Conservation Element

Data, Inventory & Analysis

Approved August 12, 1991 • Amended June 8, 2009

SUPPORT DOCUMENT

CONSERVATION ELEMENT
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1. INTRODUCTION

1.A. PURPOSE

The main purpose of the Conservation Element is to promote the conscientious conservation, use and protection of natural resources located in the Orlando area. Its second purpose is to identify and analyze natural systems located within the City of Orlando, including the integration of open space, landscaping, and drainage within a holistic framework. The Conservation Element's third purpose is to provide opportunities for economic development, while maintaining the quality of life enjoyed by City residents.

1.B. HISTORICAL BACKGROUND

The City of Orlando is among the fastest growing municipalities in the nation. The many reasons cited for choosing Orlando as a new place of residence include: quality of life with mild climate, numerous beautiful lakes, trees, and mature neighborhoods, and proximity to beaches, scenic rivers, and parks. As the City continues to grow and emerge as a new world city, it is faced with the ongoing dilemma of providing enough space for housing, industry, and commerce while maintaining the very essence of why people want to live and work here. The City must plan to provide the best of both worlds: opportunities for economic development and conservation of the natural systems on which the quality of life depends. Achieving this balance is essential to the continued "livability" and environmental sustainability of the City of Orlando.

Distinguishing it from most other urban areas, Orlando has a unique water-dominated landscape. Hundreds of small natural lakes and wetlands are scattered throughout the planning area, many interconnected by streams and ditches while others occurring within isolated drainage basins. Where these lakes are located adjacent to remaining stands of upland vegetation and mature urban woodlands, the landscape offers a rich environment highly valued by the residents of the City. Not only are these sites aesthetically desirable, but they include the most suitable locations for development.

As Orlando has grown, development has expanded into areas adjacent to older communities and neighborhoods. In a number of locations, less suitable poorly drained low-lying soils have been developed for residential, commercial and industrial land uses. Continuing growth has brought with it significant changes to the natural environment. The hydrologic system in particular is sensitive to alterations in run-off dynamics and ground surface disturbances. Such changes adversely impact stream flows, overland flow volumes, and through-flow to ground-water systems. Accelerated soil erosion from development sites combined with runoff from urbanized areas is a potential source of pollutants to surface and groundwater resources. In addition, most of the natural woodland vegetation has been cleared for agriculture or

developed uses. Also, many wetlands in the past have been filled to provide more well-drained development sites.

Emerging environmental concerns have focused on the sustainability of the area's water resources. The community now faces serious problems related to drainage, stormwater management, water quality, and the availability of potable water for future growth. As part of the Clean Water Act, the Florida Department of Environmental Protection (FDEP) has instituted the total maximum daily load (TMDL) program. TMDLs establish the maximum amount of a pollutant that a water body can assimilate without exceeding water quality standards. The introduction of TMDLs is an important step toward restoring Florida's waters to their designated uses. This program has identified 20 Orlando lakes as "impaired" water bodies, primarily due to nutrient pollution. To improve the condition of these lakes and maintain the quality level of other lakes in the community, Orlando will have to focus resources on managing pollutants conveyed through stormwater runoff in both older neighborhoods and newly developed areas.

With regard to water supply, the St. Johns River Water Management District (SJRWMD), the entity responsible for permitting water consumption, has identified limitations in the use of the Floridan Aquifer for meeting the needs of future growth. The District has concluded that the projected consumption levels in Central Florida will reduce the level of the aquifer sufficiently to impact wetlands, lake levels, stream flows and springs in the area. As such, they are requiring utilities to investigate the use of alternative water supplies, such as surface water and treated wastewater (reclaimed water) to help meet a portion of the projected demand. The District is also encouraging the adoption of permanent watering restrictions to promote conservation and limit the non-potable use of the region's potable water supplies.

Responding to these concerns, the City of Orlando must plan for the sensitive accommodation of future growth. Action is needed to direct growth to suitable areas, away from sensitive and hazardous locations as well as from resources valuable to the community. Regulation of new development is essential to the continued functioning of natural systems. Assessing the impacts of new development on critical natural resources should be an integral part of the subdivision and development review process. Existing environmental concerns should also be addressed and integrated into the development plan. Preserving and protecting the City's natural amenities as well as mitigating conditions that threaten the sustainability of our natural resources are essential to maintaining Orlando's natural beauty.

2. IDENTIFICATION AND ANALYSIS OF NATURAL RESOURCES

2.A. RIVERS

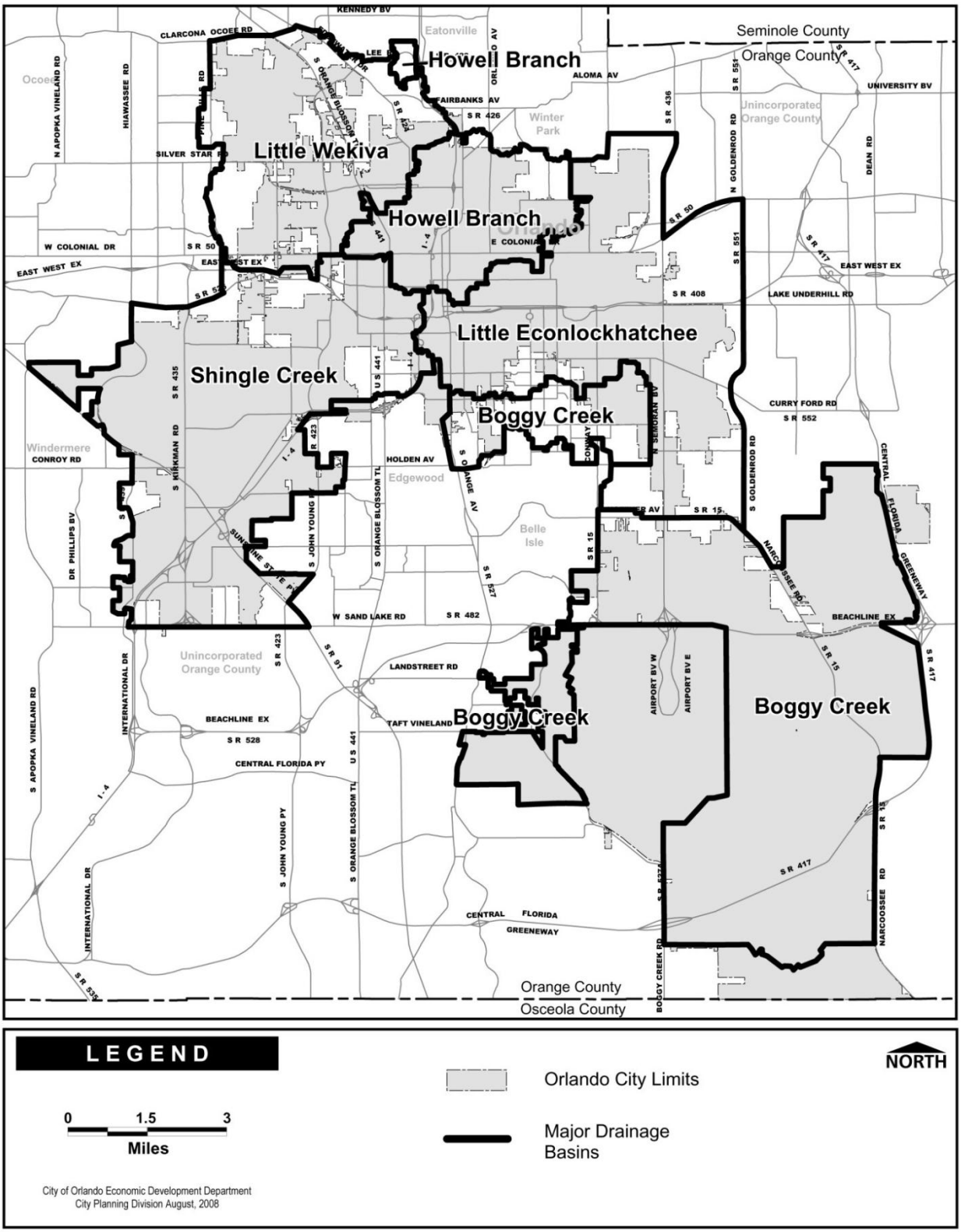
A major drainage basin divide passing through the center of the Orlando area separates the watershed for the south-flowing Kissimmee River from the north-flowing St. Johns River. Six tributaries to the two rivers have headwaters near the City of Orlando. The Shingle Creek, Boggy Creek, and Lake Hart sub-basins discharge into the Kissimmee River. Howell Branch

Creek, the Little Wekiwa, and portions of the Little Econlockhatchee sub-basin discharge into the St. Johns River. Figure C-4 displays major rivers by drainage basin for the Orlando area, broken down by sub-basin and including landlocked basins which do not drain into either basin.

Most stream channels through the Orlando area have been severely altered to improve drainage through channelization, culverts, and clearing of streambank vegetation. Flow in many stream reaches is derived primarily from groundwater flow, urban stormwater runoff, and artificially controlled lake discharges. Numerous canals have been constructed throughout the Orlando area to improve drainage, to control lake levels, and to mitigate flood hazard potential. Water quality of lakes and streams is generally degraded due nutrient pollution and turbidity problems attributable to urban stormwater runoff. Stormwater runoff from developed portions of the Orlando area presents a major flood hazard as well as a primary source of water pollutants to the surface and groundwater systems. Solutions to specific stormwater and water quality management problems require coordinated efforts designed to both reduce the volume of stormwater runoff as well as eliminate non-point sources of water pollution. Measures to address to address this problem include use of the storage and dispersal features of the natural drainage system, combined with runoff and erosion control measures designed to minimize sedimentation potential.

To improve water quality, the City must continue utilizing the best techniques and technology to remove pollutants prior to discharge into surface water bodies and drainage wells. In order to meet total maximum daily load (TMDL) requirements, it may be necessary to install stormwater treatment systems patterned after those traditionally used to treat sanitary wastewater discharges. Clearly, the City must be innovative and flexible in their approach to maintaining and improving the quality of area surface waters. A more detailed analysis of Orlando area rivers and streams can be found in the Stormwater and Aquifer Recharge Element.

Figure C-4 Major Drainage Basins



2.B. LAKES

The Central Florida region is home to numerous fresh water lakes. The beauty and water quality of these lakes first drew settlers to this area in the mid 1800's. As the City developed during the 1920's, many homes were built fronting roads which curved around the City's lakes creating interconnected scenic drives. This design practice allowed homeowners to have a lakefront view while the public retained lake access. Examples of this type of development can be seen in the Lake Cherokee and Lake Copeland Historic Districts. Post World War II development practices introduced a suburban style residential development where houses directly backed onto lakes. Accordingly, public access to lakes was reduced and the community's quality of life suffered. Recent mixed-use developments in Baldwin Park and the Southeast Sector Plan area have revived many of the traditional neighborhood design practices and, once again, are making lakes accessible to everyone.

Most of Orlando's natural lakes were formed in recent geological times and can be classified as solution lakes. Solution lakes start to form through sinkhole activity when underground limestone is dissolved by carbon dioxide enriched water. While most solution lakes are circular and steeply sided, they can be irregularly shaped when sited next to adjacent sinkholes or subjected to subsidence activity. Solution lakes usually occur in clusters and are rarely shallow. Orlando's lakes typically average depths of 10 to 12 feet. Lake Arnold, in the Dover Shores Neighborhood, with a lake depth of 41 feet, is one of the deepest solution lakes in Orlando.

Due to the nature of gravity and the action of water on uplands carrying soil and nutrients to the bottom of a drainage basin, a lake continually changes from that of a deep water reservoir, to a shallow lake, to a freshwater marsh, then to a wet prairie, and finally to a forested ecosystem. This gradual decline is called eutrophication. While at one time scientists thought this was a wholly natural process, they now recognize that climate change and other external factors are as important, or more important, in regulating the natural productivity of lakes. When the aging process of lakes becomes artificially accelerated because of human impact, it is referred to as "cultural eutrophication". (Please see Section 3 for more information).

There are approximately 120 lakes located in the Orlando planning area, ranging in size from less than two acres to over 350 acres, as described in Figure C-5A. The majority are natural, formed in sinkholes resulting from solution of underlying limestone bedrock. For descriptive purposes, four types of lakes have been identified, including: (1) lakes having inflowing streams, (2) lakes having outflowing streams, (3) lakes having both inflowing and outflowing streams, and (4) landlocked lakes. Approximately 75% of the lakes in the planning area are land-locked in their natural state.

To protect against flood damage, lake levels are artificially controlled. Fluctuations in lake stages are controlled by regulating the amount of surface inflow and outflow via man-made structures, such as drainage wells, open channels, and culverts. Surface water runoff that would otherwise enter lakes from street drainage can be diverted to the surficial or upper

Floridan aquifer through drainage wells. Surface outflows from lakes are conveyed in open channels and culverts, pumped out through pipes or may also be diverted to drainage wells.

Historically, lakes in the Orlando planning area were characterized as having excellent water quality. Today, many lakes have been degraded by cultural eutrophication, septic system effluent in areas without sewer systems, and urban stormwater runoff. Nutrient and algae standing crop levels are typically high. Older developed areas, built without the benefit of stormwater best management practices, are the primary contributors to this condition.

The City of Orlando, through the Public Works Department Streets and Stormwater Division, is responsible for managing stormwater runoff and lake water quality within City limits. The City is committed not only to controlling stormwater runoff from new development, but also to reducing stormwater pollution from older developed areas. A further discussion of stormwater may be found in the Stormwater and Aquifer Recharge Element. Figure C-5B graphically displays the location of all lakes within the City of Orlando and surrounding area.

Lake Lawsona

FIGURE C-5A: LAKE INVENTORY

	Name	Origin	Acreage
1	Adair	Natural	25
2	Amanda	Excavated	46
3	ARIC	Excavated	12
4	Arnold	Natural	26
5	Baldwin	Natural	196

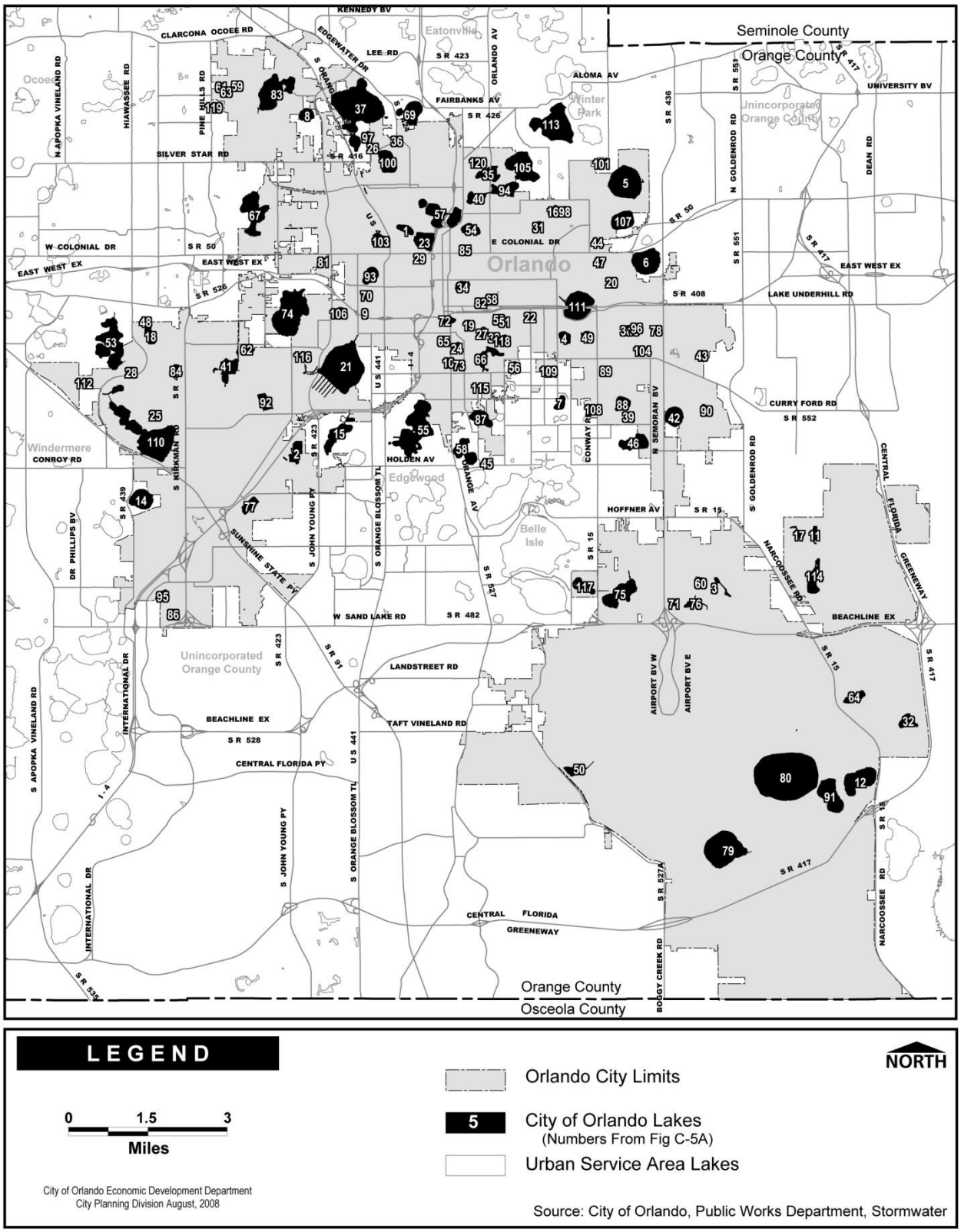
	Name	Origin	Acreage
6	Barton	Natural	134
7	Bass	Natural	23
8	Bay	Natural	34
9	Beardall	Excavated	3
10	Beauty	Natural	2
11	Bedford	Excavated	17
12	Buck	Natural	129
13	C	Excavated	4
14	Cane	Natural	85
15	Catherine	Natural	83
16	Cay Dee	Natural	12
17	Champlain	Excavated	7
18	Charter	Excavated	28
19	Cherokee	Natural	13
20	Claudette	Excavated	2
21	Clear	Natural	358
22	Como	Natural	2
23	Concord	Natural	66
24	Copeland	Natural	15
25	Crystal	Natural	3
26	Daniel	Natural	8
27	Davis	Natural	17
28	Debra	Natural	10
29	Dot	Natural	6
30	Dover	Excavated	2
31	Druid	Natural	17
32	East Park	Excavated	36
33	Emerald	Natural	3
34	Eola	Natural	28
35	Estelle	Natural	47
36	Fairhope	Natural	1
37	Fairview	Natural	397
38	Farrar N	Natural	8
39	Farrar S	Natural	2
40	Formosa	Natural	33
41	Fran	Excavated	70
42	Fredrica	Natural	65
43	G	Excavated	6
44	Gear	Excavated	6
45	Gem Mary	Natural	14

	Name	Origin	Acreage
46	George	Natural	73
47	Georgette	Natural	7
48	Geyer	Natural	3
49	Giles	Natural	29
50	Gilooly	Excavated	30
51	Greenwood	Natural	5
52	Haven	Excavated	5
53	Hiawassee	Natural	170
54	Highland	Natural	33
55	Holden	Natural	252
56	Hourglass	Natural	11
57	Ivanhoe	Natural	126
58	Jennie Jewel	Natural	65
59	Kasey	Excavated	4
60	Kathleen	Excavated	10
61	Kelly	Excavated	3
62	Kozart	Excavated	7
63	Kristy	Excavated	4
64	La Vina	Excavated	31
65	Lake of the Woods	Natural	4
66	Lancaster	Natural	43
67	Lawne	Natural	146
68	Lawsona	Natural	9
69	Little Lake Fairview	Natural	79
70	Lorna Doone	Natural	15
71	Lorri	Excavated	4
72	Lucerne	Natural	19
73	Lurna	Natural	8
74	Mann	Natural	267
75	Mare Prairie	Natural	118
76	Michelle	Natural	16
77	Millenia	Excavated	33
78	Monterey	Excavated	1
79	Mud	Natural	244
80	Nona	Natural	584
81	Notasulga	Excavated	1
82	Olive	Natural	4
83	Orlando	Natural	170
84	Pamela	Natural	14
85	Park	Natural	9

	Name	Origin	Acreage
86	Pat	Excavated	4
87	Pineloch	Natural	63
88	Porter	Natural	34
89	Rabama	Excavated	6
90	Raper	Excavated	7
91	Red	Natural	123
92	Richmond	Excavated	35
93	Rock	Natural	44
94	Rowena	Natural	58
95	Sandy	Natural	24
96	Santiago	Excavated	5
97	Sarah	Natural	13
98	Shannon	Natural	10
99	Silver NW	Natural	70
100	Silver SE	Natural	1
101	Spier	Natural	22
102	Spring NW	Natural	38
103	Spring SW	Natural	112
104	Stillinger	Excavated	1
105	Sue	Natural	143
106	Sunset	Natural	29
107	Susannah	Natural	69
108	Tennessee	Natural	11
109	Terrace	Natural	5
110	Turkey	Natural	330
111	Underhill	Natural	142
112	Vilma	Excavated	5
113	Virginia	Natural	221
114	Vista	Natural	60
115	Wade	Natural	3
116	Walker	Natural	4
117	Warren	Natural	31
118	Weldona	Natural	9
119	White Herron	Excavated	1
120	Winyah	Natural	18

Source: Public Works Department, Stormwater Division, 2008

Figure C-5B Urban Area Lakes



2.C. WETLANDS

Non-tidal wetlands consist of marshes, swamps and bogs. They are usually created by a combination of surface water flooding and groundwater discharge. Consequently, they form along non-tidal rivers, streams, lakes and ponds. They also form in isolated upland depressions where surface water collects, in association with springs and points of active groundwater discharge, and where the water table stays near the surface for a prolonged period of time. In these situations, the soil becomes saturated, commonly known as hydric, and plants adapted for life in wet conditions become established to form wetland communities.

Wetlands are important because they provide socioeconomic benefits such as flood control, erosion control, recreation, aesthetics, and educational and scientific research opportunities. The aesthetic qualities of wetland systems are very important. They are a major component of the City's expanding open space system, contributing to the community's livability. Along with these values, wetlands also provide environmental benefits by filtering pollution, removing sediments, producing oxygen and recycling nutrients. They increase aquatic productivity serve as habitats for fish, waterfowl and other animals.

The major causes of wetland loss and degradation can be directly or indirectly attributed to development. After nearly 150 years of growth, much of the high and well-drained lands in the City of Orlando have been developed. Many lands which were too wet for citrus groves or housing were ditched and drained for agricultural and industrial uses nearly fifty years ago. Very few of these once vast wetland systems remain in the Orlando area.

Figures C-6A through C-6D display the wetland areas within the City of Orlando. Figure C-7 shows acreages of wetlands in the City, organized by drainage basin. Many of these wetlands are preserved by being designated "Conservation" on the future land use (FLU) map. (See the Future Land Use Element for a discussion of the Conservation FLU designation). Other wetlands are preserved through the actions undertaken by the St. Johns River and the South Florida Water Management Districts.

Environmental Resource Permits

For many years, multiple agencies were involved in the regulation of Florida's Waters and wetlands. In 1994, a program was created that allowed applicants to apply for a comprehensive Environmental Resource Permit or ERP. The Water Management Districts act as the intake agencies for most ERP applications and then distribute them to other permitting authorities as needed. The ERP application may be used to apply for permits for surface water management, wetlands permits, dredge and fill activities, and use of sovereign submerged lands.

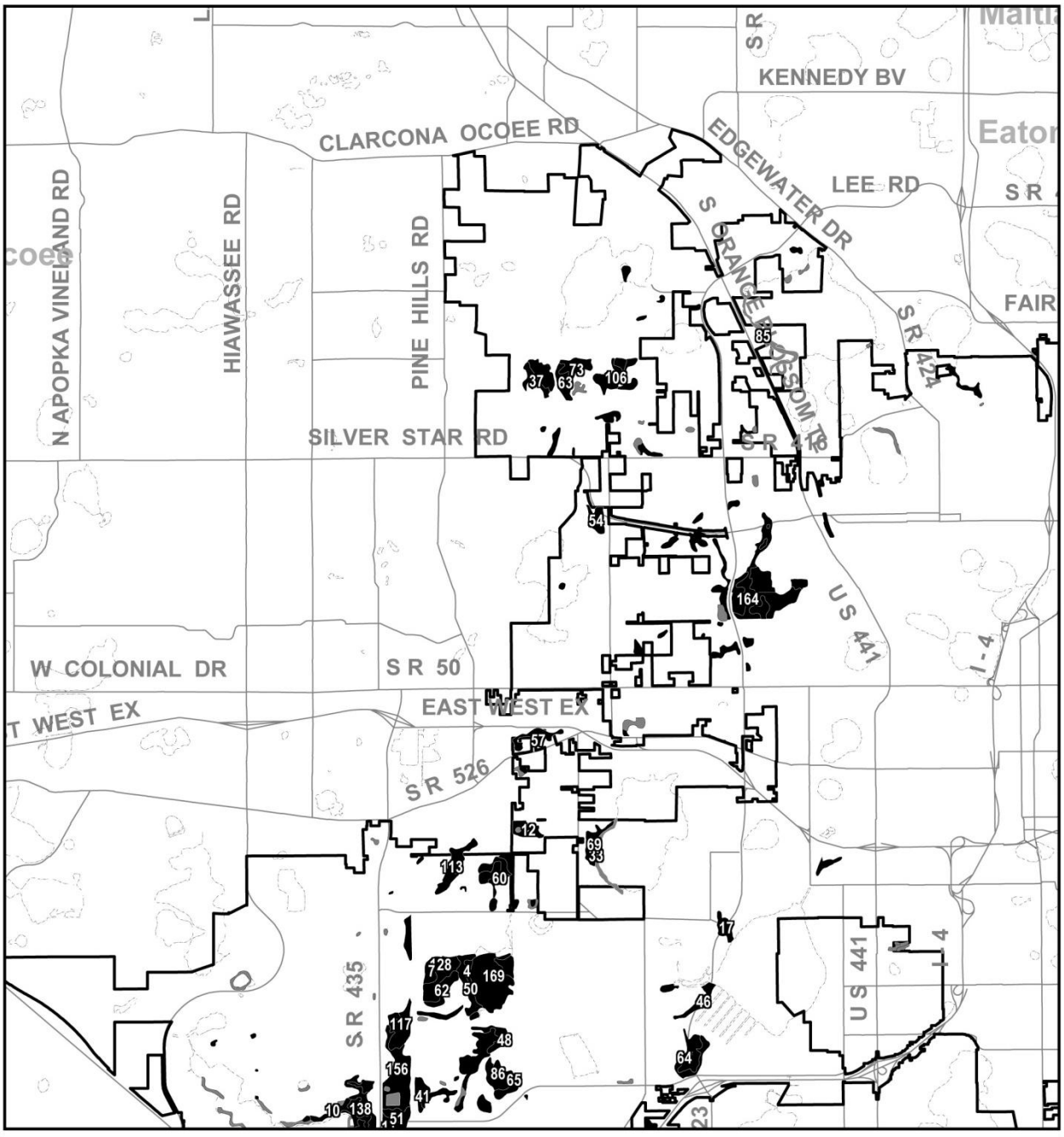
The St. Johns River and the South Florida Water Management Districts and the United States Corps of Engineers are the three agencies which share permitting authority over impacts to wetlands in the City of Orlando. Permit applicants are typically developers seeking to build in undeveloped areas where there are wetlands. They must demonstrate that they cannot

reasonably avoid impacts to existing wetlands and that they have developed an effective mitigation plan to reduce these impacts. Mitigation may include restoring existing wetlands that have been damaged, creating new wetlands, enhancing the functions of wetlands or preserving wetlands or associated uplands. When on-site mitigation is not possible, the water management districts may allow transfer of "mitigation credits" from off-site areas. As detailed in Section 62-342.100, F.A.C., off-site mitigation options allow donation of lands or funds to off-site regional mitigation areas and/or the purchase of mitigation credits from mitigation banks.

The Army Corps of Engineers has jurisdiction to regulate those wetlands which abut or impact interstate commerce. Accordingly, the Army Corps can establish jurisdiction over any tributaries which reach navigable streams, waters or water courses and associated wetlands. The Army Corps also reviews all ERP applications. Dredge and fill permits from the water management district may also require a separate permit from the Army Corps of Engineers.

Orlando Wetlands Park, Christmas Florida

Figure C-6 Part A — Urban Area Wetlands - Northwest



LEGEND

- Forested Wetland
- Non Forested Wetland
- 25 — Wetlands greater than 10 acres numbered (refer to figure C-7 for acreage)
- City of Orlando Jurisdiction

NORTH

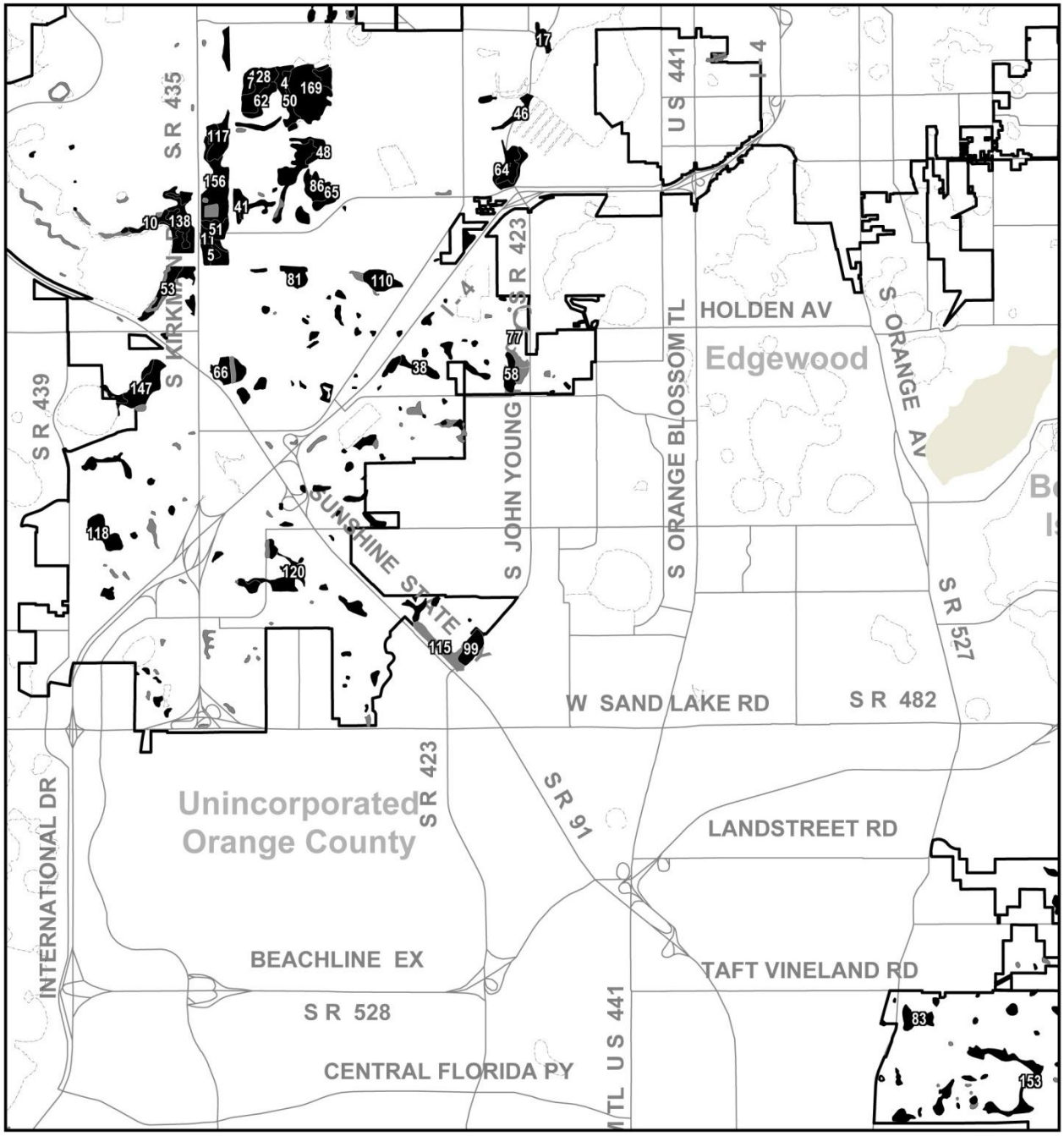
0 0.5 1 miles

City of Orlando Economic Development Department
City Planning Division August, 2008

Source: Florida Geographic Data Library

Note: The Protected Wetlands displayed on ths map are illustrative in nature, designed to display the general location of wetland systems, and should not be considered as a wetland jurisdictional line.

Figure C-6 Part B — Urban Area Wetlands - Southwest



LEGEND

- Forested Wetland
- Non Forested Wetland
- 25 — Wetlands greater than 10 acres numbered (refer to figure C-7 for acreage)
- City of Orlando Jurisdiction

NORTH

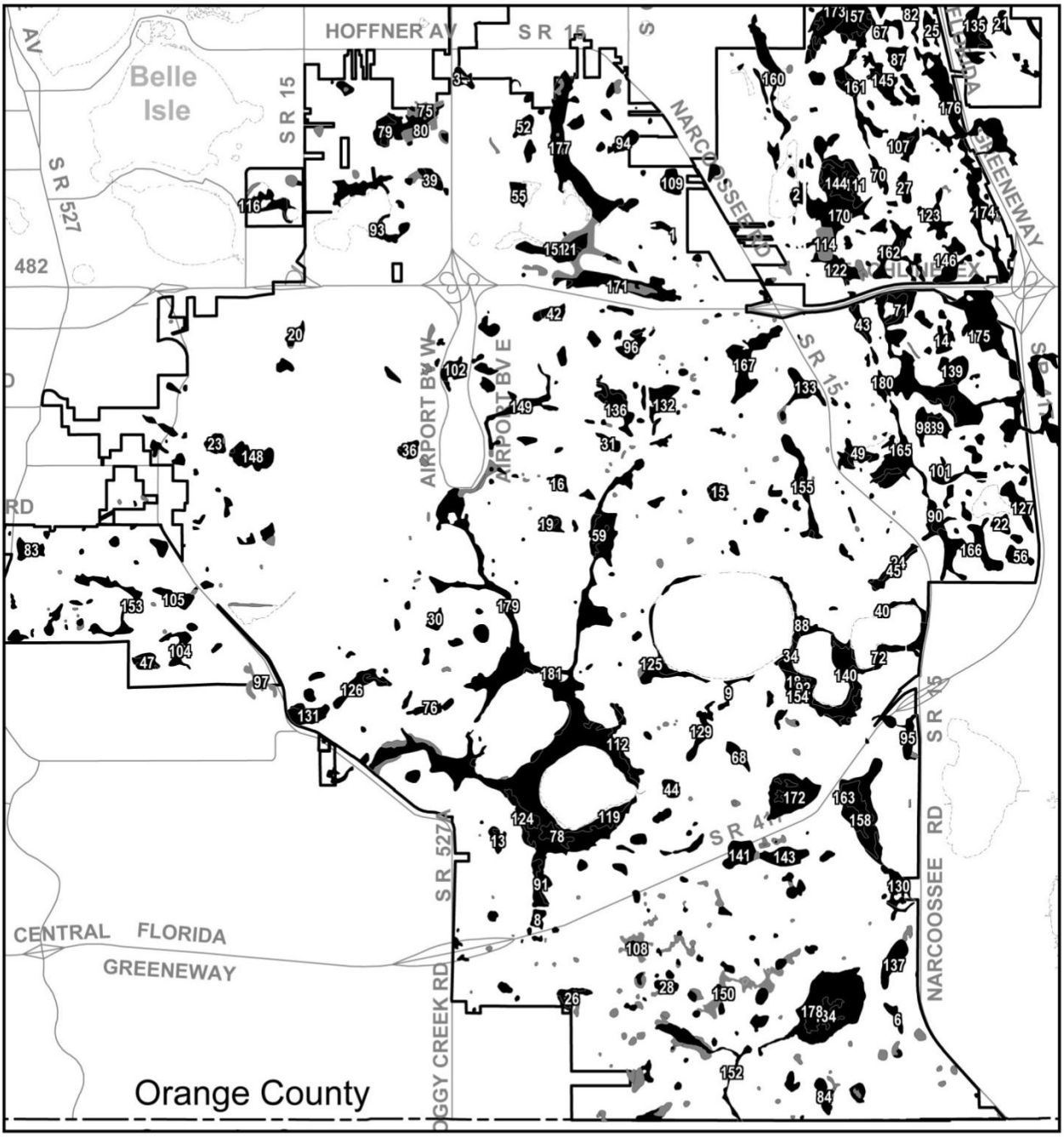
0 0.5 1 miles

City of Orlando Economic Development Department
City Planning Division August, 2008

Source: Florida Geographic Data Library

Note: The Protected Wetlands displayed on ths map are illustrative in nature, designed to display the general location of wetland systems, and should not be considered as a wetland jurisdictional line.

Figure C-6 Part C — Urban Area Wetlands - Southeast



LEGEND

- Forested Wetland
- Non Forested Wetland
- 25 — Wetlands greater than 10 acres numbered (refer to figure C-7 for acreage)
- City of Orlando Jurisdiction

NORTH

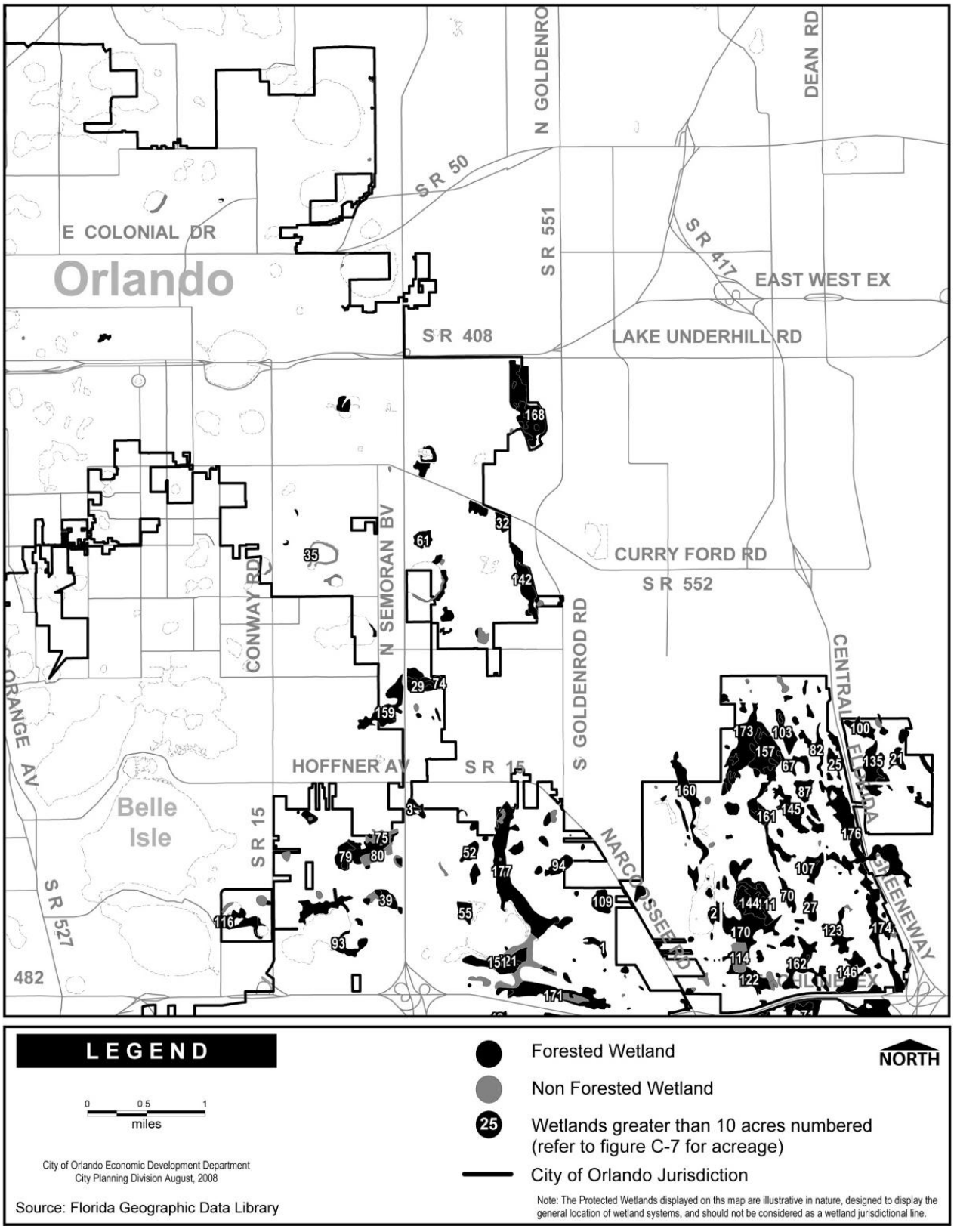
0 0.5 1 miles

City of Orlando Economic Development Department
City Planning Division August, 2008

Source: Florida Geographic Data Library

Note: The Protected Wetlands displayed on ths map are illustrative in nature, designed to display the general location of wetland systems, and should not be considered as a wetland jurisdictional line.

Figure C-6 Part D — Urban Area Wetlands - Northeast



LEGEND

- Forested Wetland
- Non Forested Wetland
- 25 — Wetlands greater than 10 acres numbered (refer to figure C-7 for acreage)
- City of Orlando Jurisdiction

NORTH

0 0.5 1 miles

City of Orlando Economic Development Department
City Planning Division August, 2008

Source: Florida Geographic Data Library

Note: The Protected Wetlands displayed on ths map are illustrative in nature, designed to display the general location of wetland systems, and should not be considered as a wetland jurisdictional line.

FIGURE C-7: WETLAND INVENTORY

NUMBER	BASIN NAME	TYPE	ACRES
1	Boggy Creek	Forested	11.0
2	Boggy Creek	Forested	12.2
3	Boggy Creek	Non-Forested	12.5
4	Boggy Creek	Forested	13.2
5	Boggy Creek	Non-Forested	13.6
6	Boggy Creek	Forested	15.3
7	Boggy Creek	Forested	15.4
8	Boggy Creek	Non-Forested	15.7
9	Boggy Creek	Forested	15.8
10	Boggy Creek	Forested	17.7
11	Boggy Creek	Forested	20.0
12	Boggy Creek	Forested	22.6
13	Boggy Creek	Forested	24.3
14	Boggy Creek	Forested	28.0
15	Boggy Creek	Non-Forested	33.5
16	Boggy Creek	Non-Forested	45.9
17	Boggy Creek	Forested	52.5
18	Boggy Creek	Forested	94.3
19	Boggy Creek	Forested	130.2
20	Boggy Creek Non-OUSWMM	Forested	10.4
21	Boggy Creek Non-OUSWMM	Forested	10.5
22	Boggy Creek Non-OUSWMM	Forested	11.1
23	Boggy Creek Non-OUSWMM	Forested	11.2
24	Boggy Creek Non-OUSWMM	Forested	11.4
25	Boggy Creek Non-OUSWMM	Forested	11.5
26	Boggy Creek Non-OUSWMM	Forested	11.5
27	Boggy Creek Non-OUSWMM	Non-Forested	12.3
28	Boggy Creek Non-OUSWMM	Non-Forested	12.5
29	Boggy Creek Non-OUSWMM	Forested	12.9
30	Boggy Creek Non-OUSWMM	Forested	13.0
31	Boggy Creek Non-OUSWMM	Forested	13.3
32	Boggy Creek Non-OUSWMM	Forested	13.4
33	Boggy Creek Non-OUSWMM	Forested	15.2
34	Boggy Creek Non-OUSWMM	Forested	16.0
35	Boggy Creek Non-OUSWMM	Forested	16.1
36	Boggy Creek Non-OUSWMM	Forested	16.4
37	Boggy Creek Non-OUSWMM	Forested	16.6
38	Boggy Creek Non-OUSWMM	Forested	16.7
39	Boggy Creek Non-OUSWMM	Forested	18.3
40	Boggy Creek Non-OUSWMM	Non-Forested	19.4

NUMBER	BASIN NAME	TYPE	ACRES
41	Boggy Creek Non-OUSWMM	Forested	20.3
42	Boggy Creek Non-OUSWMM	Forested	20.5
43	Boggy Creek Non-OUSWMM	Forested	20.9
44	Boggy Creek Non-OUSWMM	Forested	22.1
45	Boggy Creek Non-OUSWMM	Non-Forested	23.6
46	Boggy Creek Non-OUSWMM	Forested	25.9
47	Boggy Creek Non-OUSWMM	Forested	28.4
48	Boggy Creek Non-OUSWMM	Forested	33.4
49	Boggy Creek Non-OUSWMM	Forested	35.0
50	Boggy Creek Non-OUSWMM	Forested	35.5
51	Boggy Creek Non-OUSWMM	Forested	37.2
52	Boggy Creek Non-OUSWMM	Forested	44.5
53	Boggy Creek Non-OUSWMM	Forested	46.5
54	Boggy Creek Non-OUSWMM	Forested	71.8
55	Boggy Creek Non-OUSWMM	Forested	72.4
56	Boggy Creek Non-OUSWMM	Forested	229.2
57	Boggy Creek Non-OUSWMM	Forested	797.5
58	Lake Hart	Forested	10.4
59	Lake Hart	Forested	12.2
60	Lake Hart	Forested	12.2
61	Lake Hart	Forested	12.4
62	Lake Hart	Forested	12.5
63	Lake Hart	Forested	12.9
64	Lake Hart	Forested	14.1
65	Lake Hart	Forested	14.3
66	Lake Hart	Forested	14.7
67	Lake Hart	Forested	14.8
68	Lake Hart	Forested	15.0
69	Lake Hart	Forested	15.4
70	Lake Hart	Forested	16.1
71	Lake Hart	Forested	16.4
72	Lake Hart	Forested	18.8
73	Lake Hart	Forested	22.0
74	Lake Hart	Forested	22.1
75	Lake Hart	Forested	23.9
76	Lake Hart	Forested	25.9
77	Lake Hart	Forested	27.3
78	Lake Hart	Forested	32.2
79	Lake Hart	Forested	37.2
80	Lake Hart	Forested	41.0
81	Lake Hart	Forested	44.8
82	Lake Hart	Forested	64.2

NUMBER	BASIN NAME	TYPE	ACRES
83	Lake Hart	Forested	95.1
84	Lake Hart	Forested	255.9
85	Lake Hart	Forested	260.1
86	Lake Hart	Forested	972.6
87	Little Econlockhatchee	Forested	10.1
88	Little Econlockhatchee	Forested	11.7
89	Little Econlockhatchee	Forested	12.8
90	Little Econlockhatchee	Forested	16.9
91	Little Econlockhatchee	Forested	20.1
92	Little Econlockhatchee	Forested	20.8
93	Little Econlockhatchee	Forested	22.5
94	Little Econlockhatchee	Forested	25.3
95	Little Econlockhatchee	Forested	27.8
96	Little Econlockhatchee	Forested	29.1
97	Little Econlockhatchee	Forested	63.1
98	Little Econlockhatchee	Forested	70.9
99	Little Econlockhatchee	Forested	83.2
100	Little Econlockhatchee	Forested	120.8
101	Little Econlockhatchee	Forested	431.1
102	Little Wekiwa	Forested	10.3
103	Little Wekiwa	Non-Forested	12.7
104	Little Wekiwa	Forested	46.3
105	Little Wekiwa	Forested	51.3
106	Little Wekiwa	Forested	76.8
107	Little Wekiwa	Forested	109.0
108	Shingle Creek	Forested	10.3
109	Shingle Creek	Forested	11.2
110	Shingle Creek	Forested	11.6
111	Shingle Creek	Forested	13.9
112	Shingle Creek	Forested	13.9
113	Shingle Creek	Forested	17.4
114	Shingle Creek	Forested	19.8
115	Shingle Creek	Forested	20.2
116	Shingle Creek	Forested	25.1
117	Shingle Creek	Forested	26.1
118	Shingle Creek	Non-Forested	26.6
119	Shingle Creek	Forested	28.7
120	Shingle Creek	Forested	32.5
121	Shingle Creek	Forested	35.0
122	Shingle Creek	Non-Forested	43.6
123	Shingle Creek	Forested	43.7
124	Shingle Creek	Forested	57.0

NUMBER	BASIN NAME	TYPE	ACRES
125	Shingle Creek	Forested	59.2
126	Shingle Creek	Forested	69.8
127	Shingle Creek	Forested	124.9
128	Shingle Creek	Forested	311.0
129	Shingle Creek Non-OUSWMM	Forested	17.5
130	Shingle Creek Non-OUSWMM	Forested	67.9
TOTAL			**6944.1**

Wetland Inventory Trends

Annexations in the Southeast and Vista East areas since 1993 added significant wetland areas to the incorporated area. Most of the wetlands in the Southeast area fell within the 1991 GMP planning area and were inventoried in the Conservation Element. Of these wetlands, Conservation Element amendments associated with the Southeast Orlando Sector Plan designated 10 additional wetland areas as Protected Wetlands between 1994 and 1998.

The Vista East area did not fall within the unincorporated planning area for the 1991 GMP. As a result, wetlands in the Vista East area were not originally inventoried in the Conservation Element. The Vista East Annexation Area contains an estimated total wetland area of 1,427 acres. Of this amount, approximately 450 acres within five wetland areas have been designated as Protected Wetlands. The total amount of designated Protected Wetlands thus stands at approximately 3,400 acres.

The City's "Protected Wetlands" are identified on Figures C-2A and C-2B of this Element. Removal, alteration, or encroachment into an area designated as a Protected Wetland is only allowed where the activity has been found to be in the public interest, or where there are no reasonable alternatives. In such cases, impacts are limited to roadway and utility access to uplands which could not otherwise be developed, or to provide reasonable use of the property.

Many of the wetland areas in the City have been moderately to heavily disturbed by either past agricultural practices, utility easements, canaling or drainage projects, or some other form of urban development. The functional values of these wetlands range from very poor to moderate quality. These wetland systems are adequately and comprehensively regulated by state and federal regulatory agencies; additional regulation by the City would create unnecessary duplication and/or create conflicts between the City and other permitting agencies. However, the City has reserved the right to contact and provide comments to those agencies, or to intervene during the permit application review and issuance process. To ensure compliance, the City will not issue engineering permits for site alterations without prior issuance of the required permits from the other environmental regulatory agencies.

With regard to wetland buffer areas, the City determined that a minimum 25 foot average buffer zone width adjacent to wetlands would be consistent with other permitting agencies. In fact, this distance meets or exceeds that of each of the regulatory agencies. The City has stipulated that wetland buffers must be made up of either existing native plant communities, or if no existing native plant community exists, appropriate plantings must be installed, as specified in Chapter 63 of the Land Development Code.

Since adoption of a three-tiered system of wetlands protection in 1993, the City has augmented its environmental protection policies by adoption of the Transitional Wildlife Habitat Overlay (TWHO) future land use designation. The City has also supported a regional environmental planning strategy known as the Primary Conservation Network (PCN) in the Southeast area.

Transitional Wildlife Habitat Overlay (TWHO) Future Land Use Designation

GMP amendments implementing the TWHO future land use designation were adopted in 1995. The purpose of the TWHO designation is to limit or reduce land use densities and intensities where interspersed Protected Wetlands and associated upland strands provide habitat for semi-aquatic and wetland-dependent listed wildlife species. As of 1999, the TWHO future land use designation had been applied within one project in the Southeast area.

Wekiva Overlay District

The northwest portion of the City is located within the Wekiva Basin. In 2004, the Florida Legislature adopted the Wekiva Parkway and Protection Act. Provisions of the Act require that the City limit impervious surfaces, encourage clustering of development, and preserve open space in order to ensure that stormwater and wastewater do not have a negative impact on sensitive karst features or water quality within the Wekiva Basin. In 2005, the City adopted Growth Management Plan amendments to create a Wekiva Overlay future land use designation. In the following year, land development regulations were adopted to create the -W- Wekiva Overlay Zoning District and associated development requirements.

In the Wekiva Overlay Zoning District:

- On properties that comprise at least five acres and include a residential component, a minimum of 20 percent of the site must be reserved for open space, as defined in the ordinance.
- Stormwater retention must be designed as a natural amenity and be consistent with the State's Best Practices Manual.
- New golf courses must be designed to be consistent with the State's best practices manual.
- The impervious surface ratio shall not be increased through a variance or PD zoning.
- Density and intensity bonuses are prohibited within areas designated with the Resource Protection Overlay (/RP).
- Density may be transferred from Resource Protection areas to other portions of the property, within limits as defined in the ordinance.
- The Environmental Assessment submitted in conjunction with applications for development approval shall include additional information concerning on-site geological and environmental features.

Primary Conservation Network (PCN)

The PCN concept was developed as part of the Southeast Orlando Sector Plan, and reflects the City's commitment to an innovative, systemic approach to protecting natural resources in the Southeast area. This approach includes creation of a PCN to preserve high-quality habitat within an overall system of environmentally sensitive lands; to implement pre-planned and integrated

stormwater impact management; to minimize stormwater runoff; and to detain stormwater runoff with open, natural drainage systems.

The PCN concept includes both a geographically defined conservation system in the Southeast area, and a set of conservation guidelines for master planning specific projects. During the course of the Southeast Orlando planning process, the City's environmental consultant for the Southeast area completed an "Ecological Summary Report" (June 3, 1997) which justified and generally defined a PCN in the Southeast area. The PCN assembles the significant wetland areas into a corridor system which provides more than the minimum area required by current regulations for wetland preservation, upland buffers, and wildlife corridors. The PCN is designed to preserve wetland and upland areas as well as provide green space, passive recreation opportunities, and buffering between land uses.

The PCN has been designated on a conceptual basis within the City of Orlando and within adjacent unincorporated Orange County areas. The PCN designation consists of a total of approximately 3,100 acres of wetlands, along with approximately 1,000 acres of upland buffer zones. Most of this area has already been annexed into the City of Orlando.

In addition to the general location of the PCN within the Southeast area, the City has adopted guidelines for review of master plans in the Southeast area. These guidelines have been incorporated into Future Land Use Element Policy 4.1.9, and include the following directives:

- Roads that cross wetland systems should be fitted with oversized culverts and/or other facilities, devices or techniques to facilitate and maintain wildlife corridors.
- Upland buffers, preservation areas, and wetland systems should be maintained so as to prevent invasion by nuisance and/or exotic species.
- Recreation opportunities within or adjacent to environmentally sensitive lands should be limited to passive uses.
- Every attempt should be made to mitigate for impacts to wetlands and listed wildlife species through enhancement and/or preservation of habitat.
- Retaining existing native vegetation and the use of native drought-resistant plants in residential, commercial and common use areas is encouraged.
- Additional road crossings and encroachments across/into environmentally sensitive lands should be minimized.
- Placement of stormwater management ponds, utility facilities, and other similar non-residential land uses adjacent to environmentally sensitive lands is encouraged.
- A 500-foot minimum width for environmentally sensitive lands should be maintained wherever possible to allow wildlife movement.
- The reduction of fencing, as a means to delineate property ownership, is encouraged.
- Creation of an area-wide environmental education and signage program is encouraged.

The Lake Nona Development of Regional Impact (DRI) is the first project to implement the PCN concept in the Southeast area. The developers of the Lake Nona DRI have found that implementation of the PCN, while not a requirement for development, has allowed for more efficient land use on the project site and has won support from environmental permitting agencies. Importantly for the developer, this support has translated into significant reductions in permit processing times for major development projects within the southern portion of the DRI adjacent to the PCN.

The implementation of the PCN on the Lake Nona property has established a precedent for establishment of the PCN on other properties in the Southeast area within which the PCN has been designated. The Vista East area, in particular, presents opportunities for realization of the PCN concept due to the high proportion of wetlands within the various undeveloped, large-scale development projects planned along the eastern edge of the City.

2.D. AIR QUALITY

In the past, the City had relatively few policies related to protecting air quality, largely because air currents cross jurisdictional boundaries. Air quality was primarily regulated at the state and federal levels and the generally held perception was that Orlando has good air quality. Global warming has long been considered a threat, and despite the continuing controversy of its extent and possible impacts, reductions in carbon dioxide are an important tool to improve air quality. By actively engaging in measures designed to reduce global warming, the City can do its part to reduce pollutants on a local level that may have impacts to a broader area. The City has an opportunity to take a leadership role on innovative ways to reduce energy use and emissions in Central Florida. (Please see Section 3.B. for more information.)

2.E. FLOODPLAINS

Floodprone areas are relatively flat lands lying between a water body and higher ground on either side. Although floodprone areas may occur in association with any riverine environment, they are especially prominent in the low gradient downstream stretches of rivers. Most rivers and streams are subject to occasional periods of torrential flow, and when the volume of water contributed by the drainage basin exceeds the channel capacity, the excess flows over the banks and inundates parts of or all of the floodplain. The floodprone area adapts to fluctuating water levels and acts as a functional part of the river system by providing overflow areas for flood waters.

Floodprone area wetlands store water during the rainy season and release water slowly in the dry season, helping sustain channel flow. Both broad and narrow floodprone areas occur in the Orlando planning area. Flooding involving river flows and broad expanses of floodplains occur around Lake Orlando, Lake Mann, and Clear Lake. Flooding involving stream flow in narrowly confined channels occurs along Shingle Creek, Boggy Creek, and Howell Branch. Depression flooding occurs in areas of land-form depressions including enclosed sub-basins, land-locked lakes, and shallow depressions.

Development within floodprone areas has occurred because the land is usually less expensive to purchase and during dry periods it normally appears to be suited for development. However, land development is in fact more expensive in these areas than in non-flood prone areas. Additional impacts are felt by the development community, local governmental bodies, and the environment itself when development is allowed to occur in these areas. Governmental costs for infrastructure such as stormwater drainage, sewer, and streets are higher in floodprone areas than in upland areas because water tables are higher. Environmental costs to developing within these sensitive areas include a change in the movement of floodwater usually shown during periods of heavy precipitation.

Floodplains are found along riverine areas such as the Big and Little Wekiwa Rivers, Econlockhatchee River, Howell Branch Creek, Boggy Creek, and the Shingle Creek. Most flooding in Florida occurs in flood prone areas that are not connected to rivers. Lakes, sink holes and wetlands and sub-basin areas are the most common sources of flooding. The Federal Emergency Management Agency (FEMA), has identified over 40% of the land in the US as having some flood hazard. This percentage is similar in Orange County. The City of Orlando participates in the National Flood Insurance Emergency Program, and is required to enforce 100-year floodplain elevation requirements for new developments.

Figure C-8 displays floodplain acreages for the Orlando area. Figures C-9A through C-9D display the 100-year floodplains for the City of Orlando.

The 2000 Flood Insurance Rate Maps, as shown in Figures C-9A through 9D, were produced by the U. S. Geological Survey and maintained in digital format by the City's Engineering Bureau. These maps were used to create composite floodplain maps. (It should be noted that as of this writing the 2008 Floodplain maps have not yet been adopted.) This information is very important, because the City of Orlando uses the FEMA maps to delineate floodplain elevations and floodway flow velocity. Additional information on floodplains and their role in association with the City's stormwater management system can be found in the Stormwater and Aquifer Recharge Element.

FIGURE C-8: FLOODPLAIN ACREAGE

Basin	100-Year Floodplain
Wekiva River	83.96
Howell Branch	707.17
Little Econ	2,663.12
Shingle Creek	4,474.34
Lake Hart	3,588.94
Little Wekiva	1,313.44
Boggy Creek	5096.64
TOTAL	15,907.6

Source: City of Orlando Engineering Bureau, GIS, 2008

Figure C-9A Flood Plains - Northwest

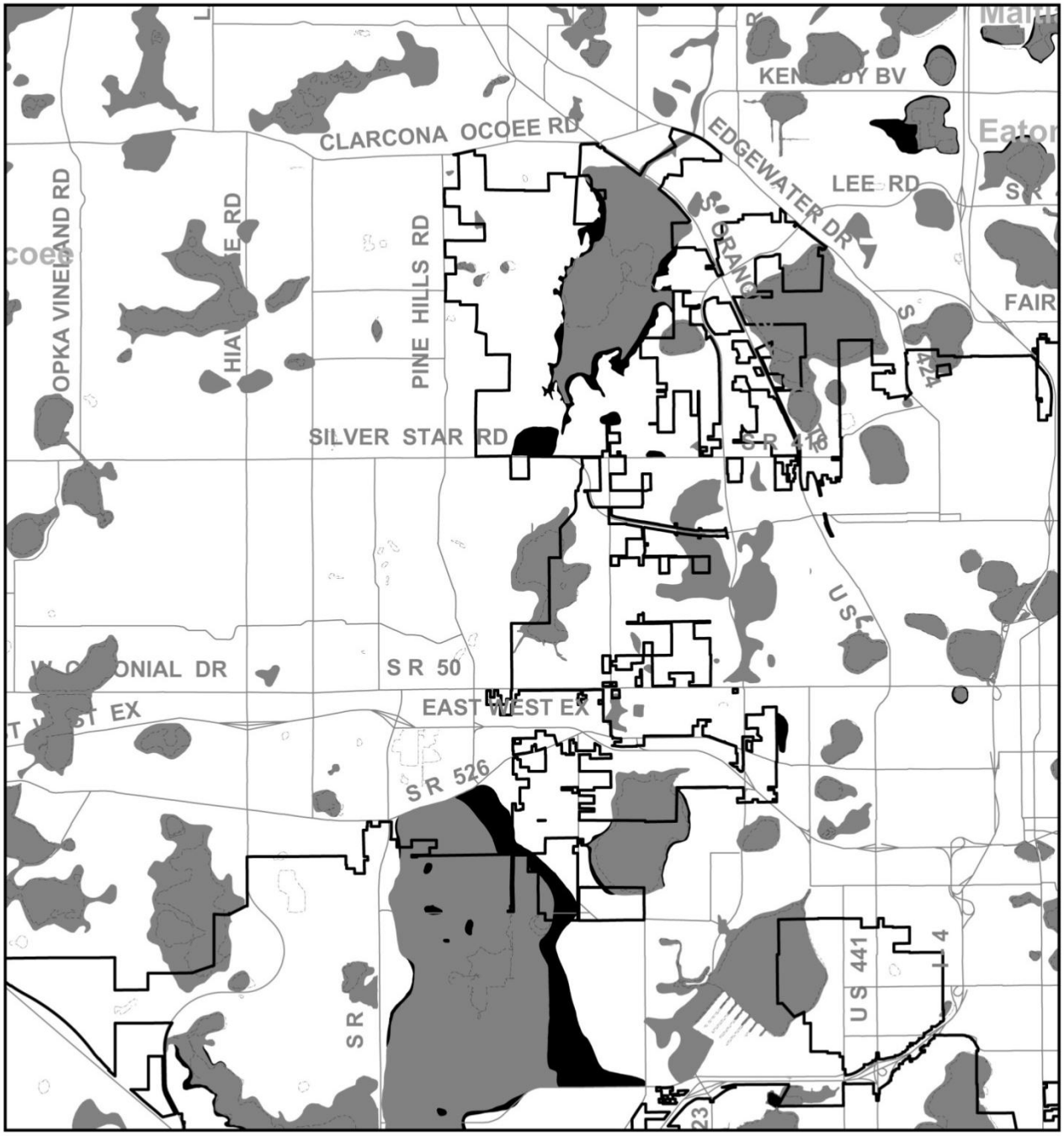


Figure C-9B

Flood Plains - Southwest

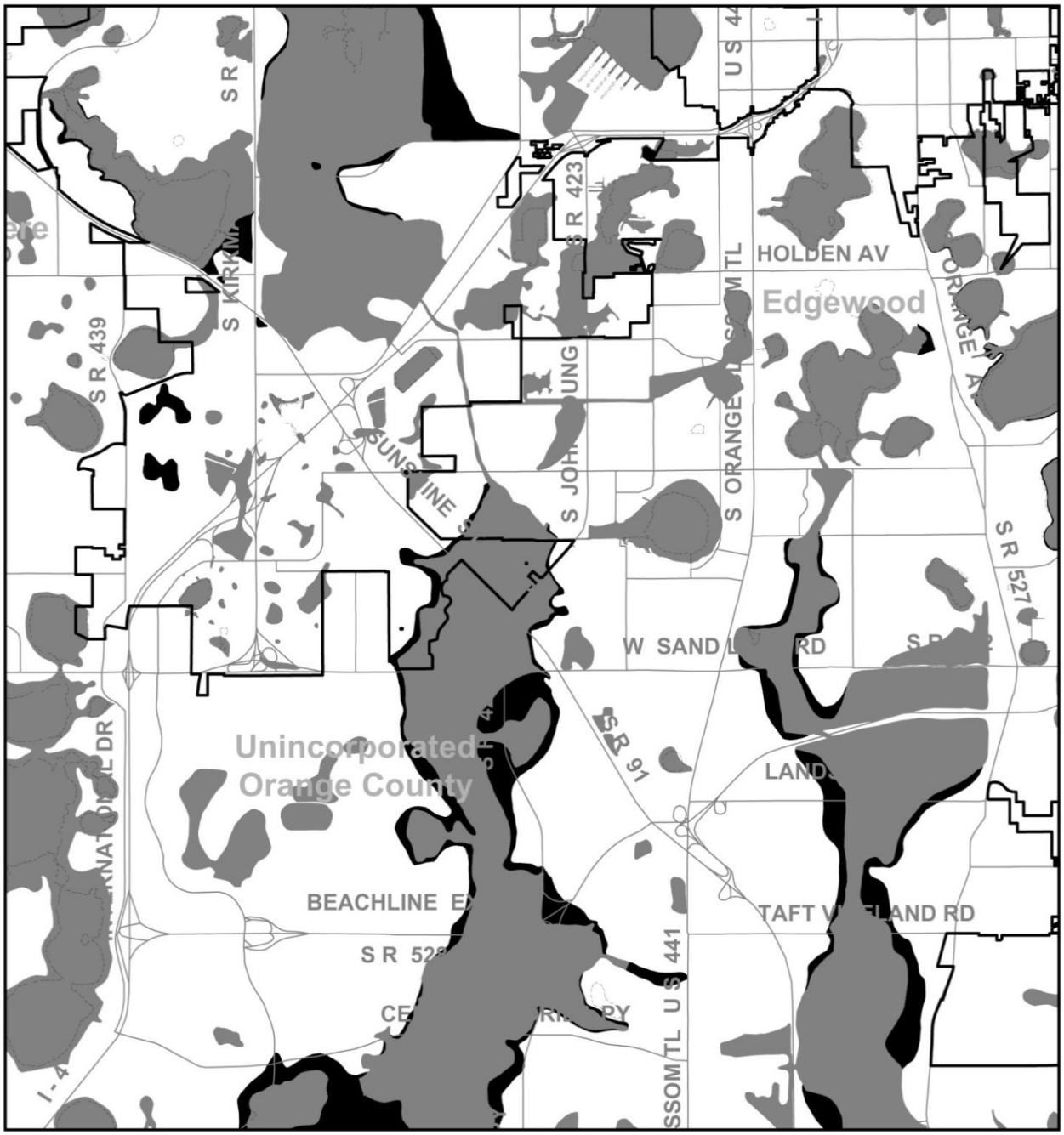


Figure C-9C Flood Plains - Northeast

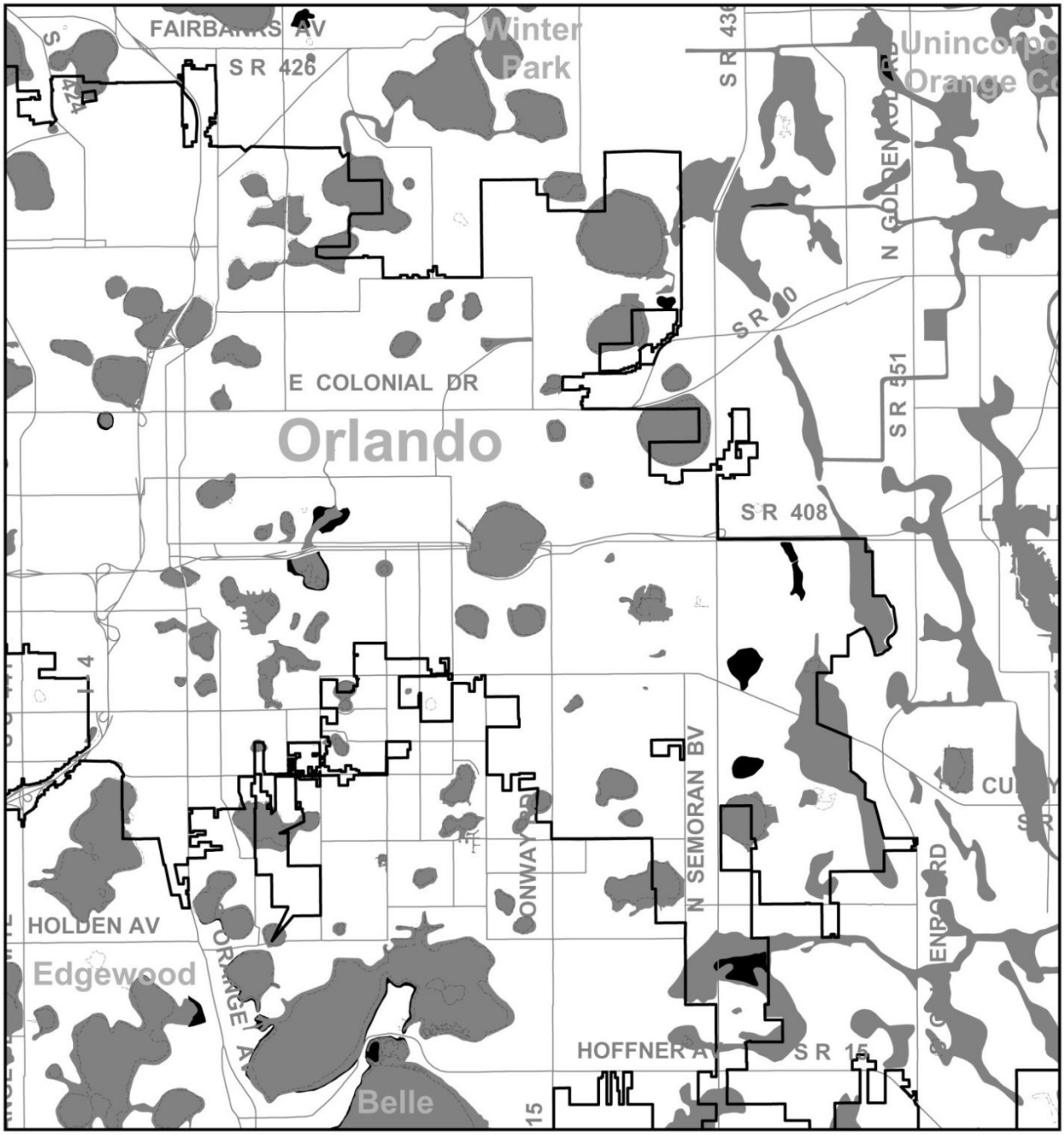
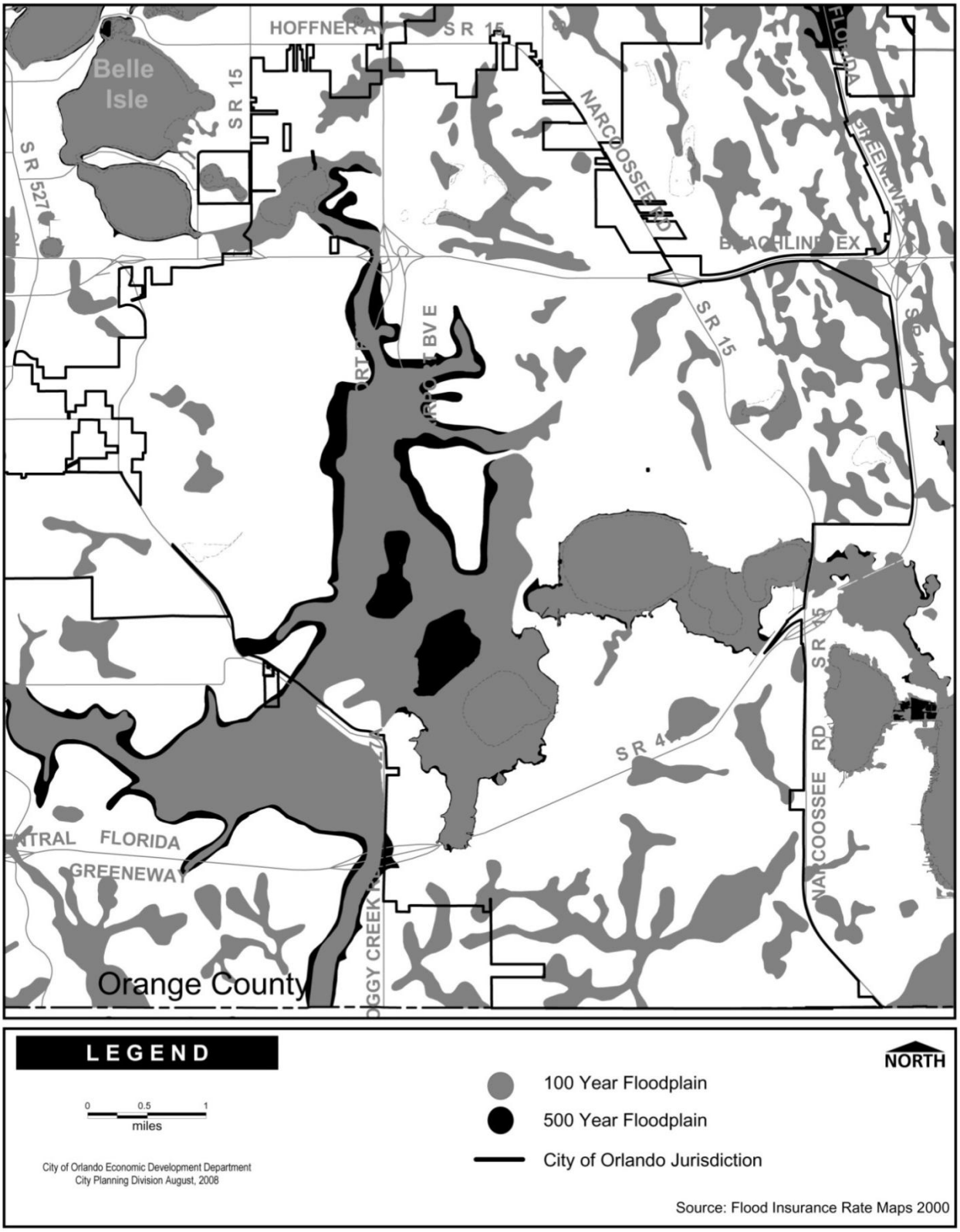


Figure C-9D Flood Plains - Southeast



2.F. MINERAL EXTRACTION

The City of Orlando does not contain any substantial known deposits of commercially valuable minerals. Most of the historic mineral extraction operations in the Orlando area, principally clay and sand, occurred in unincorporated Orange County to the northwest of the City limits. Some peat mining was done in the Americana Boulevard area, also in unincorporated Orange County. All of these mineral extraction operations have been inactive for many decades.

At the present time, there are no mineral extraction operations within the Orlando area. All sand, clay, gravel, rock and peat sources are located outside of Orlando's corporate limits and must be trucked in. New mineral extraction operations are not expected to be pursued within the twenty year planning period, due to the lack of commercially valuable minerals and the fact that most of the lands within the City are more valuable as locations for urban development.

2.G. TOPOGRAPHY

Orange County and the City of Orlando are located within the *Atlantic Coastal Plain physiographic Province* which is an area of distinctive topography, geography, and geology. Within the County there are three topographic regions:

1. Low-lying regions characterized by elevations generally less than 35 feet above mean sea-level;
2. Intermediate regions characterized by elevations generally between 35 and 105 feet above mean sea-level; and,
3. Highland regions characterized by elevations generally above 105 feet mean sea level.

The lowland regions include the St. Johns River Valley, the northern part of the Econlockhatchee River Basin and the northwestern part of Orange County east of Rock Springs. None of the lowland regions are located in the Orlando planning area.

The intermediate region occupies most of the middle parts of the County between the lowlands and the highlands. Generally the northwest, southwest, and extreme northeast portions of the Orlando planning area lie in the intermediate topographic region. Elevations are mostly between 50 and 85 feet above MSL. The intermediate region is best developed in the area between Orlando and the Econlockhatchee River, where linear low profile ridges and intervening depressions parallel the Atlantic Coast. These ridges are believed to be fossil beach ridges from periods of higher sea level.

The highlands occupy the western part of Orange County, with an island outlier in the City of Orlando and vicinity. Altitudes are generally above 105 feet, ranging from 50 feet in low spots to above 225 feet near Lake Avalon on the western border of Orange County. Over 50 percent of the Orlando planning area occurs on this highlands island, ranging in elevation from 50 feet to over 140 feet in the area of Central Florida Greenway (SR 417) and the East West Expressway (SR 408).

Topographic relief in the highlands is generally much greater than in the intermediate region. The highlands landscape is characterized by rolling hills and numerous lakes and depressions. There are typically few surface streams. In general, topographic characteristics make the highlands the most effective groundwater recharge area. Figure C-10 presents the City's urban topography.

Low-lying portions of the Orlando planning area are typically characterized by poorly drained soils, which are generally unsuitable for development uses due to poor drainage and high water table conditions. Low topographic position usually results in some flood hazard potential. Consequently, significant areas of the City below the 100 foot elevation are located within floodprone areas. Several areas are characterized by swamp and wetland vegetation.

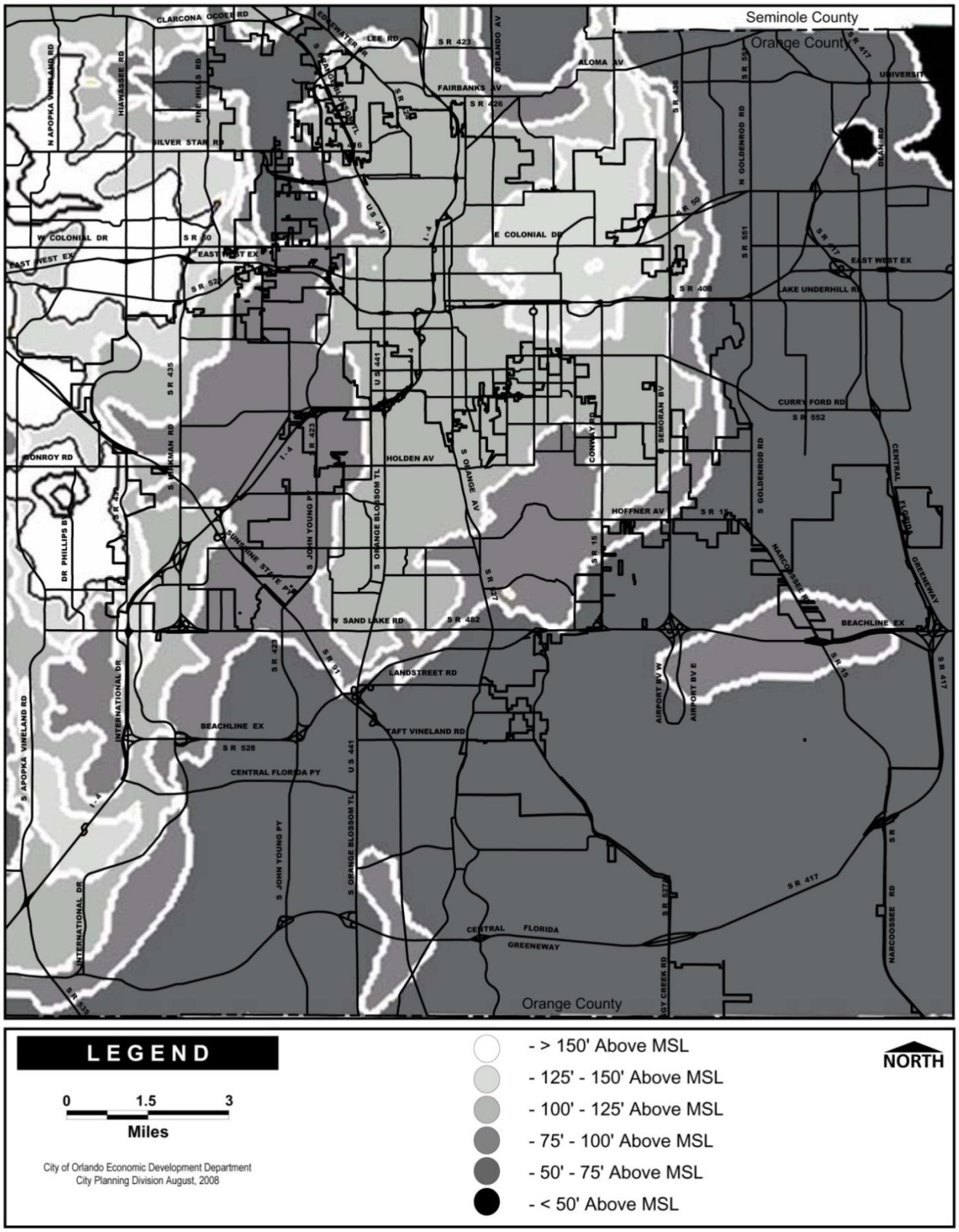
Higher areas above the 100 foot elevation are characterized by well-drained soils which are generally suitable for construction, except where locally poor drainage conditions exist. Flooding hazard in these areas is limited to areas at the perimeter of lakes.

2.H. GEOLOGY

The geologic history of Central Florida began, many millions of years of ago, when a large plateau gradually rose from the water to form the Florida peninsula. While this peninsula's upper geological layers include shales and clays, the underlying foundation is limestone, a sedimentary rock, which is hundreds of feet thick.

Sedimentary rocks are formed when particles of sediment are deposited out of air, ice, wind, gravity, or in the case of Florida--water. Limestone, a carbonate rock also known as calcium carbonate, is formed in warm shallow seas. As small sea creatures die, they sink to the sea floor where their bodies build up over time. The fossilized and calcified remains of these creatures form limestone.

Figure C-10 Urban Area Topography



Florida limestone is only 50-60 million years old, which is relatively new as compared to the 430 year old limestone in Kentucky. There are four principal types of limestone formation in the Central Florida area: the Lake City, the Avon Park, the Ocala Group and the Hawthorne Formation. The oldest and deepest (1000 feet below the surface) limestone in Orange County is the Lake City limestone. It consists of alternating layers of dolomite limestone and fossiliferous limestone. The Lake City limestone contains the primary source of water used by the City of Orlando.

The Avon Park limestone (approximately 250 to 1000 feet depth) lies on top of the Lake City limestone. It is similar in formation to the Lake City formation. The thickness of the Avon Park limestone is not accurately known, except in a few places where wells penetrate the entire formation. The Avon Park limestone contains the major source of water throughout much of Orange County.

The next type of limestone, called the Ocala Group, lies on top of the irregular surface of the Avon Park limestone. It is composed of three, better geographically defined, types of limestone called the Crystal River, the Williston, and the Inglis. These formations developed during the late Eocene Age, 36-56 million years ago. Due to erosion, the Ocala Group is known for its varying thickness and height. The Ocala Group is similar in composition to the Avon Park limestone, except that the Ocala Group usually contains less dolomitic limestone and is softer and lighter in color. The Ocala Group forms the uppermost part of the Floridan Aquifer, and where it is thick, will yield moderate to large amounts of water.

The last group, the Hawthorne Formation, which ranges from 0 to 200 feet in depth, lies on top of the Ocala Group and, where the Ocala is missing, the Avon Park limestone. This formation covers much of the Atlantic Coastal Plain of the southeastern US. It contains most of the phosphate deposits which are currently being mined in certain areas in the state.

The Hawthorne Formation varies in thickness from 0 to 200 feet, and is made up of sand, silt, clay phosphorite, phosphatic limestone, and sandstone. The formation is generally less permeable than the limestones of the Floridan Aquifer. As a result, it tends to prevent the movement of water between the water-table aquifer and the underlying Floridan system. Similarly, in low-lying and poor recharge areas, the Hawthorn Formation slows the upward movement of water and confines it under pressure. Overlying the sedimentary deposits are thick deposits of red clay sand and marine deposits composed of varying amounts of organic material.

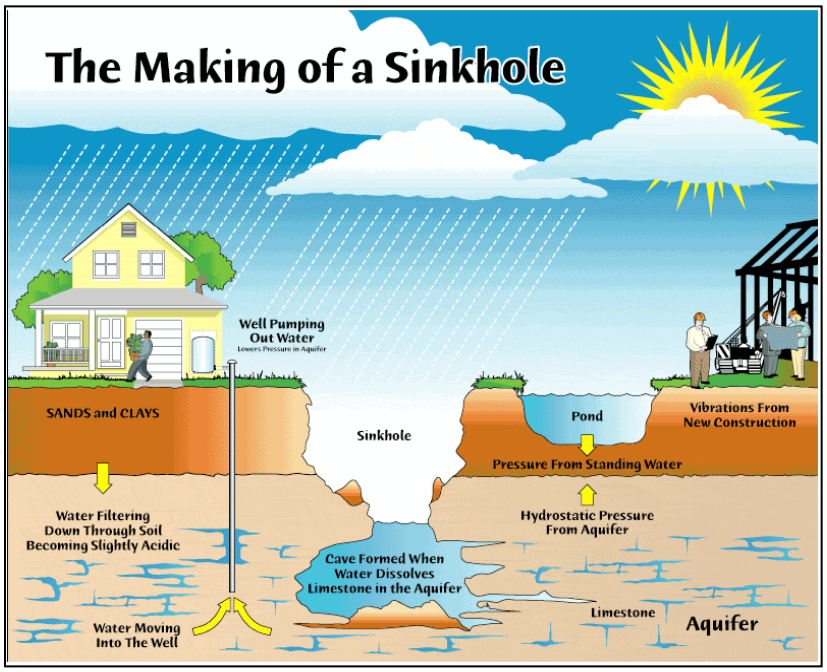
Geologic characteristics of bedrock in the Orlando area are generally suitable for most engineering uses. Geologic hazards are limited to potential subsidence in areas of active recharge where the dissolving action of water may result in the formation of cavities in the limestone bedrock. As the limestone dissolves, the weakened bedrock can no longer support the sandy overburden and it falls into the cavity to form a sinkhole. Most of Orlando's natural lakes, ponds, and closed depressions are the result of solution activity. Hydrologic conditions,

including lack of rainfall, lowered water levels, or, conversely, excessive rainfall in a short period of time, can all contribute to sinkhole development.

Florida has more sinkholes than any other state in the nation. They are an obvious feature of Florida's natural karst topography. Karst is porous underground limestone rock that has been eroded by ground water (often with a high C02 content such as stormwater). When water fills a cavity, it supports the karst area and keeps the ground above it from subsiding. If the water table drops in a karst area, the limestone cavity is exposed to further erosion which leads to the collapse of the cavity and the creation of sinkhole. The sinkhole becomes a groundwater recharge area, where surface water can enter the aquifer and replenish the groundwater supply. However, if a sinkhole is left unprotected it may be a conduit for polluted run-off to enter the groundwater system. Between 1961 and 2006, of the approximately 2,800 sinkholes that were reported in Florida, Orange County accounted for less than 1%, with a total of 189 sinkholes. Figure C-11 depicts how sinkholes form.

In many developed areas of the City, ground subsidence due to limestone erosion has resulted in structural foundation and roadbed failures. Consequently, areas with a history of subsidence are not considered suitable for development. While it is hard to predict specific areas which will be susceptible to subsidence, active recharge areas and karst features are most likely to have a high potential for subsidence. Generally, these areas include those underlain by sandy, well-drained soils in higher portions of the planning area, above elevations of 100 feet. Special planning, design, and construction techniques can be used to overcome geologic problems.

FIGURE C-11: THE MAKING OF A SINKHOLE



Source: SFWMD, 2008.

2.I. GENERAL SOIL ASSOCIATIONS AND EROSION

The general soils map found on Figure C-12 details the unique pattern of soils, relief, and drainage for the Orlando planning area. The general soils map can be used to compare the suitability of large areas of land for varying types of land use. The soils on the general soils map may differ from one place to another in slope, depth, drainage, and other characteristics that affect land management.

Soils are typically organized according to "units". The Food and Agricultural Organization of the United Nations established the World Soil Classification. According to this classification there are 106 soil units or types. They are defined by the following features:

a) Soil Phases or Soil Properties: Soils are categorized as to whether they are saline (salty), lithic or stony;
b) Textural Classes: Soils are identified as being coarse, medium or fine; and finally,
c) Slope Classes: The presentation of the soils is divided into three groups. Soils can found to be level to gently undulating, rolling to hilly, or steeply dissected to mountainous.

Soils of the Uplands and Low Ridges

This group of soils may be nearly level to strongly sloping. They can be excessively drained, moderately drained, or somewhat poorly drained soils on uplands or ridges. These soils are sandy throughout, and are common in the western and northwestern parts of the county. Much of the City of Orlando, primarily east of Interstate 4, falls within this classification. The group consists of four principal soils, with some secondary soils also present.

Candler: These soils usually occur in nearly level to strongly sloping areas. They are excessively drained soils that are consistently sandy and are usually found on broad uplands areas or ridges. They may also be interspersed with a small number of sinkholes and scattered wet areas. As shown on the general soils map, there is very little Candler soil in the Orlando area. The small area in which they are found is directly south of Old Winter Garden Road, and west of Kirkman Road. This soil unit is commonly used for citrus. In some areas, it is also used for pasture, homesites, or urban development. In the Orlando area, much of this land has been converted from citrus groves to single family detached housing.

Candler-Urban Land-Tavares: This soil is typically covered by concrete, asphalt, buildings, or other impervious surfaces which have obscured or altered the soils to such a degree that their identification is difficult. Most of this soil type is used for homes, large buildings, shopping centers, golf courses, and related urban development. Natural vegetation remains only in small, disturbed areas. The largest area of Candler-Urban Land-Tavares soils occurs north of Colonial Drive (S.R. 50), between Magnolia Avenue and Bumby Avenue. This land makes up approximately 3% of the Orlando planning area.

Tavares-Zolfo-Millhopper: The third soil sub-type occurs on nearly level to gently sloping, moderately well-drained and somewhat poorly drained soils that are sandy at all levels. It also

consists of broad, low-lying upland areas and ridges with a few scattered sinkholes and numerous lakes, ponds, and wet areas. This soil sub-type is found near Hiawassee Road in the southwest area of the City, adjacent to Turkey Lake, and makes up about 5% of the Orlando planning area. Most areas of this unit are used for citrus, pasture, or for home sites, including urban development. Most of the Tavares-Zolfo-Millhopper group occurs on or near the Metrowest DRI, which is a mixed use development of single and multi-family dwelling units, office buildings, a golf course, a school, and planned commercial uses.

Urban Land-Tavares-Pomello: This soil type usually occurs on nearly level to sloping land and is moderately well-drained, consistently sandy, and has been modified for urban land uses. The characteristics for this unit are very similar to the Tavares-Zolfo-Millhopper unit in terms of typical vegetation and topographical features (lakes, ponds, etc.) This unit makes up about 20% of the Orlando planning area. The urban land portion of this complex is covered by concrete, asphalt, buildings or other impervious surfaces that obscure or alter the soils so that their identification is not feasible. Most of the acreage of this unit is used for homes, large buildings, and other urban uses.

Soils of the Flatwoods

This group of soils consists of nearly level to gently sloping, moderately well drained to very poorly drained soils within the flatwoods. These soils make up most of the Orlando planning area. There are four map units or sub-types of soils in this group, three of which can be found within the Central Florida area. This group is dominated by the Smyrna unit.

Smyrna-Pomello-Immokalee: This soil type occurs on nearly level to gently sloping land, and consists of poorly drained and moderately drained soils that are sandy throughout and have a dark subsoil stained by organic matter. This soil type consists of broad flatwood areas interspersed with low ridges. In some areas there are scattered shallow depressions and poorly defined drainageways. This soil type can be found near Lake Nona and northeast of Turkey Lake in the Orlando area, and makes up about 7% of the entire study area. Most areas of this soil are commonly used for pasture. In the Orlando area, these soils are found near the Lake Nona DRI, which is a mixed use development consisting of housing, a golf course, a medical complex, and mixed office/commercial. Much of this area is also used by the Orlando International Airport, and is located near the proposed fourth parallel runway.

Smyrna-Basinger-St. Johns: These are poorly drained and/or very poorly drained sandy soils, consisting of broad flatwood areas interspersed with many broad sloughs, depressions, and drainageways. These soils dominate the southern portion of the Orlando planning area, south of the Beachline Expressway (S.R. 528). This soil type makes up about 30 percent of the planning area. Most of these areas are still used for rural pasture land. However, some of this land is being developed as primarily industrial sites. This includes the Lockheed-Martin complex, Airport Industrial Park Orlando, Orlando Jetport Center, Tradeport, Lee Vista, Lake Nona, and other smaller industrial developments adjacent to the Landstreet Road/CSX railyard corridor.

Urban Land-Smyrna-Pomello: These are nearly level to gently sloping, poorly drained and moderately well drained soils that have a dark sandy subsoil stained by organic matter and have been modified for urban use. This soil type is located in the broad flatwood areas interspersed with low ridges. There are scattered shallow depressions and poorly defined drainageways in some areas. This soil can be found on the outer periphery of the Orlando planning area, making up approximately 23% of the soil type for the area. The urban land part to this soil type is covered by concrete, asphalt, buildings, or other impervious surfaces that obscure or alter the soils to that their identification is not feasible. Much of this soil, which has little natural vegetation, is used for homes, large buildings, shopping centers, and related urban land uses.

Soils of the Wetlands

This group consists of nearly level, poorly drained and very poorly drained soils. These soils are on floodplains, poorly defined drainageways, swamps, and marshes. There are basically two large strands in the Orlando area; one just south of the Orlando International Airport in the Boggy Creek Swamp and Bull Slough system, and the other east of Turkey Lake.

Samsula-Hontoon-Basinger: This soil type is characterized by nearly level, very poorly drained organic and sandy soils that are subject to ponding. This unit consists of soils in swamps, sloughs, and broad poorly defined drainageways within the flatwoods. Lakes and ponds are common in some areas. This unit makes up about 11% of the Orlando planning area. Most areas of this map unit have been left idle with natural vegetation. Some areas have been drained and are used for improved pasture; while other areas have been filled and used for homesites or urban development. The two large strands that are within the urban area will continue to be substantially altered as population grows in this area.

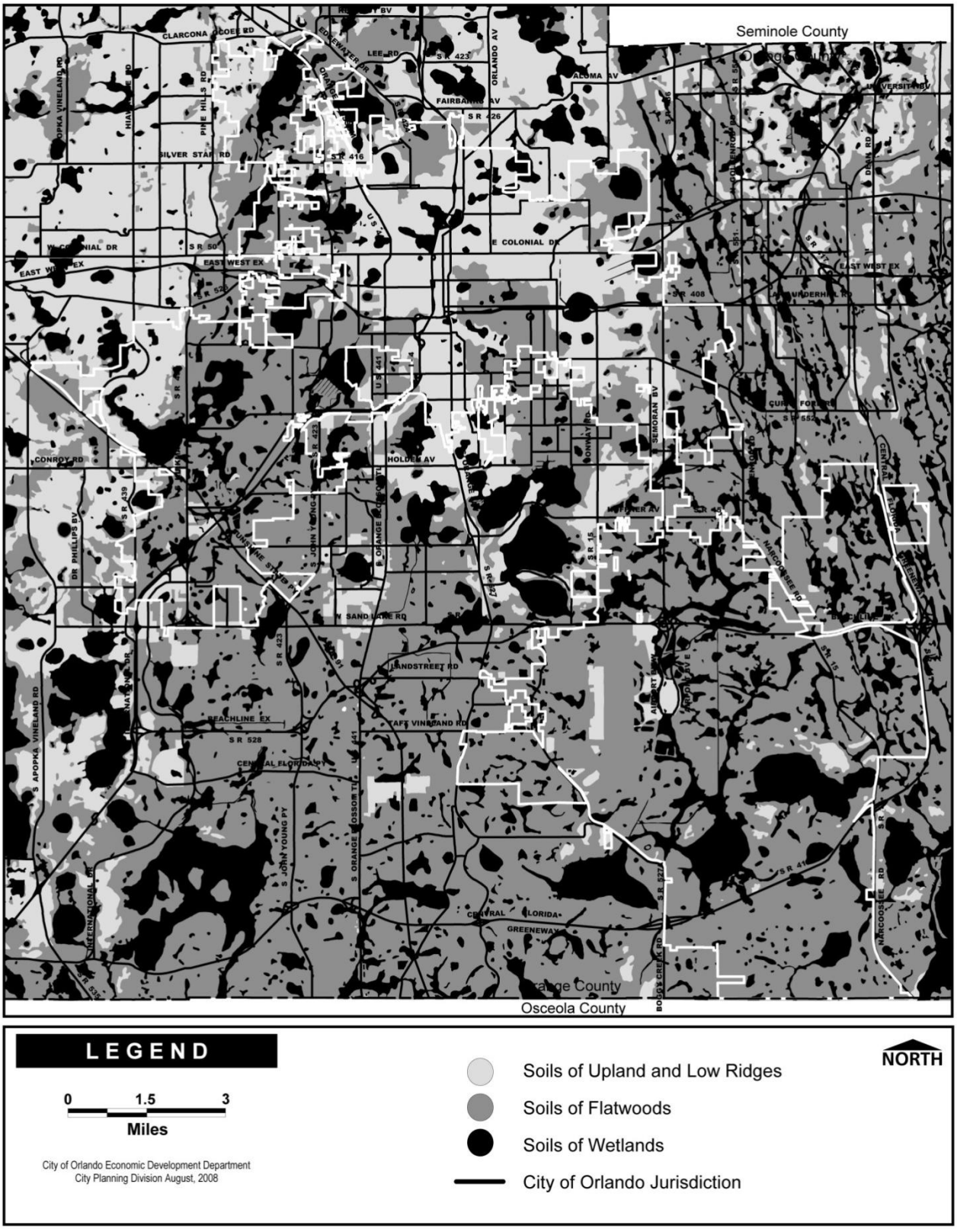
Potential Soil Erosion Problems

Erosion impacts within the City of Orlando are limited by the fact that most of the City is composed of nearly level, gently sloping land. Within Orlando, changes in elevation are extremely gradual, as was represented on Figure C-10. According to the U.S. Natural Resources Conservation Service, there are no continuing soil erosion problem areas near Orlando. However, as a direct result of the rapid urbanization of Orlando since the 1970's, the most noticeable erosion problems occur on unprotected soils located on construction sites.

Water erosion is not a major problem within the City of Orlando. The soils are sandy and nearly level. Water erosion is caused by rapid runoff, which takes place only during heavy rains on unprotected soils that have short, steep slopes. The soils of the uplands and low ridges are the most susceptible to water erosion when slopes exceed two percent. However, the two percent slope guideline is almost never exceeded within the City of Orlando. Best Management or Conservation Practices, such as maintaining a vegetative cover on the surface layer, reducing runoff, and increasing infiltration all help to control erosion.

Wind erosion is a major problem for the soils of the uplands and low ridges within the City of Orlando, particularly in areas recently cleared for construction. When developers prepare building sites, the soil is often stripped of vegetation and subjected to the forces of wind for three months or more. This form of erosion needs to be controlled in order to improve localized air quality. In order to off-set the adverse impacts of wind erosion, the LDC was revised in 1991 to place conditions on clear-cutting of vegetation. Methods such as sand-fencing, grubbing, and the maintenance of vegetative buffers are now required.

Figure C-12 General Soil Association



2.J. ECOLOGICAL COMMUNITIES

Of the 26 ecological communities identified by the Soil Conservation Society of America, four are prevalent in the Orlando/Orange County area. The ecological community concept used in this description is based on the knowledge that certain soil types usually support specific vegetative communities, which then provide the particular habitat necessary for individual species of wildlife. These vegetative communities create identifiable components of the landscape. Once the vegetative community has been recognized, general information about the characteristics of the soil in which it exists and the types of animals and plants that commonly occur is readily available.

The following communities are essentially of the climax typology which occurs in nature where human influence has not yet transformed them. Ecological climax is a theoretical concept intended to describe a relatively stable community that is in equilibrium with environmental conditions, and occurring as the terminal, end-point of succession. Under this concept, even a field with a grain crop could be expected to revert to a specific climax community if human influence were removed. While other ecological communities, such as Oak Hammocks, Sand Pine Scrub, Freshwater Marsh, and Swamp Hardwoods, exist in the Orlando area, it is the intent of this Element to describe the predominant communities.

Longleaf Pine-Turkey Oak Hills

Description - The Longleaf Pine-Turkey Oak Hills ecological community occurs throughout the State of Florida. Individual communities vary widely in size and limited numbers of other communities may occur within it. This community occurs on rolling land with nearly level to strong slopes, and is the most commonly found community in the Orlando area. Water movement is rapid through the soil. This community is easily identified by the land form and dominant vegetation of longleaf pine and turkey oak. The community contains soils of the uplands and low ridges, epitomized by Candler, Tavares, Zolfo, and Archbold units.

Typical vegetation includes longleaf pine, turkey oak, and bluejack oak in the overstory; and aster, bracken fern, grassleaf golden aster, sandhill milkweed, hairy panicum, and yellow indiangrass in the understory. Animals utilizing this community are adapted to stress conditions such as high temperature and drought. The most common animals of this community are the fox squirrel, pocket gopher, white-tailed deer, Bobwhite quail, ground dove, rufous-sided towhoe, gopher tortoise and fence lizard.

Development Opportunities and Constraints - These moderately well to excessively drained areas have relatively few limitations for urban development. In most cases, these areas were the first to be developed in and around the City of Orlando. Most of downtown originally hosted this ecological community. However, there are very few remnants of the longleaf pine-turkey oak hills community left near the central city. Larger groupings of this community can be found north and west of Turkey Lake, where a good deal of residential development activity has occurred in the recent past and is projected to occur in the future. The City of Orlando encourages development in these areas, subject to environmental constraints.

South Florida Flatwoods

Description - The South Florida Flatwoods ecological community occurs throughout south and Central Florida, including Orange County. Individual communities may comprise several thousand acres and are typically interspersed with smaller communities, especially wetlands. The soils normally found in this community include Smyrna, Pomello, Immokalee, Basinger, and Sanibel among others. Plants which characterize this community include live oak, slash pine, and South Florida slash pine in the overstory; and saw-palmetto, shining sumac, waxmyrtle, chalky bluestem, low panicum, and pineland threeawn in the understory.

Typical animals of the flatwoods are armadillo, eastern cottontail rabbit, cotton rat, deer, skunks, raccoon, opossum, Bachman sparrow, Bobwhite quail, meadowlark, pileated-woodpecker, pine warblers, red-bellied woodpecker, rufous-sided towhee, easter diamondback rattlesnake, pygmy rattlesnake, oak toad, chorus frog, and pinewoods tree frog. Feral hogs, which have recently been introduced, are also common in much of the community.

Development Opportunities and Constraints - This community is normally subject to high water tables during the rainy seasons and does have limitations for urban development. In the past, development has been allowed in these areas without regulation for stormwater and other such concerns. With the adoption of the Engineering Standards Manual and in connection with regulations stipulated through the National Flood Insurance Program, development has been allowed in these areas. The City of Orlando believes that water management systems are required for urban uses in areas which support this ecological community. There are very few samples of this community available near the City which have not already been altered in some way by development, other than some relatively pristine areas south of the Orlando International Airport and within the Vista East development area. Even these areas have been altered for agriculture purposes. The home-ranges of endangered and threatened species, and species of special concern found within this community and the previous communities are protected at the federal, state, and regional level.

Cabbage Palm Flatwoods

Description - The Cabbage Palm Flatwoods ecological community is somewhat limited in Central Florida. It most often occurs adjacent to major drainageways, swamps, and lakes. This community occurs on nearly level land. Water movement is very gradual to and through the natural drainageways, swamps, ponds, and marshes associated with the community. During the rainy season, usually June through September, the water table is in or near the soil surface. Numerous soil types occur within this community, typified by the Smyrna-Basinger-Sanibel association. The natural vegetation of this community is typically scattered pine and cabbage palm with an understory of palmetto and grasses. There is considerable uniformity and openness. It is similar to the South Florida Flatwoods community except for a higher percentage of herbaceous plants such as Caesar weed, Deer tongue and Greenbriar and the presence of cabbage palms.

The Cabbage Palm flatwoods are also a habitat for a diverse and numerous wildlife population. Larger animals are found where the flatwoods join other communities, especially the wetlands. Typical animals include cotton mice, cotton rat, cottontail rabbit, bobcat, red-shouldered hawk, rufous-sided towhee, diamondback rattlesnake, yellow rat snake, pygmy rattlesnake, black racer, chorus frog, cricket frog, and oak toad.

Development Opportunities and Constraints - This community is limited by its need for high water tables during the rainy season. The conditions that characterized the south Florida flatwood community are also present in this community. A large amount of this community has been altered as Orlando has urbanized. As in other habitats, the home-ranges of endangered and threatened species in this community continue to need protection.

Cypress Swamp

Description - The Cypress Swamp ecological community occurs along rivers, lake margins, slough and strands, or interspersed throughout other communities such as flatwoods. This community is poorly drained and water is at or above ground level for much of the year. Bald cypress is the dominant tree and is often the only plant which occurs in significant numbers. Cypress swamps growing on sand, rock and shallow mucky pond areas are not as productive as those found on alluvial flood lain soils. Soils commonly associated with this community are nearly level or depressional, poorly drained and have loamy subsoils and sandy surfaces. Representative soil associations include Samsula-Hontoon Basinger and Chobee-Felda-Floridana. Vegetation which characterizes this community includes Bald Cypress, Blackgum, and Red maple in the overstory; and common buttonbush, southern waxmyrtle, and cinnamon fern in the understory. Animals include opossum, raccoon, cotton rat, numerous egrets and other waterfowl, chorus frog, cricket toad, diamondback rattlesnake, and yellow rat snake.

Development Opportunities and Constraints - This ecological community is most often associated with wetlands. This ecological community is subject to a high water table throughout the year. Major reclamation of land is required for urban use, usually culminating in the destruction of the community through dredging and filling. Therefore, development potential is limited. In order for development to occur in these areas, it must be proven that the development is in the public interest. Other regulatory agencies such as the applicable water management districts and the U.S. Army Corps of Engineers much authorize the development as well.

2.K. ENDANGERED AND THREATENED SPECIES

There are a number of species in the Orlando area which are federally listed as endangered, threatened, or species of special concern. Listed species include the Florida panther, bald eagle, Florida scrub jay, wood stork, red-cockaded woodpecker, indigo snake, sand skink, gopher tortoise, Florida bonamia, scrub lupine, papery whitlow-wort, the sand butterfly pea, hand fern, snowy egret, tricolored heron, white ibis, white squirrel banana, sand skink, Britton's beargrass,

scrub milkwort, Small's jointweed, scrub plum, wild coco, Sherman's fox squirrel, scrub stylisma, Florida black bear, and clasping warea.

Those species living in wetland ecological communities are protected to a greater extent than species living in upland communities. The upland communities are vulnerable to development and do not have the protection afforded to wetlands by Federal and State legislation. For this reason, the City of Orlando has adopted the TWHO future land use designation to protect upland habitats adjacent to wetland areas. The City has also encouraged implementation of the PCN concept in the Southeast area to protect wildlife corridors between significant wetland areas.

As part of the Southeast Sector planning process, the City has supported additional ecological analysis of annexed properties located south and east of the Orlando International Airport. The dominant naturally occurring vegetative communities in the Southeast area include pine flatwoods, live oak, mixed hardwood, sand pine/oak scrub, and xeric oak. The large contiguous wetland systems in the area are primarily mixed forested or cypress systems with freshwater marsh or wet prairie fringe. The forested wetlands, depressional marshes, sand pine, and xeric oak communities provide a relatively high potential for the occurrence of listed species. Thirteen listed species have been documented within or near the immediate vicinity of the study area (Lotspeich and Associates, 1997). These species include Florida scrub jay, southern bald eagle, gopher tortoise, Florida sandhill crane, Sherman's fox squirrel, red-cockaded woodpecker, American alligator, gopher frog, little blue heron, snowy egret, tri-colored heron, white ibis, and wood stork.

2.L. URBAN WOODLANDS

One of the principal features of Orlando's livability has been the integration of hardwood canopy trees in the design of the City. The older residential portions of the City of Orlando are favored with tree-lined boulevards which act to shield homes from the heat of the sun. New and infill developments are encouraged to use hardwoods in their landscape designs. The City is committed to preserving the practice of allowing hardwood canopy trees in public rights-of-way and incorporating xeriscape practices into the City's urban design.

Much of the developed land within the Orlando planning area has been heavily planted with native as well as introduced vegetation. The pattern of urban woodlands indicates that the older established subdivisions in and around the central part of the City have mature stands of hardwood shade trees with an extensive tree canopy. Prior to the 2004 hurricanes, these heavily wooded areas occupied approximately 40% of the developed residential sites in the City. The 2004 tumultuous hurricane season resulted in a loss of more than 20,000 trees (both City and private) in the City of Orlando, where the average annual loss is typically 500 trees. The City in an effort to reestablish its urban canopy, introduced the *10,000 Tree Initiative* in 2005. This initiative allows citizens and neighborhood associations to purchase trees at wholesale prices. Residential areas which exhibit wooded characteristics but lack an adequate tree canopy include suburban residential developments located around and outside of the central part of

the City, occupying approximately 25% of the developed sites in the City. Other areas in the City, particularly in the newer mixed use developments sited in the southeast and southwest, are now starting to attain a true canopy.

2.M. ORLANDO AREA CLIMATE

The Orlando area can be described as semi-tropical, characterized by abundant summer rainfall, moderate to warm temperatures year round, and wide yearly and monthly fluctuations in precipitation. Annual rainfall ranges from 40 to 60 inches, with an average (1953-2003) of 49.04 inches.

Thunderstorm fluctuations result in frequent, although not usually severe, episodes of flooding and drought. Temperature is more constant than precipitation. Prolonged cold spells or heat wave conditions rarely occur in the Orlando area.

Over 50 percent of the total annual summer precipitation in the Central Florida region is convectional in nature, occurring as afternoon rain showers or thunderstorms. These showers normally occur during the four summer months of June through September. Convectional rainfall in the area has the potential of producing one-storm totals in excess of 4 inches. A typical summer thunderstorm will produce between 0.5 and 3 inches of precipitation in a period of 15 minutes to one hour.

The remaining months of the year are extremely dry when compared with the summer season. Rainfall for the eight months of the dry season usually represents less than 50 percent of the annual total. Rainfall during the cooler months is primarily attributable to the passage of frontal systems across the area. Unlike convectional thunderstorms, frontal precipitation is usually light to moderate in intensity and occurs for a longer duration. Daily precipitation totals during the drier months usually remain under 0.5 inches and rarely exceed 2 inches. The likelihood that some level of drought will occur during the dry season each year is fairly high. By early spring, surplus surface and groundwater from the preceding summer wet season has typically been dissipated through evapo-transpiration, runoff, and aquifer recharge. Unless adequate precipitation is experienced during the early spring, drought may develop during the months of April, May, and June.

Typical average summer temperatures range from lows near 71 F to highs around 92 F. Winter temperatures range from lows near 50 F to highs in the low 70's. Orlando's average high temperature in August is 92 F; and 74 F in February (1981-2007) (MSN.com, 2008). Frosts and/or freezing temperatures generally occur at least once during each winter season. High summer temperatures and humidity in the Orlando area combine to create weather conditions uncomfortable to many residents. In the more heavily treed, older portions of the City, unpleasant weather conditions are attenuated by the shading and cooling features provided by mature tree canopy.

3. KNOWN POLLUTION PROBLEMS

Known pollution problems for rivers, lakes, floodprone areas, wetlands, air, soils, and ecological communities, as well as the potential impacts of hazardous wastes on the preceding natural resources, are discussed in detail in the Conservation Element, as well as more generally in other plan elements. The Stormwater and Aquifer Recharge Element discusses water quality issues, including proposed improvements to surface water runoff. The Potable Water Element discusses potential environmental impacts, and describes the City's water conservation strategies. The Solid Waste Element discusses the potential for pollution from hazardous waste, along with a discussion of hazardous waste management practices. This section is designed to consolidate the information found in the above-mentioned elements, and to summarize the know pollution problems within the City.

3.A. RIVERS, LAKES, FLOODPLAINS AND WETLANDS

The major pollution problems affecting riverine systems, lakes, floodprone areas, and wetlands are caused by stormwater runoff from the developed portions of the City. Runoff itself does not cause pollution; rather it is the water's ability to pick up and transport other substances that creates pollution problems for these natural features. Sources of pollutants are lawns, roadways and parking lots, septic tanks, commercial and industrial discharges, landfills, and the illegal dumping of non-hazardous wastes.

Cultural eutrophication of natural waters is one of the most significant water quality problems that exists today. The quality of a number of local lakes and streams are degraded to the point that their use for active and passive recreation is eliminated because of visual, odor and health reasons. Nutrient enrichment of lakes, streams and estuaries results from pollutants associated with population growth, run-off from commercial development, and fertilizers from agriculture. This process of cultural eutrophication produces excessive growths of bacteria, algae and aquatic plants that degrade the quality and diversity of the water environment. Some of the most damaging sources of nutrients are fertilizers, pet wastes, leaves, yard clippings, dust, debris and detergents. A highly eutrophic or over-nourished water body upsets the natural balance that normally exists between the various food chain levels. Organisms at the low end of the food chain, such as bacteria and algae, experience significant population growth. As long as the algae is alive and exposed to sunlight, it produces oxygen; but when the algae dies or during night time hours, dissolved oxygen in the water is used. The radical swings from high oxygen content to low oxygen content are too extreme for the survival of many aquatic species. Dense clouds of algae also prevent sunlight from reaching the lake bottom, inhibiting the growth of beneficial bottom-rooting vegetation.

Improvements to surface water runoff must provide treatment control. Both quantity and quality of stormwater are controlled through the State of Florida's regulatory Best Management Practices (BMP). The primary BMPs for stormwater are: retain, detain, recharge, filter and use. Use of these methods will ensure that stormwater volumes, peak discharge rates and pollution loads leaving a site are not greater after development than before development.

The City uses the regulations promulgated by the St. Johns River and South Florida Water Management Districts to minimize the potential adverse water quality impacts of new development. Over time water quality will improve as new development continues to meet treatment standards and the City continues to address the pre-1984 backlog of stormwater projects through the capital improvement process. A detailed description of these methods is provided in the *Stormwater and Aquifer Recharge Element.*

3.B. AIR POLLUTION

In a 1905 paper, entitled "Fog and Smoke", the author, Dr. Henri Antoine Des Voeux, wrote that there was something produced in great cities which was not found in the country, a smoky fog… called "smog"….(Answers.com, 2008). His comments were well understood in London, where the thick haze, also known as "pea-soupers", was so pervasive it had become a regular backdrop in Victorian detective novels. While public health research was just starting to emerge, early findings indicated that poor air was a leading cause of chronic respiratory illness and countless deaths.

In the United States, air pollution didn't become a national concern until the late 1940's when serious smog incidents in Donora, Pennsylvania and Los Angeles, California raised public awareness. To address these problems, the Federal government introduced the Air Pollution Control Act of 1955**.** The act identified air pollution as a national issue and recognized that research and corrective measures needed to be pursued. The Air Pollution Control Act of 1955 was soon followed by the Clean Air Act in 1963, an amendment in 1966, and the Clean Air Act Extension in 1970**.**

The 1970 Clean Air Act was significant in that it established the primary and secondary standards for ambient air quality, set new limits on emissions from stationary and mobile sources to be enforced by state and federal governments and increased funds for air pollution research. This ambitious legislation was followed by Clean Air Act Amendments in 1977 which required older industrial facilities to meet new clean air standards.

During the 1980's, as national economic development superseded environmental issues, little was done in the area of clean air legislation. It wasn't until 1990 that the law was again strengthened through the Clear Air Act of 1990 which addressed five main areas: air quality standards, motor vehicle emissions and alternative fuels, toxic air pollutants, acid rain and stratospheric ozone depletion.

Although the 1990 Clean Air Act is a federal law covering the entire country, the States are the responsible entities charged with carrying out the legislative mandate. States are not allowed to have weaker pollution controls than those set for the nation and must, by law, develop state implementation plans (SIPs) that detail how each state enforces the Clean Air Act. Over the past 18 years, the States and local governments have increasingly stepped forward as the leaders in promoting air quality.

Air Pollution in Florida

Air pollution continues to be a major concern in Florida's larger metropolitan areas. The low-lying Florida peninsula allows a great deal of pollution to be dispersed to the Atlantic Ocean and Gulf of Mexico, but conflicting conditions work to retain air pollutants. Inversions can occur whenever the ground is cool and overhead air is relatively warm. This process functions to hold cool air and its associated pollutants close to the earth, thus reducing natural dispersion.

Air quality testing and permitting in the Orlando area is accomplished through the Florida Department of Environmental Protection (FDEP), Division of Air Resource Management. The Division implements the federal Clean Air Act and appropriate Florida Statutes, monitors the state's air quality, administers Florida's air pollution control programs, promotes pollution prevention, and coordinates air related activities at all levels of government. The Division carries out its broad mandate through the Bureau of Air Regulation, the Bureau of Air Monitoring and Mobile Sources**,** and the Office of Policy Analysis and Program Management**.**

FDEP issues permits for major and minor stationary sources of air pollutants as well as the construction, modification, expansion or operation of any facility or development that may be a potential source of air pollution. Common facilities include incinerators, refineries, paper mills and other industrial processes. Both new and existing sources of air pollution must meet ambient air quality standards for six pollutants: sulfur dioxide, particulate matter, carbon monoxide, ozone, nitrogen dioxide and lead. The FDEP classifies every county in the state as either an attainment area, non-attainment area or managed area. Non-attainment areas are areas of the state which do not currently meet ambient air quality standards for a certain pollutant.

Air quality in the City of Orlando can be generally considered moderate to good. Nation-wide, air pollution is caused primarily by industry and by the automobile. The majority of air pollutant contributors in the Orlando planning area are minor, privately owned industrial-based facilities which are monitored under the present DEP permitting system. Aside from these traceable industrial producers, the major source of pollution in the region continues to be the automobile.

Over the past twenty years, the City has experienced acceptable levels of carbon monoxide, nitrogen dioxide, sulfur dioxide, ozone, lead, and particulate matter as shown in Figure C-13. On March 12, 2008, the U.S. Environmental Protection Agency (EPA) tightened the National Ambient Air Quality Standard (NAAQS) for the pollutant ozone (O_3), the principal component of smog, in order to address increasing evidence of global warming and related health problems. Orange County had been recognized since the late 1980's as an ozone "maintained" area, however that may change based on the 2008 requirement.

Ozone is a particularly critical trace gas because it plays two roles. In the lower atmosphere it adds to the greenhouse gases, keeping the earth warm. But it serves a more critical function in the upper atmosphere where it blocks nearly all of the sun's deadly UV rays from reaching the earth. Ozone is the major constituent of smog, and is most commonly produced from the

hydrocarbons emitted by automobiles. Ozone is "cooked" in the air by photochemical processes during the heat of daylight hours, especially during the summer months. In high enough concentrations it can cause or exacerbate such respiratory conditions as asthma, bronchitis, and emphysema.

The State of Florida has established stricter ozone levels to reflect the 2008 federal requirements. The primary (health-protective) standard has been dropped from 0.08 parts per million (ppm) to 0.075 ppm while the secondary (public welfare-protective) standard has also been set at 0.075 ppm level. Orange County, with an ozone reading of 0.081 ppm, is one of ten Counties in Florida which has an ozone level greater than the new standards. FDEP will create a management plan to help reduce ozone levels before the regulations become effective in 2009.

FIGURE C-13: ATTAINMENT/NON-ATTAINMENT DESIGNATIONS FOR ORANGE COUNTY

Pollutant	Designation
Carbon Monoxide	Attainment
Nitrogen Dioxide	Attainment
Sulfur Dioxide	Attainment
Ozone	Non-Attainment
Lead	Attainment
Particulate Matter	Attainment

Source: Florida Department of Environmental Protection, Division of Air Resources Management, 2008.

Enforcement of State and Federal regulations is carried out by the Orange County government. Orange County, through its Air Quality Management (AQM) Division, currently monitors air quality in order to determine the effectiveness of control strategies. The AQM enforces federal, state and local air pollution regulations through permitting and compliance activities within Orange County. In particular, it operates stationary air monitoring sites to check the ambient (outdoor) air for ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide, particulate matter, volatile organic compounds and air toxics. Orange County's current air quality index (AQI) can be accessed by visiting Division of Air Resources Management website.

Carbon Dioxide and Greenhouse Gases

Carbon footprint is a term which, until recently, was only found in scientific literature. It is commonly defined as a measure of the impact human activities have on the environment in terms of the amount of greenhouse gases produced, measured in units of carbon dioxide. A subset of the broader *ecological footprint* which addresses all human demands on the biosphere, the carbon footprint serves as tool in evaluating the mitigation of carbon dioxide emissions through the introduction of alternative, nonpolluting activities such as reforestation and solar energy.

In July 2007, Governor Charlie Crist signed two executive orders (07-126; 07-128) addressing the need to reduce Florida's carbon footprint. These orders impose new emission limits for automobiles and trucks, toughen energy conservation goals for state agencies and require

state-owned vehicles to use alternative fuels such as ethanol and biodiesel. The rules, which strengthen existing laws, establish targets for Florida to reduce its greenhouse gas emissions to 2000 levels by 2017, to 1990 levels by 2025 and by 80 percent of 1990 levels by 2050. Florida will also adopt the California motor vehicle emission standards, pending approval of the U.S. Environmental Protection Agency waiver. The standard is a 22 percent reduction in vehicle emissions by 2012 and a 30 percent reduction by 2016.

The City of Orlando is actively engaging in measures designed to lessen its carbon footprint by taking a leadership role in reducing energy use and emissions through innovative technology and education. In order to help meet existing and new standards, the City is actively promoting a multi-modal transportation system and increasing densities in the urban core to lessen reliance on the automobile. Mass transit, including bus and rail alternatives, along with car-pooling, additional bikeways, and other innovative transportation system opportunities are essential if current air quality conditions are to be enhanced. In addition, increasing the housing options in the core area of the City will provide opportunities for the workforce to live in proximity to the major employment centers, reducing the need for long commutes. Innovative measures will be required in order to enhance air quality in the area, and the City of Orlando is dedicated to initiating and advocating those procedures. (For a more complete discussion of Orlando's initiative in this area, please see Section 5.)

3.C. MINERALS

There are no known pollution impacts derived from mineral extraction operations within Orlando because there are no substantial commercially valuable mineral deposits and no commercial mineral extraction operations located within the City's corporate limits.

3.D. IMPACTS OF POLLUTION ON SOILS, WILDLIFE, AND VEGETATIVE COMMUNITIES

Soil pollution can have a direct effect on wildlife, agricultural interests, and natural vegetative communities. Soils can be polluted in any number of ways, from the illegal dumping of hazardous waste to pollutants carried by stormwater. Also, depending on the soil type, pollutants can infiltrate into the surficial aquifer system at varying rates. Sandy soils accelerate the pollution of the groundwater, while clayey soils may retain pollutants.

Effective ways to protect wildlife and vegetative communities from the effects of pollution include correcting stormwater problems as identified earlier in this section, eliminating soil erosion by requiring the retention of natural vegetation, and regulating land development to ensure that hazardous waste and other toxic substances are located away from valuable natural features.

3.E. HAZARDOUS WASTES

The illegal dumping and accidental spillage of hazardous waste can affect all of the above-mentioned natural resources to varying degrees. Hazardous waste takes a number of different forms in the Orlando area and may include accidental chemical spills, leakage from inoperative

petroleum storage tanks, residential spills and dumping, industrial storage and abandoned landfill sites. However, the common result of improperly disposing of all these hazards is that soils become polluted, leading to contamination of the surficial aquifer. According to the FDEP, the lower Floridan aquifer is usually not seriously impacted by hazardous waste spills. However, it is possible that the lower Floridan aquifer is affected in those areas where the hydrological connection of the lower and surficial aquifers is the most pronounced.

As of 2007, the FDEP has identified 95 potential hazardous waste problems within Orange County, of which 50 are located within Orlando's corporate limits. All of these sites were caused by some type of chemical spill involving either organic, inorganic, or heavy metal substances, violating State groundwater quality standards.

The FDEP has instituted Groundwater Enforcement Actions on these sites. Groundwater Enforcement Actions are used by the FDEP rather than court actions, in order to enforce clean-up of the hazardous waste. In effect, the FDEP and the violator enter into a form of contract called a Consent Order, which outlines what the violator is required to do to resolve the pollution problem. The first step in the process is to identify the extent of the hazardous waste contamination. The violator is responsible for hiring consultants to measure the impacted area and for developing an adequate clean-up plan. The second step in the Consent Order is to clean up the effects of the spill, with the goal being a re-creation of original conditions. The FDEP oversees this entire process.

Another potential source of hazardous waste pollution is petroleum contamination from aboveground and underground storage tanks. This includes commercial gas stations, private storage facilities such as bulk chemical storage facilities, and public storage facilities. In reality, any gasoline station or storage facility can be considered a potential hazardous waste problem.

In 1983, Florida was one of the first states to pass legislation and adopt rules for underground and aboveground storage tank systems. Since then, over 28,000 facilities have reported discharges of petroleum products from storage tank systems. This is an important finding, since Florida relies on groundwater for about 92 percent of its drinking water needs.

By the year 2010, all new and replacement storage tank systems must have secondary containment, and all remaining single-wall systems must replace their systems with secondary containment. FDEP's Division of Waste Management contracts with Orange County to perform annual compliance inspections.

The FDEP also maintains an inventory of the total number of tanks within Orange County, the number that are contaminated, and the number that have been cleaned up. There are 3,008 total facilities within Orange County, with 9,591 tanks. Of these, 818 tanks have caused some contamination. The FDEP data indicates that 641 of these tanks are located within the City of Orlando or in the immediate vicinity.

Other potential hazardous waste pollution problems include residentially-produced wastes and industry-produced wastes. These waste types usually end up at the County's solid waste

disposal sites. The City of Orlando does not collect any hazardous wastes from its residents. The FDEP and the Orange County Environmental Protection Department (EPD) are responsible for hazardous wastes generated within the City limits. The issues of residential and industry-generated hazardous waste collection and disposal are discussed more fully in the Solid Waste Element.

4. POTENTIAL USES OF NATURAL RESOURCE AREAS

4.A. CONSERVATION AREAS

The City of Orlando, through the GMP and LDC, protects environmentally sensitive lands by adopting appropriate future land use and zoning designations. The Resource Protection (RP) Overlay future land use designation and RP Overlay zoning district are used to identify potential conservation areas. The Conservation future land use designation and Conservation (C) zoning district have been created for the purpose of actively protecting lakes, wetland areas, and floodways. The Wekiva Future Land-Use Overlay District and the Wekiva Overlay Zoning District (W) provide open space preservation and protection of environmentally sensitive areas within the Wekiva Basin. The Transitional Wildlife Habitat Overlay (TWHO) future land use designation has been adopted to protect the upland habitats of semi-aquatic and wetland-dependent listed species. This two-tiered approach acts to protect Orlando's valuable natural resources. Figure C-14 displays conservation areas which are currently designated with the RP Overlay, the Conservation future land use designation, and the TWHO. This figure also identifies City parks which have outstanding environmental qualities. Figure C-14 is designed to present a general location for these areas. Please see the Future Land Use Map Series for the exact location of Conservation, RP Overlay and TWHO boundaries.

In order to measure the effectiveness of the above-mentioned land development strategies, the City has committed to maintaining at least 20% of its total land area as open space land. At present, this level of service standard has been attained. However, in order to maintain an appropriate amount of open space and to foster the community's continued livability, the City of Orlando must continue to protect existing environmentally sensitive areas. A discussion of the City's open space system is included in the Recreation, Open Space & Cultural Element.

4.B. POTENTIAL RECREATION USES

A number of the City's most important conservation areas are owned by the City and managed by the Family, Parks and Recreation Department. There are currently nine parks operated by the City which have as their principal feature the natural environment: Orlando Wetlands Park (1,280 acres), OUC Wilderness Park (250 acres), Eagles Nest Park (485 acres), Mayor Carl T. Langford Park (23 acres), Harry P. Leu Gardens (50 acres), Airport Lakes Park (56 acres), Greenwood Urban Wetlands Park (14 acres), Bill Frederick Park (formerly Turkey Lake; 173 acres), and the Park of the Americas (26 acres). The locations for these parks are presented on Figure C-14.

The Orlando Wetlands Park is located 30 minutes east of the City of Orlando via Colonial Drive (S.R. 50) near Christmas, Florida. This 1,280 acre wilderness park features the pristine landscape of undeveloped Florida. The park is home to many forms of wildlife, including the following observed species: great blue heron, woodstork, turkey, pileated woodpecker, redwing blackbird, the eastern diamond back rattlesnake, american alligator, the skink, whitetail deer, raccoon, opossum, armadillo, feral cat, otter, and grey fox. There are six plant communities present on the site, including wet prairie, mixed marsh, hardwood swamp, wetland hardwood hammock, lake communities, and one naturally occurring cypress dome. Tree species include the southern red cedar, laurel oak, Carolina ash, cabbage palm, wild orange, slash pine, and wax myrtle. The park is accessible to the public for nine months of the year.

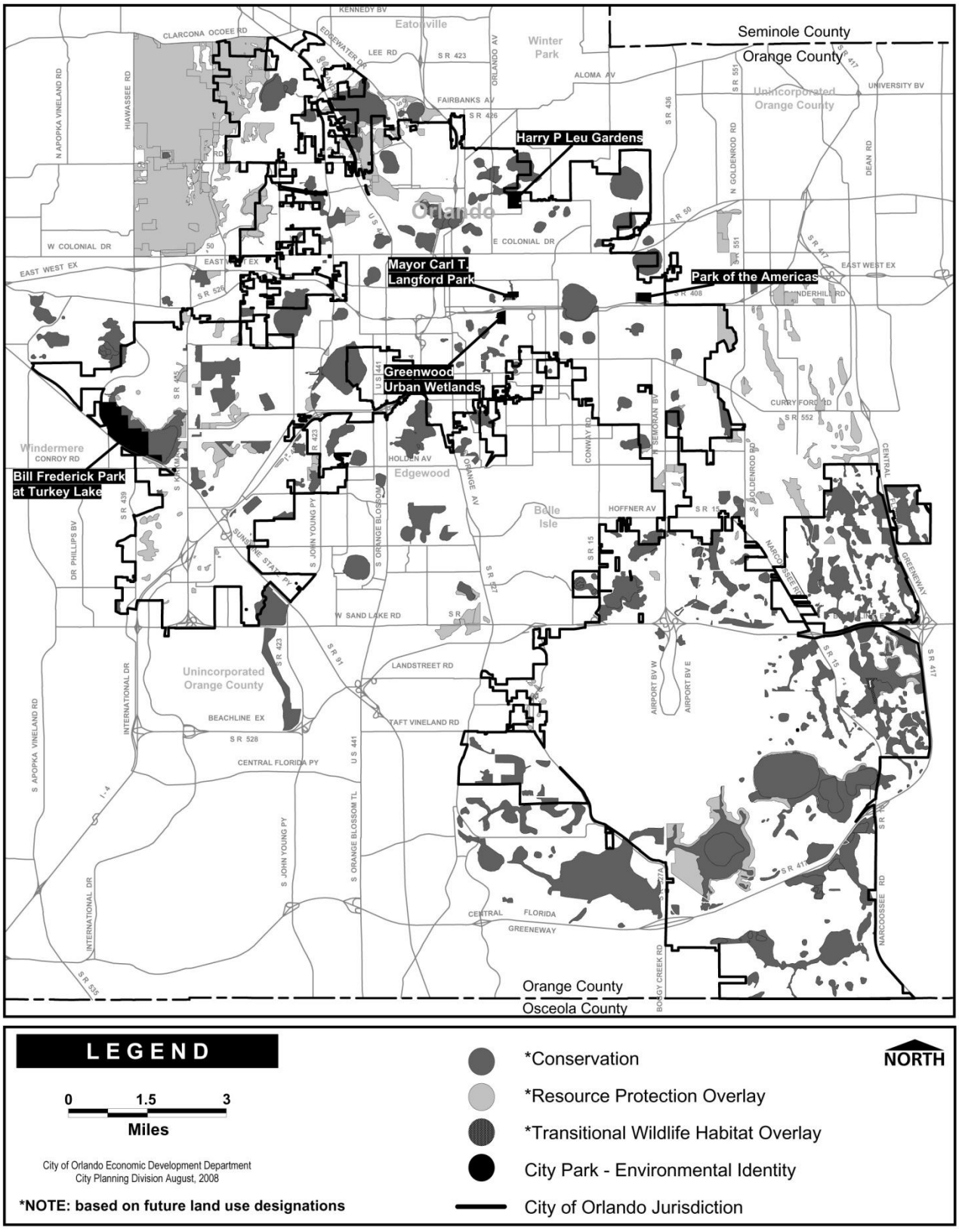
The OUC Wilderness Park is an undeveloped 250 acre park located approximately 8 miles south of the intersection of Colonial Drive and Alafaya Trail near the Stanton Energy Center. Access to this park is limited. When the Alafaya Trail extension is completed, the City will explore the possibility of minimal development to improve access. The City of Orlando is dedicated to protecting the viability of the ecosystem at this park, and so any development would be minimized in order to maintain the area's pristine nature. Ecological communities found at this location include wet prairie, pond cypress swamp, and oak hardwood swamp. Mammalian species found on site include the marsh rabbit, southern flying squirrel, grey fox, the wild hog, bobcat, and white-tailed deer.

The Mayor Carl T. Langford Park is a 23 acre park located near downtown Orlando. It serves as a nursery for the Family, Parks and Recreation Department, as well as a learning center. Its principal feature is its vegetative variety. There are many different kinds of trees and shrubs including live oak, cabbage palm, southern magnolia, red mulberry, elderberry, ardesia, azaleas, saw palmetto, along with herbs and vines such as resurrection fern, wood sorrel, caesar weed, bromeliads, pepper vine, smilax, and morning glory.

Harry P. Leu Botanical Gardens is one of the principal tourist attractions located within the City of Orlando. This 50 acre facility features numerous walkways and sitting areas, by which a multitude of plant species may be observed. The Greenwood Urban Wetland project was completed through the Lake Enhancement Program, and has given the City a unique, functional and aesthetically pleasing park site. Bill Frederick Park is a 173 acre developed metropolitan/special facility, offering camping, hiking and fishing.

The City has recently developed a number of parks with attractive environmental attributes through its Cornerstone Parks Program. Eagles Nest Park, Airport Lakes Park and Clear Lake Park all have valuable wetlands, extensive lake shore, and upland areas with a mature tree canopy.

Figure C-14 Resource Protected Conservation Areas



4.C. COMMERCIAL USES OF CONSERVATION AREAS

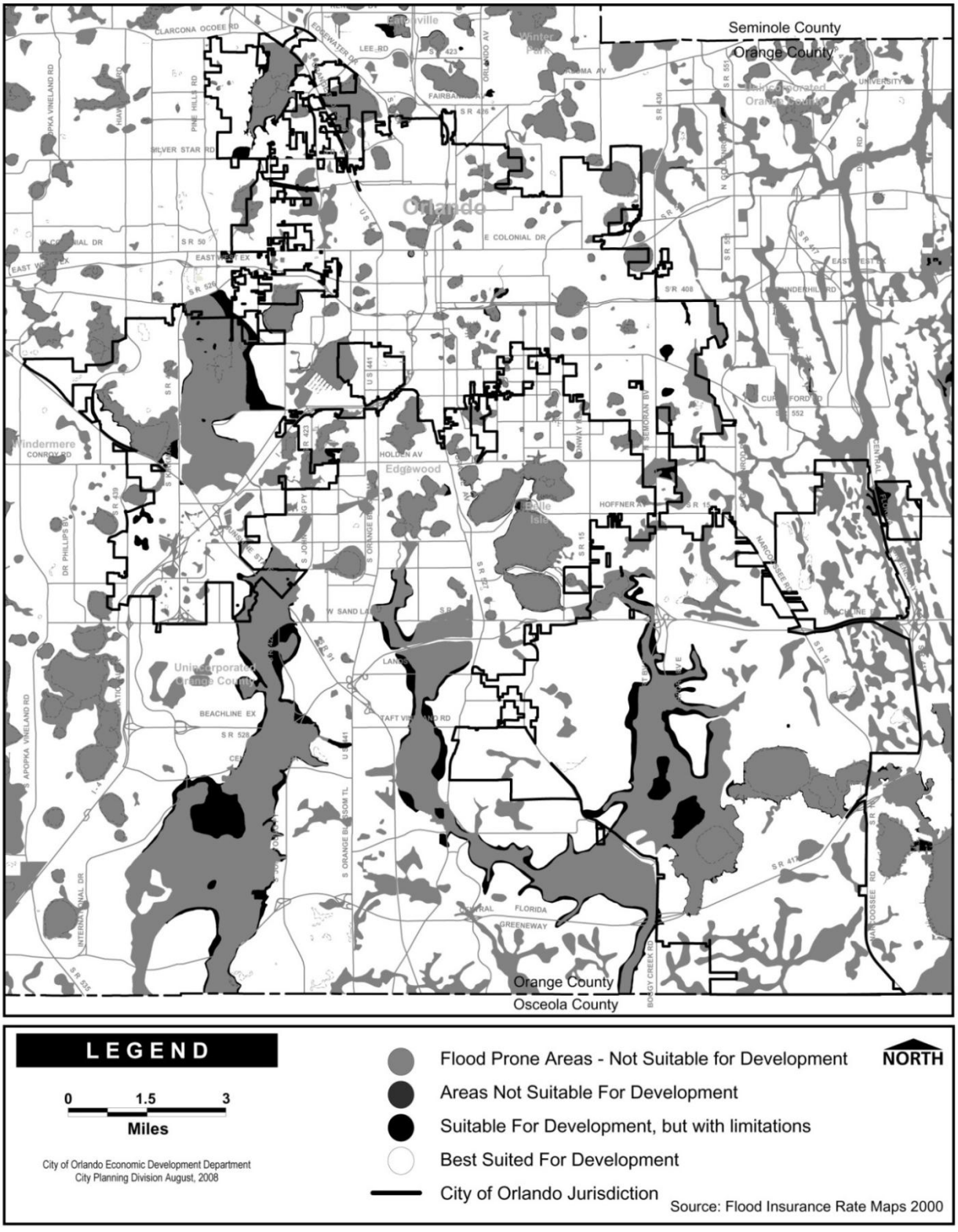
The City of Orlando is, like most municipalities, urban-oriented. Therefore, there are very few commercial uses of designated conservation lands within the City's jurisdiction. There are no commercial forestry or mineral extraction operations located within the Orlando planning area. Other commercial uses of natural resources in the Orlando planning area, such as hunting and fishing, are extremely limited. Some private hunting does occur at the Orlando Wetlands Park as a result of a condition set by the former owner of the property, but its impact is minimal. Commercial uses of fish and other wildlife that do not affect the general wildlife population should not be discouraged. However, recreational use of the land should take precedence over commercial fishing or hunting.

4.D. ENVIRONMENTAL SUITABILITY FOR DEVELOPMENT

Figure C-15 evaluates the environmental suitability for development of lands within and adjacent to the City of Orlando. Factors used in creating this map include floodplains, general soil information, and wetlands formation. The added expense involved in the development and redevelopment of flood prone areas, both for property owners and for local government, limits the development suitability of this land, as discussed in the discussion of floodplains in this Element. When the presence of floodplains is combined with other environmental factors such as poor soil conditions, and wetlands, the result can be areas which are not suitable for development at all.

The flood prone areas shown in Figure C-15 are typically not suitable for development. These areas have undergone detailed development suitability analyses as DRIs or through other development approvals. These DRIs include MetroWest, LeeVista, Lake Nona, Beltway Commerce Center, Airport Lakes, Semoran Commercenter, and the Orlando International Airport. Due to this research, a portion of the development has been identified as Conservation on the future land use map.

Figure C-15 Environmental Suitability for Development



5. GREENWORKS – NEW DIRECTIONS IN CONSERVATION

In the spring of 2007, Mayor Buddy Dyer established a green team, comprised of City staff with diverse backgrounds, education and abilities. The team's mandate was to create a comprehensive sustainability plan for the City by combining existing environmental programs with best practices from across the nation.

The result of these efforts is *Green Works Orlando*, a multifaceted plan which serves to protect and enhance Orlando's natural resources, promote environmental awareness, and support a green infrastructure in a fiscally responsible manner. To accomplish these goals, the City has established five Green Works "pillars":

- Energy Efficiencies and Green Buildings
- Transportation
- Sustainable Infrastructure and Conservation
- Green Spaces
- Advocacy and Education

5.A. ENERGY EFFICIENCY AND GREEN BUILDING

Defining Green Building and LEED Certification

Green Building, sometimes known as sustainable building, is a term that refers to designing and building structures that are environmentally sound and follow the tenets of sustainability. Green building practices address the entire building life cycle by: 1) increasing the efficiency with which buildings and their sites use and harvest energy, water, materials; and, 2) reducing building impacts on human health and the environment, through better site planning, design, construction, operation, maintenance, and removal of materials.

According to the U.S. Department of Energy's Center for Sustainable Development, buildings consume 40% of the world's total energy, 25% of its wood harvest, and 16% of its water (USDOE, 1996). In the United States, the building industry is the nation's largest manufacturing sector, representing more than 50% of the nation's wealth and 13% of its Gross Domestic Product. With the increased costs of natural resources and skilled labor, the building industry has sought new ways to produce sustainable products.

In 2000, the U.S. Green Building Council (USGBC), a nonprofit organization comprised of architects and designers, introduced the Leadership in Energy and Environmental Design (LEED) program. LEED has become the de facto voluntary certification standard for green building practices across the United States. Certification addresses six areas: energy efficiency, indoor environmental quality, materials selection, innovation, sustainable site development, and water savings. Each of these areas is assigned a range of points. Given the number of points earned, a building can achieve a basic, silver, gold or platinum LEED certification.

Nationwide, as construction costs have continued to rise, communities are turning to green construction and sustainable business practices. Since 2007, 121 cities, towns and counties

across the country have adopted LEED programs while 29 cities now require LEED certification or "certifiable buildings" for private developments. The City of San Francisco currently has the most stringent requirements in the nation, requiring private development to meet the LEED Gold requirement by 2012.

There are alternatives to the LEED program. The Florida Green Building Coalition has adopted green building standards that are specific to Florida's climate and development patterns. Standards are available for single buildings, including homes, high rises and commercial buildings. In addition, Gainesville, Hillsborough County, Miami Lakes, Orange County, Sarasota County, and Tampa all have local green building programs or green building incentives for private developments.

While Orlando has not officially adopted a LEED program, it is ranked 5th in Florida for the most LEED registered projects. One of the first City-sponsored green projects is the LEED certified Savannah Park Fire Station. Serving the Lake Nona neighborhood, the station's green design utilizes environmentally friendly building materials and optimizes water and energy conservation. The estimated energy savings of the Savannah Park Fire station will be $8,800 dollars per year.

Savannah Park Fire Station 15

Why Building Green is Important

Green buildings are healthier, use fewer resources and are economically efficient. On average, LEED certified buildings:

- Reduce energy costs by 30%
- Reduce carbon dioxide (CO_2) emission by 40%
- Reduce water consumption by 45%
- Reduce landfill waste by 60%
- Reduce degradation of environmentally sensitive land
- Reduce water pollution

- Cost 0-10% more than conventional buildings depending on the certification level, but yield demonstrable reductions in operating costs (30% reduction in energy consumption on average).

Energy and Energy Efficiency

In the central Florida region, green building has become increasingly attractive with the rise in volatility of energy prices. Coal, the main fuel for electric generation in Central Florida, doubled in price from April 2007 to April 2008. Due to anticipated greenhouse gas (GHG) mitigation requirements and continued demand for fossil fuels, electricity rates are predicted to rise as much as 30% over the next 5 years. The rise in energy costs may also spur communities across Central Florida to pursue the development of much needed solar energy programs.

Other natural resources are also at risk. By 2012, local governments will no longer be able to increase the rate of groundwater withdrawal, and will have to develop alternative water supplies to meet demand. Ensuring sufficient future water supply will only be possible through conservation measures or surface water withdrawals (which regions to the north of Orlando will likely challenge). As energy costs continue to rise they, too, will contribute to the costs of pumping, processing and delivery of water.

While federal and state legislation addressing climate change and energy have had a positive impact on building efficiencies, a number of cities across the nation have taken additional steps. In response to the Kyoto protocol (an international agreement which addresses climate disruption), Seattle Mayor Greg Nickels launched the US Mayors Climate Protection Agreement. This agreement serves to advance the goals of the Kyoto Protocol through civic leadership and action. In fall 2007, Mayor Dyer signed the agreement thereby committing to reduce community-wide greenhouse gas emissions 7% below 1992 levels by 2012. This pledge will be challenging since each new resident to Orlando increases the City's carbon footprint by 20 tons per year. Moreover, since buildings represent approximately 40% of total carbon dioxide emissions, the City will have to pursue aggressive policies which will not only reduce emissions caused by new construction but also retrofit existing buildings. Most climate experts stress that new buildings need to become net energy neutral by 2030 to ensure an 80% reduction in GHG emissions by 2050.

Economic Benefits of Green Building

Municipalities which have made the strategic decision to aggressively pursue sustainability initiatives have experienced tremendous economic benefits. These communities are now recognized for vibrant and livable lifestyles which foster clean, green technology industries. Nationwide, as Americans seek the best places to live, it is the green, sustainable communities which have gained the greater competitive advantage and are rated as the most desirable and/or livable communities in the country.

Green building creates enormous economic benefits by reducing operating costs, enhancing asset value and profits, improving employee productivity and job satisfaction, and optimizing

life-cycle economic performance. The *Life-Styles of Health and Sustainability* market segment is now a $230 billion industry according to the Natural Marketing Institute. Morgan Stanley expects renewable energy revenue will generate $1 trillion/year by 2030 (Cortese, 2003). Cities known for environmental sustainability, such as Seattle, Chicago, and Austin, have benefited from the green building market. In Florida, Gainesville and Sarasota have growing sustainability programs which will have a long-term positive impact on the environment and the economy.

Green design is an undisputed selling point, remarkably enhancing commercial and residential project value. The boom in the green building market has given rise to its own cottage industry, known as green lending. Green lending is supported by large and small commercial lenders and focuses solely on green design and related emerging regulations. Even with the downturn of the national real estate market and less cash available to lend, many large institutional lenders have increased the percentage of funds allocated to green projects.

As the City progresses through the 21st century, its residents are exploring the role of environmental awareness in an increasingly urban environment. People living in an urban setting such as Orlando have a smaller ecological "footprint" than people in suburban or rural settings because they drive fewer miles per year, their homes use land efficiently, and they are less likely to cause pollution or development to occur on undeveloped land. In other words, promoting urban patterns in cities like Orlando is one of the best ways to accommodate growth for the future while respecting the planet's ecological resources. The Future Land Use Element identifies policies to promote infill development and re-use of existing buildings.

With a concentration of architecture, planning, and engineering firms with green expertise, Orlando could gain a regional advantage in green building. The City's new Events Center is currently applying for LEED certification. Similar initiatives will be pursued in the design, construction and operation of both the performing arts center and the renovation of the Citrus Bowl. While basic LEED certification typically requires a 0-4% construction premium; long term, it yields tremendous energy and water savings for the owner. Green building will also create a market for skilled higher wage green jobs in the Central Florida Region.

Health Impacts

In addition to promoting energy efficiency and sustainability, there are positive public health consequences of building in a healthy and safe manner. Americans spend approximately 90% of their lives indoors, yet indoor air quality can be 10 times worse than outdoor air quality. Indoor air quality is a major contributor to respiratory and airborne-related illnesses. Green buildings help improve air, thermal, and acoustic environments, enhance occupant comfort and health, minimize strain on local infrastructure and contribute to overall quality of life.

Implementing Green Building Practices

Across Orlando, "green building" practices that incorporate recyclable or renewable materials, reuse water, and reduce electricity use are becoming more popular. Beyond the environmental

benefits, green buildings can result in operation and maintenance cost savings, healthier indoor air quality, and improved employee productivity.

In an effort to promote these benefits, the City is exploring a number of initiatives including a green standard for homes, expedited permitting for green projects and requirements for all civic buildings to comply with green building standards. Some incentives which may be offered to the private sector include sustainable design density and intensity bonuses and reduced fees. The City is also working with OUC to establish standards and incentives for onsite solar and wind electricity generation. Final decisions on these initiatives are expected by 2010.

5.B. TRANSPORTATION AND SUSTAINABLE INFRASTRUCTURE

Pillars 3 and 4 of the Greenworks initiative address transportation and other types of infrastructure. During the 20th century, urban sprawl, scattering of services away from residential areas, lack of bicycle pathways, poor public transportation, and the destruction of railway tracks, have resulted in very poorly designed cities and transportation networks. Orlando experiences many of these problems and is now looking for ways to create an attractive sustainable environment.

The City's Growth Management Plan promotes a unified land use/transportation system that places equal importance on automobiles, transit, bikes, and pedestrians. In the City's highest projected growth areas—Downtown, Baldwin Park, and the Southeast Orlando Sector Plan—the concepts of Smart Growth and New Urbanism form the underlying principles for future development. These principles focus on a fine grain mix of land uses, multi-modal transportation solutions that are bicycle and pedestrian-friendly, protection of important environmental features, the provision and proper siting of open space and parks, and the celebration of the public realm. Healthy, livable neighborhood centers promote walkability, affordable housing, and mixed use transit-oriented development. By utilizing these concepts, growth will be directed in a responsible, sustainable manner.

Other measures the City will pursue to meet these challenges include modifying the City fleet to bio-diesel and hybrid vehicles, converting every street signal to Light Emitting Diode (LED) technology, improving bicycling and pedestrian opportunities and implementing a car sharing program in downtown Orlando. In addition, the City will partner with regional transportation providers to enhance transportation choices including the proposed commuter rail system and Lymmo, the free downtown bus circulator.

Potable water treatment plants, sewer lines, potable water distribution lines, and storage facilities ensure protection of public health and the environment. In Orlando, much of the drinking water and wastewater infrastructure in the US was built during the 50 years following World War II, paralleling the increase in population. Orlando must prepare for the arriving wave of infrastructure rehabilitation and replacement which will occur over the next several decades.

To address these challenges, Orlando is embracing new green technology. For example, due to the success of the Orlando Easterly Wetlands project (See Pillar 4), the City is expanding

reclaimed water projects. Reclaimed water is highly treated wastewater which can be used for irrigation of green space such as golf courses, apartment complexes, roadway medians, school grounds, and parks. The City is also planning to pilot test a green power reactor which will utilize waste water sludge to create renewable energy resource.

As it concerns solid waste, the City is joining Orange County and OUC to pursue a solid waste gasification facility. Gasification burns waste at very high temperatures, creating *syngas*, a fuel for electricity generation. The high temperatures burn dioxins and other pollutants traditionally associated with incinerators. If built, a gasification plant would allow the City to eliminate the recycling fleet and local residents would place all materials in a single cart for disposal at the gasification facility.

5.C. GREEN SPACES

The fourth pillar, greenspace, was once considered land that had not yet been developed. Now, greenspace is recognized as a basic community necessity that should be planned and developed as an integrated system. A linked open space system offers the potential for an extensive network of pathways and trails that people can use to walk or bike from neighborhoods to parks, schools, work and other destinations. For wildlife the connectivity provided by a system of stream corridors, wetlands and forested areas may be crucial to their survival.

In order to enhance green spaces in Orlando, the City is exploring the development of a Green Network which can provide corridors that allow wildlife access and safe passage to their remaining habitat. A green network also helps define and buffer neighborhoods and provides visual relief and contrast from the built environment. Orlando's Green Network initiative provides a blueprint, or more appropriately a greenprint, for long-range planning. The plan is similar to a long-range transportation plan, except routes are green and natural rather than paved. Orlando's Green Network initiative will create a framework for future growth while also ensuring that significant natural and cultural resources will be preserved for future generations.

In addition to developing a green network, Orlando has already started a number of green programs that will help beautify and preserve our green spaces. Since 2004, the City's Parks Division, Green-up Orlando and Keep Orlando Beautiful, Inc. have supported the ambitious 10,000 Trees Initiative. First started after the 2004 hurricanes, this initiative has been very successful in restoring Orlando's tree canopy. Keep Orlando Beautiful has also been active in sponsoring community gardens. Community gardens are an important tool in engaging children and adults in beautifying the neighborhood while educating the community on the importance of locally-grown plants and vegetables.

The collective lifestyle of Orlando residents is dependent on the provision of diverse recreational and cultural opportunities. Given the breadth of improvements that are needed, in the short term, the City (Family, Parks and Recreation Department) should develop a strategic plan. A strategic plan would assist in prioritizing the use of the staff and resources and will help

guide future activities and budget decisions. The plan should be flexible and be designed to address planning needs and priorities at a three, five and ten year period.

Safeguarding our City's precious wetlands and being environmentally smart are important components of the greenspace pillar. The Orlando Easterly Wetlands Project is an effort by the City of Orlando to reuse highly treated reclaimed water from its 40-million-gallon-per-day (mgd) Iron Bridge Regional Water Reclamation Facility for environmental enhancement. The project began in the mid-1980s when the City, faced with the need to increase its permitted treatment capacity, was unable to expand its wasteload allocation into sensitive area waterways due to concentrations of nitrogen and phosphorus in the Iron Bridge facility's effluent. (Nitrogen and phosphorus are common wastewater byproducts that can promote algae blooms that in turn deplete oxygen in a water body and result in fish kills and other undesirable conditions.)

Recognizing that aquatic ecosystems can be used to naturally remove nitrogen and phosphorus, the City created a large-scale wetland treatment system on an active cattle pasture that had previously been a wetland. Earthen berms were constructed throughout the site, and 2.1 million aquatic macrophytes were planted to create 17 cells that further "polished" the reclaimed water piped in from the Iron Bridge facility and discharged it with no adverse impact into the environmentally sensitive St. Johns River system.

After more than a decade of demonstrated performance, the Orlando Easterly Wetlands reclamation project has proven to the world that large-scale, created wetlands can be used on a long-term basis - and with resounding success - for both the advanced treatment of wastewater and beneficial reuse.

5.D. ADVOCACY AND EDUCATION

In the fall of 2007, the City signed a Local Government for Sustainability agreement to become a partner in the Cities for Climate Protection Campaign. "ICLEI-Local Governments for Sustainability" is an international membership association of local governments and national and regional government organizations that have made a commitment to sustainable development. Joining this campaign requires that the City pledge to take a leadership role in reducing its own greenhouse gas emissions and promoting public awareness of the causes and impacts of global climate change. The City of Orlando has already begun its educational programs through Keep Orlando Beautiful. This program addresses awareness by educating, encouraging and empowering City employees, residents and business owners to reduce pollution and live an environmentally-friendly lifestyle.

Partnership with Orange County

In October 2007, the City of Orlando signed a Green Partnership Pledge with Orange County and OUC. The Pledge promises to jointly provide a cleaner, greener and more secure energy future for the Central Florida community and generations to come. The partnership has already created tangible benefits. In April 2008, the U.S. Department of Energy (DOE) announced that it

selected Orlando as one of 12 Solar American Cities. The City was awarded a grant of $200,000 to be used over two years. Under the guidance of the DOE, the City will partner with Orange County Government and OUC to develop a strategic energy plan with a focus on implementing solar energy and other sustainable growth strategies to mainstream solar energy and implement multiple projects in the next two years.

The DOE, in addition to providing funding, will also provide technical assistance to help the City and County integrate solar technologies into energy planning. The Department will support both communities in streamlining local regulations and practices so as to encourage solar adoption by residents and businesses. As part of this process, the DOE will present solar financing options and promote solar technology through community outreach.

A View of Downtown Orlando

6. CURRENT AND PROJECTED WATER NEEDS

6.A. EXISTING CONDITIONS

Orlando's potable water supply comes from groundwater sources. Both nonartesian and artesian groundwater conditions exist in the Orlando planning area. Nonartesian conditions occur where the upper surface of the zone of saturation is not confined; water is free to rise and fall directly in response to variation in rainfall and discharge. Artesian conditions occur where the water is confined and rises in wells above the point at which it has first penetrated. The nonartesian aquifer in Orange County is comprised of 40 feet of clay, hardpan and shell of varying permeability. Almost all natural recharge to the underlying Floridan Aquifer passes through the nonartesian system.

The Floridan Aquifer is the primary artesian system in Orange County. The two most important producing zones occur at depths between 400 and 600 feet, and 1000 and 1500 feet. Transmissivity is 500,000 gpd per foot and 4,000,000 gpd per foot respectively for the two zones. The lower zone is heavily pumped in Orange County to supply water for domestic consumption.

Most recharge to the Floridan Aquifer occurs by infiltration of rain through relatively thin, semipermeable confining beds. Soil and hydrologic conditions most favorable for recharge occur primarily in higher areas, generally above 100 feet above Mean Sea Level (MSL). Conversely recharge is poor where permeable surface sands are underlain by thick confining beds of clay, generally below 100 feet above MSL. Figure C-16 is a graphic depiction of a typical cross-section of the Floridan Aquifer.

Artificial recharge to the Floridan Aquifer occurs throughout the urban area through approximately 300 to 400 drainage wells constructed for purposes of conveying surface water directly to the upper zone of the Floridan Aquifer. The quality of recharge water to the aquifer system is highly variable. Both natural and drainage well water quality ranges from uncontaminated rainwater to urban runoff high in nutrients and suspended sediments.

Safe sustained yield of water from the Floridan Aquifer is dependent upon a continued balance between groundwater recharge and withdrawal. Existing rates of natural recharge may decrease due to ongoing conversion of surface recharge areas to impervious surfaces. In addition to discharge of stormwater to surface drainageways through an enclosed system of piping decreases the amount of water that reaches the aquifer. Consequently, providing for on-site recharge of uncontaminated groundwater is an important component of stormwater control.

Potential pollution of surface water that reaches the aquifer recharge water presents an additional threat to continued use of groundwater for domestic consumption. This may occur where drainage well water is contaminated from polluted urban runoff. The City's stormwater system designs include those which maximize removal of pollutants prior to discharge into the drainage well system.

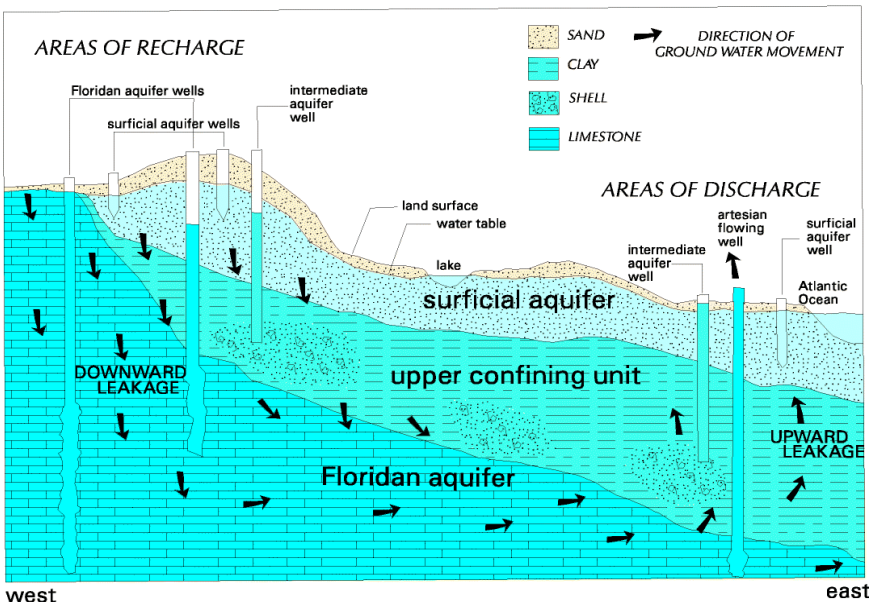
6.B. PROTECTING FUTURE WATER SUPPLIES

Orlando's drinking water is drawn from the lower portion of the Floridan Aquifer. At the present time, much of Orlando's stormwater drainage is removed by drainage wells into the upper Floridan Aquifer. This situation poses a potential contamination problem to the City's water supply, because these two layers are hydraulically connected.

The aquifer also needs protection from unsustainably high withdrawals of potable water. This is a regional problem, and the amount of water needed for existing development and future growth is less than what the aquifer can provide. Conservation and alternative water sources will be needed. To address these issues, the Potable Water Element includes a number of

policies related to conserving potable water and expanding alternative sources. To augment the supply of water derived from the aquifer, the City has implemented a regional reclaimed water transmission system to deliver treated wastewater effluent (reclaimed water) to developing areas for irrigation purposes. Additional information concerning current and projected water needs, wellfield protection, and recharge areas for the City of Orlando may be found in the Stormwater and Aquifer Recharge Element and Potable Water Element.

FIGURE C-16: CROSS SECTION OF THE FLORIDA AQUIFER



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