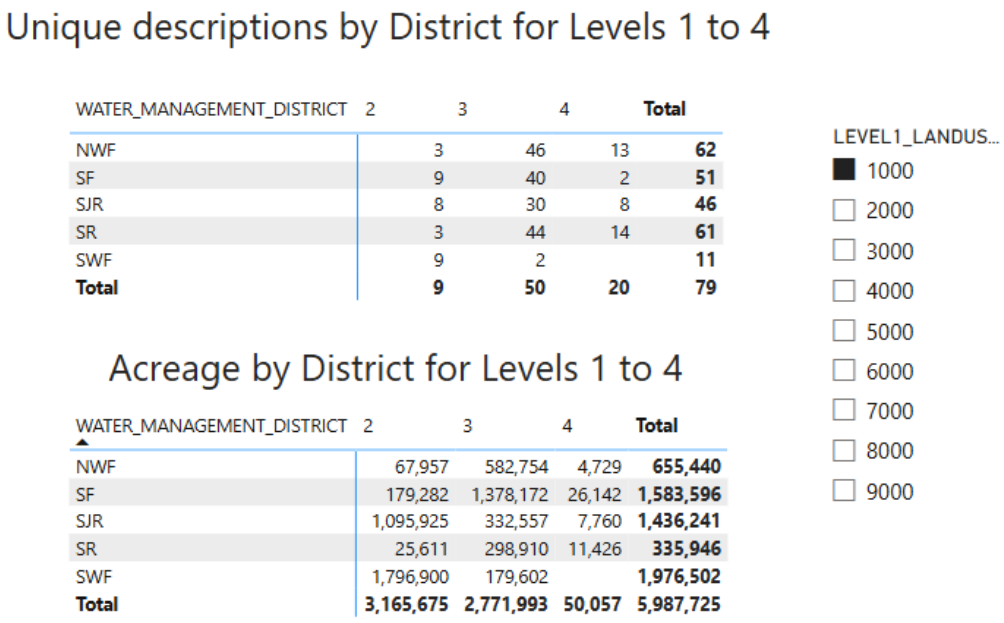


Figure 7. Total acreage by district for level 2, 3, and 4 LU descriptions.



Unique descriptions by District for Levels 1 to 4

WATER_MANAGEMENT_DISTRICT	2	3	4	Total
NWF	3	46	13	**62**
SF	9	40	2	**51**
SJR	8	30	8	**46**
SR	3	44	14	**61**
SWF	9	2		**11**
Total	**9**	**50**	**20**	**79**

Acreage by District for Levels 1 to 4

WATER_MANAGEMENT_DISTRICT	2	3	4	Total
NWF	67,957	582,754	4,729	**655,440**
SF	179,282	1,378,172	26,142	**1,583,596**
SJR	1,095,925	332,557	7,760	**1,436,241**
SR	25,611	298,910	11,426	**335,946**
SWF	1,796,900	179,602		**1,976,502**
Total	**3,165,675**	**2,771,993**	**50,057**	**5,987,725**

LEVEL1_LANDUS...
1000
2000
3000
4000
5000
6000
7000
8000
9000

Figure 8. Number of unique LU descriptions and total acreage by District for 1000 level land use (Urban and Built Up)

Unique descriptions by District for Levels 1 to 4

WATER_MANAGEMENT_DISTRICT	2	3	4	Total
NWF	4	17	1	**22**
SF	5	18	1	**24**
SJR	4	17	3	**24**
SR	4	16	1	**21**
SWF	6	2		**8**
Total	**6**	**19**	**5**	**30**

Acreage by District for Levels 1 to 4

WATER_MANAGEMENT_DISTRICT	2	3	4	Total
NWF	64,003	498,919	80,218	**643,140**
SF	1,525	2,161,661	599,168	**2,762,354**
SJR	21,850	954,974	32,481	**1,009,305**
SR	52,535	551,784	104,366	**708,685**
SWF	1,515,525	56,180		**1,571,705**
Total	**1,655,439**	**4,223,517**	**816,234**	**6,695,189**

LEVEL1_LANDUS...
- ☐ 1000
- ■ 2000
- ☐ 3000
- ☐ 4000
- ☐ 5000
- ☐ 6000
- ☐ 7000
- ☐ 8000
- ☐ 9000

Figure 9. Number of unique LU descriptions and total acreage by District for 2000 level land use (Agriculture)

Unique descriptions by District for Levels 1 to 4

WATER_MANAGEMENT_DISTRICT	1	2	3	Total
NWF		3	2	**5**
SF		3	3	**6**
SJR		3		**3**
SR		3	2	**5**
SWF	1	3		**4**
Total	**1**	**3**	**3**	**7**

Acreage by District for Levels 1 to 4

WATER_MANAGEMENT_DISTRICT	1	2	3	Total
NWF		193,732	22,593	**216,325**
SF		161,735	127,397	**289,132**
SJR		344,426		**344,426**
SR		139,611	7,722	**147,332**
SWF	1	272,954		**272,955**
Total	**1**	**1,112,458**	**157,712**	**1,270,170**

LEVEL1_LANDUS...
- ☐ 1000
- ☐ 2000
- ■ 3000
- ☐ 4000
- ☐ 5000
- ☐ 6000
- ☐ 7000
- ☐ 8000
- ☐ 9000

Figure 10. Number of unique LU descriptions and total acreage by District for 3000 level land use (Rangeland)

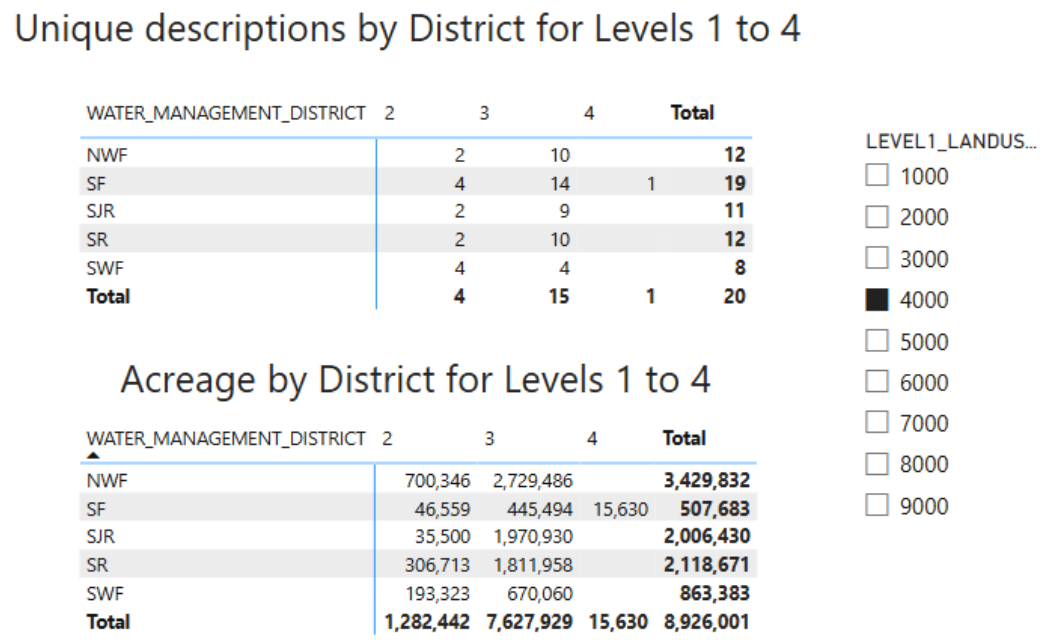


Figure 11. Number of unique LU descriptions and total acreage by District for 4000 level land use (Upland Forest)

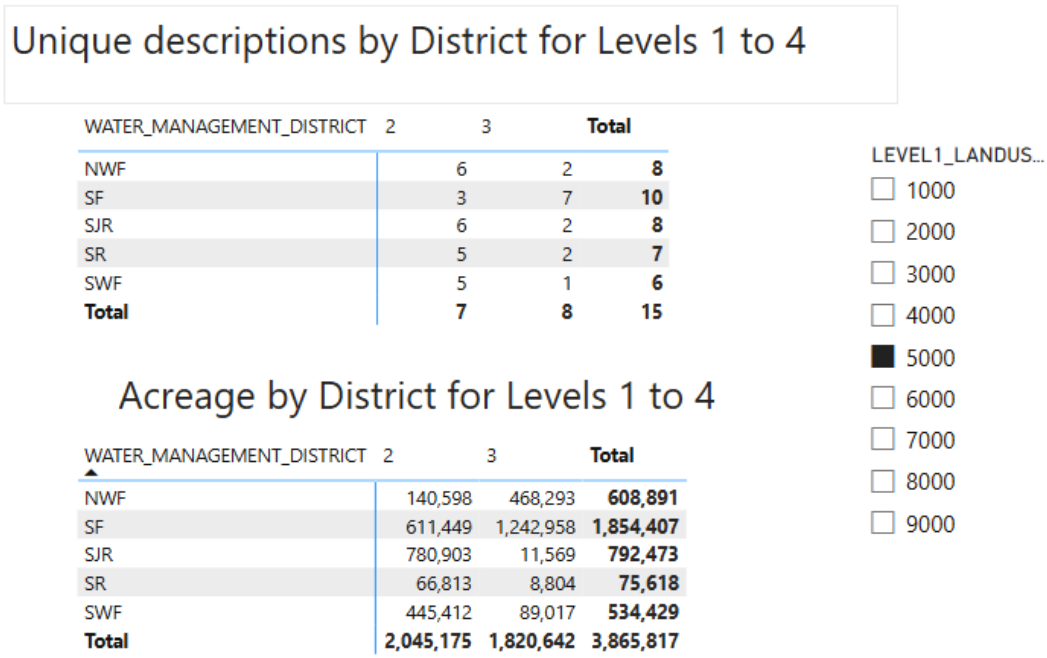


Figure 12. Number of unique LU descriptions and total acreage by District for 5000 level land use (Water)

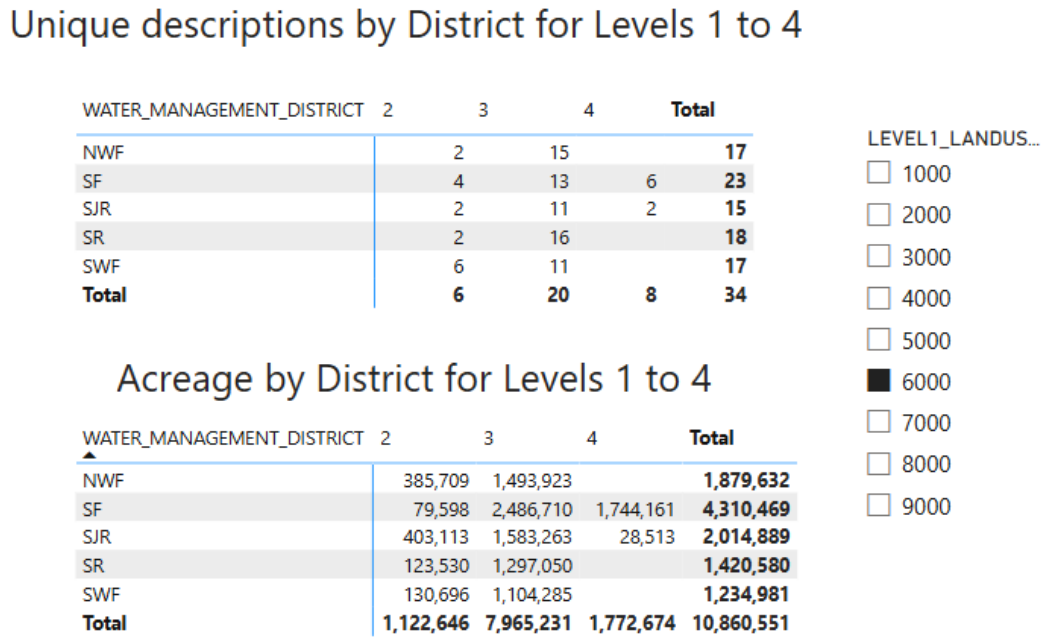


Figure 13. Number of unique LU descriptions and total acreage by District for 6000 level land use (Wetlands)

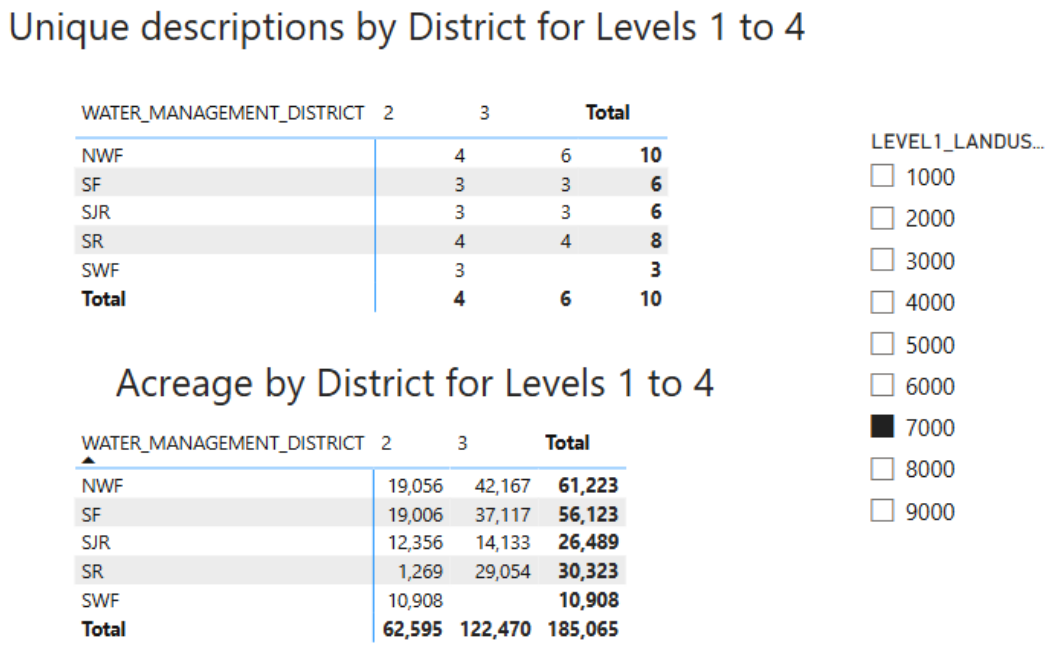


Figure 14. Number of unique LU descriptions and total acreage by District for 7000 level land use (Barren Land)

Unique descriptions by District for Levels 1 to 4

WATER_MANAGEMENT_DISTRICT	2	3	4	Total
NWF	1	15	2	**18**
SF	3	10	2	**15**
SJR	1	13		**14**
SR	1	12	2	**15**
SWF	3			**3**
Total	**3**	**16**	**3**	**22**

Acreage by District for Levels 1 to 4

WATER_MANAGEMENT_DISTRICT	2	3	4	Total
NWF	694	121,768	2,863	**125,325**
SF	4,266	140,107	1,277	**145,650**
SJR	1,291	162,166		**163,458**
SR	329	45,943	1,081	**47,353**
SWF	117,973			**117,973**
Total	**124,554**	**469,984**	**5,221**	**599,759**

LEVEL1_LANDUS...
- ☐ 1000
- ☐ 2000
- ☐ 3000
- ☐ 4000
- ☐ 5000
- ☐ 6000
- ☐ 7000
- ■ 8000
- ☐ 9000

Figure 15. Number of unique LU descriptions and total acreage by District for 8000 level land use (Transportation, Communication, and Utilities)

Unique descriptions by District for Levels 1 to 4

WATER_MANAGEMENT_DISTRICT	4	Total
NWF	1	**1**
SJR	1	**1**
Total	**2**	**2**

Acreage by District for Levels 1 to 4

WATER_MANAGEMENT_DISTRICT	4	Total
NWF	33,128	**33,128**
SJR	320,573	**320,573**
Total	**353,701**	**353,701**

LEVEL1_LANDUS...
- ☐ 1000
- ☐ 2000
- ☐ 3000
- ☐ 4000
- ☐ 5000
- ☐ 6000
- ☐ 7000
- ☐ 8000
- ■ 9000

Figure 16. Number of unique LU descriptions and total acreage by District for 9000 level land use (special classifications)

Land Use Code Nomenclature Discrepancies

There are occasionally minor naming inconsistencies in some LU descriptions across the districts. Meaning: a particular LU code might have slightly different LU descriptions across districts, typically for level 3 or 4 descriptions. For example, 8120: Railroads is sometimes called 8120: Railroads and Railyards in SFWMD. LU description differences are readily identifiable when using the LULC data dashboard and reviewing tables of LU descriptions. These naming differences could be readily corrected for statewide consistency through standard LU code to LU description crosswalk tables. No data users identified a particular need for level 3 or 4 codes not following standard naming conventions.

Land Use and Land Cover Differences

Land use describes the actual human use or purposes of an area, while land cover describes the physical surface characteristics. The LULC data includes attributes to represent both LU and LC. As shown in the figures below, the vast majority of designations of land use and land cover are the same. SFWMD has the largest acreage for which the land use and land cover codes are not the same, which is expected as SFWMD also has the largest acreage in total. Also evident in the figures below is that SWFWMD does not use separate land use and land cover codes; this simplification of the data was implemented in that district to streamline workflows for LULC updates.

Data users indicated that the distinction between LU and LC is important in some applications. This is particularly relevant where the LC is more relevant to represent runoff characteristics of an area (example: a large feature might have LU description of 1730 = Military, while the land cover might be Pasture or Wetlands or Forests of some type).

For about 37M acres, LU is identical to LC, while for about 2M acres, LC is categorized differently than LU (**Figure 17**). The most common LU descriptions statewide for which there are different LC: 1110: Low Density, Fixed Single Family Units, 4410: Coniferous Plantations, and 1130: Low Density, Mixed Units (Fixed and Mobile Home Units); representing about 178,000, 123,000, and 116,000 acres, respectively. Tables summarizing all LU and LC areas for which LC and LU are different can be queried for all combinations of district, land use, and other filtering options on the LULC data dashboard.

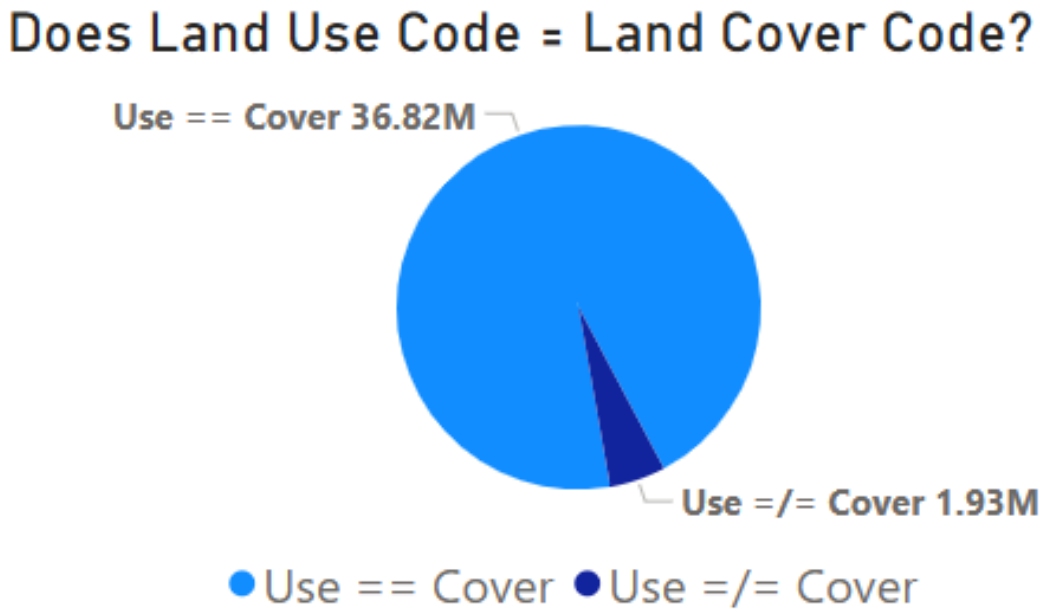


Figure 17. Statewide summary of acreage for which LU and LC are identical and when they are different

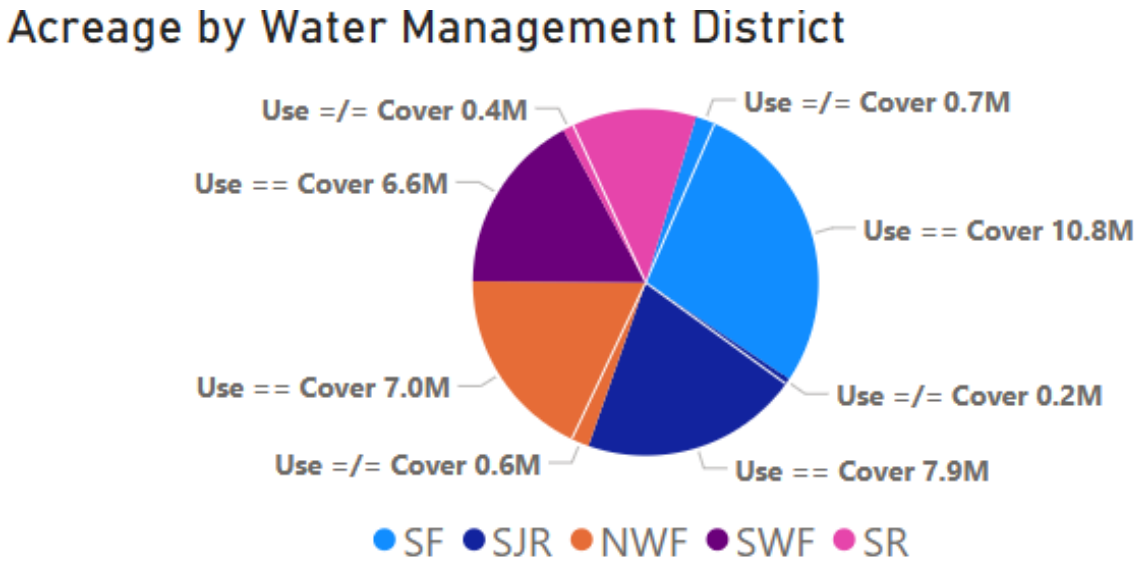


Figure 18. Statewide summary of acreage for which LU and LC are identical and when they are different

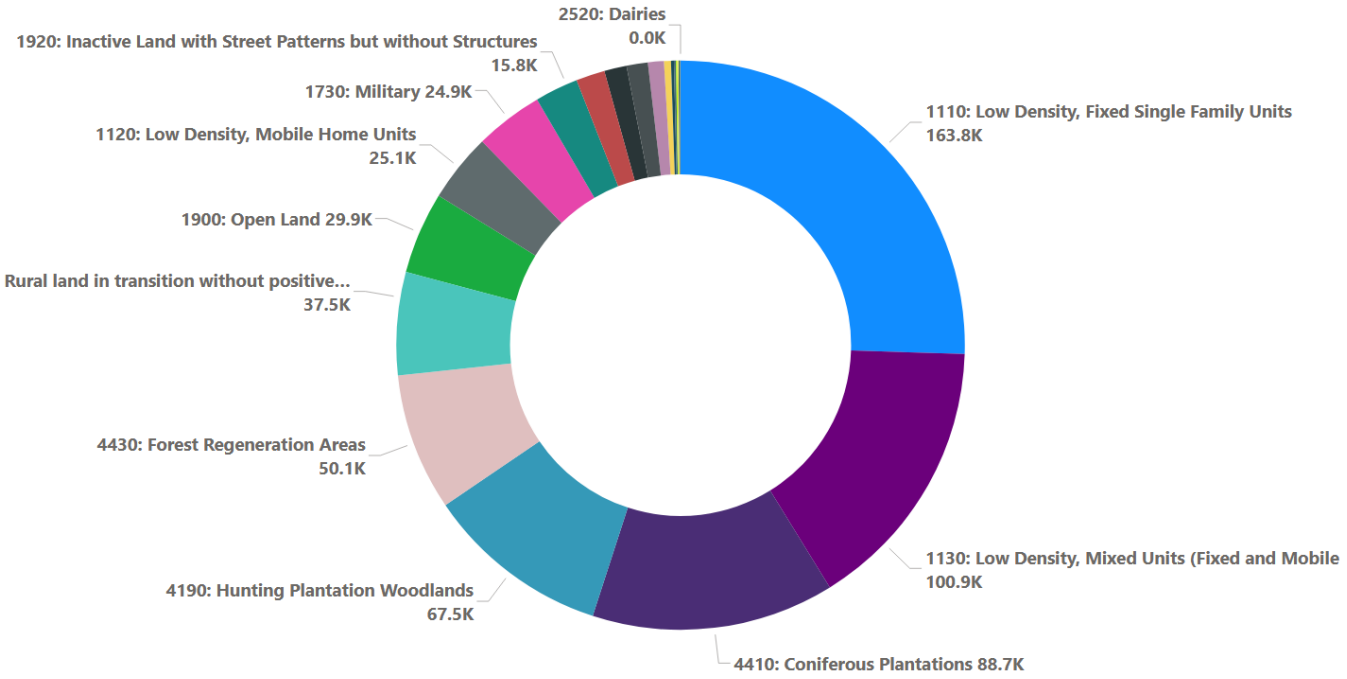


Figure 19. NWFWMD – LU descriptions for which LC is not identical to LU

In the chart above for NWFWMD (**Figure 19**), the land use codes 1110, 1130 and 4410 have the largest acreage for which the land cover codes are different. The land use codes 1110 and 1130 (Level 1: Urban and Built-Up) have land cover codes 1940 (Grass Surface) and 4340 (Upland Mixed - Coniferous/Hardwood) representing the most acreage. The land use code 4410 (Level 1: Upland Forest) has only one land cover code 6250 (Hydric Pine Flatwoods) with total acres above 88,650.

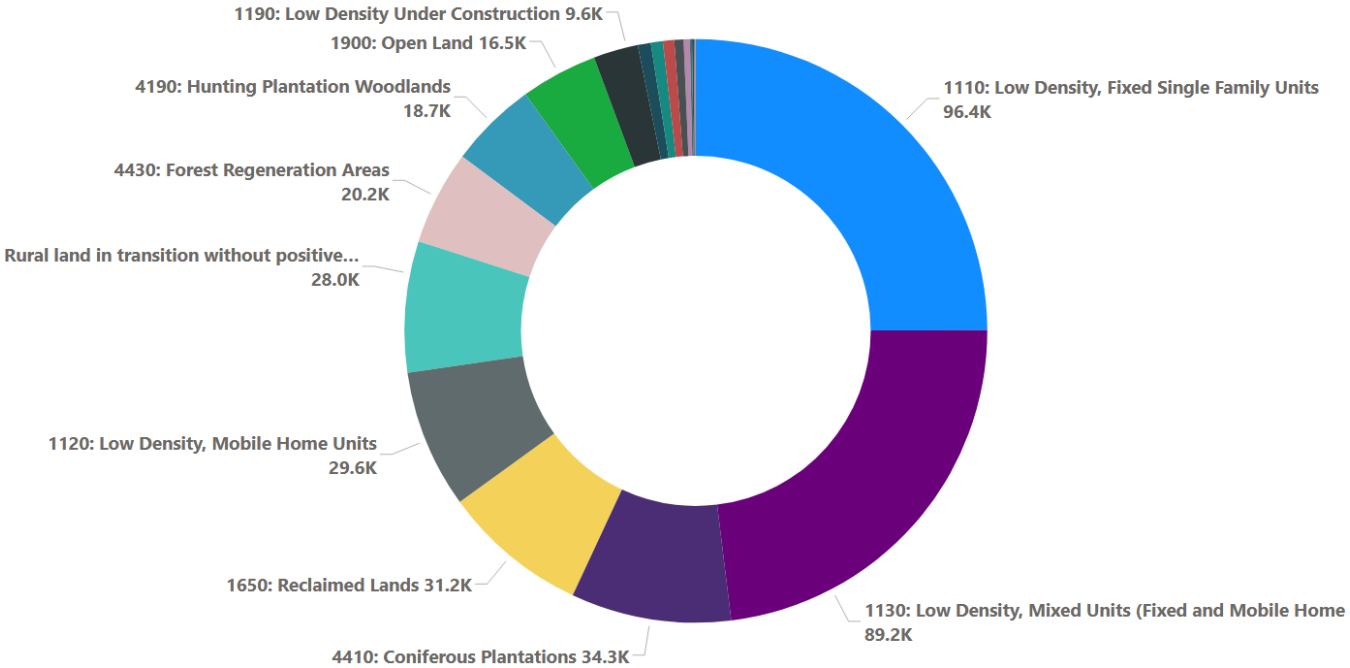


Figure 20. SRWMD – LU descriptions for which LC is not identical to LU

SRWMD (**Figure 20**) has LU and LC differences that are similar to those in NWFWMD; this is expected as DEP maintains the LULC data in both districts. The land use codes 1110, 1130 and 4410 have the largest acreage for which the land cover codes are different. The land use codes 1110 and 1130 (Level 1: Urban and Built-Up) have land cover codes 1940 (Grass Surface) and 4340 (Upland Mixed - Coniferous/Hardwood) containing the most acreage. The land use code 4410 (Level 1: Upland Forest) has only one land cover code 6250 (Hydric Pine Flatwoods) covering that LU, with total acres around 34,000.

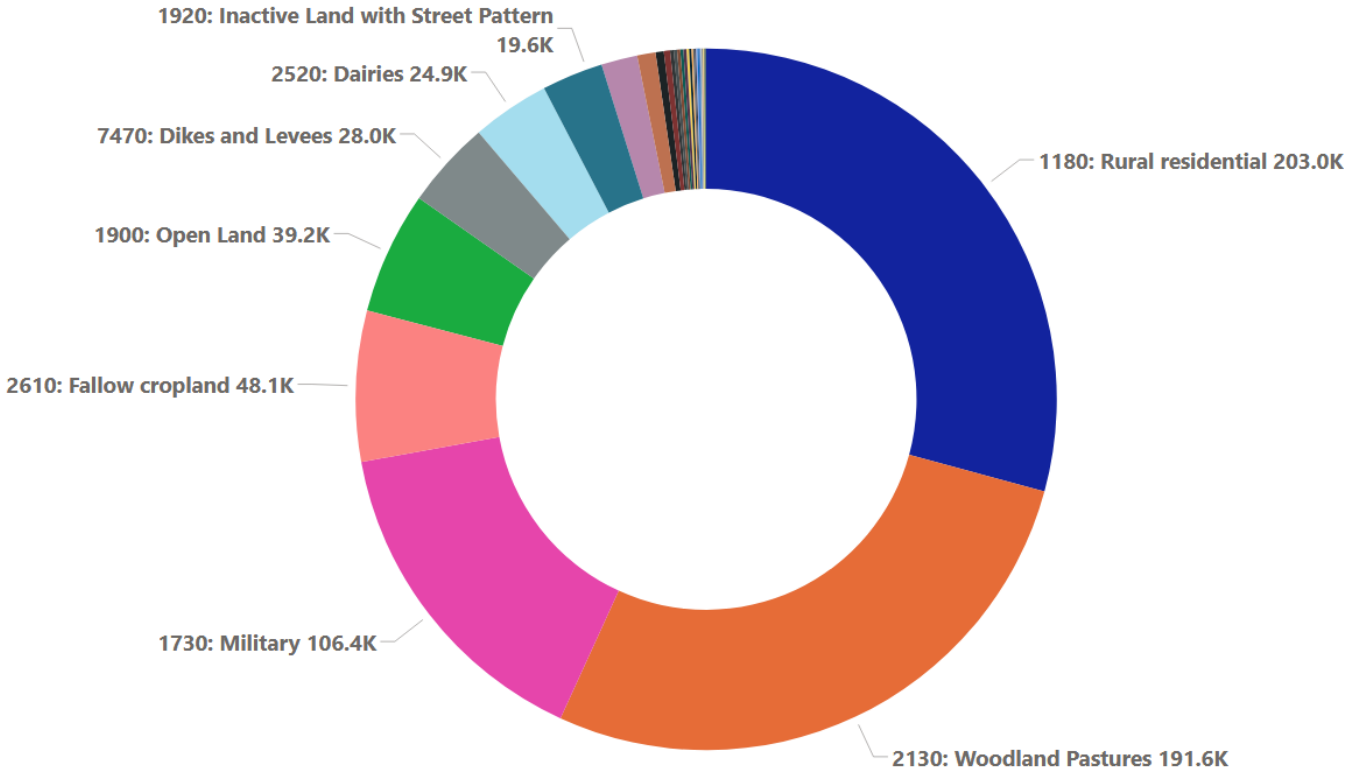


Figure 21. SFWMD – LU descriptions for which LC is not identical to LU

In SFWMD, the land use codes 1180, 2130 and 1730 have the largest acreage for which the land cover codes are different. The land use code 1180 (Level 1: Urban and Built-up) has land cover codes 3100 (Herbaceous Dry Prairie) and 4110 (Pine Flatwoods) with the most acreage for 1180 LU. These land cover codes have total acres of 63,694 and 56,150 respectively. The land use code 2130 (Woodland Pastures) has land cover codes 4110 (Pine Flatwoods), 4271 (Oak – Cabbage Palm Forest), 4340 (Upland Mixed - Coniferous/Hardwood) and 4200 (Upland Hardwood Forests) containing the most acreage. The land use code 1730 (Military) has land cover codes 2120 (Unimproved Pastures), 3210 (Palmetto Prairies), 4110 (Pine Flatwoods) and 4410 (Coniferous Plantations) covering the most acreage between 13,500 and 16,950.

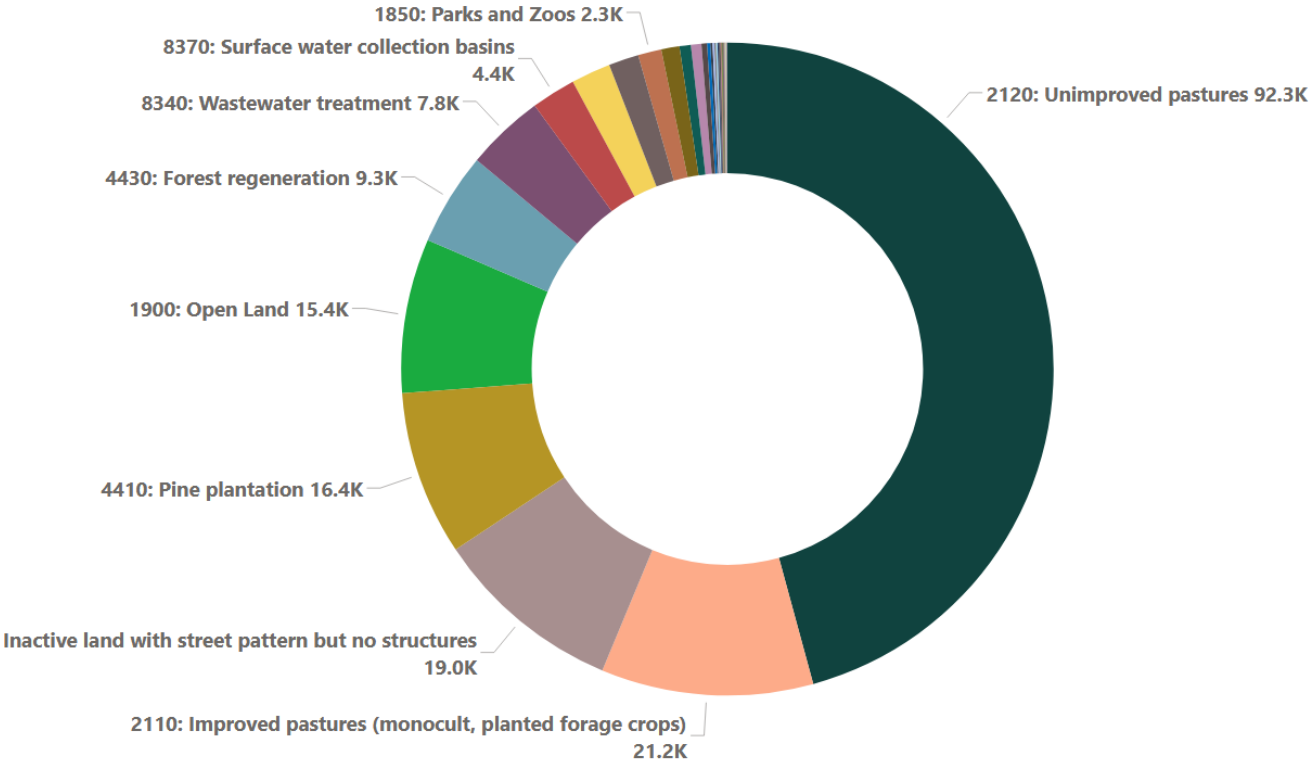


Figure 22. SJRWMD – LU descriptions for which LC is not identical to LU

In SJRWMD, the land use codes 2120, 2110, and 1920 have the largest acreage for which the land cover codes are different. The land use code 2120 (Unimproved pastures) has land cover codes 3300 (Mixed upland nonforested) and 3200 (Shrub and brushland (wax myrtle or saw palmetto, occasionally scrub oak)) covering the most acreage. These land cover codes have total acres of 63,368 and 19,163 respectively. The land use code 2110 (Improved pastures) has land cover codes 6430 (Wet Prairies) containing the most acreage (20,885). The land use code 1920 (Inactive land with street pattern) has land cover codes of 4210 (Xeric Oak), 3100 (Herbaceous upland nonforested), 4340 (Upland mixed coniferous/hardwood) and 3200 (Shrub and brushland (wax myrtle or saw palmetto, occasionally scrub oak)) representing the most acreage between (from 5,300 to 2,500 acres for those 4 LC types)

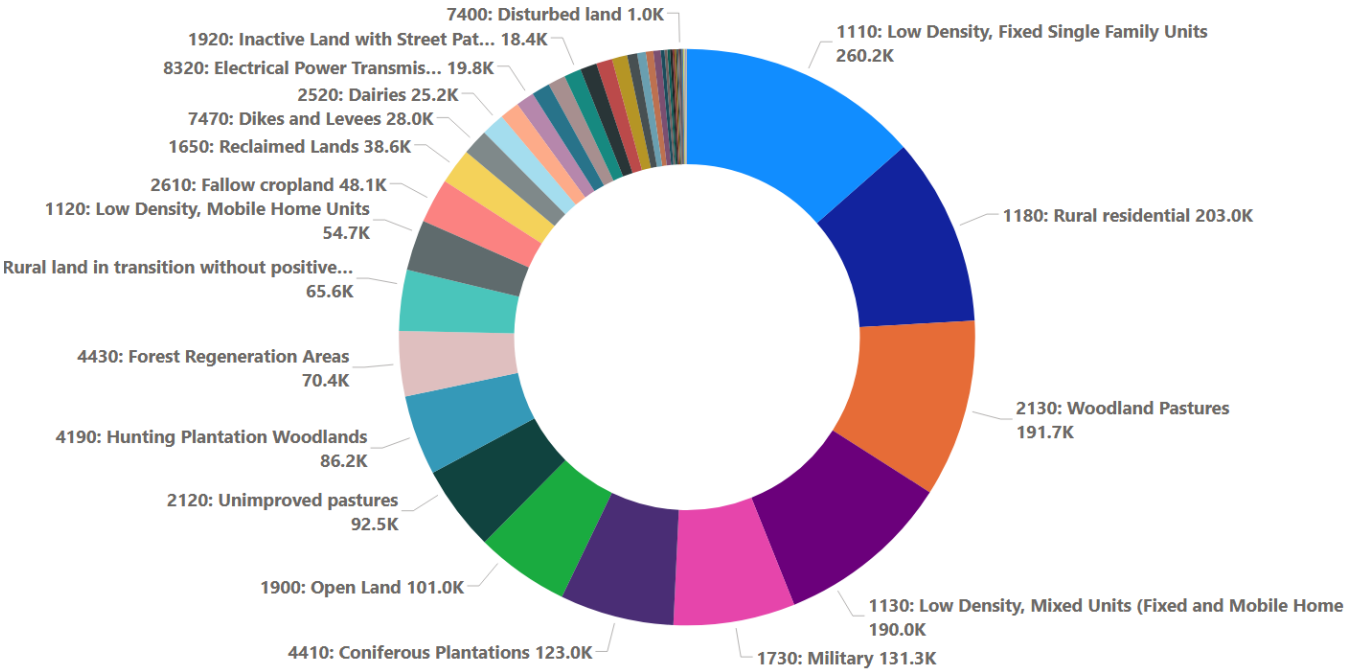


Figure 23. Statewide – LU descriptions for which LC is not identical to LU

The land use codes with the largest acreage for which the land cover codes are different as seen in the chart above are 1110, 1180, 2130, 1130, 1730 and 4410. The land use codes 1110 and 1130 is represented by the most acreage by the following land cover codes: 1940 (Grass Surface), 4340 (Upland Mixed – Coniferous/Hardwood), 4200 (Upland Hardwood Forests), and 3100 (Herbaceous (Dry Prairie)). The land use code 1180 includes the following land cover codes with the most acreage: 3100 (Herbaceous (Dry Prairie)), 4110 (Pine flatwoods), and 2110 (Improved Pastures). The land use code 2130 contains the land cover codes 4110 (Pine flatwoods), 4271 (Oak – Cabbage Palm Forest), 4340 (Upland Mixed Coniferous/Hardwood), and 4200 (Upland Hardwood Forests) with the largest acreage. The land use code 1730 includes landcover codes 7400 (Distributed Lands), 2120 (Unimproved Pastures), 3210 (Palmetto Prairies), and 4110 (Pine flatwoods) covered by the most acreage. The land use code 4410 includes only the land cover code 6250 (Hydric Pine Flatwoods) with the most acreage.

Land Use Data Overlaps

There are some situations for which land use areas in reality are inherently overlapping other land uses. For example, transmission lines are above and overlapping wetlands or agricultural lands or other land uses; transportation land uses (bridges) are sometimes overlapping other transportation land uses or wetlands or water. This seems to occur most commonly for 8320 (Electrical Power Transmission Lines)

and 8170 (Oil, Water or Gas Long Distance Transmission Lines) – as these land uses are nearly always suspended above the land surface and have other land uses beneath them. As the LULC dataset does not allow for features to actually overlap, data developers have to make judgements about when and how to digitize features that overlap other areas. In some cases, due to the need to streamline workflows (reduce digitization effort) this creates incomplete representations of the overlapping features (most commonly for linear features like 8170 and 8320). Districts often use different LU and LC for these inherently overlapping features, but this does not resolve the need to choose between which features to delineate in many instances. Land uses of "1840: Marinas and Fish Camps" were reviewed in detail, and in all examples, it seemed that the land use covering only the land-based portions were included in LU code 1840 features.

Several examples of the challenges involved in representing overlapping land uses are shown in the following figures.

Figure 24. 3 LULC features, 8320: Electrical Power Transmission Lines (orange outline), that are "interrupted" by wetland features (yellow outline; 6170 and 6430).

Figure 25. 8320: Electrical Power Transmission Lines (orange outline) that are "interrupted" by agricultural features.

Figure 26. 5100: Streams and waterways (Yellow Outline) overlapping roadway features (Orange Outline); 8100: Transportation (SWFWMD on left); 8140: Roads and Highways (SJRWMD on right)

Figure 27. 1840: Marinas and Fish Camps – not overlapping water – only land-based portions shown (SJRWMD on left, SRWMD on right)

Critical Assets Identification

Critical assets are identified by section 380.093, F.S., as having particular importance for increasing the resilience to flood risks. DEP maintains an existing dataset of locations and attributes for critical asset types in Florida. During the development of DEP's critical assets dataset, numerous DEP datasets were used as the authoritative data sources for certain asset types ("Wastewater Treatment Facilities and Lift Stations" and "Water Utility Conveyance Systems" and "Solid and Hazardous Waste Facilities" and "Wetlands" are 4 examples for which DEP's datasets were used). DEP's LULC dataset was used as the authoritative data source for the "Wetlands" critical asset features in the statewide dataset, the other authoritative DEP data sources for critical assets were from other data sets with point geometry. As evidenced in **Table 4**, there is often not sufficient detail in the LU descriptions from the LULC data for those features to directly serve as the critical asset locations. It should be noted that even with level 3 LU codes, the LU descriptions in the LULC data are often not detailed enough to directly align with the critical assets data. For example, 1740: Medical and Health Care might be used for 3 different critical asset types: "Emergency Medical Service Facilities", "Health Care Facilities", or "Hospitals". For some critical asset types there is direct alignment with LU codes from the LULC data; 1730: Military for "Military Installations" and 8110: Airports for "Airports" as 2 examples. A summary table (**Table 4**) lists all the LU codes that might align with a critical asset type, including which districts utilize each code.

However, **because critical asset locations are known and represented by DEP's critical assets data layers, those locations could be used statewide to update LU descriptions in the LULC data to align with the critical assets data and improve consistency statewide in the descriptions of LU at locations overlapping critical assets.** This could efficiently be achieved statewide or by individual Districts through:

- Use a critical assets data layer to select the LULC features that contain or intersect with the LULC data (in GIS terms this might be called a "select by location" operation) in order to refine the LU code and/or geometry at those locations. Example: use the "schools" critical assets point features to select by location the LULC features that contain the "schools" points. Those selected features are a subset of the LULC data to be reviewed to adjust LU description to "1710: Educational Facilities" where needed and/or refine geometry to reduce feature size to align with a school property (based on parcel boundaries or photointerpretation). There will be numerous cases of "schools" points being found inside large LULC features that are commercial or institutional or some type of residential land use description. Schools could be digitized out of the larger features and LU code update to "1710: Educational Facilities" or a new code that aligns with asset type.

See a list of critical assets data types (geometry) and data sources in **Appendix B table 8**.

An additional function of the LULC data could be to provide the areal representation of critical asset locations represented as points. While many of the authoritative data sources for critical assets are point datasets, having point locations limits the ability to characterize flood risks in a more detailed way (for example: quantifying flooded areas and ranges of flood depths across the area of a critical asset location).

Table 4. Critical Asset Types and Groups and LU Descriptions potentially relating to the asset type

Critical Asset Type	Asset Group	LU code aligning with Asset Type	Districts with aligning LU code
Colleges and Universities	Critical community and emergency facilities	1710: Educational Facilities	NWF, SF, SR
Community Centers	Critical community and emergency facilities	NA 1860: Comm. Rec. Facilities	NWF, SR
Correctional Facilities	Critical community and emergency facilities	1760: Correctional	NWF, SF, SR
Disaster Recovery Centers	Critical community and emergency facilities	NA	
Emergency Medical Service Facilities	Critical community and emergency facilities	1740: Medical and Health Care	NWF, SR
Emergency Operation Centers	Critical community and emergency facilities	NA	
Fire Stations	Critical community and emergency facilities	NA 1750: Governmental	NWF, SR
Health Care Facilities	Critical community and emergency facilities	1740: Medical and Health Care	NWF, SR
Hospitals	Critical community and emergency facilities	1740: Medical and Health Care	NWF, SR

Critical Asset Type	Asset Group	LU code aligning with Asset Type	Districts with aligning LU code
Law Enforcement Facilities	Critical community and emergency facilities	NA	
Local Government Facilities	Critical community and emergency facilities	1750: Governmental	NWF, SJR, SR
Logistical Staging Areas	Critical community and emergency facilities	NA	
Risk Shelter Inventory	Critical community and emergency facilities	NA	
Schools	Critical community and emergency facilities	1710: Educational Facilities	NWF, SF, SR
State Government Facilities	Critical community and emergency facilities	1750: Governmental	NWF, SJR, SR
Communications Facilities	Critical Infrastructure	8200: Communications	NWF, SF, SR, SJR, SWF
Disaster Debris Management Sites	Critical infrastructure	NA	
Drinking Water Facilities	Critical Infrastructure	8330: Water Supply Plants - Including Pumping Stations	NWF, SF, SR, SJR
Electric Production and Supply Facilities	Critical Infrastructure	8310: Electric Power Facilities	NWF, SF, SR, SJR
Electric Production and Supply Facilities	Critical Infrastructure	8315: Electric Power Sub Stations	NWF, SR
Military Installations	Critical Infrastructure	1730: Military	NWF, SF, SR, SJR
Solid and Hazardous Waste Facilities	Critical Infrastructure	8350: Solid waste disposal	NWF, SF, SR, SJR
Solid and Hazardous Waste Facilities	Critical Infrastructure	8340: Sewage Treatment	NWF, SF, SR, SJR
Stormwater Treatment Facilities and Pump Stations	Critical Infrastructure	8340: Wastewater treatment	NWF, SF, SR, SJR
Wastewater Treatment Facilities and Lift Stations	Critical Infrastructure	8340: Wastewater treatment	NWF, SF, SR, SJR
Water Utility Conveyance Systems	Critical Infrastructure	8330: Water Supply Plants - Including Pumping Stations	NWF, SF, SR, SJR
Conservation Lands	Natural, cultural, and historical resource	NA	
Historical and Cultural Assets	Natural, cultural, and historical resource	NA	
Parks	Natural, cultural, and historical resource	1850: Parks and Zoos	NWF, SF, SR, SJR
Shorelines	Natural, cultural, and historical resource	6520: Shorelines	SWF
Surface Waters	Natural, cultural, and historical resource	5100: Streams and Waterways;	NWF, SF, SR, SJR, SWF
Surface Waters	Natural, cultural, and historical resource	5110: Natural River, Stream, Waterway;	SF
Surface Waters	Natural, cultural, and historical resource	5120: Channelized Waterway;	NWF, SF, SR
Surface Waters	Natural, cultural, and historical resource	5200: Lakes	NWF, SF, SR, SJR, SWF
Surface Waters	Natural, cultural, and historical resource	5250: Open water within a freshwater marsh / Marshy Lakes	SJR
Surface Waters	Natural, cultural, and historical resource	5300: Reservoirs;	NWF, SF, SR, SJR, SWF
Surface Waters	Natural, cultural, and historical resource	5400: Bays and Estuaries	NWF, SJR, SWF
Surface Waters	Natural, cultural, and historical resource	5410: Embayments opening directly into the Gulf of Mexico or the Atlantic Ocean	NWF, SF
Surface Waters	Natural, cultural, and historical resource	5420: Embayments Not Opening Directly to Gulf or Ocean	SF

Critical Asset Type	Asset Group	LU code aligning with Asset Type	Districts with aligning LU code
Surface Waters	Natural, cultural, and historical resource	5430: Enclosed saltwater ponds within a salt marsh, 5430: Saltwater Ponds	SF, SJR
Surface Waters	Natural, cultural, and historical resource	5500: Major springs	NWF, SJR, SR
Surface Waters	Natural, cultural, and historical resource	5600: Slough Waters	NWF, SF, SR, SJR
Surface Waters	Natural, cultural, and historical resource	5700: Major Bodies of Water	SWF
Surface Waters	Natural, cultural, and historical resource	5710: Atlantic Ocean	SF
Surface Waters	Natural, cultural, and historical resource	5720: Gulf of Mexico	SF, SR, SWF
Wetlands	Natural, cultural, and historical resource	6100: Wetland Hardwood Forests;	SWF
Wetlands	Natural, cultural, and historical resource	6170: Mixed wetland hardwoods;	NWF, SF, SR, SJR
Wetlands	Natural, cultural, and historical resource	6180: Cabbage Palm Wetland	NWF, SF, SR
Wetlands	Natural, cultural, and historical resource	6200: Wetland Coniferous Forests;	SF, SWF
Wetlands	Natural, cultural, and historical resource	6400: Vegetated Non-Forested Wetlands;	SF, SWF
Wetlands	Natural, cultural, and historical resource	6460: Mixed scrub-shrub wetland	NWF, SJR, SR
Wetlands	Natural, cultural, and historical resource	6500: Non-vegetated wetland	NWF, SF, SR, SJR, SWF
Airports	Transportation and evacuation route	8110: Airports	NWF, SF, SR, SJR
Airports	Transportation and evacuation route	8113: Private Airports	SF
Airports	Transportation and evacuation route	8115: Grass Airports	NWF, SF, SR
Bridges	Transportation and evacuation route	8140: Roads and Highways	NWF, SF, SR, SJR
Bus Terminals	Transportation and evacuation route	8130: Bus and Truck Terminals	NWF, SJR, SR
Major Roadways	Transportation and evacuation route	8140: Roads and Highways	NWF, SF, SR, SJR
Marinas	Transportation and evacuation route	1840: Marinas & fish camps	NWF, SF, SR, SJR
Ports	Transportation and evacuation route	8150: Port facilities	NWF, SF, SJR
Rail Facilities	Transportation and evacuation route	8120: Railroads and Railyards	NWF, SF, SR, SJR
Railroad Bridges	Transportation and evacuation route	8120: Railroads and Railyards	NWF, SF, SR, SJR

Several examples (**Figures 28 to 33**) illustrate the suitability and challenges of using LULC as the area coverage for overlapping critical asset locations.

Notable in **Figure 28** (Airport example): there are 5 DOR parcel features that cover the airport, having use code (DOR_UC) as “Counties” (DOR_UC = 86). In this instance, LULC polygon is the more suitable feature (compared to parcels) to represent airport area both in terms of LULC description and geometry.

Notable in **Figure 29** (Schools example): multiple public school campuses (different critical asset point locations overlapping) are overlapping only 1 DOR parcel feature (School Board of Leon County). There are 4 LULC features representing the separate campus and bus compound areas and also several features represent the wetland and forested areas on the school property. LULC geometry could be suitable here for the area coverage for overlapping critical asset locations.

Notable in **Figure 30** (Local Government Facilities example): a 5 acre parcel feature provides a suitable means of representing the area of that asset. In this instance, the overlapping LULC does not separately delineate the government facilities asset, rather it is part of a larger 665 acre 1400: Commercial and Services LU feature. Parcel geometry could be suitable here for the area coverage for overlapping critical asset locations, and that geometry could be used to update LULC features to align with the critical assets data.

Notable in **Figure 31** (Ports example) neither the parcel data or the LULC are readily usable as an areal representation of the port critical asset. The overlapping LULC feature (1800: Transportation) would need geometry edits to work as intended for critical asset coverage. Similarly, numerous parcel features would need merged or revised to work as intended for critical asset coverage.

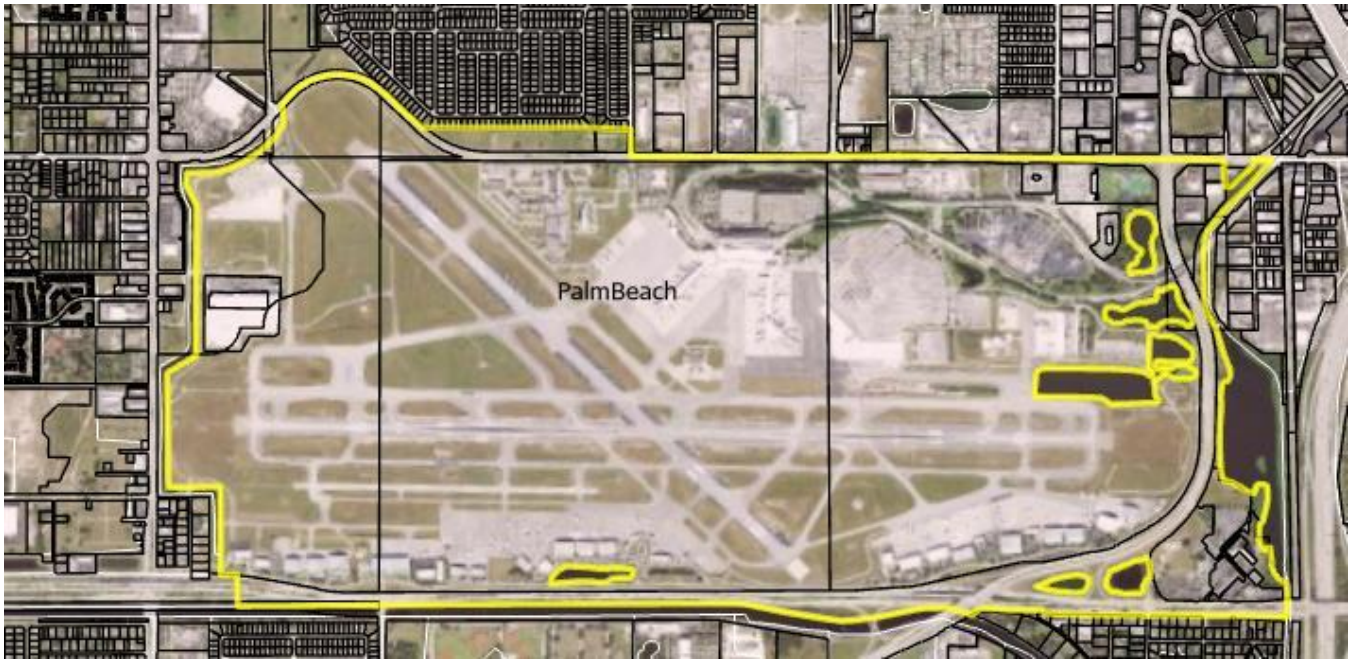


Figure 28. Palm Beach International Airport. Yellow outline feature is the LULC feature for the airport. DOR parcels shown with black outline.

Figure 29. Multiple public school campuses on 1 DOR parcel feature. Orange outline feature is the parcel feature for this school complex. LULC features shown with white outline. Note: 4 LULC features represent separate campus and bus compound areas and also several features represent the wetland and forested areas on the school property.

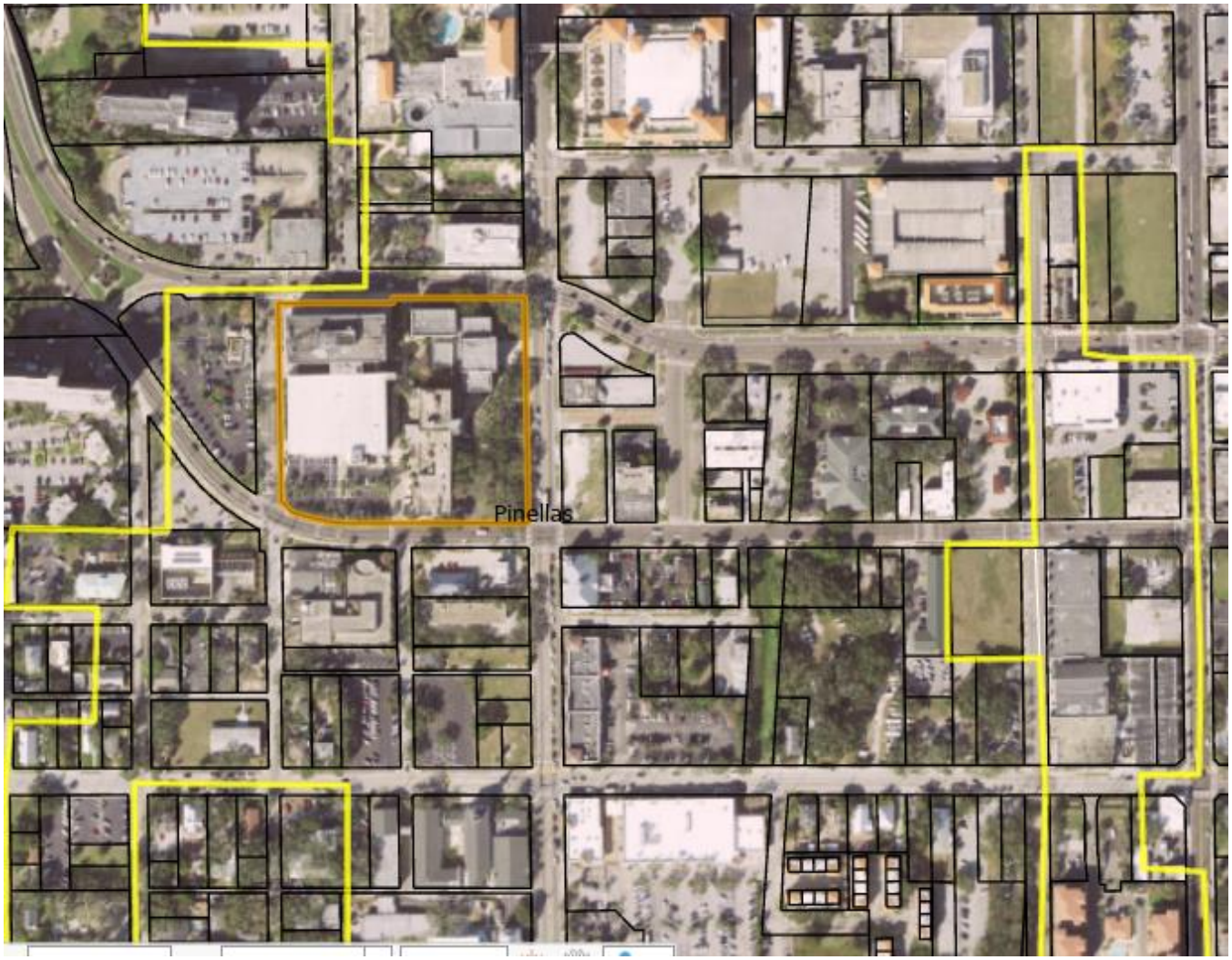


Figure 30. Local Government Facilities asset type; orange outline feature is the parcel feature (Pinellas County BOCC) that aligns with the critical asset location (5 acres). Yellow outline indicates the LULC feature covering a large area (1400: Commercial and Services; 665 acres)

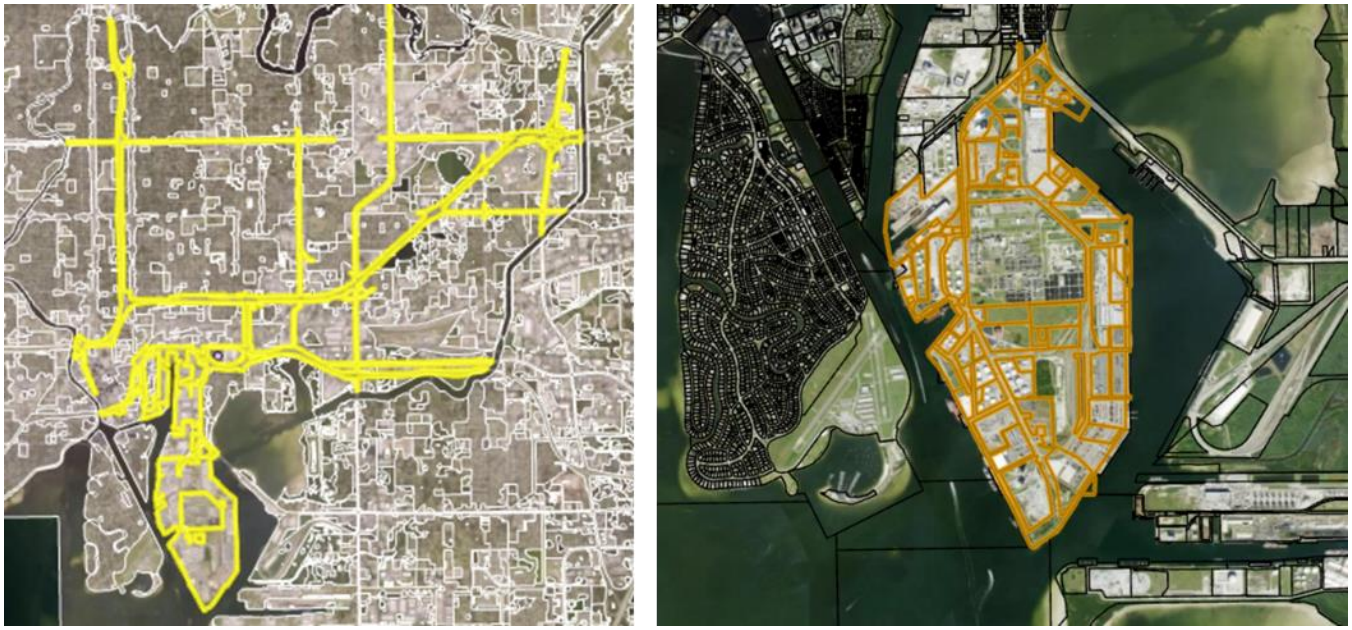


Figure 31. Port of Tampa. Yellow outline indicates the LULC feature covering the port and nearby roadway areas (1800: Transportation); see image on right of 74 parcels that might be usable with modifications to represent the port area.

Agricultural Land Use

It was noted in surveys and interviews that LULC data users sometimes need more detailed LU descriptions, depending on the LU data application, in agricultural LU types. This section summarizes the key differences in how DEP's statewide LULC differs from FDACS's FSAID dataset of agricultural land use. The FDACS FSAID dataset was created in response to water supply planning challenges related to crop type differences and water demand model differences across district boundaries. As such, for water supply planning purposes, FSAID data and not LULC data is predominately used by the districts. For LU data uses in which runoff quantity estimates are most important, detailed crop information might be less important. For LU data uses in which nutrient load estimates are relevant, more detailed crop classifications are usually needed.

FSAID agricultural lands data was originally developed around 2014 from numerous data sources, including DEP's LULC data. Other data layers used for the FSAID agricultural lands development: irrigated areas and water use permits from the districts, DOR parcel data, vegetation indices data and more. The LULC data from DEP and the districts was a key foundation in assembling the FSAID data. Departures from the LULC data were largely based on annual data refinements, using input from USGS field verification, district staff, FDACS staff, water use data, water use permit changes and other information

to identify potential change in agricultural lands. Also, during the development and updates of the FSAID data, crop types were renamed and irrigation systems were assigned based on permit information and/or imagery interpretation.

Specific crop types can be important to classify for nutrient load estimates for some use cases. Example: cotton and peanut are both agronomic crops, grown in rotation (both referred to as Row Crops in LULC data) – but they have very different fertilizer application amounts because peanut is a nitrogen-fixing crop and receives only small nitrogen applications, if any. For data uses where fertilizer input loads are important as part of nutrient load estimates, a more detailed and statewide consistent crop categorization is important. For data uses where nutrient loads or water use estimates are not as relevant, the statewide LULC crop types are likely to be suitable.

SJRWMD and SFWMD typically classify crop types at level 3 or 4. Excluding all the fallow crop types from the FSAID data, there are 278 unique crop types, but these are categorized into 14 crop groups. There are 30 unique LU description for agricultural lands in the LULC dataset, categorized into two level 2 LU codes for agriculture.

A notable difference in FSAID and LULC agricultural lands is the difference in citrus area between the two datasets. Citrus acreage is likely overrepresented in the LULC dataset: about 400,000 acres of citrus land (in SJRWMD and SFWMD only); compared to about 180,000 acres in SJRWMD and SFWMD based on current FSAID coverage. The main reason for the acreage difference is that the FSAID data identifies fallow citrus as a crop type unique from citrus (fallow meaning it is not in production, based on imagery interpretation or field verification it is unlikely to be irrigated or managed for active production). Total statewide citrus is not readily comparable as citrus in SWFWMD is part of the Cropland and Pastureland land use used for most agriculture in the district.

Some “Open Lands” or “Rangelands” were included as part of the FSAID agricultural lands during the original development of the data if those lands overlapped a parcel zoned for agriculture. This is likely why the FSAID total acreage is about 10% larger than the total LULC level 2000 areas. The total agricultural areas by District for the FSAID and LULC are summarized in **Figure 32**. Note that in all districts, the FSAID and LULC agricultural acres are similar, with FSAID areas being slightly larger overall. Notable in **Figure 33**: similarity in acreage between LULC and FSAID for several major crop types. Cropland and Pastureland and Row Crops, major crop areas in LULC data, are not major crop areas in FSAID, as there has been deliberate effort over the past 12 years to re-name crops for those two crop categories as they are not detailed enough for some use cases in the FSAID dataset.

With DEP and the districts using FSAID for their data uses which require more detailed crop or irrigation information, this might allow for LULC updates to be completed at Level 2 or Level 1.

Alternatively, the FSAID agricultural lands data could be incorporated directly in the LULC dataset. This would require the FSAID crop nomenclature to be crosswalked to align with LU descriptions (readily achievable) and would require spatial cleanup and topology adjustments to ensure continuous LULC data coverage (this spatial cleanup would be substantial and might be complicated to maintain, but this could probably be resolved). Including the FSAID agricultural lands could be done during a District's LULC update cycle. This would greatly reduce imagery review time (as agricultural lands would not need to be reviewed), but it would increase geoprocessing for the boundary and topology clean-up to produce a continuous coverage map with no overlapping features.

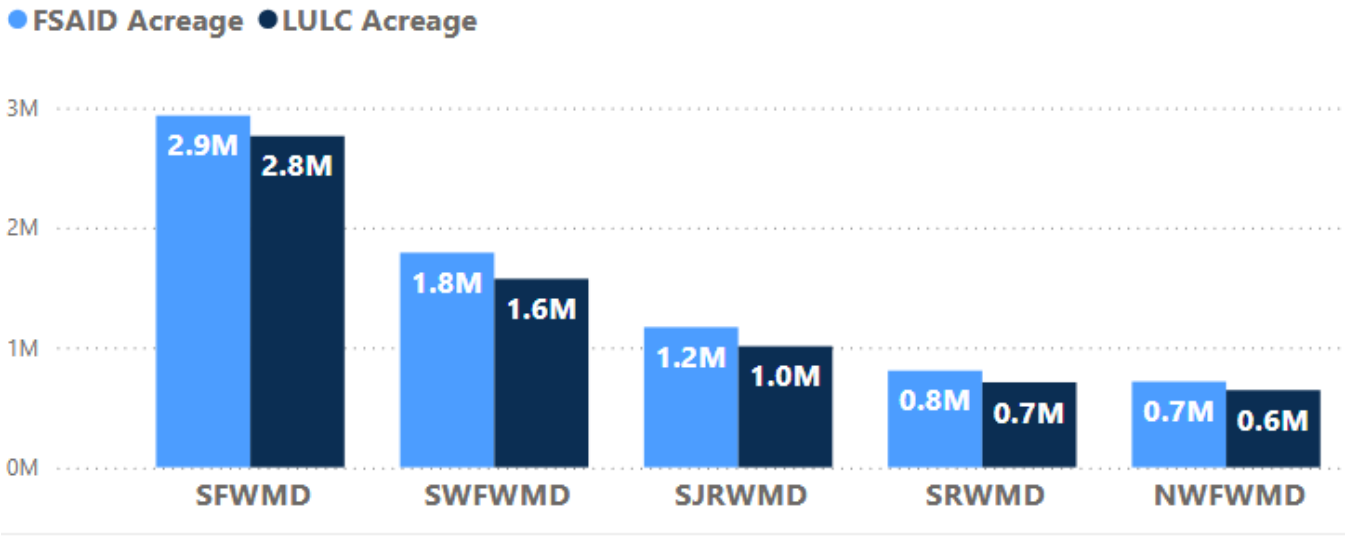


Figure 32. FSAID and LULC agricultural acreage totals by District.

LULC crop types

LANDUSE_DESCRIPTION	Sum of Acreage
2110: Improved Pastures	1,448,352
2100: Cropland and Pastureland	1,092,714
2140: Row Crops	626,619
2156: Sugar Cane	599,168
2110: Improved pastures (monocult, planted forage crops)	570,420
Total	**6,695,189**

FSAID crop types

Crop	Sum of Acreage
ImprovedPastures	1,732,606
Grass_Pasture	912,619
Sugarcane	576,096
SeasonalGrazing	493,790
UnimprovedPastures	429,212
WoodlandPastures	400,643
Total	**7,411,074**

Figure 33. FSAID and LULC agricultural acreage for major crop types in each dataset

Note: these tables are not connected or related; they are shown here just to compare crop types

FL LULC Data Viewer

As described in the Executive Summary, an online LULC data viewer was developed to allow for additional visualization to support the data summaries provided in this report. **The dashboard can be accessed here:**
https://datavisual.balmoralgroup.us/FL-LULC-dataviewer.

This dashboard includes pages covering the main sections of data analysis included in this report:

- Map summary page: including feature size comparisons, total acreage and filtering by District, LU land use, LU description and more
- Classification levels comparisons: summary tables and visuals showing areas, feature size, and number of unique LU descriptions at levels 2, 3, or 4 with filtering by a variety of data types
- Land use and land cover differences: including a variety of filtering options, including ability to select if LU = LC or LU <> LC
- Critical asset codes: data visuals showing LU descriptions aligning with critical asset types (based on approximate name matching).
- Agricultural lands summaries: compares acreage totals and acreage by crop type between LULC agricultural lands and FSAID agricultural lands.

The following appendix (**Appendix A**) provides more detail on survey and interview and focus group information gathering.

Appendix A – Interview, Focus Group, and Survey Summaries

LULC Data Refinement

Survey Response Summary

LULC Data Development

In general, the respondents all had similar time frames for updates to LULC and sources of imagery and supporting data, and would each make updates to their LULC data independent of each other. The main differences between how each agency updated their LULC was in how each went to different levels of category in each classification, as well as different sizes of MMU for each category.

Feature Delineation

Survey respondents had a variety of methods that each used to delineate feature classifications, generally dividing areas based on their own photointerpretation keys. Most would not divide areas based on specific features, and instead group them using the visual area as a contiguous classification. Some others would base their delineation on certain features. For example, wet areas are analyzed to determine if area is wet due to a recent rain or if area is inundated with water on a regular basis, then using ancillary and historical data to accurately classify wet and dry areas.

Classification Level

All respondents indicated that they always or sometimes need Level 2 or 3 LU classifications for their LULC data uses. The Level 3 and 4 categories were used as well depending on each respondent use cases. **Table 5** showcases the survey responses indicating what level of classifications were used in LULC development.

Table 5. Survey Responses Indicating Level of Classifications Used

Level 1 Land Use	LU Level	Always	Sometimes	Never	total responses
100 URBAN AND BUILT UP	Level 2	11	3	0	14
	Level 3	5	9	0	14
	Level 4	2	9	0	11
200 AGRICULTURE	Level 2	11	3	0	14
	Level 3	9	5	0	14
	Level 4	4	8	0	12
300 RANGELAND	Level 2	11	3	0	14
	Level 3	7	5	0	12
	Level 4	3	8	0	11
400 UPLAND FORESTS	Level 2	10	4	0	14

Level 1 Land Use	LU Level	Always	Sometimes	Never	total responses
	Level 3	6	7	0	13
	Level 4	2	9	0	11
500 WATER	Level 2	11	3	0	14
	Level 3	6	7	0	13
	Level 4	2	9	0	11
600 WETLANDS	Level 2	11	3	0	14
	Level 3	7	6	0	13
	Level 4	4	9	0	13
700 BARREN LAND	Level 2	10	4	0	14
	Level 3	5	7	0	12
	Level 4	2	9	0	11
800 TRANSPORTATION,	Level 2	10	4	0	14
COMMUNICATION, AND	Level 3	7	5	0	12
UTILITIES	Level 4	2	9	0	11
900 SPECIAL	Level 2	9	4	0	13
CLASSIFICATIONS	Level 3	6	6	0	12
	Level 4	1	11	0	12

Source: TBG Work Product

Minimum Mapping Unit

Most respondents utilized a minimum mapping unit (MMU) of 2 acres in their photoidentification keys, save for one who utilized a 5-acre MMU. Some use cases necessitated smaller MMU, for example wetlands classifications, that required MMUs as small as .5 acres, but the majority of classifications used a 2-acre minimum.

LULC Data and Process Evaluation and Development

Manual photo interpretation was used almost exclusively by all survey respondents. Machine learning has also been explored by one respondent, but manual photo interpretation was still 80% of their LULC development.

Deviation from FLUCCS Classification

Most survey respondents noted no significant deviations from the FLUCCS Classifications, other than some small grammatical discrepancies or minor deviations in cases with items with width like highways and rivers.

Known Land Uses Not In FLUCCS

The most commonly noted land use that wasn't included so far in FLUCCS was the delineation of solar farms and similar solar power areas. All survey respondents noted that solar classification

codes weren't available but noted as able to identify. Hurricane damage was also noted by several respondents as a classification that could be identified but not associated with a code.

Other noted classifications not available were public gravel boat ramps (for small boats only), roll on/roll off recycling areas, areas where a RV is located but is used for a primary residence, heliports (mostly grass) at recreational trailheads which are used for emergency medical evacuations, agriculture outbuildings and farm implement buildings. Further identifiable but uncoded classifications included duck ponds in hunting preserves, oil and gas booster stations, abandoned buildings or homes (those which are falling down or without roofs), Residential streets, sidewalks, and turf grass, man-made lagoons and swimming pools, separated golf course putting greens and fairways, and detailed lists of agricultural tree crops or rotating crop codes.

Known Land Covers Not In FLUCCS

One survey respondent noted that a more detailed list of Florida native Level 4 tree cover would improve the FLUCCS classification, but most respondents noted no other needed land cover codes.

Resources Invested in LULC Development

Resources regularly used in LULC development included internal staff costs, contracted data services, and in some cases, ortho photo imagery. The majority of regular costs for LULC development came from annual internal staff costs.

Aerial Imagery Source(s)

Most survey respondents sourced their aerial imagery from the FDOR & FDOT certified aerials by county, as well as several who used NAIP imagery where counties did not regularly collect. Other sources of imagery included vendor contracts of aerial digital orthophoto imagery and oblique Imagery from Property Appraiser sites when available (for verification of FLUCCS Codes).

Other Supporting Data Source(s)

Several respondents utilized Google Maps for references, as well as historical LULC data sets for the respective areas in their purview. Other supporting data sources included Cadastral data, Florida Soil Survey – SSURGO, National Wetlands Inventory (NWI), National Elevation Dataset (NED - USGS), FDACs Agriculture Lands, FNAI, parcel data, elevation data, Plant Community Maps, soil survey data (USDS SSURGO), Property Appraiser Parcel Data, Digital Elevation Models, Environmental Resource Permits, and Water Use Permits.

Frequency of Updates to LULC

Most respondents claimed an approximate 18 months to update their respective LULC datasets, but times ranges from as little as 10 months to over 18 months. Accounting for QC and other data refinements, it is about every 3 years that LULC data are updated over a whole District.

Known Quality Issues/Differences Between LULC Datasets

The majority of respondents indicated that there were inconsistencies between datasets based on classification levels that each department would use, as well as classifications for areas that would also differ from department to department. Especially noted was the SFWMD's LULC dataset, as several survey respondents noted that dataset to be temporally inconsistent and have more level 3 and 4 classification than other WMDs. Districts would also vary in time frame of updates, and boundaries of classifications.

Known Updates Needed Within FLUCCS

Most survey respondents noted no necessary updates needed, but some did make recommendations such as a classification beyond Level 4 or additional classification.

Other Issues Raised

Several survey respondents indicated a desire to utilize machine learning for automating change detection for more targeted updates and processing speeds as well. Other issues presented included reducing the minimum mapping units many codes given the utilizations of newer and higher resolution technologies, the reliance on the FDOR/FDOT aerial imagery in creating a district-wide coverage requiring the usage of imagery across multiple years due to the collection cycle, and the difficulty of delineating land use presenting a challenge in developing data to determine trends.

SME Interviews Summary

LULC Data Development

Agencies tend to develop data separately, but most code both land use and cover. This, however, did not apply to all counties. Additionally, agencies supplemented data with primarily similar polygon-based databases such as Google Maps and ERP.

Feature Delineation

In general, largely the same delineation process occurs for all agencies, only digressing for certain land uses and covers. In particular, water resources and agricultural lands change frequently, and are the most difficult to properly delineate. Agencies tend to make choices for these resources depending on the end goal of the data refinement process, and the end users of work products.

Classification Level

Most frequently, agencies classify to level 2, though many expressed the desire to classify to level 4 if possible, though this again depends on the end user's needs. Some agencies expressed that budgetary reasons, as well as time management, are barriers to classifying at a more detailed level, though budget tends not to be as much a reason for lower classification as much as time spent manually interpreting photography.

In interviews, agencies indicated that in most cases, level 3 was the maximum mapped to, based on the needs of users not requiring level 4 classifications for most features. With the majority of end users not requiring a level of detail that high, agencies remarked that dedicating staff time and funding to code features to the detail of level 4 classifications was unneeded. Agencies also mentioned several level 4 classifications that were listed in the FLUCCS codes as being rarely used for mapping, such as sawgrass cattail and dog fennel. In contrast to that, some interviewees detailed level 4 classifications that were actually useful for mapping, like cement plants and phosphate mines. However, these useful level 4 classifications were typically delineated on a user requested basis as the majority of users of the data would not benefit from that level of classification, with most agencies remarking that level 3 classifications were sufficient in almost all cases.

LULC Data and Process Evaluation

While agencies tend to be exploring automation as means to improve data evaluation, some still expressed trepidation at fully committing to the process. Even those who expressed a desire to implement more automation in the process worried about the potential accuracy effects, and the resulting increase in time dedicated to QC-ing data which is typically a manual process. Data sources used by agencies to supplement are typically LiDAR, NHD, FNAI elevation, FDACS land, and previous LULC data which are used to assist with QC for delineation of features.

Deviation from FLUCCS Classification

Interviews revealed that agencies usually do not deviate greatly from the FLUCCS classifications – small deviations for Solar and Hurricane Damage were the only noted deviations from FLUCCS.

Known Land Uses Not In FLUCCS

As stated above, the primary Land Use codes not included in the FLUCCS Classification list are Solar and Hurricane Damage codes. These, however, are not generally seen as being required, especially as Solar farms could potentially be classified under the utilities land use code.

Known Land Covers Not In FLUCCS

The primary Land Cover codes not included in the FLUCCS Classification list are Solar and Hurricane Damage codes. These, however, are not generally seen as being required. Additional land cover codes that have been identified as being potentially useful by interviewees would be a delineation of pervious from impervious surfaces, though it was not indicated that any agency has implemented these codes as such.

Minimum Mapping Unit

Agencies expressed a desire for increased resolution, however an average minimum mapping unit of 1 acre was identified in interviews, as larger MMUs tend to have more error than smaller units. Resolution is generally desired so long as accuracy is not compromised.

Resources Invested in LULC Development

Most of the identified resources invested into LULC product development are time cost invested in the PI and QC phases, along with monetary cost of aerial imagery – though mostly, imagery is free through FDOT/FDOR. SWFWMD does pay for their own imagery to resolve the variability in imagery collection dates across different Counties. Annual update costs summarized as follows:

Table 6. Annualized Cost for LULC Updates

Agency	Annual Update Cost
DEP	$150,000
SFWMD	$119,000
SJRWMD	$125,000
SWFWMD	$337,000
Total	**$731,000**

Source: TBG Work Product

Aerial Imagery Source(s)

Imagery was provided to most agencies for free through the Department of Revenue and/or Department of Transportation. One agency did instead opt to purchase their own aerial imagery, with the priority of creating as temporally consistent and accurate of images as possible.

Frequency of Updates to LULC

As above, updates to LULC are limited to how often they get aerial imagery from DOR and how accurate/detailed this imagery is. Many wanted to begin utilizing AI – but prioritize accuracy over frequency of updates and were not confident in the ability of machine learning for this use yet. In general, these more frequent updates are not viewed as necessary to agencies, as they reliably complete work with the products they are provided construction, these may get updated.

Known Quality Issues/Differences Between LULC Datasets

Temporal differences of imagery and inconsistency of classification level were the most common issue identified by agencies, though it is not viewed as a limiting factor in completing work. These issues are typically most noticeable on the boundaries between districts. Minor adjustments may be necessary for an agency to compensate for these differences. Some districts noted that they digitize LULC beyond their boundaries in order to compensate for LULC classification differences across boundaries that cause challenges for their data users.

Known Updates Needed Within FLUCCS

Not many updates were noted as an urgent requirement, and the main updates agencies requested was the addition of Solar and Hurricane Damage, as well as impervious/pervious surfaces codes.

Other Issues Raised

Interviews revealed that agencies have no statutory requirements to update or maintain LULC, but many agencies' work depends upon updating the data and so it is generally felt as a necessity anyways. Finally, agencies were generally grateful to see DEP paying close attention to the process and working to improve the LULC data.

LULC Data Use

Survey Response Summary

LULC Data Usage

Most survey respondents detailed their usage of LULC data being focused on modeling, with almost every survey respondent indicating the usage of LULC data for water supply planning and surface or groundwater modeling. Water quality restoration plans were also a common source of usage for LULC data, as well as MFL assessments and permitting/other regulatory uses. LULC data was used in urban planning, growth management, and zoning evaluations by a few respondents. Some unique LULC data usage cases were in evaluation of agricultural lands for enrollment in agricultural Best Management Practices, determination of LULC within a potential property acquisition, describing or summarizing ecological changes, and in conservation and land management plans.

Frequency of Use

Usage frequency of LULC data varied greatly depending on each respondent's usage of LULC data. Most used it generally 2-3 times per month, but some would use it as often as multiple times a week or some as sparsely as once or twice a year. Modeling cases tended to use LULC data more infrequently on a more periodic basis, while those who used it to create maps or doing GIS analysis used it more often, frequently referring to the datasets.

Minimum Mapping Unit

Most survey respondents indicated using a minimum mapping unit of 0.5 acres or 1 acre for most class definitions. Some respondents' classifications utilized an under 0.5 acre MMU, and some cases even had no minimum mapping unit and opted to map as precisely as possible for features that may be smaller than their standard MMUs. This was mostly the case for classifications that often had small, yet important to note features such as 500 Water and 600 Wetlands. The largest MMU noted was 2.5 acres, and this was used for classifications of features that often have very large areas like 300 Rangeland or 700 Barren Land.

Level of Detail for Categories

Most responses indicated almost always using level 2 details in each category, with most indicating to sometimes all the way down to level 3 and 4 detail in many categories. 100 Urban

and Built Up saw the most usage of always using level 2 classifications and a high usage of level 3 and 4 classifications.

Feature Delineation Impacts

Survey respondents generally all agreed that insufficient delineation details affect the precision and accuracy of modeling. While some aggregation was acceptable, the specifics of features and polygons was critical for the high detail usage needs of some modelers, depending on the calculations each modeler was trying to achieve.

Known Updates Needed and Other Data Sources

Most respondents had no issues raised with the current datasets, but some commented on the possibility of the addition of more details. Impervious surface and updates to Urban Land Use to include building height details were requested by some, as well as finer details to plant community and crop lands classifications. Some respondents also noted that aerial imagery from sources like Google Earth or NOAA C-CAP were useful for verification, but most did not rely on other data sources to supplement LULC data.

Frequency of Updates to LULC

About half the respondents indicated either needing an annual or more often than annual update frequency to LULC data for their usage, while the other half indicated that an update of every 3 years or less often worked fine for their usage.

Known Quality Issues/Differences Between LULC Datasets

Most respondents had no issues with the differences between datasets, but those who did detailed issues with cross-district datasets revolved around the frequency of updates, as most districts updated their imagery or their LULC data sets on different schedules. They also noted differences in the delineation and designations of land uses with different attributes and levels of detail on areas where overlap existed. This raised issues with modeling and LULC update processes.

SME Interviews

LULC Data Usage

In general, the interviewed district members utilized LULC data for a variety of use cases. This included watershed modeling, nutrient load modeling, BMAPs, wetlands, environmental permitting, among other usages. Most users supplemented their usage of LULC data with other data layers and sources of imagery as well to validate and confirm LULC information. Most were also satisfied with the current levels of coding and frequency of updates to LULC, but many did note inconsistencies between districts' respective LULC datasets in the classification of specific features.

Feature Delineation & Classification Level

Most interviewees indicated that when possible, more detail was better, both in usage of level 3 and 4 classifications as well as more accurate delineation of features. In most cases, the detail provided by current LULC data was sufficient, and none interviewed noted that a decrease in detail would be acceptable. Most modelers, such as those who were modeling water resources and nutrient loadings, required level 4 classifications for wetlands and agricultural features in order to have accurate models, as several noted the differences in crop types and their effects on watersheds and nutrients. Most other classifications such as urban or recreational usage lands provided sufficient detail for their usages as a level 2 classification though. In many cases, the users of LULC data would request needed changes or updates to the LULC data, and developers would incorporate that feedback into classification updates.

LULC Data and Process Evaluation

When interviewed, most users indicated that they primarily use LULC data, but supplement that with other data sources. This included data layers like soil data, elevation data, the NHD/FHD, FNAI, and parcel data. Other sources of imagery included historical aerials, and other satellite imagery providers such as Google maps.

Deviation from FLUCCS Classification

Most users interviewed noted no need for any deviations from the FLUCCS codes classifications, and that current LULC classifications were sufficient for their needs. A few users did indicate that impervious surfaces designations would help as an addition to the codes when building models.

Known Land Uses and Land Covers Not In FLUCCS

Many users indicated that impervious surfaces would benefit the LULC data, a sentiment shared by some data refinement interviewees. Impervious surfaces would benefit the modelers when dealing with groundwater absorption in urban areas.

Minimum Mapping Unit

Most users had no issues with the current MMUs used in LULC datasets. It was noted that wetlands and agricultural lands were better off with smaller MMUs in order for more detailed classifications to better capture usage of water resources, but in general, no changes were seen as necessary in MMU size.

Frequency of Updates to LULC

Generally, more frequent updates are desired, but for the most part users did not see the current schedule of updates as insufficient and increasing the frequency was not a high priority at this level. Some users did note certain areas (specifically noted were areas of urban development and agricultural crops) that would be helped more by more frequent updates than others, as they were most susceptible to large changes that happened between updates. Users also noted that if LULC data was updated more frequently, it would be used more often in modeling updates.

Known Quality Issues/Differences Between LULC Datasets

The main differences that the interviewed users ran into regarding the differences between datasets was the potential inconsistencies in classification levels from district to district. This was a key issue for watershed and wetlands modeling for areas that ran over district borders. Some users noted the potential for improvement if more consistent classification was used between districts.

Known Updates Needed

Most users interviewed expressed desire for greater consistency, especially between districts' LULC datasets. While interviewees were able to make do with what was available, more consistency between datasets for imagery color grading and classifications of feature types was a common request. For example, one user noted that some districts differed on how each would classify specialty crops and to what level agricultural areas were coded at, and that greater consistency between districts would make for better models.

Appendix B – Supporting Information

LULC Example Crosswalk Table

The following table shows the 3 generalized land cover groups for agriculture; Note – there is a complete crosswalk table used by SJRWMD that relates each LCCODE to 1 of the 13 generalized land covers used for the modeling application; 13 total LC values used.

LCCODE is the landcover code, LC_DESC is the landcover description, and MOD_LC_DESC is the modified LC description used by SJRWMD: 13 values total; only the 3 ag types shown below. 14 of the DEP LULC land cover values were required to generalize to the "Groves" and "Pasture" categories; all remaining DEP LULC agricultural land cover types were generalized to "General agriculture" for SJRWMD's modeling application.

Table 7. Survey Responses Indicating Level of Classifications Used

LCCODE	LC_DESC	MOD_LC_DESC
1820	Golf courses	General agriculture
2140	Row crops	General agriculture
2143	Potatoes and cabbage	General agriculture
2150	Field crops	General agriculture
2153	Hay fields	General agriculture
2156	Sugar cane	General agriculture
2160	Mixed crop	General agriculture
2300	Feeding operations	General agriculture
2310	Cattle feeding operations	General agriculture
2320	Poultry feeding operations	General agriculture
2330	Swine feeding operations	General agriculture
2400	Nurseries and vineyards	General agriculture
2410	Tree nurseries	General agriculture
2420	Sod farms	General agriculture
2430	Ornamentals	General agriculture
2431	Shade ferns	General agriculture
2432	Hammock ferns	General agriculture
2440	Vineyards	General agriculture
2450	Floriculture	General agriculture
2460	Timber nursery	General agriculture
2500	Specialty farms	General agriculture
2520	Dairies	General agriculture
2530	Kennels	General agriculture
2590	Other specialty farm	General agriculture
2610	Fallow cropland	General agriculture
2620	Old field	General agriculture

LCCODE	LC_DESC	MOD_LC_DESC
2200	Tree crops	Groves
2210	Citrus groves	Groves
2220	Fruit orchard	Groves
2221	Peaches	Groves
2224	Blueberries	Groves
2230	Other groves	Groves
2231	Pecans	Groves
2240	Abandoned tree crops	Groves
2100	Pasture	Pasture
2110	Improved pastures	Pasture
2111	Wet Prairie	Pasture
2120	Unimproved pastures	Pasture
2130	Woodland pastures	Pasture
2510	Horse farms	Pasture

Source: SJRWMD; TBG Work Product

Critical Assets Data Sources and Geometry Type

The table below lists the DEP critical assets data type in terms of GIS geometry and also provides the source. That information is potentially applicable for use of DEP's critical assets data layers to complete quality control for more standardized representation across district boundaries of LULC data associated with critical assets.

Table 8. Critical Assets data source and geometry type for DEP's Critical Assets data

Asset Type	Asset Group	Geometry	Source Entities
Affordable Public Housing	Critical community and emergency facilities	polygon	Florida Housing Data Clearinghouse
Colleges and Universities	Critical community and emergency facilities	point	FDEM
Community Centers	Critical community and emergency facilities	point	FDEM
Correctional Facilities	Critical community and emergency facilities	point	FDEM
Disaster Recovery Centers	Critical community and emergency facilities	point	FDEM
Emergency Medical Service Facilities	Critical community and emergency facilities	point	FDEM
Emergency Operation Centers	Critical community and emergency facilities	point	FDEM
Fire Stations	Critical community and emergency facilities	point	FDEM

Asset Type	Asset Group	Geometry	Source Entities
Health Care Facilities	Critical community and emergency facilities	point	FDEM
Hospitals	Critical community and emergency facilities	point	FDEM
Law Enforcement Facilities	Critical community and emergency facilities	point	FDEM
Local Government Facilities	Critical community and emergency facilities	point	FDEM
Logistical Staging Areas	Critical community and emergency facilities	point	FDEM
Risk Shelter Inventory	Critical community and emergency facilities	point	FDEM
Schools	Critical community and emergency facilities	point	FDEM
State Government Facilities	Critical community and emergency facilities	point	FDEM
Communications Facilities	Critical infrastructure	point	FDEM; USGS National Structures Dataset (NSD)
Disaster Debris Management Sites	Critical infrastructure	point	FDEM
Drinking Water Facilities	Critical Infrastructure	point	DEP
Electric Production and Supply Facilities	Critical Infrastructure	line, point	Department of Homeland Security (DHS) Homeland Infrastructure Foundation-Level Data (HIFLD); EPA
Military Installations	Critical Infrastructure	polygon	USDOT Bureau of Transportation Statistics
Solid and Hazardous Waste Facilities	Critical Infrastructure	point	EPA; DEP
Stormwater Treatment Facilities and Pump Stations	Critical Infrastructure	point, line	USGS NHD; NWFWMD, SFWMD, SJRWMD, SWFWMD SFWMD; USACE National Inventory of Dams
Wastewater Treatment Facilities and Lift Stations	Critical Infrastructure	point	DEP
Water Utility Conveyance Systems	Critical Infrastructure	point	DEP
Conservation Lands	Natural, cultural, and historical resource	polygon	Florida Natural Areas Inventory (FNAI)
Historical and Cultural Assets	Natural, cultural, and historical resource	line, polygon, point	Bureau of Archaeological Research
Parks	Natural, cultural, and historical resource	polygon	DEP; National Transportation Atlas Database (NTAD)
Shorelines	Natural, cultural, and historical resource	line	Florida Fish and Wildlife Conservation Commission
Surface Waters	Natural, cultural, and historical resource	line, polygon	USGS NHD DEP

Asset Type	Asset Group	Geometry	Source Entities
Wetlands	Natural, cultural, and historical resource	polygon	DEP
Airports	Transportation and evacuation route	point	FDEM and FDOT
Bridges	Transportation and evacuation route	line	FDOT
Bus Terminals	Transportation and evacuation route	point	FDEM
Major Roadways	Transportation and evacuation route	line	FDOT USGS National Transportation Dataset (NTD)
Marinas	Transportation and evacuation route	point	FDEM
Ports	Transportation and evacuation route	point, line	FDEM FDOT-SIS
Rail Facilities	Transportation and evacuation route	point, line	FDOT-SIS National Transportation Atlas Database (NTAD)
Railroad Bridges	Transportation and evacuation route	point	FDEM

Source: DEP; TBG Work Product