DISTRICT 5 TRUCK PARKING

Spatial Desktop Scan Technical Memorandum

FDOT

September 2019

Contents

Tables

Figures

Appendices

Introduction

The Florida Department of Transportation (FDOT) recently completed a Truck Parking Study (Phase 1) that evaluated truck parking supply and demand conditions within FDOT District Five and recommended a set of action items in order to address parking shortage issues. The purpose of Phase 2A of the Study is to identify potential truck parking sites in coordination with key public and private stakeholders to potentially advance the recommendations from Phase 1 of the Study.

The first step of the Phase 2A Study is to conducted a comprehensive desktop scan using a GIS-based multi-criteria decision making model approach, which is documented in this Technical Memorandum. The model was used to locate land parcels suitable for developing truck parking facilities along the I-4 Corridor in Volusia, Seminole, Orange and Osceola Counties based on selected criteria. The modeling was conducted using the Spatial Modelbuilder functionality within ArcGIS Desktop 10.6.1. Aside from some minor pre- and post-processing steps, the desktop scan analysis followed a two-tier process. Tier 1 was a raster-overlay process focused on identifying the areas within the District suitable for truck parking based on a variety of spatial characteristics. The Tier 2 process looked for land-ownership parcels meeting specific criteria which fell within the high-suitability areas identified by Tier 1.

Input Data

Different data sources were used as inputs to the model. Table 1 illustrates these different data sources below

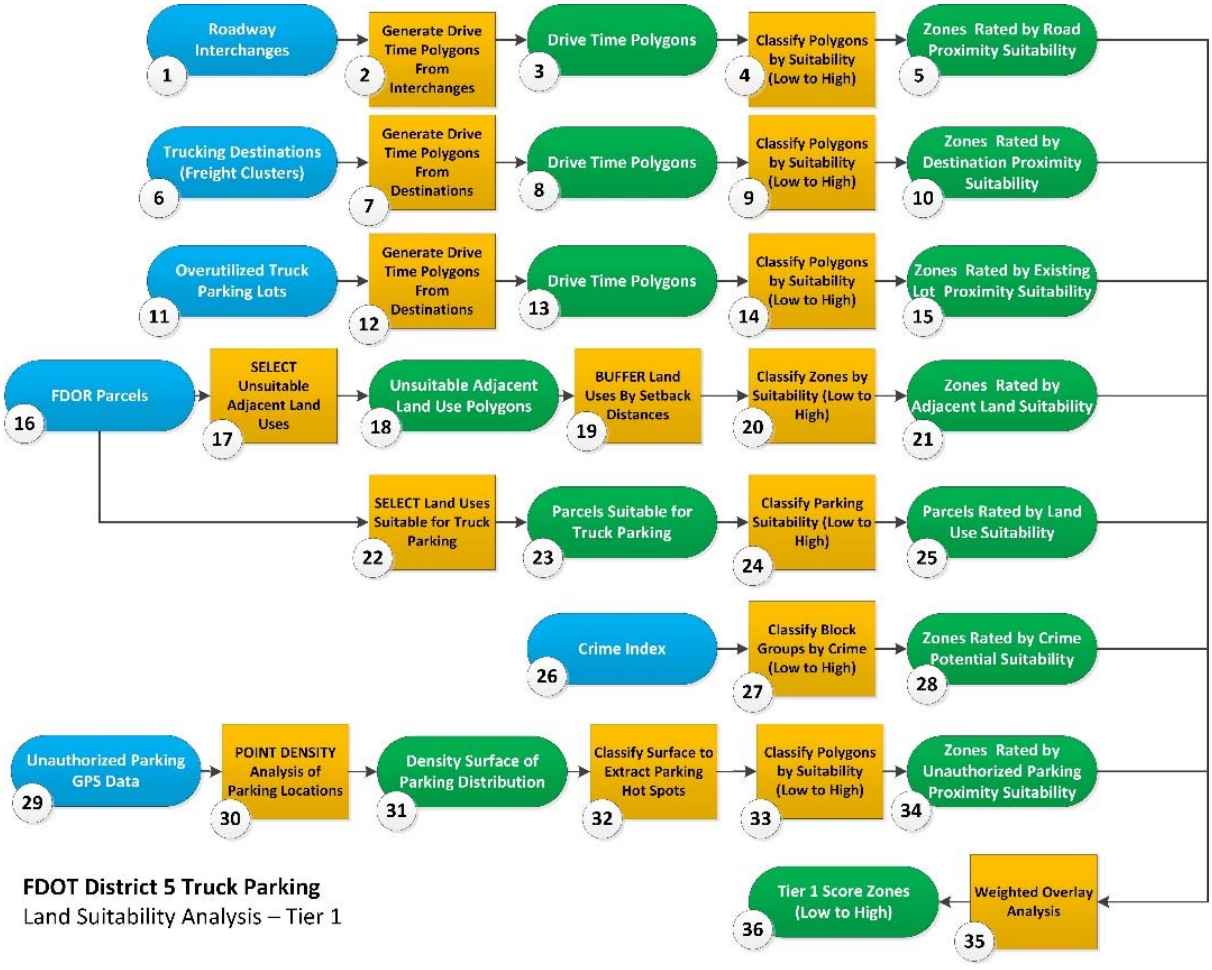
Table 1. Data Sources

Data-Source	Description of Dataset	Update Frequency	Purpose of Dataset	Remarks
Department of Revenue (DOR)	Parcel data with land use information	Annual	Input data to the model	Free
Department of Economic Opportunity (DEO)	Establishment data for employment and wages	Quarterly	Input data to the model	Free, subject to 3-80 rule
FDOT Statewide Truck GPS Study	Over capacity truck parking lots and Unauthorized trucks	-	Input data to the model	Results from the Statewide Truck GPS Study
Crime Index Data	Statistics about major categories of personal and property crime	Annual	Input data to the model	ESRI Demographic Data

Tier 1 Land Suitability Model

The Tier 1 model is dubbed the land suitability model. The model combined seven different criteria with a Weighted Overlay into a single, overall land suitability layer (Figure 1). Each criterion defined an area of the landscape according to its desirability for providing a truck parking facility. Most of the criteria were defined from the perspective of a truck driver looking for a suitable place to park. The seven input criteria are described in detail below.

Figure 1. Tier 1 Modeling Flowchart



Road Proximity

When developing the inputs of a multi-criteria decision making model, it was useful to keep in mind the phrase “all else considered equal.” That is, each *individual* factor was evaluated as if it was the only one that would affect the desirability of an area for truck parking. For Road Proximity the most desirable locations would be those within a very short drive from an interchange exit, followed by those only a bit further away, and so on. To develop this input

layer a Drive Time analysis was conducted in ArcGIS Online from the interchange locations on I-4 (Figure 1, Steps 1 – 3). Interchanges within 10 miles of the District boundary were included in the Drive Time analysis to account for any suitable areas within the District that might be near an I-4 interchange just outside the District's jurisdiction. The Drive Time analysis was conducted using the option for actual average traffic for noon on Wednesday to provide more realistic conditions than the default "no traffic" option, while also avoiding excessively long drive-times that might be associated with peak-hour time periods. The output drive time polygons were rated on a suitability scale of 1 to 5 (Table 2) before being rasterized to create the Road Proximity raster layer (Figure 1, Steps 4 and 5).

Table 2. Drive Time Suitability Scores

Drive Time (Minutes)	Suitability Rank	Suitability Score
0 – 5	Very High Suitability	1
5 – 10	High Suitability	2
10 – 15	Moderate Suitability	3
15 – 20	Low Suitability	4
20 - 30	Very Low Suitability	5

Destination Proximity

Truck drivers may also prefer parking sites located near to where they intend to pick up or drop off a load. To identify these areas, the Freight Clusters within District 5 previously identified in a study of statewide Freight Activity Areas were used as the "Trucking Destination" input to a Drive Time analysis (Figure 1, Step 6). Freight Clusters within 10 miles of the District boundary were included in each District drive time analysis to account for trucking destinations located outside, but near, to the District. The subsequent Drive Time analysis steps (Figure 1, Steps 7 – 10) and drive time suitability scores (Table 2) were the same as those used in Roadway Proximity.

Over-utilized Truck Parking Lot Proximity

A number of authorized truck parking lots currently exist statewide to support the trucking community. Where those existing truck parking lots were over capacity indicated a demand for truck parking that was not being met. A new truck parking facility in the vicinity of an over-capacity lot would relieve that demand. Over-utilized Truck Parking facilities were identified as those with ≥ 75% capacity for any hour bin over a 24-hour period (Figure 1, Step 11). Over-capacity truck parking lots within 10 miles of the District boundary were included in each District drive time analysis to account for parking lots located outside, but near, to the District. The subsequent Drive Time analysis steps (Figure 1, Steps 12 – 15) and drive time suitability scores (Table 2) were the same as those used in Roadway Proximity.

Adjacent Land Use Suitability

New truck parking lots should be located in appropriately zoned Commercial or Industrial areas. However, some Commercial and Industrial parcels may not be suitable for supporting truck parking since they entail trucks driving through or near areas of unsuitable adjacent land use such as schools, churches or residential areas. To address this concern, land use parcels from the Florida Department of Revenue (FDOR) with unsuitable land use codes (Appendix A) were extracted (Figure 1, Steps 16 – 18), converted to raster format, and buffered using the Euclidean Distance tool (Figure 1, Step 19). The Euclidean Distance Tool determined the distance of each raster pixel from any of the unsuitable adjacent land uses. Those pixels were then assigned a truck parking suitability score based on their proximity to unsuitable land uses, with those closest receiving a poor score and those furthest away receiving a Very High Suitability score (Table 3).

Table 3. Unsuitable Adjacent Land Use Suitability Scores

Distance (Meters)	Suitability Rank	Suitability Score
> 1,200	Very High Suitability	1
800 – 1,200	High Suitability	2
400 - 800	Moderate Suitability	3
200 - 400	Low Suitability	4
< 200	Very Low Suitability	5

Land Use Parcel Suitability

This part of the Tier 1 model identified those parcels whose existing land use would be compatible with development of a truck parking lot (Figure 1, Steps 22 – 25). Vacant Commercial and Industrial sites topped the list of 56 land use types (Appendix B). Each land use type was assigned a suitability score from 1 (Very High Suitability) to 5 (Very Low Suitability) to reflect its potential for conversion to a truck parking facility. Any land use type not listed in Appendix B was assigned a Very Low Suitability score of 5.

Crime Potential

All else being equal, truck parking facilities should be located in places where the vehicles and their drivers will not be at high risk for crimes against their persons or property. The Esri Demographics Crime Index layer for Florida was downloaded and incorporated into the Tier 1 model for this purpose. The Total Crime Index was tied to the national average crime rate. A Total Crime Index value of 100 for a Census Block Group represented the national average crime rate, while a TCI value of 200 indicated a Block Group with twice the amount of crime as the national average, and so on. Each Census Block Group in the District was assigned a Crime Score ranging from 1 (Very High Suitability) indicating a Crime Index at or below the national average, up to 5 (Very Low Suitability) for Block Groups with more than ten times the national average crime rate. Table 4 shows the relationship between Crime Index values and truck parking suitability scores. The Census Block Groups were rasterized by their

Crime Score suitability values to prepare them for use in the Weighted Overlay analysis (Figure 1, Steps 26 – 28).

Table 4. Crime Index Suitability Scores

Crime Index Value	Suitability Rank	Suitability Score
≤ 100	Very High Suitability	1
100 - 250	High Suitability	2
250 - 500	Moderate Suitability	3
500 - 1000	Low Suitability	4
≥ 1,000	Very Low Suitability	5

Unauthorized Parking Proximity

Lastly, any place where a large number of unauthorized truck parking occurred was considered an indicator of high demand for legitimate truck parking facilities. To develop this layer, truck parking GPS location data filtered to extract only those trucks that were stationary for 3+ hours were obtained for the District and the area 10 miles beyond the District boundary. The ArcGIS Point Density tool was used to develop a raster density surface weighted by the parking duration for each vehicle (Figure 1, Steps 29 – 31), under the presumption that longer-duration immobility represented actual long-term parking, and where many trucks engaged in long-term parking should represent a higher demand for new truck parking facilities. The point density output was classified using a Quintile (5-class) classifier, and those classes were reclassified to the 1 to 5 truck suitability scale (Figure 1, Steps 32 – 34).

Weighted Overlay Analysis

The final step in the Tier 1 analysis involved combining each of the seven input criteria layers described above using the ArcGIS Weighted Overlay tool (Figure 1, Steps 35 - 36). The Weighted Overlay performed a weighted average of all the input pixels at each location in the District. Several different weighting schemes for the input layers labeled A through D were evaluated, starting with the Tier 1A model that weighted each layer the same. The weights for each of the models appear in Table 5.

The output raster from each alternative model was examined visually in ArcGIS to determine whether known parcels suitable as potential truck parking facilities were flagged as Very High or High Suitability. The Tier 1C and 1D models rated very little of the District as Highly Suitable and missed most of the potential truck parking locations. The equally weighted Tier 1A model performed better, but still missed some parcels even when they were immediately adjacent to another High Suitability parcel. The Tier 1B model was best at locating known truck parking candidates, but was also not excessive in rating areas as High Suitability for truck parking. Consequently, the Tier 1B model was used to develop the land suitability layer (Appendix C).

Table 5. Alternative Weighted Overlay Model Weights

Factor #	Factor Description	Tier 1A	Tier 1B	Tier 1C	Tier 1D
1	Interchange Drive Time	15%	19%	20%	5%
2	FAA Drive Time	15%	19%	20%	5%
3	Capacity Parking Drive Time	14%	14%	10%	5%
4	Crime Index	14%	14%	5%	5%
5	Unauthorized Parking	14%	14%	5%	40%
6	Unsuitable Land Use Proximity	14%	10%	20%	35%
7	Suitable Land Use	14%	10%	20%	5%
	Totals	**100%**	**100%**	**100%**	**100%**

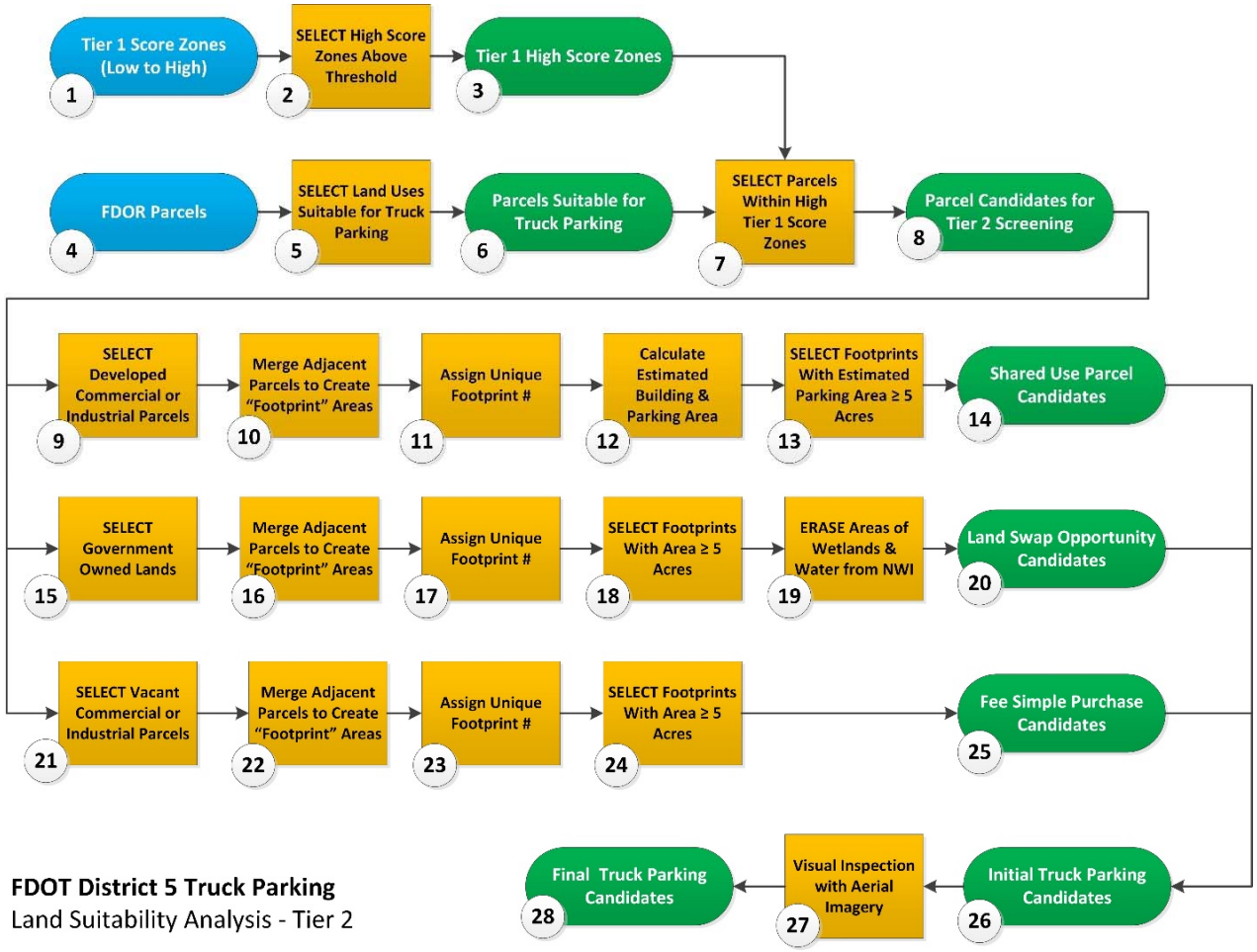
Tier 2 Parcel Suitability Model

The Tier 1 land suitability model described above identified the broad spatial areas that were most suitable for siting a truck parking facility. The purpose of the Tier 2 models was to locate specific parcels within those areas of high suitability that would meet the minimum requirements for truck parking sites. There were three kinds of parcels identified by the Tier 2 process:

- Shared Use Parcel Candidates – This group included existing developed Commercial or Industrial parcels with large parking areas which might be available as part of a shared use agreement for truck parking.
- Land Swap Opportunity Candidates – These were vacant, government-owned parcels that could provide an opportunity for the FDOT to negotiate a land swap or shared use agreement.
- Fee Simple Purchase Candidates – These were vacant Commercial or Industrial zoned parcels that could be purchased for development into truck parking sites.

Figure 2 outlines the Tier 2 modeling process, which began with selecting out the polygon areas that had been identified as Very High or High Suitability for truck parking by the Tier 1 model (Steps 1 – 3). Those Tier 1 High Score Zones were used to perform a Spatial Select on suitable FDOR parcels to extract only those parcels with appropriate existing land use that were located in areas of high suitability for truck parking sites (Figure 2, Steps 4 – 8). From that point the subsequent Tier 2 modeling steps took a different path depending on which of the three parcel candidate types were identified.

Figure 2. Tier 2 Modeling Flowchart



Shared Use Parcel Candidates

The complete ArcGIS Spatial Modelbuilder Tier 2A model for this process appears in Appendix D, but its key steps are shown in Figure 2. This process began with selecting those already developed Commercial and Industrial parcels within from the parcel candidates within the Tier 1 High Score Zones (Figure 2, Step 9). The ArcGIS Dissolve tool was used to merge together adjacent parcels into a single "footprint" polygon which was then assigned a unique ID number (Figure 2, Steps 10 - 11). This step ensured that no feasible sites were rejected because their individual parcels fell below the minimum size requirement (5 acres), even though two or more adjacent parcels would collectively meet or exceed that size limit.

For the Shared Use candidates the important size criterion was not the overall size of the combined parcels, but the availability of ≥ 5 acres of parking. The size of the parking was estimated by subtracting the total size of buildings on each parcel from the overall parcel size (Figure 2, Step 12). This calculation assumed that the buildings on the parcel were a single story, so that the total living area of the buildings was the same as the building footprint. However, if any buildings were multi-story that would only have decreased the building

footprint and increased the potential size of parking area estimated by this method. Conversely, this calculation method could not account for other uses on each parcel such as internal roads, landscaping, drainage, and water treatment ponds that reduced the total available parking area. Nonetheless, these steps help to filter out most of the Commercial and Industrial parcels whose potential parking areas were too small for further consideration (Figure 2, Steps 13 – 14).

Land Swap Opportunity Parcel Candidates

The ArcGIS Spatial Modelbuilder Tier 2C model for identifying vacant government parcels (Appendix E) involved selecting out the appropriate parcels and merging them into unique footprints ≥ 5 acres in size (Figure 2, Steps 15 – 18). Because many of the government-owned parcels were conservation lands, National Wetlands Inventory data were used in an ArcGIS Erase of wetlands and water features on each government parcel to leave only the upland areas that might be suitable for establishing a truck parking facility (Figure 2, Steps 19 and 20).

Fee Simple Purchase Parcel Candidates

Finally, the ArcGIS Spatial Modelbuilder Tier 2B model (Appendix F) identified those parcels ≥ 5 acres in size in high suitability areas that were vacant but zoned Commercial or Industrial, as outlined in Figure 2 (Steps 21 – 25).

Identification of Final Truck Parking Candidates

The three Tier 2 models generated dozens of Initial Truck Parking Candidate locations throughout the four counties of the study area (Figure 2, Step 26). However, many of those candidate sites were located relatively far from I-4 and would not be useful providing parking options for drivers on that highway. To address this concern the 10-minute drive time polygon around I-4 interchanges was used to select candidate locations most convenient to the highway. To winnow the number of candidate locations further each footprint polygon was evaluated by inspecting recent aerial imagery in ArcGIS Online and rated as Good, Fair, or Poor on the following criteria:

- Shape – A footprint was rated Poor if it was so narrow or oddly shaped that truck trailers could not be easily parked, and Fair if most of the footprint could accommodate trucks. The footprint was rated Good if the site had a shape that could be easily configured for parking.
- Location\Access – The footprint was rated Poor if the access was not adjacent to an arterial or major collector suitable for trucks, or if the access required use of a road with difficult access (e.g., tight turns) or through undesirable land use (e.g., residential). The footprint was rated Fair if access was through a side street off of an arterial or major collector, and Good if there was direct access from an arterial or major collector.
- Land Use Compatibility – The footprint was rated Poor if the on-site land use appeared to be incompatible (e.g., fully developed with no shared parking opportunity, or an obvious wetland). Footprints were rated Fair if the on-site land use was acceptable (e.g., a vacant

lot), but adjacent land uses were extremely incompatible (e.g., adjacent to a school or cemetery, or completely surrounded by dense residential use). A footprint was rated Good if both on-site and adjacent land uses were compatible.

Those footprints rated Good by the aerial imagery evaluation were extracted to create the Final Truck Parking Candidates (Figure 2, Steps 27 – 28).

Results

Land Suitability Analysis

The maps in Appendix G illustrate the areas rated as Very High or High Suitability for Volusia, Seminole, Orange and Osceola Counties. Only parcels that fell within those areas, and that also met the Tier 2 screening criteria, were evaluated for further consideration.

Identification of Parking Site Candidates

The number of parking site candidate footprints identified by the Tier 2 selection process exceeded 1,200 for the four counties in the I-4 corridor study area (Table 6). To further refine the number of candidates the 10-minute drive-time area around all I-4 interchanges was identified using ArcGIS Online (Figure 3), and only those parcel candidates accessible within that drive-time area were retained for further analysis (Figure 4).

Table 6. Count of parking site candidates by footprint type.

Footprint Type	Count of Footprints
Developed Commercial & Industrial	321
Vacant Commercial & Industrial	388
Vacant Government	175
Total	**1,203**

Figure 3. I-4 Corridor 10-minute drive time polygon

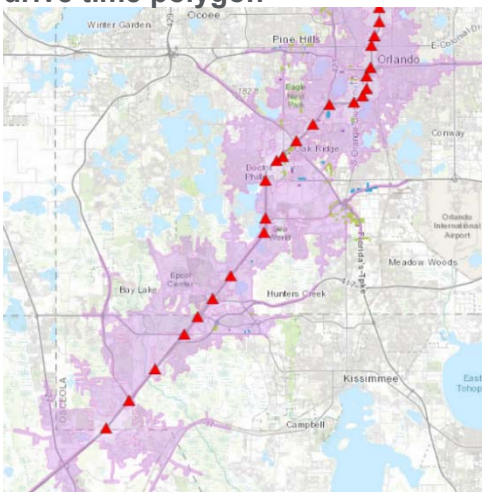
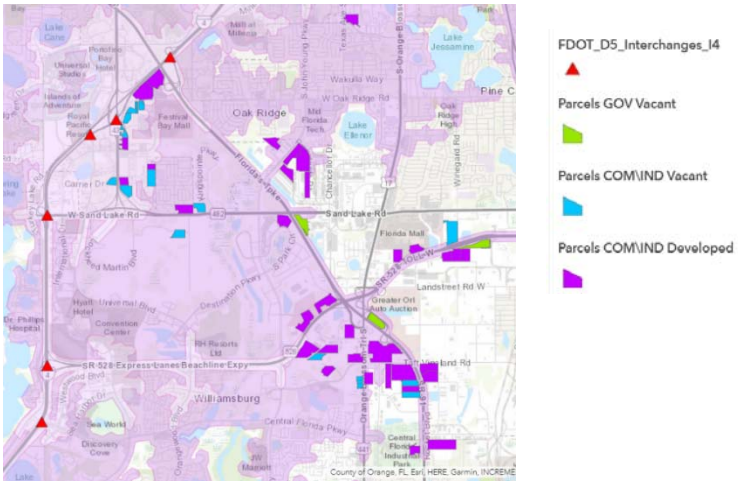


Figure 4. Parcel footprint candidates within 10-minute drive time.



Selecting only those parcel candidates within a 10-minute drive of I-4 reduced the number of footprints to a few hundred. As noted above, each of those parcel footprints was individually evaluated using aerial imagery in ArcGIS Online and rated Good, Fair or Poor. Table 7 lists the number of Good footprints by type for each county. The location of those footprints is illustrated in the maps for Volusia, Seminole, Orange and Osceola Counties (Appendix H).

Table 7. Number of parcel candidate footprints by type and county.

County	Developed Commercial & Industrial	Vacant Commercial & Industrial	Government Vacant	Total
Volusia	5	14	1	20
Seminole	16	18	4	38
Orange	39	12	6	57
Osceola	0	2	0	2
Total	**60**	**46**	**11**	**117**

ArcGIS Online Web Map

To make the results of this analysis more widely available to the District, the Final Truck Parking Candidate footprint and parcel layers were published to an ArcGIS Online web maps located here: District 5 Truck Parking Candidates Web Map.

Appendix A. List of Unsuitable Adjacent Land Uses for Truck Parking

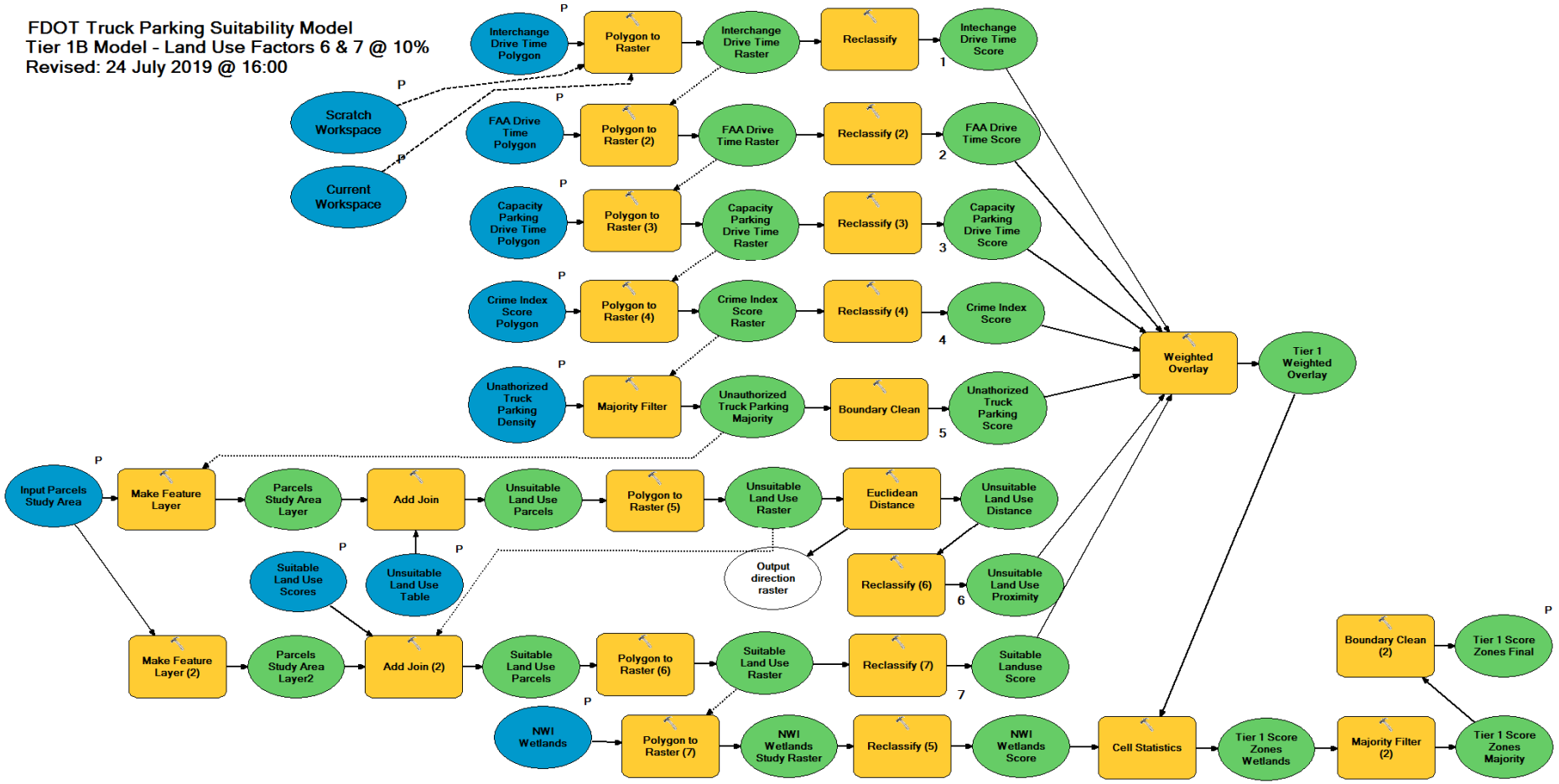
FDOR Use Code	Land Use Description
000	Vacant Residential with/without extra features
001	Single Family
002	Mobile Homes
003	Multi-family - 10 units or more
004	Condominiums
005	Cooperatives
006	Retirement Homes not eligible for exemption
007	Miscellaneous Residential (migrant camps, boarding homes, etc.)
008	Multi-family - fewer than 10 units
009	Residential Common Elements/Areas
012	Mixed use - store and office or store and residential combination
017	Office buildings, non-professional service buildings, one story
018	Office buildings, non-professional service buildings, multi-story
019	Professional service buildings
021	Restaurants, cafeterias
022	Drive-in Restaurants
023	Financial institutions (banks, saving and loan companies, mortgage companies, credit services)
024	Insurance company offices
071	Churches
072	Private schools and colleges
073	Privately owned hospitals
074	Homes for the aged
075	Orphanages, other non-profit or charitable services
076	Mortuaries, cemeteries, crematoriums
077	Clubs, lodges, union halls
078	Sanitariums, convalescent and rest homes
079	Cultural organizations, facilities
082	Forest, parks, recreational areas
083	Public county schools - including all property of Board of Public Instruction
084	Colleges (non-private)
085	Hospitals (non-private)
097	Outdoor recreational or parkland, or high-water recharge subject to classified use assessment

Appendix B. Parcel Truck Parking Suitability Scores

FDOR Use Code	Land Use Description	Suitability Score
010	Vacant Commercial with/without extra features	1
040	Vacant Industrial -with/without extra features	1
041	Light manufacturing, small equipment manufacturing plants, small machine shops, instrument manufacturing, printing plants	1
042	Heavy industrial, heavy equipment manufacturing, large machine shops, foundries, steel fabricating plants, auto or aircraft plants	1
043	Lumber yards, sawmills, planing mills	1
044	Packing plants, fruit and vegetable packing plants, meat packing plants	1
045	Canneries, fruit and vegetable, bottlers and brewers, distilleries, wineries	1
046	Other food processing, candy factories, bakeries, potato chip factories	1
047	Mineral processing, phosphate processing, cement plants, refineries, clay plants, rock and gravel plants	1
048	Warehousing, distribution terminals, trucking terminals, van and storage warehousing	1
015	Regional Shopping Centers	2
020	Airports (private or commercial), bus terminals, marine terminals, piers, marinas	2
028	Parking lots (commercial or patron), mobile home parks	2
029	Wholesale outlets, produce houses, manufacturing outlets	2
031	Drive-in theaters, open stadiums	2
049	Open storage, new and used building supplies, junk yards, auto wrecking, fuel storage, equipment and material storage	2
070	Vacant Institutional, with or without extra features	2
080	Vacant Governmental - with/without extra features for municipal, counties, state, federal properties and water management district (including DOT/State of Florida retention and/or detention areas)	2
086	Counties (other than public schools, colleges, hospitals) including non-municipal government	2
087	State, other than military, forests, parks, recreational areas, colleges, hospitals	2
088	Federal, other than military, forests, parks, recreational areas, hospitals, colleges	2
089	Municipal, other than parks, recreational areas, colleges, hospitals	2
090	Leasehold interests (government-owned property leased by a non-governmental lessee)	2
092	Mining lands, petroleum lands, or gas lands	2

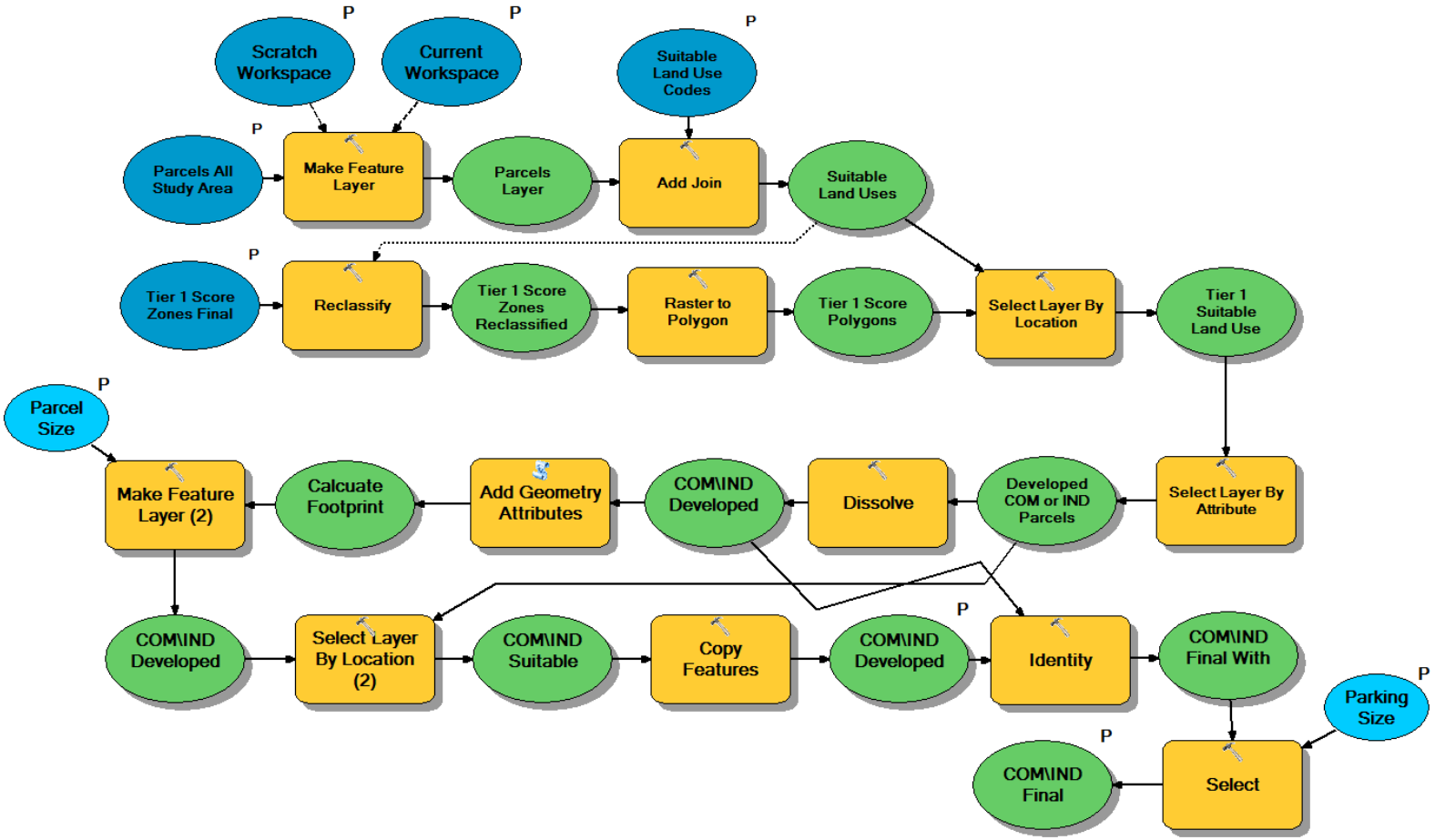
FDOR Use Code	Land Use Description	Suitability Score
013	Department Stores	3
014	Supermarkets	3
016	Community Shopping Centers	3
026	Service stations	3
032	Enclosed theaters, enclosed auditoriums	3
035	Tourist attractions, permanent exhibits, other entertainment facilities, fairgrounds (privately owned)	3
036	Camps	3
050	Improved agricultural	3
051	Cropland soil capability Class I	3
052	Cropland soil capability Class II	3
053	Cropland soil capability Class III	3
054	Timberland - site index 90 and above	3
055	Timberland - site index 80 to 89	3
056	Timberland - site index 70 to 79	3
057	Timberland - site index 60 to 69	3
058	Timberland - site index 50 to 59	3
059	Timberland not classified by site index to Pines	3
060	Grazing land soil capability Class I	3
061	Grazing land soil capability Class II	3
062	Grazing land soil capability Class III	3
063	Grazing land soil capability Class IV	3
064	Grazing land soil capability Class V	3
065	Grazing land soil capability Class VI	3
066	Orchard Groves, citrus, etc.	3
068	Dairies, feed lots	3
069	Ornamentals, miscellaneous agricultural	3
011	Stores, one story	4
039	Hotels, motels	4
067	Poultry, bees, tropical fish, rabbits, etc.	4
099	Acreage not zoned agricultural - with/without extra features	4

Appendix C. Truck Parking Suitability Model Tier 1B



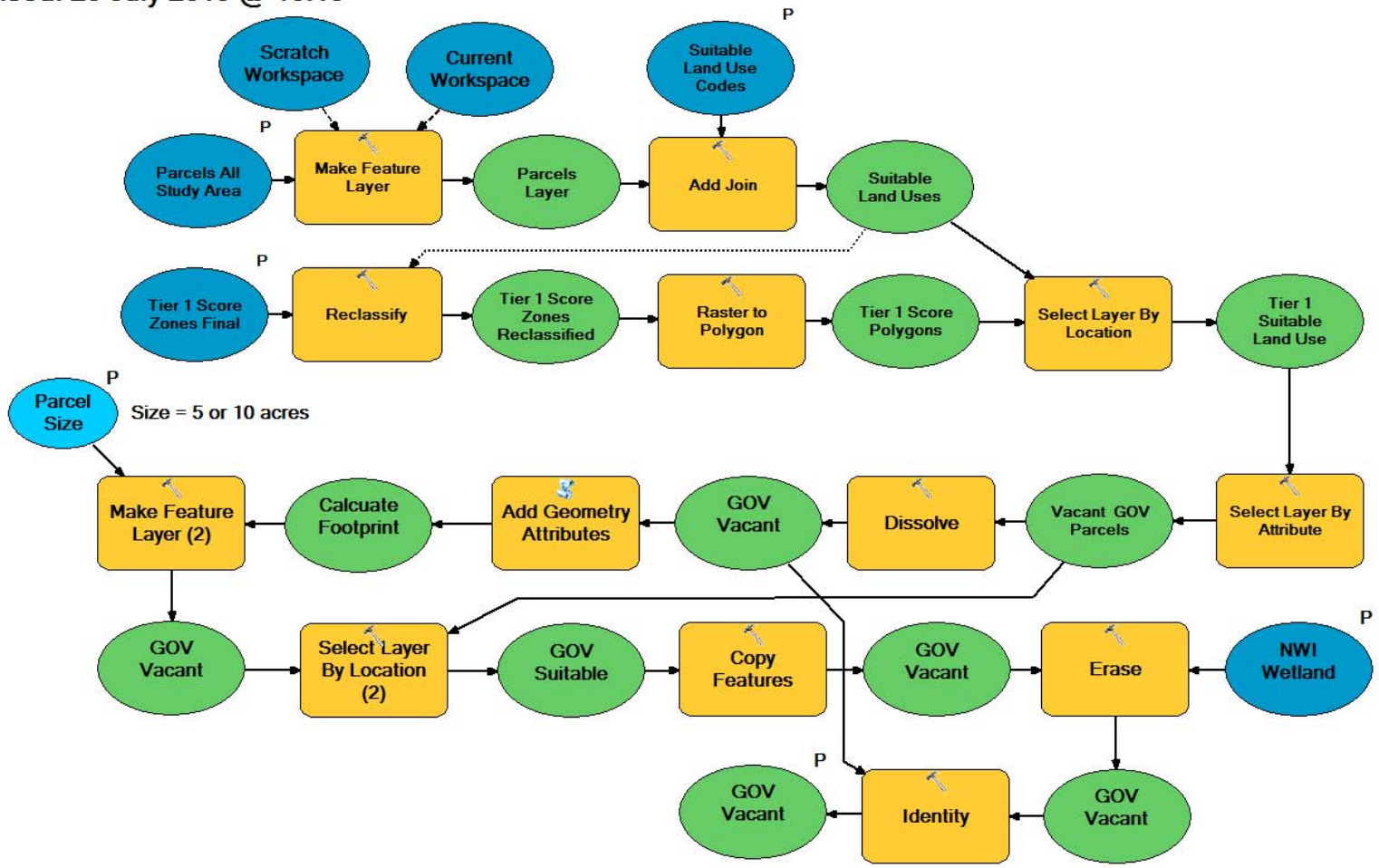
Appendix D. Truck Parking Suitability Model Tier 2A

FDOT Truck Parking Suitability Model
Model: Tier 2 A, Developed COM\IND Land Uses - District 5
Revised: 26 July 2019 @ 17:00



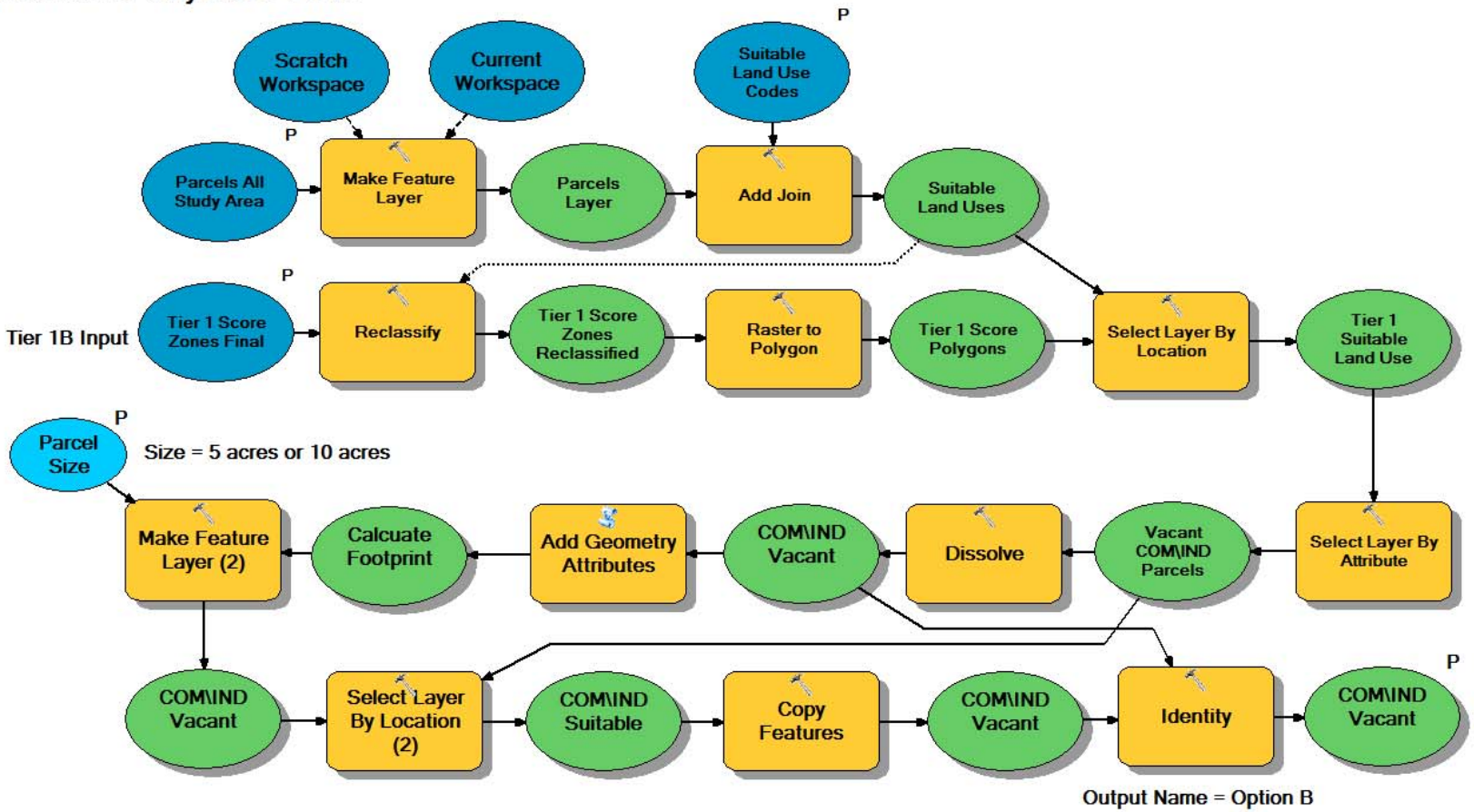
Appendix E. Truck Parking Suitability Model Tier 2C

FDOT Truck Parking Suitability Model
Model: Tier 2 C, Vacant Non-Wetland GOV Land Uses - District 5
Revised: 25 July 2019 @ 15:15



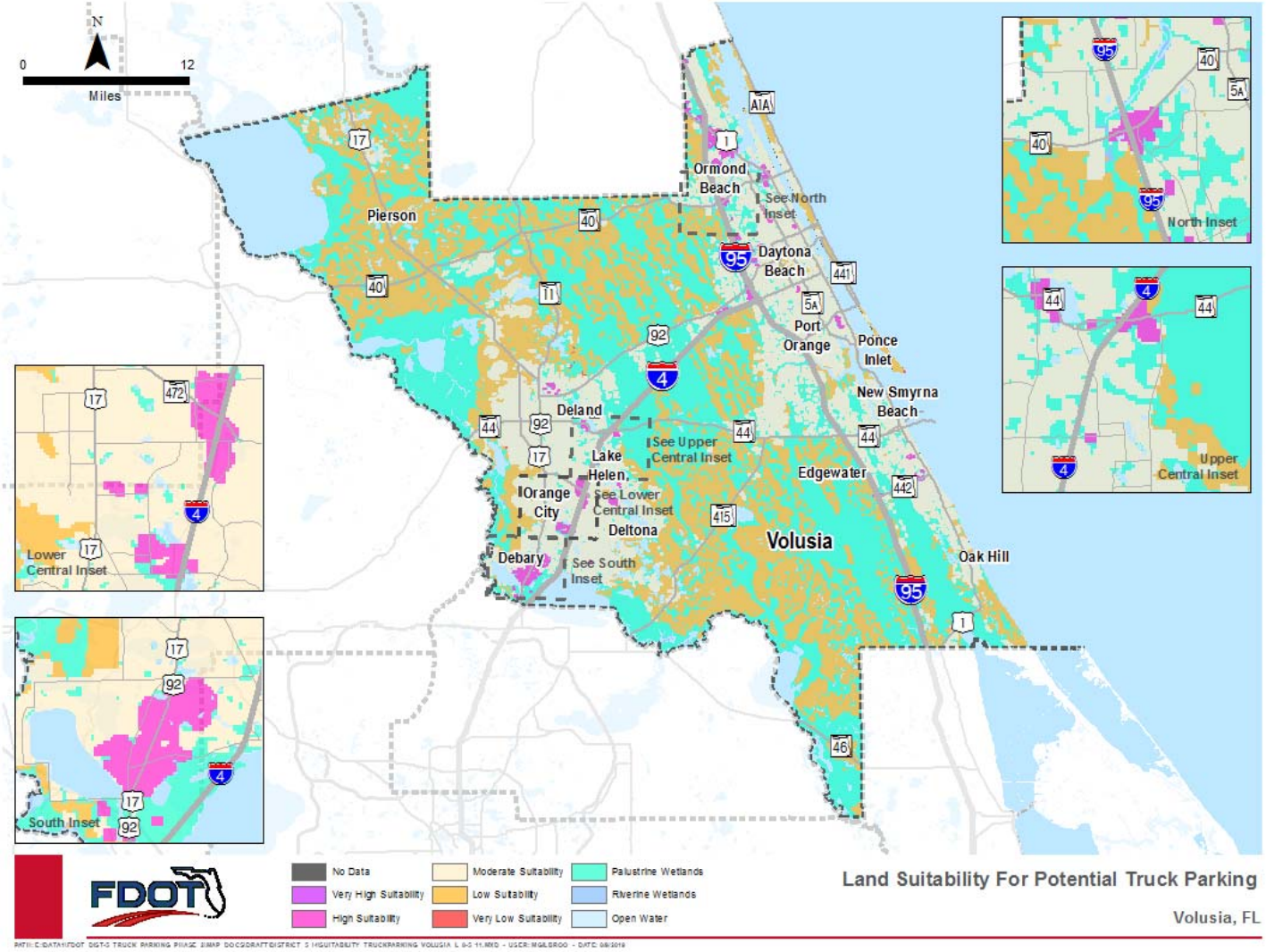
Appendix F. Truck Parking Suitability Model Tier 2B

FDOT Truck Parking Suitability Model
Model: Tier 2 B, Vacant COM\IND Land Uses - District 5
Revised: 25 July 2019 11:43

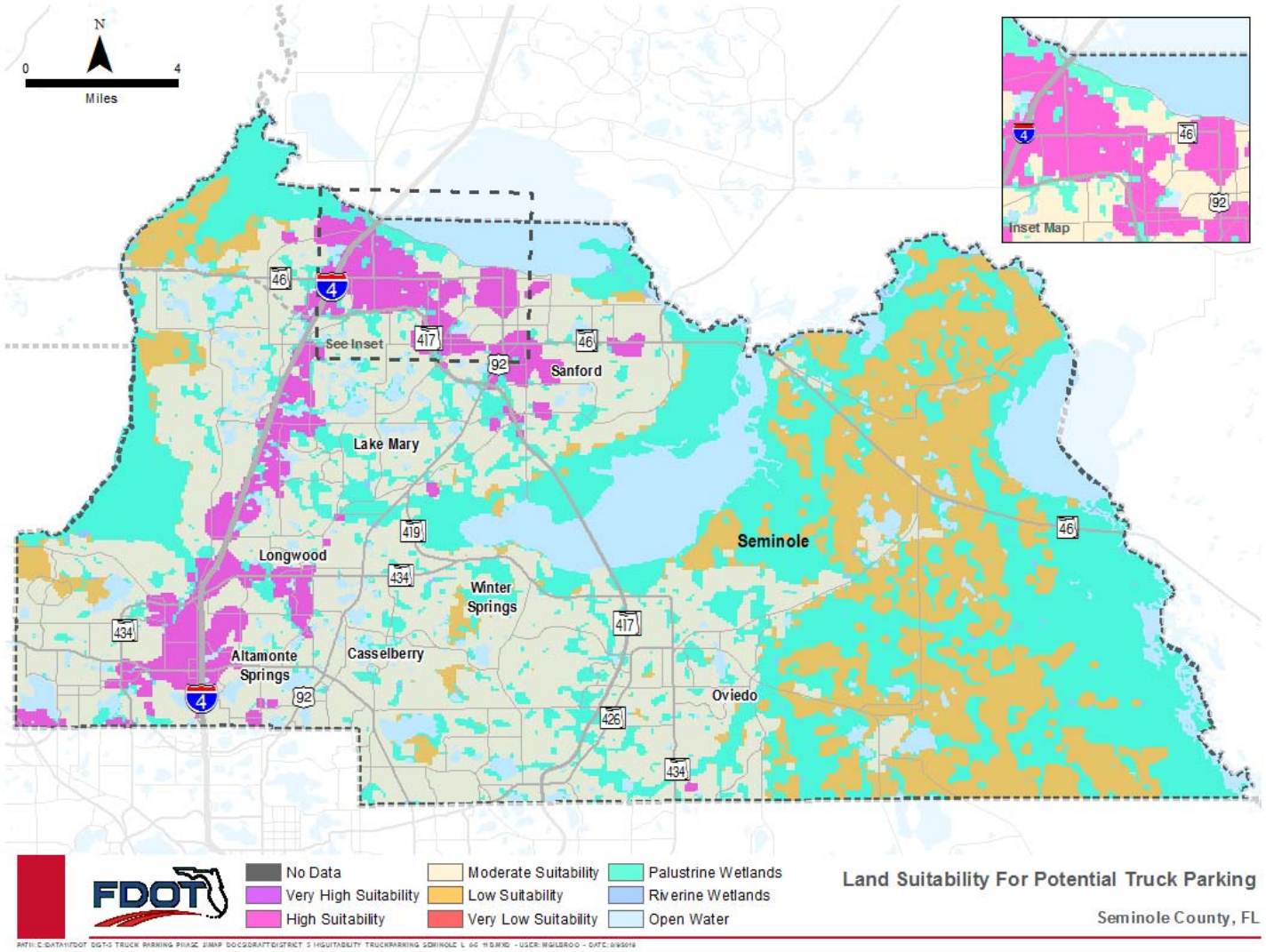


Appendix G. County Land Suitability Maps

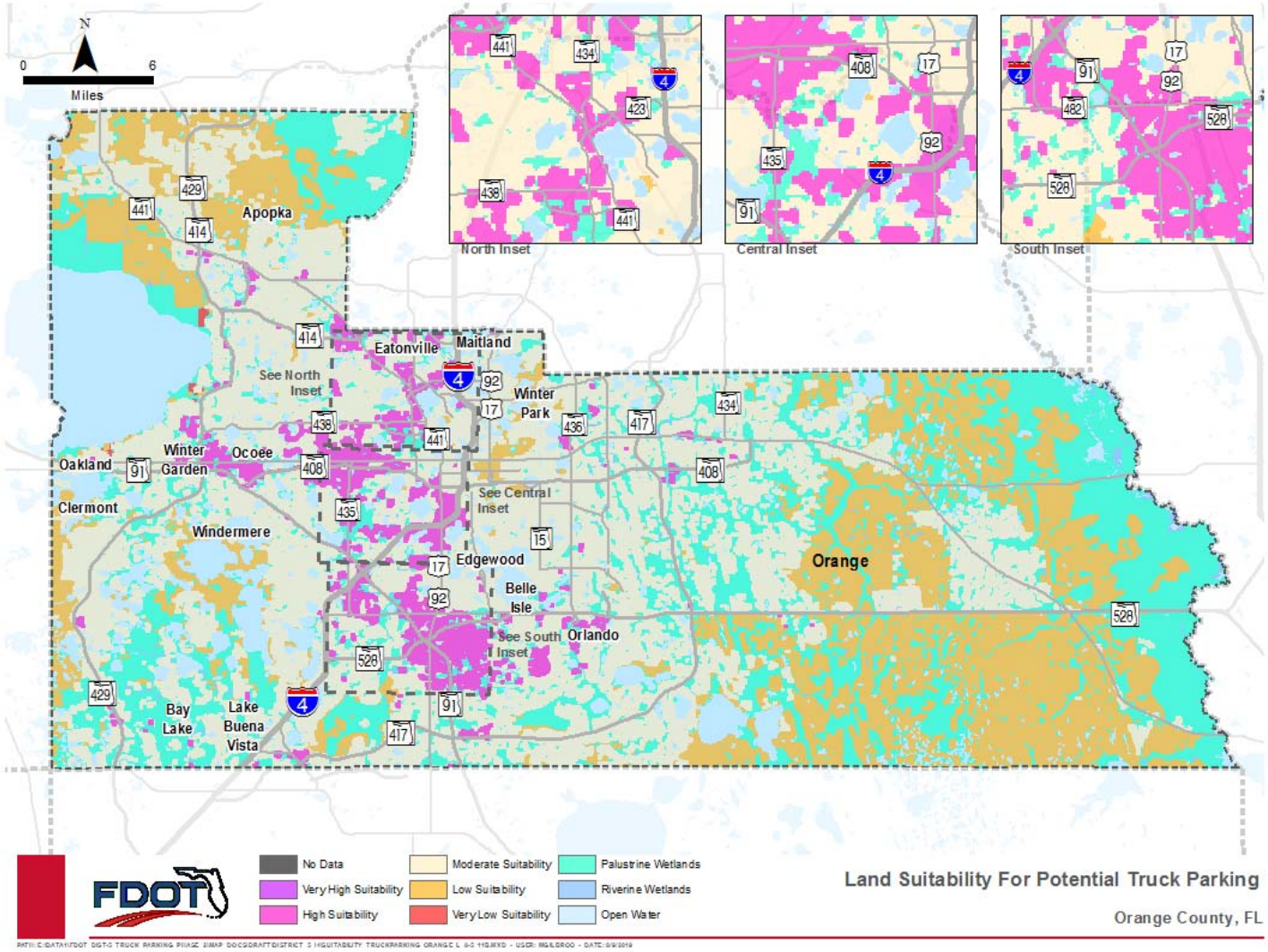
Appendix G-1. Volusia County Land Suitability Maps



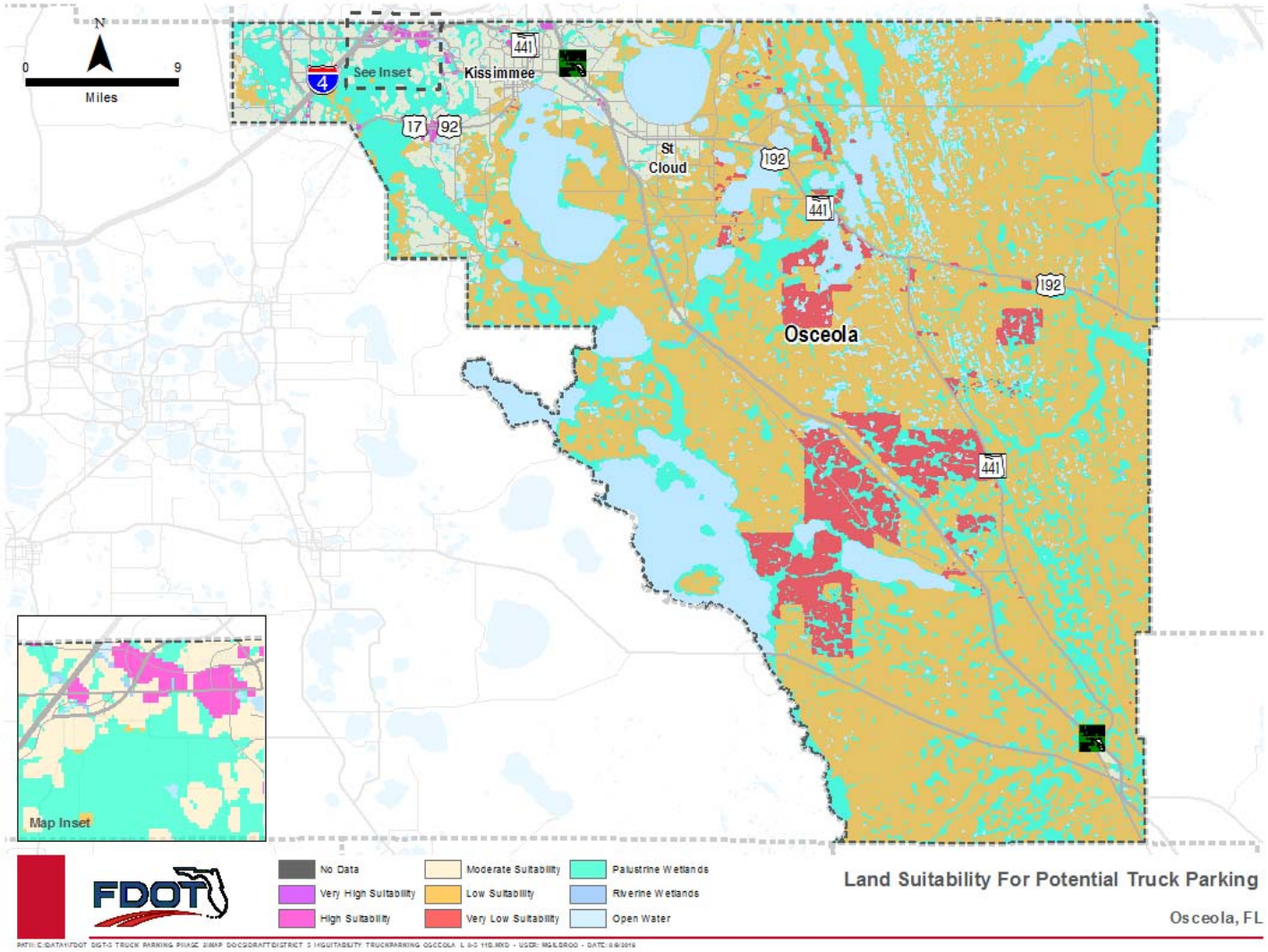
Appendix G-2. Seminole County Land Suitability Maps



Appendix G-3. Orange County Land Suitability Maps

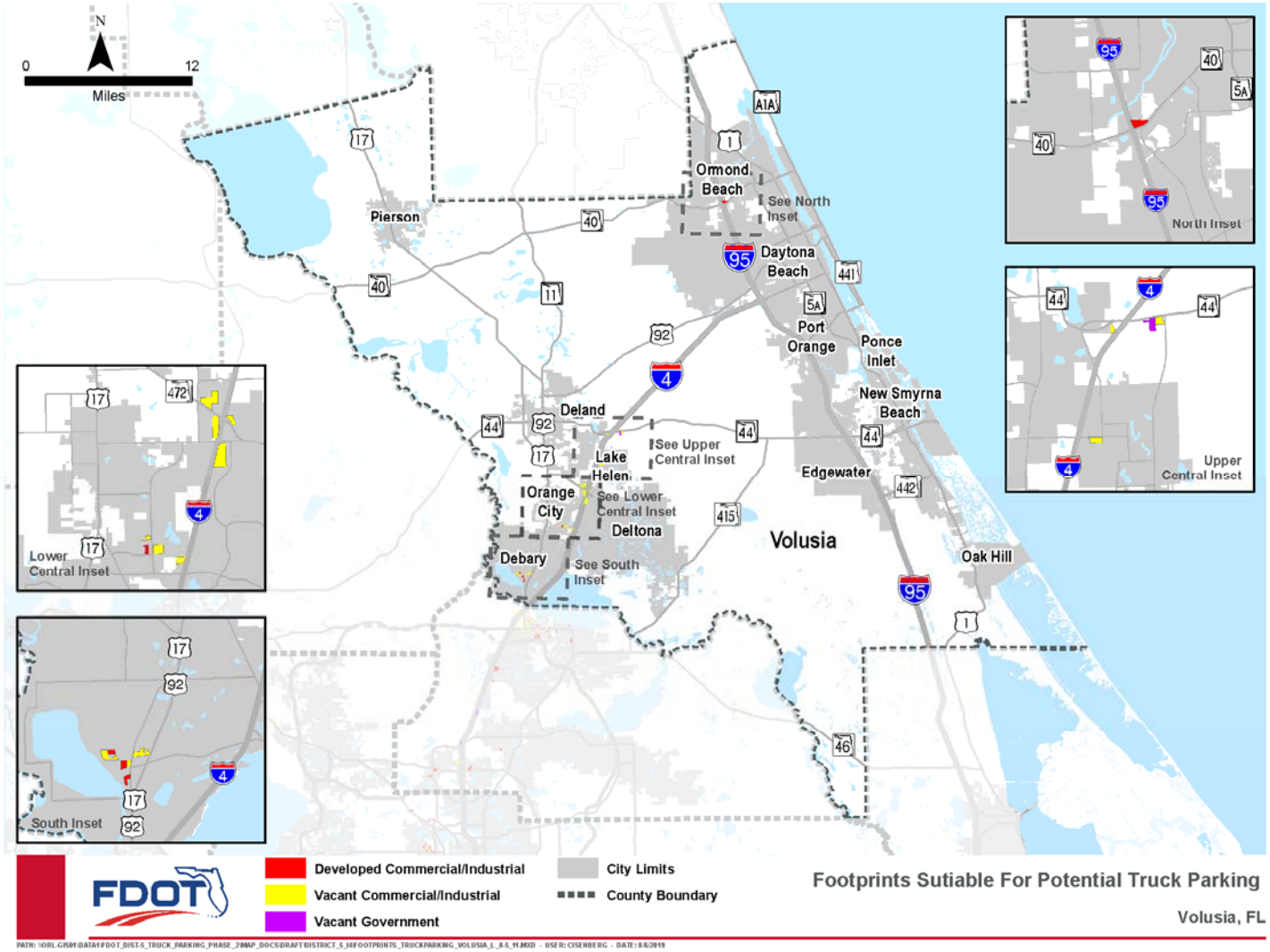


Appendix G-4. Osceola County Land Suitability Maps

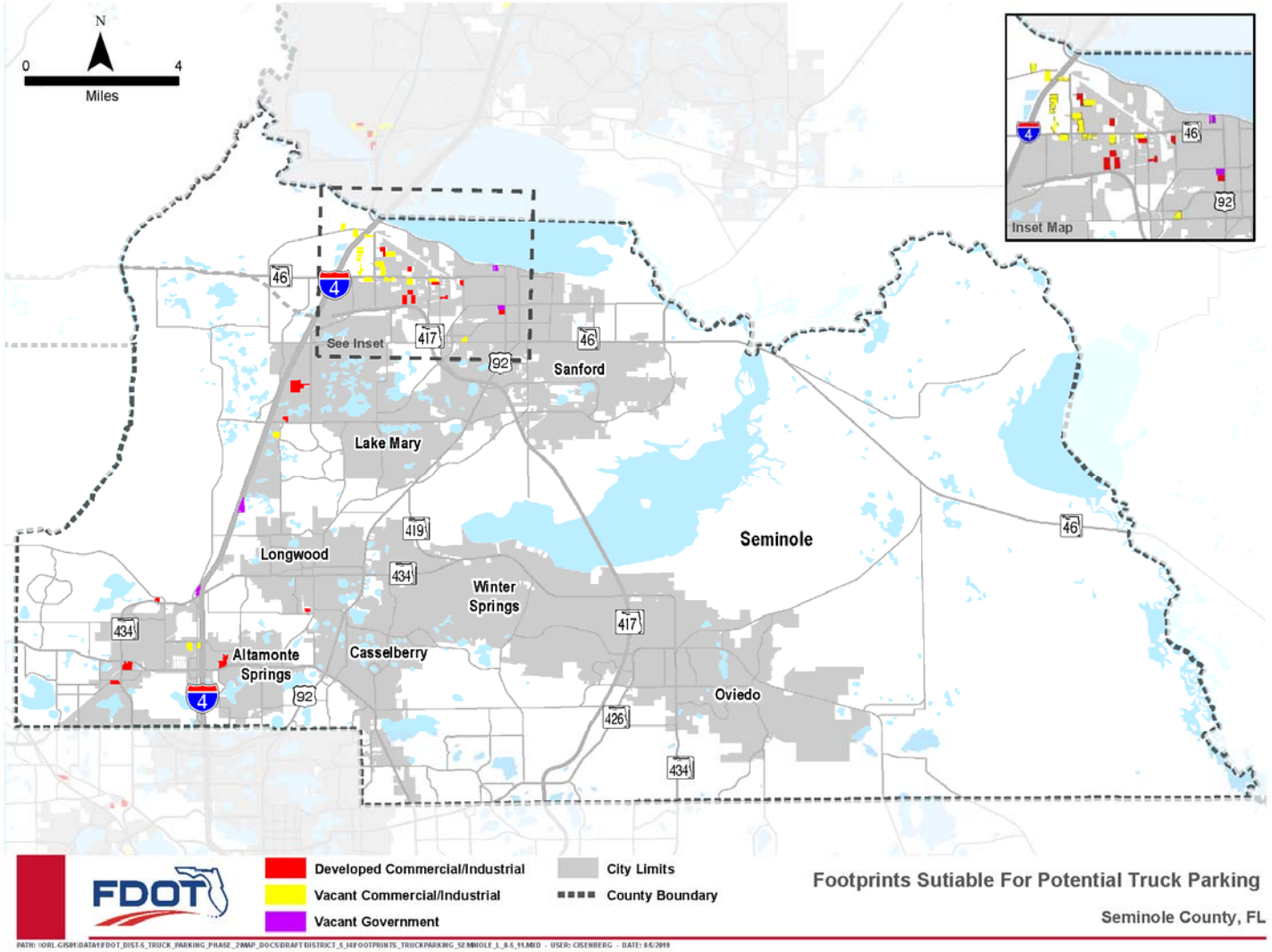


Appendix H. County Truck Parking Candidate Footprint Maps

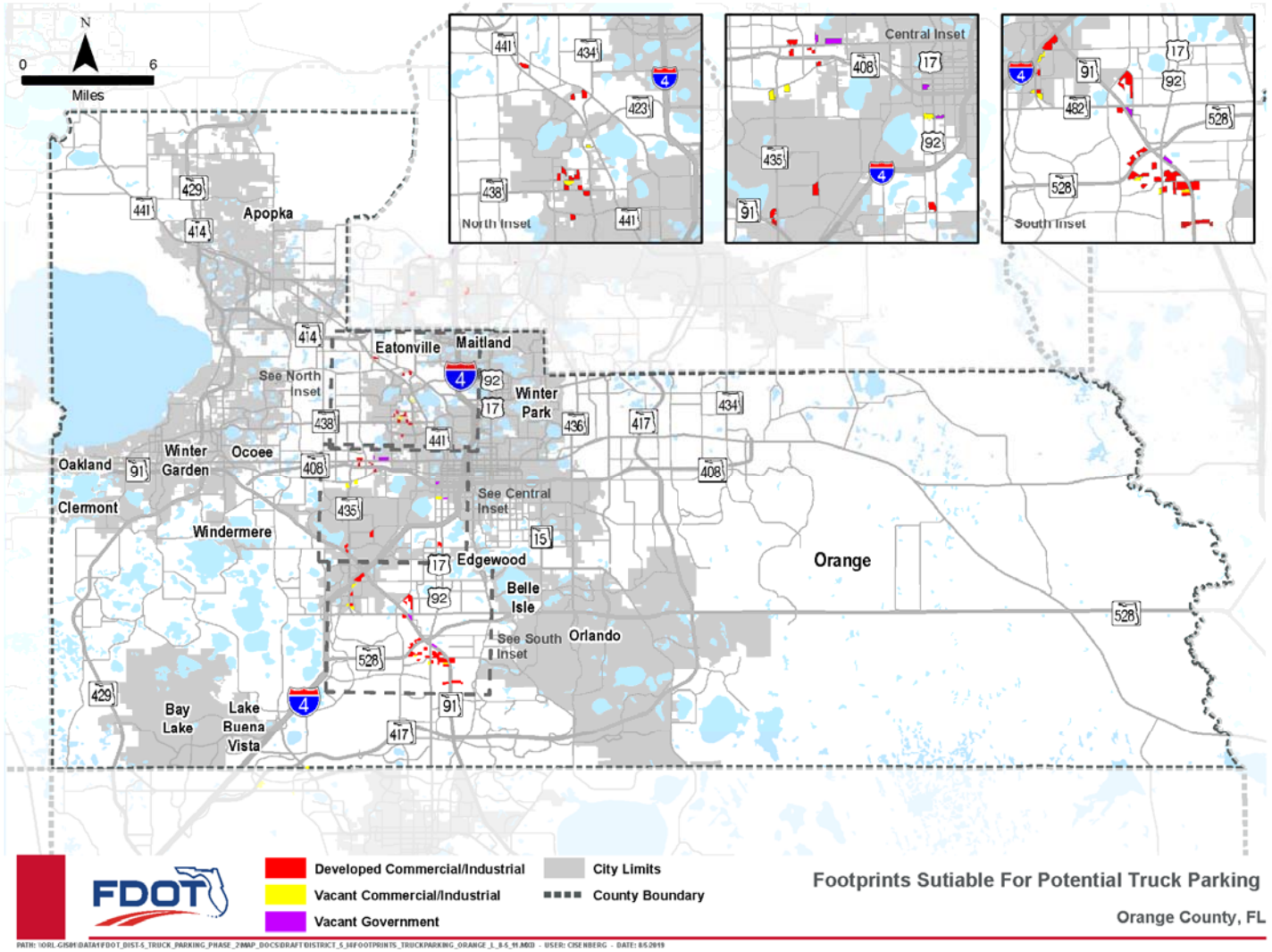
Appendix H-1. Volusia County Truck Parking Candidate Footprint Maps



Appendix H-2. Seminole County Truck Parking Candidate Footprint Maps



Appendix H-3. Orange County Truck Parking Candidate Footprint Maps



Appendix H-4. Osceola County Truck Parking Candidate Footprint Maps