# Feasibility of Utilizing Miami-Dade County Waterways For Urban Commuter Travel

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In coordination with: Civil Works, Inc.

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#### Introduction

Many mobility options are available for the citizens of Miami-Dade County. Commuters have access to employment centers using many modes. Even with this range of options, congestion within the urban area of the county continues to increase.

As a coastal county, Miami-Dade County includes waterways that are currently used for the transport of goods and for pleasure. These waterways include Biscayne Bay and the canals on the east and west side of the Bay. Biscayne Bay is bound on the east by Miami Beach and serves as the outlet for many manmade and natural waterways. A major shipping and cruise destination, the Port of Miami spans Biscayne Bay at the south end of the City of Miami.

This study will assess the feasibility of using the existing waterways within the Urban Growth Boundary of Miami-Dade County for commuter travel. The Urban Growth Boundary includes the following municipalities:

Aventura Miami
Bal Harbour Miami Beach
Pay Herbor Island Miami Shores

Bay Harbor Island Miami Shores
Biscayne Park North Bay Village
Coral Gables North Miami Beach

El Portal Opa Locka
Florida City Pinecrest
Golden Beach South Miami
Hialeah Gardens Sunny Isles Beach

Homestead Surfside
Indian Creek Sweetwater
Islandia Virginia Gardens
Key Biscayne West Miami

Medley

The limits of the study area are depicted on Map 1. Study Area Boundary.

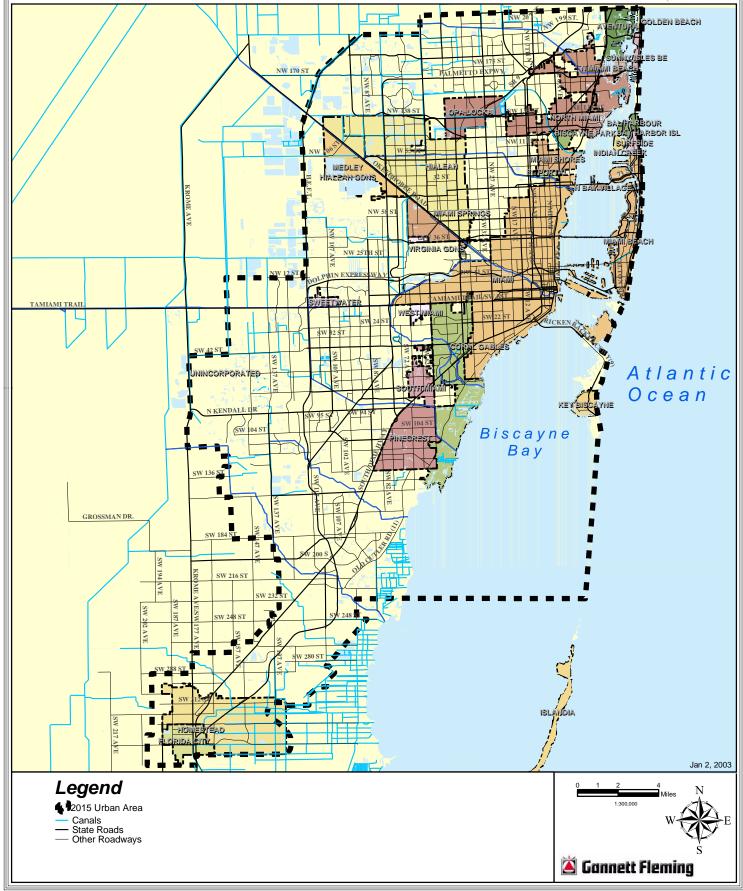
#### **Background**

Unique to waterborne service is the recognition that the land-water interface requires that docks be available for boarding and discharging passengers. The use of existing docks may be possible, subject to the conditions under which the permit for the dock was issued, however new docks may be required to be constructed if there are no existing facilities that meet the needs of the water transit service.

#### UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 1. STUDY AREA

Miami-Dade County 2015 Urban Expansion Area





Commuter travel on the waterways is used to complement traditional land-based mass transit service in some jurisdictions. Locally, Broward County recently initiated scheduled water taxi service in Fort Lauderdale that connects to Broward County Transit service. Water ferry services operate in the San Francisco Bay area, service between Logan Airport and the downtown financial district is available in Boston and Washington State has a history of operating a range of scheduled waterborne commuter services.

In addition to reviewing existing successful operations to identify characteristics with applicability in Miami-Dade County, this assessment of the feasibility of using the waterways of Miami-Dade County for Waterborne Commuter Travel will identify:

- applicable vessel types and sizes, based on successful operations in other locations;
- □ feasible routes, based on an analysis of the physical and permitting opportunities and constraints in Biscayne Bay and the adjacent canals;
- estimated travel time between identified origins and destinations for various modes of travel including potential waterborne travel; and,

#### **Waterborne Transportation Efforts**

The terms "water taxi", "water bus" and "ferry" are used interchangeably in this report to refer to waterborne transportation service. The term "taxi" does not denote service that is on-demand unless specifically so defined.

#### **Previous Efforts in Miami-Dade**

In 1993/1994, a private company, Water Taxi, Inc. started water taxi service in the Miami-Dade area. Service was provided along three routes:

- □ West Biscayne Bay
- □ East, along the Collins Canal
- Across the bay between Miami Beach and Downtown Miami

Service was provided seven (7) days a week from approximately 10 AM to 1:30 AM. All day passes were available for \$7.00 for travel between stops on one side of Biscayne Bay and for \$14.00 to travel across the Bay. Service targeted visitors and tourists and was not coordinated with land-based transit service. Docking arrangements were negotiated with existing individual dock permitees. Stops along the routes included:

City of Miami Stop Locations

- □ Biscayne Marriott Hotel & Marina
- □ Watson Island
- □ Bicentennial Park

- □ Port of Miami
- Bayside Marketplace
- Downtown Waterfront Hotels

Miami Beach Stop Locations

- Doral Ocean Beach Hotel
   Fontainebleau Hilton
   Indian Creek Hotel
   Holocaust Memorial
   Lincoln Road Mall
   Miami Beach Marina
- □ Miami Beach Convention Center

Private service is currently provided between Fisher Island and Miami Beach. Fare information and frequency of service is not available.

Water taxi/commuter service in Miami's Downtown and inner harbors is gaining private support. In the fall of 2002, the Bayfront Park Management Trust scheduled meetings with representatives of several downtown interests with the goal of creating a link between downtown business and entertainment destinations for residents and tourists.

#### **Local Waterborne Efforts**

#### Water Bus – Ft. Lauderdale, Florida

Applicability in Miami-Dade County is high for <u>service characteristics</u>, <u>vessel</u> <u>types/waterway characteristics</u>, and <u>funding/operations characteristics</u>. Ridership is primarily tourism based, however efforts to attract commuters are under development.

#### Service Characteristics

Broward County Transit (BCT) entered a public/private partnership with Water Taxi, Inc. in November 2001, to provide fixed route water taxi service consisting of 22 stops along a north and south route. Service is provided between 6:30 AM and 12:30 AM, seven days a week.

Commute Length: n/a Ridership: n/a Number of Stops: 22

Headway: 60 minutes

Waterbody: Intracoastal Waterways and Canals

Connections between waterborne service and six BCT transit bus routes are coordinated by BCT. Seven (7) and 31-day BCT passes are accepted on the water bus/taxi. Fare/passes include \$4.00 for an adult one-way pass or \$5.00 for an all day unlimited pass. Three (3)-day, 7-day and annual passes are also available. Discounts for youth, seniors and disabled persons are available for one-way and 31-day passes.

The water-based service stops are located at existing docks. BCT did not construct any improvements waterward of the high water line. Federal Ferry Boat Discretionary Funds received by BCT in support of this service went in part to make ADA access improvements to existing dock facilities.

#### Vessel Types/Waterway Characteristics:

Three vessel types are in operation with a total of 18 vessels in the fleet. The fleet includes open-air boats, 38' Megas and new 42' enclosed hybrid-electric boats. Passenger capacity ranges between 27 to 74 passengers. Hybrid-electric vessels are driven by electric motors and rely on a generator and batteries for power. They have low exhaust emissions due to the bio-diesel used at low consumption rates. The vehicles by design are low wash/wake and designed to operate in shallow areas along intracoastal waterways and canals. The low wash/wake boats are also designed to minimize the impacts to manatees. Service is currently provided along the Intracoastal Waterway and new river, both narrow water bodies.

#### Funding/Operations

Federal funds assist in meeting the capital needs for this service. Broward County applied for Federal Ferry Boat Discretionary Funding (FFBDF) over three grant cycles, receiving funds after a third application for the construction of 8 hybrid-electric boats and the improvement of docking facilities to meet ADA standards. Funding in the amount of \$2 million was awarded after receiving Congressional support. The required 20 percent local match was met by Water Taxi Inc. with the donation of an additional two 42' hybrid-electric boats. Each boat is valued at approximately \$238,000. Seven of the ten hybrid-electric boats were in operation in Fall 2002.

The use of electric vessels makes this service eligible for alternative fuels grants/federal funding.

Water Taxi, Inc. operated a private water taxi service in Broward County prior to implementation of the current service. Water Taxi, Inc. had negotiated use agreements with dock permitees that remain in effect. Under a ten-year operation and leasing agreement, vessels are owned by Broward County Transit and leased to Water Taxi, Inc. Water Taxi, Inc. operates the service under the level of service and fare structure established in the lease agreement.

Obtaining the right to access existing docks as well as the need for any additional permits is the responsibility of Water Taxi, Inc. In addition to the retention of farebox revenues, Broward County provides Water Taxi, Inc. with a subsidy in the amount of 1.5 million annually from CMAQ dollars if available. The subsidy will be provided for three years at which time the sole compensation will be the collection of farebox revenues; currently in year two of the contract.

#### Ridership Characteristics

Ridership has increased since execution of the operating agreement between Broward County and Water Taxi, Inc. Fares were reduced and passes that allow free transfers to other BCT services made available. Since the implementation of the new fare structure, Broward has seen an increase in ridership, up 200 to 300% each month from the previous year (July 2002 ridership is reported at 24,000, an increase of 15,000 over July 2001 ridership). Ridership is primarily tourism with efforts to attract commuters under development.

#### Hover Craft USA - St. Petersburg, Florida

Applicability in Miami-Dade County is high for <u>vessel types/waterway characteristics</u> (Biscayne Bay).

#### Service Characteristics

Fixed route service is provided between the St. Petersburg Pier, one resort hotel and Egmont Key (natural preserve) seven days a week. Service is provided between 9:30 AM and 5:00 PM. Service began in 2002 and is privately funded with no coordination with land-based transit service.

Number of Stops: 3

Headway: 60 to 150 minutes Waterbody: Tampa Bay

#### Vessel Types/Waterway Characteristics

Vessel type is hovercraft, is designed to operate in shallow waters. The hovercraft floats two feet over the surface of the water or land and does not disturb vegetation, dolphins or manatees. A 17- passenger hovercraft that can travel up to 40 miles per hour is used to provide service in St Petersburg across Tampa Bay. A 12 passenger hovercraft vehicle can be constructed; the smaller vehicle size would permit operation along the Miami-Dade canals at a 35 mile per hour speed without wake.

Vessels operate on bio-diesel fuel, a biodegradable source of energy.

#### **National Waterborne Efforts**

#### Golden Gate Transit Larkspur Ferry- San Francisco, California

Applicability in Miami-Dade County is high for <u>service characteristics</u> and <u>vessel types/waterway characteristics</u> (Biscayne Bay).

#### Service Characteristics

The Larkspur Ferry provides service between San Francisco and two cities, Larkspur and Sausalito. Larkspur service runs from 6 AM to 9 PM. The ferry system is owned and operated by Golden Gate Transit, a public agency.

Commute Time: 30-50 minutes and 70-90 minutes

Number of Stops: 2 per route Headway: 30-45 minutes

Waterbody: San Francisco Bay, within dredged channels

Ridership is primarily commuter during the peak hours. Approximately 1,400 free parking spaces are provided for commuters at the Larkspur station. Service from Sausalito is provided between 7 AM to 7 PM with a commute length of 70 to 90 minutes. No parking is available at the Sausalito station.

Free Golden Gate transit buses connect Larkspur and Sausalito terminals to 20 surrounding neighborhoods during peak commute hours. Free roundtrip MUNI transfers are available at each ferry terminal.

#### Vessel Types/Waterway Characteristics

Golden Gate Transit operates various vessels ranging from 325 to 750 passenger capacity. The fleet consists of three steel, mono-hull vessels and two catamarans. The steel vessels have a vertical clearance of 30' and a draft of 6'; the catamarans have a vertical clearance of 6' and draft of 3'4". Capacity on the catamaran vessel is 325 to 408 passengers.

#### **Funding/Operations**

Golden Gate Transit is an Independent District without taxing authority. Transit services including bus and ferry are subsidized from toll revenues collected on the Golden Gate Bridge. Approximately 1/3 of the transit operating costs are covered by farebox revenues with the remainder met by toll revenue. Federal and State grants are used for capital projects.

#### Baylink Ferry - San Francisco, California

Applicability in Miami-Dade County is high for <u>service characteristics</u>, <u>vessel</u> <u>types/waterway characteristics</u> (Biscayne Bay) and <u>funding/operation characteristics</u>.

Commute Length: 55 minutes

Ridership: 702,000 annual (FY 01/02)

Number of Stops: 3

Headway: 30- 180 minutes Waterbody: San Pablo Bay

#### Service Characteristics

Located in California, water taxi service is provided between Vallejo and 2 stops in San Francisco. Service operates between 6 AM and 8:30 PM with 30 to 180 minute headway. Ridership is approximately a 70-30 split of commuters to non-commuters. Service expansion is planned to accommodate a 3-boat schedule for a total of 16 daily roundtrips, an increase over the current service providing daily 11 roundtrips.

#### Vessel Types/Waterway Characteristics

Baylink Ferries operate aluminum catamarans that accommodate 300 passengers. The vertical clearance is 40 feet and the vessel draft is 6 feet.

#### Funding/Operations

Ferry vessels and facilities are owned by the City of San Francisco with service operated and maintained by a private company, Blue and Gold Fleet.

Capital investments for vessels and terminals are acquired through federal and state grants. In a typical year, three-quarters of the operating costs are covered by farebox revenue. This has been accomplished through small fare increases over time. Currently, an unlimited

monthly pass is \$200. A one-way adult trip is \$9 with two-way travel discounted to \$14. Last year approximately \$4.5 million in operating revenue was retrieved from the farebox. The remaining operating costs are subsidized by toll revenue, primarily from the northern bridges.

The creation of a public agency to operate the ferry system was rejected by the City of Vallejo. Because private companies cannot access federal grants, the City entered into a five-year cost-plus operating contract with a private operator. Federal funds assist in meting the capital needs for this service.

#### Alameda/Oakland Ferry - San Francisco, California

Applicability in Miami-Dade County is high for <u>service characteristics</u>, <u>vessel</u> <u>types/waterway characteristics</u> (Biscayne Bay) and <u>funding/operation characteristics</u>.

Commute Length: 20 - 50 minutes

Ridership: 445,000 annual (2002)

Number of Stops: 4

Headway: 60 minutes

Waterbody: San Francisco Bay

#### Service Characteristics

Ferry service operates between two points in San Francisco and the City of Alameda and Port of Oakland between 6 AM and 9 PM. Free parking is available in Alameda and Oakland. Weekdays three boats are in operation with limited service offered on weekends. Seasonal service is also provided to Angel Island State Park and the Giants' Pacific Bell Park.

Public transit connections are available at or near all East Bay and San Francisco ferry terminals. East Bay Bus transfers are free with a ferry ticket. San Francisco bus transfers are free with purchase of 10, 20, and 40 ferry ticket books. Transfers are valid on MUNI buses, trolleys and light rail.

#### Vessel Types/Waterway Characteristics

The Alameda/Oakland Ferry operates two vessel types: a 2 deck vessel that accommodates 320 passengers and a 380 passenger, triple deck catamaran. Both vessels types have a draft of 7'.

#### Funding/Operations

The Alameda/Oakland Ferry is a public transit system operated by the City of Alameda and the Port of Oakland. A private operator, Blue and Gold Fleet, provides service under a performance contract with the City of Alameda. To reduce risk to the private operator, the City is negotiating a guaranteed fixed-fee partnership.

#### **Logan Airport Water Shuttle – Boston, Massachusetts**

Applicability in Miami-Dade County is low.

Commute Length: 8 - 15 minutes Ridership: annual (FY 01/02)

Number of Stops: multiple Headway: 15 minutes Waterbody: Harbor

#### Service Characteristics

Daily service is provided from Logan Airport to various stops in the financial district along a one-mile route. Service is provided every 15 minutes from all airport terminals. Free bus shuttle operates between the airport and the water shuttle dock and buses meet scheduled water shuttle arrivals and departures.

On-call water taxi service is available 6 AM to 8 PM Monday through Friday and 10 AM to 8 PM on Saturday and Sunday and does not operate on a fixed route or schedule. A one-way ticket is \$10; roundtrip is \$17.

#### Vessel Types/Waterway Characteristics

Service is provided by a 28 passenger vessel with a length of 39' and a draft of 2 feet. The vertical clearance is 13 feet. The vessel is partly enclosed with passenger seating provided under cover and on deck.

#### Coronado-San Diego Ferry – San Diego, California

Applicability in Miami-Dade County is high for service characteristics.

Commute Length: 60 minutes

Ridership: 80,000 annual (approximate FY 01/02)

Number of Stops: 3

Headway: 60 minutes Waterbody: San Diego Bay

#### Service Characteristics

Two services are provided in San Diego Bay: a privately owned and operated ferry service and a supplemental commuter service subsidized by the local government. The regular ferry service runs between a single stop in San Diego and a single stop on Coronado Island. Leases for both docks are held by the private operator. Service runs from 9:00 AM to 11:00 PM seven days a week. Service has been in operation for 16 years with fares only increasing from \$1.00 to \$2.00 over the 16 year time period.

The supplemental commuter service operates between the same two stops and an additional stop on Coronado Island. Service starts at 5:20 AM. The supplemental (subsidized) ferry serves a large commuter population, providing service to US NAS North Island.

The ferry was in service prior to the bridge connecting San Diego to Coronado Island. When the toll bridge was constructed ferry service was no longer permitted. Ferry service was later permitted to resume in 1986/1987. In addition to the ferry service, the same private operator provides water taxi service that utilizes public marina docks.

#### Vessel Types/Waterway Characteristics

There are two vessels in operation, both accommodating 300 passengers. The vessels are approximately 90' in length and 20' wide. They operate in the dredged channel of San Diego Bay.

#### Funding/Operations

The regularly scheduled service is a privately run operation that receives no public funds. The commuter system operates as a fixed fee partnership between Harbor Excursion and the local government.

#### Washington State Ferries - Washington

Low applicability in Miami-Dade County.

Annual Ridership: 26 million (FY 01/02) Number of Stops: multiple routes/stops

Headway: varies Waterbody: varies

#### Service Characteristics

Largest system in the U.S., serving eight counties within the state of Washington and the providence of British Columbia, Canada. The system consists of 10 routes with 20 terminals.

In 1999 the system carried more than 11 million vehicles and 26 million people. Approximately 20,900 passengers a day are walk-on passengers.

#### Vessel Types/Waterway Characteristics

Vehicles in the fleet range from passenger-only vessels (230 person occupancy) to large automobile/passenger vessels (218 vehicle/2500 person occupancy).

#### Harbor Hopper Water Taxi - Oxnard, California

Low applicability in Miami-Dade County.

Commute Time: varies Number of Stops: 5

Headway: 60 minutes

Waterbody: Channel Islands Harbor

#### Service Characteristics

Private water taxi service within the Channel Islands Harbor serves 5 stops, seven days a week. Ridership is tourism-based and for special events in Oxnard, California.

#### Vessel Types/Waterway Characteristics

Vessels range in capacity from 6 passengers to 22 passengers. Draft is 1.5 feet and vertical clearance is 10 feet.

**Table 1** summarizes the characteristics of existing waterborne transportation efforts surveyed.

**Table 1. Characteristics of Surveyed Waterborne Transportation Systems** 

Transit Service	Land Based Transit Connection	Discount Fares	Interchangable Passes / Free Transfers - Water & Land Based Transit	# of Routes/Stops	Headway (minutes)	Operating Structure
Fort Lauderdale Waterbus	*			2/22	60	Pub/Pvt
St Petersburg Hover Craft				1/3	60 - 150	Pvt
Golden Gate Larkspur Ferry	<b>*</b>	-	-	2/4	30 - 45	Public
Baylink Ferry	<b>*</b>	-	-	1/3	30 - 180	Fixed Fee
Alameda/Oakland Ferry	<b>*</b>		**	2/4	60	Pub/Pvt
Logan Airport Water Shuttle	**	-\$	**	1/3	7	Pvt
Corondo/San Diego Ferry				1/3	60	Pvt / Fixed Fee
Washington State Ferries	**			10/20	n/a	Public
Harbor Hopper Water Taxi				1/5	60	Pvt

## Regulations and Funding Sources Funding Sources

Federal funding is available to public agencies for capital and operating operations of waterborne commuter travel.

#### Ferry Boat Discretionary Program (FBDP)

The FBDP is a special funding category for the construction of ferry boats and ferry terminal facilities. It was created by Section 1064 of the Intermodal Surface Transportation Efficiency Act of 1991 and reauthorized by Section 1207 of the Transportation Equity Act for the 21<sup>st</sup> Century (TEA 21) through fiscal year 2003.

Thirty-eight (38) million dollars are allocated in each fiscal year (1999 - 2003). TEA 21 requires that \$20 million each year be set aside for marine highway systems that are part of the National Highway System for use by Alaska (\$10 million), New Jersey (\$5 million) and Washington State (\$5 million), leaving \$18 million for open competition among all applicants.

Obligation limitations imposed on the Federal-aid Highway Program under the provisions of TEA-21 also impacts the amount of funds available to all states under the FBDP. It is expected that approximately 14 million will be available for candidate projects for fiscal years 2002 and 2003. Funding for fiscal year 2003 will not be appropriated until the passage of the FY 2003 DOT Appropriations Act at which time the extent of congressional funding will be known.

The federal share of project cost is 80%. Eligible projects include the construction of ferry boats and ferry terminal facilities in accordance with 23 U.S.C 129. FBDP funds may only be used for capital projects.

Reauthorization of the FBDP is difficult to predict, however the program has congressional support.

#### Selection Criteria

There are no statutory criteria and FHWA has not established regulatory criteria for the selection of FBDP projects. The following criteria are considered during the selection process:

- □ Expeditious completion of project.
- □ State priorities- individual state priority has been the single most important criteria for initial selection by the program office.
- □ Leveraging of private or other public funding.
- □ Amount of FBDP funding requested.
- □ National geographic distribution of funding with the FBDP.
- □ Solicitation for projects usually begins in March and the announcement of selected projects and allocation of funds is usually accomplished by the middle of November.

Solicitation for projects in FY 2003 will not begin until after the passage of the FY 2003 DOT Appropriation Act.

#### **Congestion Mitigation and Air Quality Improvement Program**

Funds are used to implement projects that result in air quality improvement.

Eligible Projects include:

- □ Transit and Public Transportation Programs
- Service or system expansion
- Provision of new transit service
- □ Financial incentive to use existing transit service
- □ Alternative "Clean" Fuels
- Experimental Pilot Projects

All recipients of CMAQ funds are required to provide FHWA with annual reports detailing CMAQ expenditures. Waterborne transportation systems are eligible for CMAQ funding.

#### **Bus and Bus-Related Capital Investment Grants**

Grant money under this Federal Program is available to assist in the financing of bus and bus-related capital projects. All public bodies and agencies as well as certain public corporations, boards and commissions are eligible to receive money under this grant. Eligible projects include but not limited to:

- □ Acquisition of buses for fleet and service expansion
- □ Bus maintenance and administrative facilities
- Transfer facilities
- □ Bus malls
- □ Transportation centers
- □ Intermodal terminal
- Park and ride facilities
- □ Costs incurred in arranging innovative financing for eligible projects

Funding requirements include a 20 percent local match. Funding is allocated for a total of three years (year appropriated plus two years).

#### **Urbanized Area Formula Grants, Formula Grants**

Grants available to urbanized areas and states for transit-related projects. Designated recipients must be public bodies with the legal authority to receive and dispense Federal funds located within a transportation management area (generally defined as an urbanized area with a population of 200,000 or more). Eligible projects include:

- Planning, engineering design and evaluation of transit projects and other technical transportation-related studies
- Capital investments in bus and bus-related activities
- □ Capital investments in new and existing fixed guideway systems

Funding appropriation is based on legislative formulas and the Federal share is not to exceed 80% of the net project costs. The Federal share may be up to 90% for the cost of vehicle-related equipment attributable to compliance with the Americans with Disabilities Act and the Clean Air Act and for projects or portions of a project related to bicycle. Funding is awarded for a total of four years (the year appropriated plus three years).

#### **Job Access and Reverse Commute**

Grants are intended to encourage transit service to assist welfare recipients and other low-income individuals with access to jobs, training and other social services. Transit service should be designed to develop services to transport workers to suburban job sites.

All local governmental authorities and non-profit entities are eligible to receive Job Access and Reverse Commute grant money. Eligible projects for Job Access grants include:

- □ Capital and operating cost of equipment, facilities and associated capital maintenance times related to providing access to jobs
- □ Costs of promoting the use of transit by workers with nontraditional work schedules, use of transit vouchers, use of employer-provided transportation

Eligible expenditures for Reverse Commute grant funds are operating costs, capital costs, and other costs associated with reverse commute by bus, train, carpool, vans or other transit service

#### **Clean Fuels Formula Grant Program**

The Clean Fuels Formula Grant Program is designed to accelerate the deployment of advanced bus technologies, incorporating low emission vehicles into the nation's transit fleets. The program was developed to assist in the purchase of vehicles, construct alternative fuel fueling facilities, modify existing garages and promote the use of biodiesel fuel. Public transit operators in clean air non-attainment or maintenance areas are eligible for these funds to purchase or lease of vehicles (including vessels). Funds are allocated based on the number of vehicles in the bus fleet and the number of passenger miles weighted by the severity of nonattainment for either ozone or carbon monoxide.

No funds are allocated to this program, match is 80 percent Federal and 20 percent local.

## **Characteristics of Successful Waterborne Operations Summary of Successful Operations**

The characteristics of a successful waterborne transit system are the same as that of a land-based system. Service must be *reliable*, *convenient and competitive*. For the commute trip, *reliability* means that service is provided each day on a regular schedule; *convenience* requires that stops are located near trip ends, where residential and employment densities will support transit; and *competitive* requires that service competes with other modes in terms of time and cost.

There are common elements to the successful operations outlined above that contribute to their success and have applicability to waterborne transportation in Miami-Dade County. Service in Miami-Dade County may operate within or across Biscayne Bay offering limited stop service and within linear waterways with multiple stops, therefore, service characteristics applicable to both potential service types are listed.

#### **Service Characteristics**

- 1. Successful operations provide physical connection to the land-based transit system or park and ride facilities.
- 2. Successful operations provide for discount fares. In many, transfers are permitted between the waterborne service and land-based service.
- 3. With the exception of service in Broward County, successful operations provide service between limited points (2-3 stops).
- 4. Commute lengths for service provided between 2-3 stops ranges from a low of 20 minutes to a high of 90 minutes. The median commute length of the 6 systems for which commute length was identified is 40 minutes.
- 5. With the exception of service in Boston between Logan and the financial district, headways are 30 minutes or longer.
- 6. Passenger capacity is generally over 100; this is a reflection of the type of service provided and the type of waterbody traveled.

#### Vessel Types/Waterway Characteristics

While most successful operations operate within bays and harbors, successful waterborne service can be classified based on the capacity of the vessel and the type of waterbody that the vessel will operate on. Based on research into the successful local and national waterborne efforts, three general classifications can be defined (minimum draft and vertical clearance dimensions cited are based on the survey of successful operations; some minimums may be decreased through custom vessel design):

1. Water Taxi Service (Class I) – vessel capacity of less than 100. Service may be limited stop or to multiple stops along a route. Draft may be as little as 3 feet and the minimum vertical clearance requirement is 6 feet, increasing to 15 feet for some vessel designs. Vessels operate in bays and in canals/channels.

- 2. Water Ferry Service, Pedestrian only (Class II) vessels capacity is greater than 100. Service is between two to four stops. Draft is typically 4 to 7 feet and minimum vertical clearance is generally 6 to 40 feet. Vessels operate in bays and harbors.
- 3. Water Ferry Service, Pedestrians and Cars (Class III) vessels that accommodate automobiles as well as pedestrians. Service is between two to four stops. Minimum draft is 7 to 20 feet. Vertical clearance varies greatly by capacity and design. Vessels operate in bays and harbors.

Hovercraft offer an alternative to conventional propeller-driven vessels. Capacity on a hovercraft is available through custom design in the same range as that of a conventional propeller-driven vessel. Hovercraft, by virtue of their propulsion system, do not impact seagrassbeds and would not present the same hazard to manatees as conventional propeller-driven vessels when underway.

#### **Funding/Operations**

All non-private operations surveyed used federal funds to make capital improvements.

Research identified that successful waterway services can be administered through a variety of operating alternatives. Operation of commuter-oriented waterborne service is similar to that of a land-based transit whether publicly or privately operated. Four categories of operating alternatives are used in the successful operations surveyed.

- Public Agency Entirely owned and operated by public agency. The operating agency may be the transit agency responsible for land-based transit or an independent agency/authority/district.
- Public/Private Partnership The public agency acts as the administrator and provides subsidies to private vendors that operate the system. Typically private vendors maintain an agreed-upon level of service in exchange for retaining farebox revenues. Additional subsidy may be provided.
- □ <u>Fixed Fee Partnership</u>- Public agency acts as the administrator and a private vendor operates the system. The operator is guaranteed a fixed profit over all expenses (operations, maintenance, administrative and insurance).
- □ Private Owned and operated by a private vendor.

Previous private efforts have failed in Miami-Dade County. Based on other efforts, some partnership is generally required between public and private agencies. Public money is often needed to secure grants and funding for capital and/or operating expenses. Within Miami-Dade County, the two-funding/operating arrangements with the highest applicability for Miami-Dade County are Public/Private Partnership and Fixed Fee Partnership.

#### Recommendation for Potential Waterway Service in Miami-Dade County

#### **Recommended Service Characteristics**

- 1. Waterborne transportation in Miami-Dade County should be connected to the existing land-based transit service. Discount passes should be made available and transfers between the two systems should be facilitated.
- 2. Park and ride facilities should be provided where demand is identified.
- 3. Because there are limited examples of successful service with multiple stops, Miami-Dade County should compare the travel time for proposed specific service route alternatives to the travel time for competing modes of travel after stops have been identified.
  - Service of this type would be similar to local bus routes; many stops make access convenient, but greatly increase the time it takes to make a trip. Boarding times on a waterborne system are greater than those of a land-based system, requiring careful assessment of the benefit of multiple stops before "local" service characteristics are selected. Commute time should be comparable to that of competing modes.
- 4. Headways for service that cross Biscayne Bay may be as long as 60 minutes. Headways for multiple stop service should recognize peak hour demand and competing modes.

#### Suitable Vessel Types

Miami-Dade County has the opportunity to provide service in all of the three classes defined.

Within Biscayne Bay, all three service classes may be represented. Multiple stop service connecting locations on a single side of the Bay could connect residential generators located north and south of downtown with the downtown. Limited stop service could be provided as express service between the same residential generators and downtown attractors (employers) on a single side of the Bay. Service could also connect both sides of the Bay. Vessels that transport people and automobiles could be employed to provide connections on the Bay both on a single side of the Bay and across the Bay. Class III service would require the construction of a docking facility that would permit the loading and unloading of vehicles. The landward facilities would have to include storage areas for vehicles waiting to board the vessel.

Waterborne service within the waterways downstream of the salinity dams could also be of the three service classes identified. Limitations to Class II and III service are the water depth and vertical clearance within a particular canal and the availability land to provide for the storage of vehicles waiting to board the vessel.

Upstream of the salinity dams located on each canal, service opportunities are limited to Class I or II. Opportunities for Class II service would be limited by the water depth and vertical clearance within a canal. Class III service could not be provided due to vessel size, particularly the minimum draft required for the vessels that provide this type of service.

#### Recommendation for Funding/Operations

Miami-Dade County could provide service operated solely as a public operation or could pursue a public-private partnership to provide access to federal funding sources. Seven of the nine successful operations surveyed operated under public/private partnership. Maintenance and operations of the waterborne service is provided by the private vendor with scheduling

performed by the public agency. Performance standards and monitoring should be employed to insure contract compliance.

Financial subsidy of the service will likely be required to keep fares competitive with the cost of competing transportation modes. Broward County made application for Ferry Boat Discretionary funds for three grant cycles before award. Congressional support was required to secure the award. Miami-Dade County should recognize the time lapse between application for grant funding and award.

## **Miami-Dade Waterway Characteristics Study Area**

For the purpose of this assessment, the waterways within the urbanized area of Miami-Dade County are classified as Currently Navigational and Currently Non-Navigational to differentiate between the sources and completeness of data available for each classification. Water level and vertical clearance data for the Currently Navigational Waterways is derived from the National Oceanic and Atmospheric Association's Navigational Charts (NOAA NAV Charts) and the data is complete and accurate. It is continuously maintained with frequent updates (Notice to Mariners) because it has a commercial application that funds the maintenance of the data.

Water level and vertical clearance data for the Currently Non-Navigational Waterways is not maintained for the purpose of navigation; currently the canals are not used for water transportation and access by the public is incidental. The availability of data for these waterways is limited. While the SFWMD maintains a record of canal characteristics such as the elevation of vertical obstructions (NVGD), the data is not complete and is organized by obstruction based on permit number and location within a geographic area.

Data on water depth is not available, except at control structures that may be located several miles apart. Water depth data for the intervening section of canal is not available. The SFWMD has undertaken hydrological modeling efforts on one or two canals within its jurisdiction. Water depth will vary seasonally, based on atmospheric conditions (weather) and the stormwater and resource management policies of the South Florida Water Management District. Based on historic maintenance of the canals by the SFWMD, a minimum water depth of 3 feet can be assumed for all Primary Canals.

The Florida Department of Transportation and Miami-Dade County Public Works Departments maintain records of the vertical obstructions within the canals in the study area, however the data is related to the roadway and structure crossing the canal: data identifying the vertical clearance of the obstruction over the waterway is not available from FDOT or the MDPW Department.

The study area is defined as Biscayne Bay and the following waterways:

C-2	Snapper Creek Canal	□ C-7	Little River Canal
C-3	Coral Gables Waterway/Canal	□ C-9	Snake Creek Canal

- □ C-4 Tamiami Canal □ C-100 Cutler Canal
- □ C-6 Miami River/Canal □

#### **Currently Navigable Waters of Biscayne Bay and Adjacent Canals**

For the purpose of this study, the Currently Navigational Waterways are defined as the following (canals are from the confluence of the canal with Biscayne Bay unless noted):

- Biscayne Bay
- Maule Lake
- □ Snake Creek Canal (C-9): Maule Lake to S29 Control Structure
- □ Little River Canal (C-7) to S27 Control Structure
- □ Miami River/Canal (C-6) to S26 Control Structure
- □ Coral Gables Canal (C-3) to Ponce de Leon Bridge
- □ Snapper Creek Canal (C-2) to S22 Control Structure
- □ Cutler Canal (C-100) to S 123 Control Structure
- □ Tamiami Canal (C-4): Miami Canal to Blue Lagoon Lake

#### **Currently Non-Navigational Waterways**

For the purpose of this study, the Currently Non-Navigational Waterways are defined as follows:

- □ Snake Creek Canal:S29 Control Structure to the Urban Growth Boundary (UGB)
- □ Little River Canal:S27 Control Structure to UGB
- ☐ Miami River/Canal: S26 Control Structure to UGB
- □ Coral Gables Canal: Ponce de Leon Bridge to UGB
- □ Snapper Creek Canal: S22 Control Structure to UGB
- □ Cutler Canal: S123 Control Structure to UGB
- □ Tamiami Canal: Blue Lagoon Lake to UGB

#### **Applicable Plans and Regulations**

Regulations and plans have been adopted at the federal, state and local levels to regulate activity in and preserve the natural state of Biscayne Bay and the canals. The applicable regulations and plans and their impact on waterway transportation in Miami-Dade County are summarized below.

#### **Plans**

#### **Federal**

#### Biscayne Bay National Park

Includes most of south Biscayne Bay waterward of the mean high water line, and extends eastward to the barrier islands into the Atlantic Ocean. Coral reefs and other submerged

habitat are protected through park regulations, which include restrictions on habitat destruction. The boundary of the Biscayne Bay National Park is depicted on **Map 2**.

#### **State**

#### Outstanding Florida Waters, Section 403.061, Florida Statutes

Biscayne Bay is designated an Outstanding Florida Water, subject to the use and operating restrictions in Section 403.061 (27), Florida Statutes. The limits of the OFW designation within Biscayne Bay is the same as the boundary of the Biscayne Bay Aquatic Preserve.

The Department of Environmental Protection cannot issue permits for dredging or filling within OFWs without a showing of public interest. The relevant factor in determining public interest is whether the activity will adversely affect the conservation of fish and wildlife, including endangered or threatened species or their habitats.

Activities to allow or enhance public usage, or to maintain pre-existing activities (with certain safeguards) are exceptions to the limits on permitted activities within Outstanding Florida Waters.

#### Biscayne Bay Aquatic Preserve Act, Chapter 258, Florida Statutes

The Biscayne Bay Aquatic Preserve Act was established in 1974 by the Florida Department of Natural Resources (now the Florida Department of Environmental Protection). The Preserve is bounded on the north by State Road 826/Sunny Isle Boulevard in north Miami-Dade County and to the south by State Road 905A/Card Sound Road in Northern Monroe County. The preserve includes all publicly owned islands and submerged land, excluding Biscayne National Park, privately own submerged land and the water column within these boundaries.

Biscayne Bay is designated in Dade and Monroe Counties as an aquatic preserve under the provisions of Section 258.397 of the Florida Statues, fulfilling the Legislature's intent that Biscayne Bay be preserved in an essentially natural condition so that its biological and aesthetic values may endure for the enjoyment of future generations.

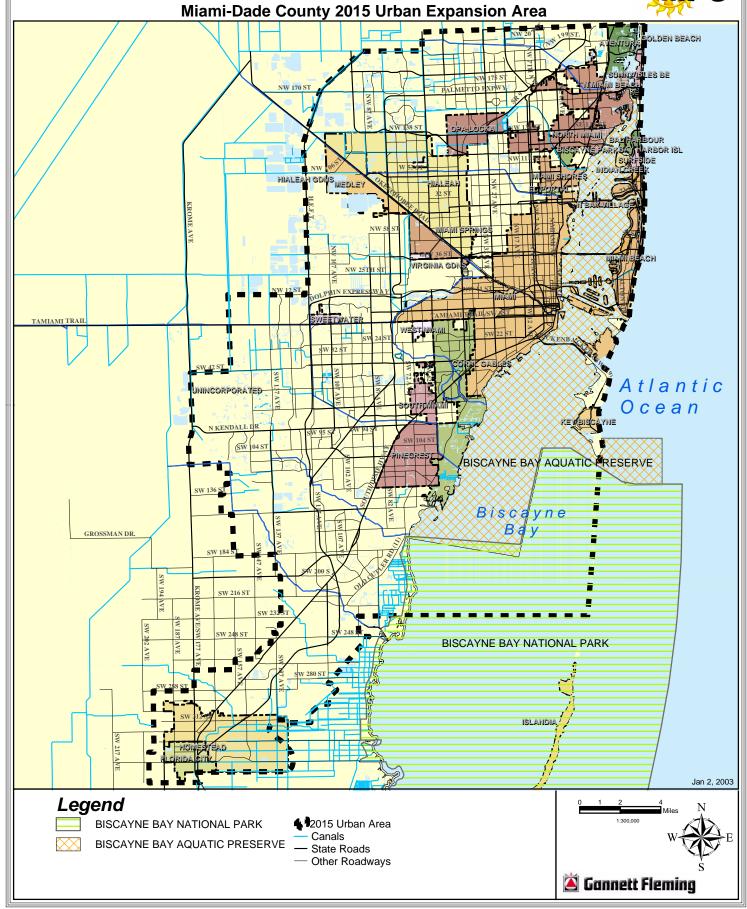
The Aquatic Preserve Act requires that any sale, transfer or lease of state-owned submerged lands be supported by a showing of extreme hardship and a determination that the sale, transfer or lease is in the public interest. This regulation has effectively limited the construction of all private marinas and docking facilities other than facilities that serve single-family residential uses in Biscayne Bay.

The Biscayne Bay Aquatic Preserve designation does not prohibit surface transportation within its limits. Subsection 258.397(4), FS states that the rules and regulations adopted to carry out the provisions of the plan may regulate human activity such as boating, fishing and swimming, as long as it does not interfere "unreasonably with lawful and traditional public uses of the preserve." It further states that other uses not originally contemplated may be permitted if the use is found compatible.

**Map 2.** depicts the limits of the OFW designation/Biscayne Bay Aquatic Preserve within Biscayne Bay.

#### UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 2. BISCAYNE BAY NATIONAL PARK AND AQUATIC PRESERVE

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#### 2002 Biscayne Bay Action Plan

The Florida Legislature created the Biscayne Bay Partnership Initiative (BBPI) in 1999 to survey the status and management of the Bay and provide recommendations for actions to protect, improve and enhance the Bay's resources and its social, economic and natural value. The 2002 Biscayne Bay Action Plan (BB Action Plan) was created as a result of the BBPI study. The purpose of the BB Action Plan is to guide the use of the Bay, balancing appropriate economic use with improved public access, increased habitat restoration and environmental protection.

As a public resource, the BB Action Plan promotes access to the Bay by all sectors of the community as long as the activity is sustainable and does not damage the Bay's natural resources. The BB Action Plan also promotes links between shoreline activities, sites that provide access to the Bay, and transportation modes.

#### Local

#### Dade County Manatee Protection Plan

The Manatee Protection Plan (DCMPP) provides for the implementation of policies to ensure the protection of the manatee and its habitat in Florida. The Dade County Manatee Protection Plan is one of the thirteen mandatory manatee protection plans in Florida. The main objectives of the plan are to:

- reduce the number of manatee fatalities attributed to human-related activities such as boating and flood gate controls;
- protect and improve manatee habitat;
- minimize harassment of manatees;
- increase public awareness; and,
- monitor manatee populations and their habitat.

By defining the plan for manatee protection within Miami-Dade County, implementation of the Manatee Protection Plan is regulatory in nature. The DCMPP designates speed zones and authorizes the Miami-Dade County Department of Environmental Resources Management (DERM) to issue annual operating permits for improvements within designated manatee protection zones.

#### Regulations

Use of the waterways and construction of docks in Biscayne Bay and the adjacent canals are regulated by the following federal, state and local agencies:

- □ Army Corps of Engineers (ACOE)
- □ U.S. Fish and Wildlife Service (USFWS)
- □ Department of Environmental Protection (FDEP)
- □ South Florida Water Management District (SFWMD)
- □ Florida Fish and Wildlife Commission (FFWC)
- □ Miami-Dade County Department of Environmental Resources Management (DERM)
- Miami-Dade County Planning Department

Permits are required to construct docks, seawalls and perform other activities that may result in the disturbance of submerged lands or shoreline vegetation. Within Florida Aquatic Preserves, the authority to review permits for these activities is delegated to the Florida Department of Environmental Protection (FDEP). The FDEP also issues proprietary approval granting consent to use submerged lands of the State of Florida if a project is consistent with specified standards (submerged lands lease).

The process of permitting the construction of docks and facilities has been streamlined. In 1995, the Environmental Resource Permit (ERP) Program became effective. This program merged the permit requirements of the U.S. Army Corps of Engineers (ACOE), the Florida Department of Environmental Protection (FDEP), and most Water Management Districts, thereby managing the review and issuance of a permit for an activity through a single agency, with coordination between applicable regulatory agencies.

The assignment of the review and approval of an ERP to an agency is structured such that one agency will complete all environmental permits: if an activity includes landward development that must obtain a permit from the applicable water management district, the WMD would also review the dock permit application. If the activity does not require a permit from the WMD, under a coordination agreement with the FDEP projects that may affect the West Indian Manatee would be reviewed by the ACOE under the State Programmatic General Permit.

#### **Federal**

#### U.S. Army Corps of Engineers

The Army Corp of Engineers (ACOE) under Sec 404 of the Clean Water Act (3 USC 1344) and Sec 10 of the Rivers and Waters Act of 1899 has jurisdiction over navigable waters defined by law (33 CFR §329) and is responsible for the issuance of permits for the construction of new docks or modifications to existing docks or permits. By virtue of operating a water-based commuter service within the segments of the SFWMD drainage canals, the canals would be defined as Waters of the U.S. pursuant to 33 CFR. Individual Permits are required for the construction of new commercial docks.

Projects determined to potentially affect a Federally listed threatened or endangered species or destroy or adversely modify its designated critical habitat are classified as "yellow" and are subject to review by the ACOE. The ACOE implements formal consultations with the U.S. Fish and Wildlife Service, the Environmental Protection Agency and the National Marine Fisheries Service in its review process. A Combined Federal Position (CFP) is drafted and forwarded to the FDEP. Conditions of the CFP can be included in the authorization and the activity permitted by the FDEP.

The use of existing docks by operations that are consistent with the conditions of the permit under which the dock was constructed does not require amendment to the permit and is not subject to additional review by the ACOE.

#### U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) defines Critical Manatee Habitat (CMH) as a federally designated area with physical and/or biological features essential to the propagation of an endangered species. In Miami-Dade County, CMH includes all waters of Card and Barnes Sounds, Manatee Bay, Biscayne Bay and all adjoining and connected lakes, rivers, canals and waterways from the southern tip of Key Biscayne northward and including Maule Lake.

Manmade structures not necessary to the normal needs or survival of the manatee are excluded from these areas.

The USFWS has recently addressed issues related to secondary and cumulative impacts of the construction of a dock. Pending rulemaking by the USFWS, interim measures govern the issuance of permits to construct new or modify existing docks. The issuance of permits for new facilities has been affected by the interim measures, temporarily reducing certainty about the ability to obtain permits for new facilities.

#### **State**

#### Florida Department of Environmental Protection

The Department of Environmental Protection has regulatory authority over activities occurring in waters of the State of Florida under Chapter 373 FS. The FDEP is responsible for review of submerged lands leases unless the permit for the requested activity is reviewed by the Water Management District, in which case the WMD will provide the proprietary authorization under permit streamlining agreements.

Activities determined to have no effect on the West Indian Manatee are permitted by the FDEP.

#### South Florida Water Management District

Any land-based construction is subject to permit by the South Florida Water Management District. If land-based improvements are associated with a proposed water-based activity (dock permit), the SFWMD will review both permits as well as review applications to use sovereign submerged lands (lease).

Within the Currently Non-Navigable canals maintained by the SFWMD, an ERP permit would be required for the construction, alteration, maintenance, removal, modification or operation of activities that would alter, divert, impede, or otherwise change the flow of surface waters. The SFWMD would review applications to construct new dock facilities or modify existing facilities to determine the impacts to the flow of waters within the canals.

#### Florida Fish and Wildlife Commission

The Florida Fish and Wildlife Commission (FFWC) is responsible for resource and manatee habitat review. Currently, the ACOE performs a formal consultation with the FFWC prior to issuance of a permit for the construction of a commercial dock.

#### Local

#### Miami-Dade Department of Environmental Resources Management (DERM)

Section 24-58 of the Code of Miami-Dade County provides for protection of coastal resources including seagrass beds, mangrove forests and fringes and coral and sponge hard bottom communities by requiring a Class I Permit for all work in, on over, or under the tidal waters of Miami Dade County and its municipalities. The Department of Environmental Resources Management (DERM) issues two levels of Class I Permit: the Standard Form Permit and the Short Form Permit. In most cases, the modification of an existing dock or the construction of a new dock is a Short Form project.

New facilities are subject to Miami-Dade County's *Marine Facility Siting Criteria* adopted in its Manatee Protection Plan. The review of proposals for new or expanded marine facilities includes consideration of the draft of the vessels and the water depth. In waterbodies that may be too narrow for manatees to avoid vessels by moving aside, water depth must be at least 3 feet deeper than the average draft of vessels using the facility.

Within the Dade County Manatee Protection Plan (DCMPP), limited special use dockage is permitted. These docks are defined as courtesy docks, water dependant public transportation dockage and certain commercial/charter fishing boat docks. These facilities are limited to 1 vessel slip per 500 feet of shoreline, or one slip per parcel, whichever is more restrictive, for that portion of the shoreline of Biscayne Bay from the Port of Miami bridge south to SW 15th Road including Bayside and the Miami River from the mouth upstream to the NW 5th Street Bridge.

The location of Fuel and Transitory Docks are governed by the DCMPP under the *Marine Facility Siting Criteria*. Docks that could serve planned commuter services would be included in this category of docks. New docks of this type are recommended only in areas that are least important as manatee habitat because of the frequent number of vessel trips possible. The DCMPP provides for the expansion of these types of dockage facilities in certain areas where Commercial Marina Sites are permitted:

- 1. East side of Biscayne Bay along Miami Beach between Haulover and Government Cuts;
- 2. Some existing marinas located south of the Rickenbacker Causeway; and
- 3. Matheson Hammock Park.

Areas south of the Rickenbacker Causeway are identified as not suitable for marina expansion of development:

- 1. West Biscayne Bay from Crandon Marina to the south shore of Pines Canal;
- 2. Coconut Grove shoreline from the south side of Dinner Key Marina to the Coral Gables Waterway;
- 3. All of the Coral Gables Waterway located east of SW 57<sup>th</sup> Avenue and all other canals in Coral Gables (excluding the Matheson Hammock Marina area);
- 4. Kings Bay/Deering Bay waterways located between theoretical SW 140<sup>th</sup> Street and SW 160<sup>th</sup> Street;
- 5. Black Point area waterways; and

6. Homestead Bayfront Park/Biscayne National Park marina basin areas.

The construction of docks in locations other than those recommended in the DCMPP for the type of dock proposed maybe evaluated according to criteria listed on page 115 of the DCMPP for approval. Adherence to the criteria does not automatically ensure permitting of the proposed facility. Four of the criteria are locational: the proposed facility must be 1) located in a slow speed or idle speed zone; 2) cannot be located in a cold-weather aggregation area or other area where sensitive manatee activities occur, or in a travel corridor from these areas and travel to the facility cannot be through said areas; 3) does not require any new dredging or filling that would degrade shallow water habitat and 4) travel to the facility should not travel through manatee travel corridors. Additional criteria include limits on multi-family facilities and require a net benefit to manatees or their habitat (mitigation).

Cold-weather aggregation areas, other areas where sensitive manatee activities occur and travel corridors to same are described in the DCMPP on pages 12-15:

- 1. *Seagrass Beds*: either side of the ICW channel in Dumfoundling Bay; in north Biscayne Bay between 79th Street Causeway and Julia Tuttle Causeway; between the Port of Miami and the Rickenbacker Causeway and Coral Gables Waterway and south of the marked boat channel to Black Creek.
- 2. Fresh Water Sources: Snake Creek Canal, Biscayne Canal, Little River, Miami River, Tamiami Canal, and Black Creek Canal.
- 3. Warm Water Refuges: Coral Gables Waterway, upper Miami River and Little River,
- 4. *Other Aggregation Areas*: northwest side of Virginia Key, portion of Little River immediately downstream of the salinity control structure, and the north portion of Black Point marina basin.
- 5. *Travel Corridors*: Intracoastal Waterway and the west shoreline of Biscayne Bay between the Port of Miami and Chicken Key.

The Manatee Protection Plan accomplishes much of its protection goals through the designation of *speed zones*. Speed restrictions are designed to protect the West Indian Manatee's habitat and travel corridors. In 1991, the Florida Governor and Cabinet adopted by rule vessel speed restrictions for manatee protection throughout the Bay and surrounding canals. The following designations are enforced within the Bay and surrounding canals:

No Entry	Slow Nov 15-Apr 30; 30 MPH Other
No Entry Nov 15-Apr 30; Idle Other	Slow Nov 15-Apr 30; 35 MPH Other
Motor Boat Exclusion	30 MPH
Idle/No Wake	35 MPH
Slow Speed	

In 1979, the Florida Department of Natural Resource (DNR) designated the Black Creek Area as a manatee sanctuary. An "Idle Speed/No Wake" zone was assigned to waters in the vicinity.

**Map 3.** depicts the opportunities and constraints to the provision of waterborne transportation within the Currently Navigable Waterways, depicting the limits of speed zones implemented in the DCMPP and protected seagrass beds.

#### Miami-Dade County Comprehensive Plan

The Coastal and Conservation Elements of the Miami-Dade County Comprehensive Plan provide for the protection and restoration of wetlands and the monitoring of benthic habitats and wildlife.

Coastal Policy 1A designates mangrove protections areas and establishes guidelines for alteration that prohibits the reduction or adverse affect to habitat used by endangered or threatened species.

Conservation Element policies specifically address endangered species protection: Objective 9 and related polices prohibit activities that adversely affect habitat that is critical to federal or state designated endangered species unless the activity is a public necessity and their is no alternative sites where the activity can occur.

The development of marina and other water dependant projects is conditioned upon a determination that the construction or subsequent operation of such a project shall not destroy or degrade habitats used by endangered or threatened species.

#### **Operating Constraints**

#### **Currently Navigable Waterways**

Biscayne Bay is a shallow, subtropical lagoon located within Miami-Dade and Monroe counties. The average natural depth is nine feet, however much of the Bay has been modified and dredged changing the average depths to six to ten feet except in the main channels and deeper dredged areas.

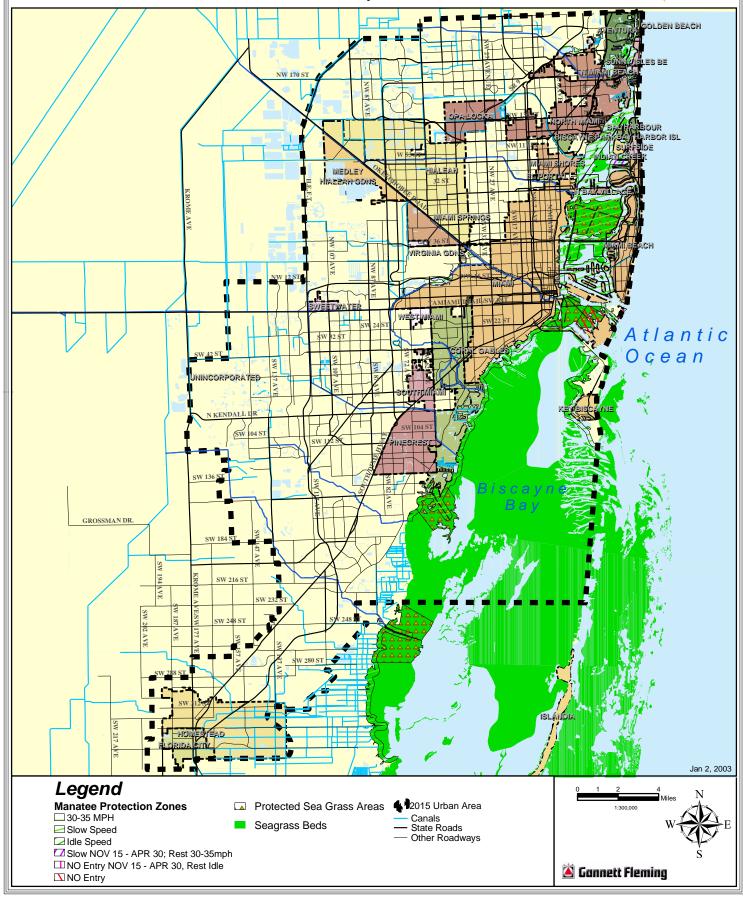
Operating constraints within the Currently Navigable Waters, including Biscayne Bay consist of:

water depth	no entry zones/speed zones
vertical clearance	seagrass locations
channel locations	existing dock locations

#### UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 3. SEAGRASSES AND MANATEE SPEED ZONES

#### Miami-Dade County 2015 Urban Expansion Area





#### **Water Depth and Vertical Clearance**

The water depth and vertical clearance within the Currently Navigable Waters is documented on the NOAA Navigational Charts sold commercially to boaters. The 3ft minimum water depth for the operation of non-hovercraft vessels is available immediately adjacent to the shoreline or at minimal distance from shore and channels to existing docks within Biscayne Bay. Physical constraints to water travel within Biscayne Bay are depicted on **Maps 4-1** through **4-4**.

A minimum water depth of 3 feet is available in Maule Lake and the Currently Navigational sections of the Snake Creek Canal, Little River Canal, Miami River/Canal, Coral Gables Canal, Snapper Creek Canal, Cutler Canal and the Tamiami Canal.

Minimum vertical clearance required for the operation of small commuter vessels with a passenger capacity of less than 100 (based on existing vessels designs) is 6 feet. Passenger-only vessels with a capacity of greater than 100 have a minimum vertical clearance of 6 feet, and can require up to 40 feet based on vessel design. All bridges within Biscayne Bay except those along the Venetian Causeway have a vertical clearance of 6 feet or greater. Minimum vertical clearance is also available in Maule Lake and in the Currently Navigational sections of the seven canals within the study.

Physical constraints to waterborne transportation service within Currently Navigable and Currently Non-Navigable portions of the seven canals under evaluation are depicted in **Map Series 1** found in **Appendix A.** 

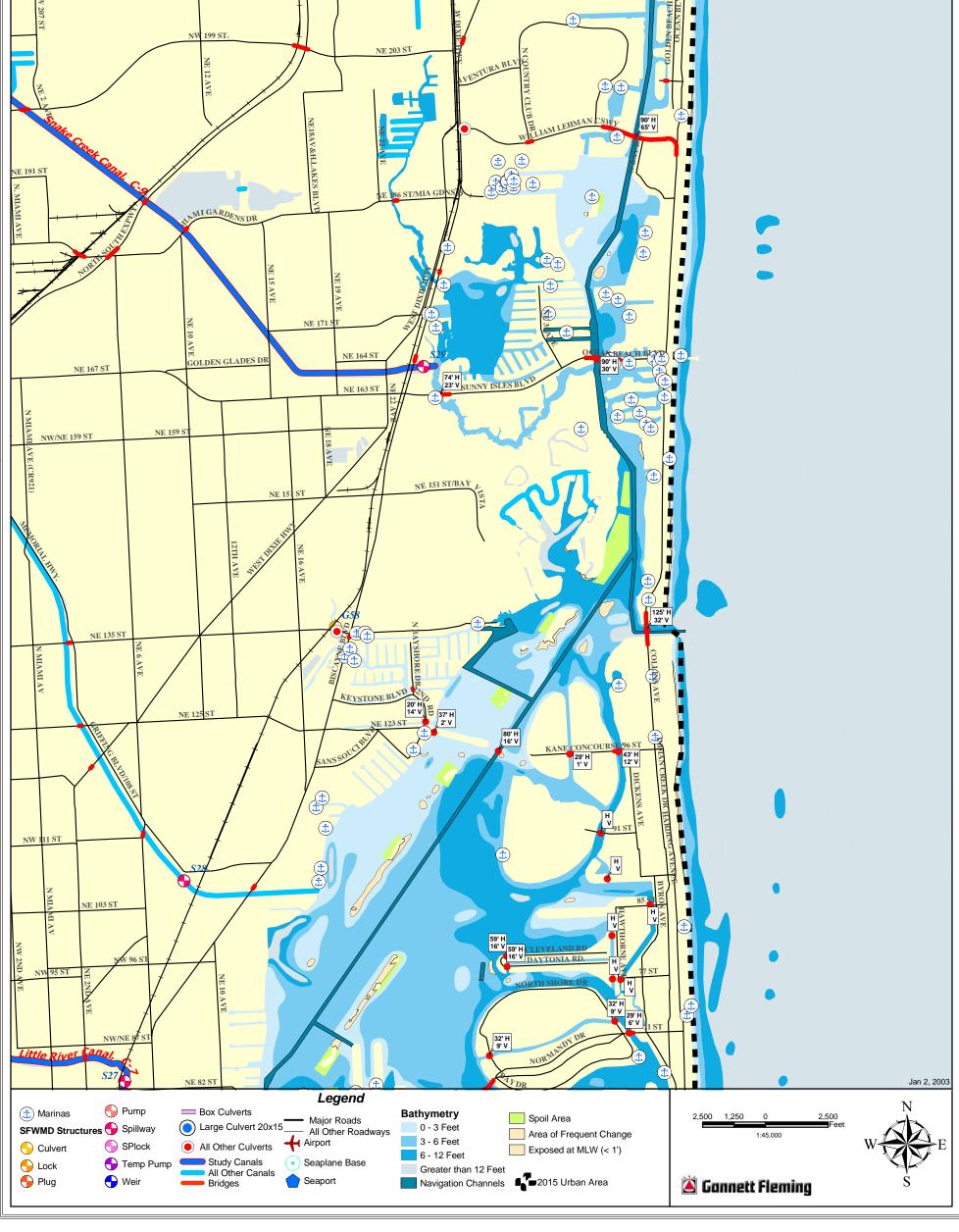
#### **Channel Location**

The Intracoastal Waterway (ICW) is maintained on the west side of Biscayne Bay. To limit impacts to seagrasses and shoreline habitat, commuter service that connects only a few stops along the western shore of the Bay (north/south travel) may be required to use the dredged channels, including the ICW. Service to multiple stops located on a single side of the Bay may be permitted to travel outside the ICW based on an assessment of impacts to seagrasses and manatees.

#### **No Entry/Speed Zones**

Speed zones (including no entry) were established by the DCMPP for manatee protection. The imposed speed zones act as an operating constraint on the Bay and the Currently Navigable Sections of the canals within the study. Speed zones change during certain months of the year, becoming more restrictive in the winter months when manatees are present in greater numbers. The limits of the No Entry/ Speed Zone within Biscayne Bay are depicted on Maps 5-1 through 5-4. Speed zones along the canals are depicted in Map Series 1 found in Appendix A.

## UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 4 - 1. PHYSICAL CONSTRAINTS TO CURRENTLY NAVIGABLE WATERWAYS **BISCAYNE BAY SHEET 1** FROM GOLDEN BEACH TO MIAMI BEACH (‡) MIGARDENSDR GOLDEN GLADES DR NE 167 ST 74' H 23' V SUNNY ISLES BLVD NE 159 S



### UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 4 - 2. PHYSICAL CONSTRAINTS TO CURRENTLY NAVIGABLE WATERWAYS **BISCAYNE BAY SHEET 2** FROM MIAMI BEACH TO MIAMI NW 81 ST (±) (±) JULIA TUTTLE CSWY 20TH ST(CR952) Legend Major Roads All Other Roadways Pump Box Culverts Marinas **Bathymetry** Spoil Area Large Culvert 20x15 SFWMD Structures Spillway 0 - 3 Feet Area of Frequent Change 1:45,000 3 - 6 Feet All Other Culverts SPlock Culvert Exposed at MLW (< 1') 6 - 12 Feet Study Canals All Other Canals Seaplane Base Temp Pump - Lock Greater than 12 Feet Navigation Channels 2015 Urban Area Seaport Weir Plug Bridges Gannett Fleming

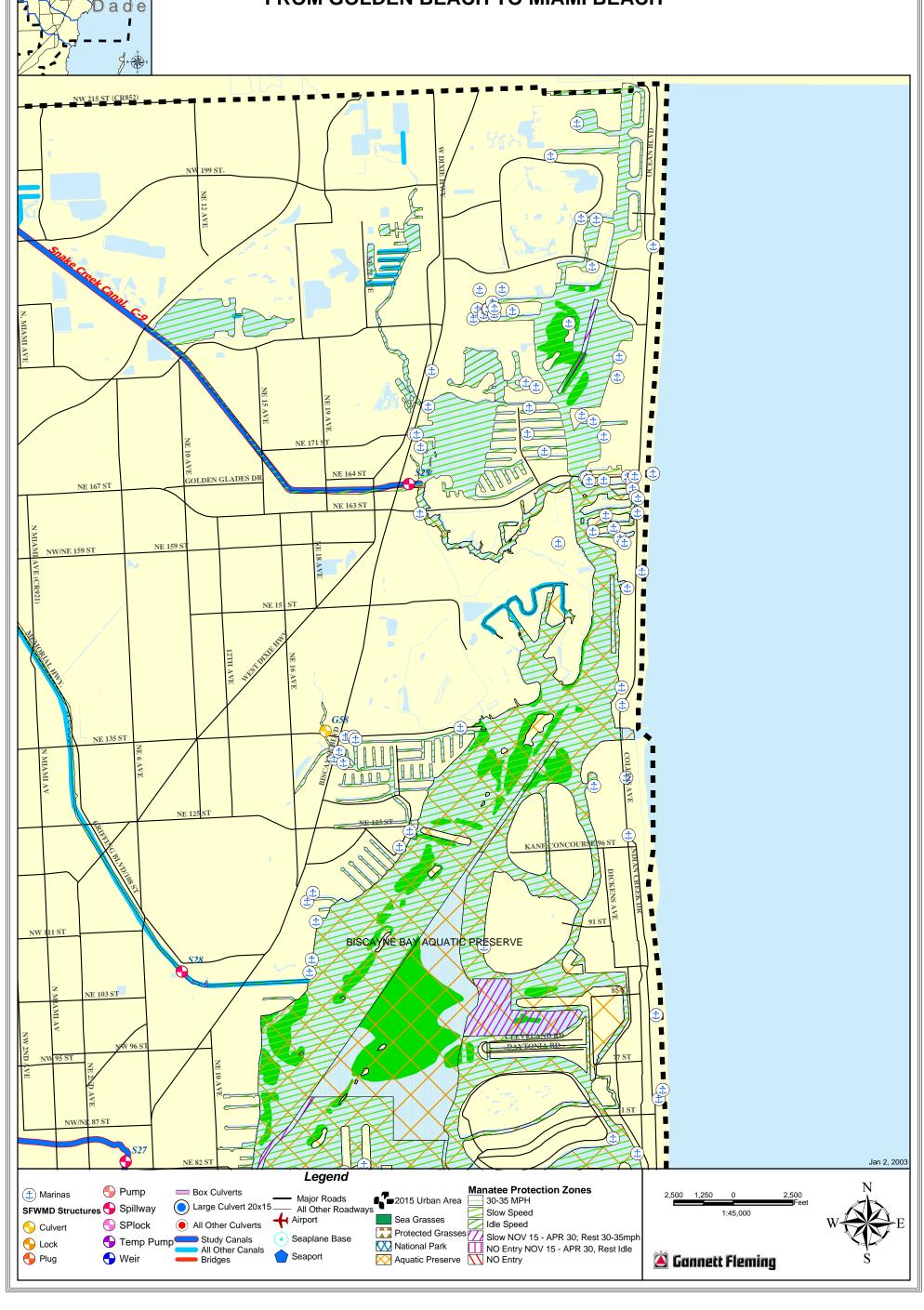
## UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 4 - 3. PHYSICAL CONSTRAINTS TO CURRENTLY NAVIGABLE WATERWAYS **BISCAYNE BAY SHEET 3** FROM CORAL GABLES TO BLACK CREEK AREA Legend Pump (±) Marinas Box Culverts Bathymetry Spoil Area Major Roads SFWMD Structures Spillway Large Culvert 20x15\_ 0 - 3 Feet All Other Roadways Area of Frequent Change 1:45,000 3 - 6 Feet SPlock Airport All Other Culverts Culvert Exposed at MLW (< 1') 6 - 12 Feet Study Canals Temp Pump Seaplane Base Lock Greater than 12 Feet All Other CanalsBridges Navigation Channels 2015 Urban Area Weir Gannett Fleming Plug Seaport

## UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 4 - 4. PHYSICAL CONSTRAINTS TO CURRENTLY NAVIGABLE WATERWAYS **BISCAYNE BAY SHEET 4** FROM CORAL GABLES TO BLACK CREEK AREA SW 104 ST S22 SW 112 ST SW 120 ST CHAPMAN FIELD DR SW 128 S **(** (±) (±) CORAL REEF RD S118 RICHMOND DR/SW 168ST SW 168 ST S123 EUREKA DR/SW 184 ST SW 186 ST S122 Legend Pump Box Culverts Marinas **Bathymetry** Spoil Area Major Roads All Other Roadways Airport Large Culvert 20x15\_\_\_ SFWMD Structures Spillway 0 - 3 Feet Area of Frequent Change 1:45,000 3 - 6 Feet All Other Culverts SPlock Culvert Exposed at MLW (< 1') 6 - 12 Feet Study Canals All Other Canals Seaplane Base Temp Pump - Lock Greater than 12 Feet Navigation Channels 2015 Urban Area Seaport Weir Plug Bridges Gannett Fleming

# UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 5 - 1. OPERATIONAL CONSTRAINTS TO CURRENTLY NAVIGABLE WATERWAYS BISCAYNE BAY SHEET 1







## UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 5 - 2. OPERATIONAL CONSTRAINTS TO CURRENTLY NAVIGABLE WATERWAYS **BISCAYNE BAY SHEET 2** FROM MIAMI BEACH TO MIAMI NW 81 ST NW 79 ST NW 71 ST NW 62 ST (CR93 YNE BAY AQU<del>ATIC PRE</del>SERV Jan 2, 2003 Legend Manatee Protection Zones Pump Box Culverts (t) Marinas Major RoadsAll Other Roadways ■2015 Urban Area 30-35 MPH Large Culvert 20x15 SFWMD Structures Spillway Slow Speed 1:45,000 Airport Sea Grasses Culvert SPlock All Other Culverts Idle Speed Protected Grasses Slow NOV 15 - APR 30; Rest 30-35mph Study Canals Temp Pump Seaplane Base \_\_\_ Lock National Park NO Entry NOV 15 - APR 30, Rest Idle All Other Canals Gannett Fleming Plug Weir Seaport Aquatic Preserve NO Entry Bridges

## UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 5 - 3. OPERATIONAL CONSTRAINTS TO CURRENTLY NAVIGABLE WATERWAYS **BISCAYNE BAY SHEET 3** FROM MIAMI TO CORAL GABLES BISCAYNE BAY AQUATIC PRESERVE Legend Manatee Protection Zones Pump Box Culverts (±) Marinas 2015 Urban Area Major Roads 30-35 MPH Large Culvert 20x15 SFWMD Structures Spillway All Other Roadway Slow Speed 1:45,000 Airport Sea Grasses Idle Speed Culvert SPlock All Other Culverts Protected Grasses Slow NOV 15 - APR 30; Rest 30-35mph Study Canals Temp Pump Seaplane Base National Park NO Entry NOV 15 - APR 30, Rest 30-35mp NO Entry NOV 15 - APR 30, Rest Idle NO Entry Lock All Other Canals Gannett Fleming Plug Weir Seaport Bridges

### UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 5 - 4. OPERATIONAL CONSTRAINTS TO CURRENTLY NAVIGABLE WATERWAYS **BISCAYNE BAY SHEET 4** FROM CORAL GABLES TO BLACK CREEK AREA N KENDA SW 104 ST S22 SW 112 ST SW 112 ST/KILLIAN DR SW 120 ST CHAPMAN FIELD DR SW 128 ST SW 128 ST THIMINI E AAAAAAA SW 144 ST BISCAYNE BAY AQUATIC PRESERVE CORAL REEF RD S118 RICHMOND DR/SW 168ST SW 168 ST EUREKA DR/SW 184 ST SW 186 ST S122 BISCAYNE BAY NATIONAL PA Legend Manatee Protection Zones Pump Box Culverts (<u>‡</u>) Marinas Major RoadsAll Other Roadways 2015 Urban Area 30-35 MPH Large Culvert 20x15 SFWMD Structures Spillway Slow Speed 1:45,000 Airport Sea Grasses Idle Speed SPlock All Other Culverts Culvert Protected Grasses Slow NOV 15 - APR 30; Rest 30-35mph Temp Pump Study Canals Seaplane Base \_\_\_ Lock National Park NO Entry NOV 15 - APR 30, Rest Idle All Other Canals Plug Heir Weir Seaport Aquatic Preserve Gannett Fleming NO Entry Bridges

Commuter travel opportunities and service must be available to users of the system year-round. Waterborne commuter travel is not possible within areas of the Bay with a No Entry designation for any portion of the year. This designation is limited to an area northwest of Virginia Key. The S29 Control Structure is located at the NE 82nd Street Bridge on the Little River Canal. Immediately downstream of the control structure, the Little River Canal is subject to a No Entry Zone established by the DCMPP applicable November 15 through April 30. With this restriction, this section of the Little River Canal is not suitable for commuter travel.

As indicated previously, a waterborne transportation system must compete with other modes of travel available to the commuter. Travel time is a critical component of the decision to use a particular mode. For this reason, opportunities for multiple stop service in areas with idle and slow speed restrictions for any portion of the year are limited due to the increased travel time as a result of the speed limit. Multiple stop waterborne transportation service, like local land-based transit service is most competitive with other modes when serving the short trip or the captive rider.

Most of Biscayne Bay adjacent to both the eastern and western shorelines are subject to the Slow Speed Zones established by the DCMPP. Maule Lake and the Ojus Canal are also subject to the Slow Speed Zone and the Oleta River is subject to an Idle Speed Zone.

The Snapper Creek, Tamiami, and Cutler Canals are subject to a Slow Speed Zone within their Currently Navigational sections. The Currently Navigational portions of the Coral Gables Waterway/Canal, Miami River, Little River and Snake Creek Canals are subject to Idle Speed Zone restrictions.

#### **Seagrass Locations**

Seagrass locations are considered areas where sensitive West Indian Manatee activities occur. Their location is documented in the DCMPP and depicted on **Maps 5-1** through **5-4**. Protected Grasses exist at Chicken Key, south of the Miami River and the Little River Canal, affecting north-south travel in Biscayne Bay between the Cutler and Snapper Creek Canals.

#### **Existing Dock Facilities**

The DCMPP and the designation of Biscayne Bay as an Aquatic Preserve limit the ability to construct new docks within some parts of the study area. Within the Biscayne Bay Aquatic Preserve, waterborne transit service offered by Miami-Dade County may have to rely on access provided by existing dock facilities. Limits on the construction of transient docks or commercial use docks are outlined in the Regulations section of this report; these limits are applicable to Biscayne Bay and the seven canals in the study with Currently Navigational sections.

Those areas suitable for new or expanded marine facilities to serve commuter transportation (limited use and commercial docs) are identified under the description of the local regulatory environment in this report. Other locations may be considered for the expansion of docks for this use subject to the criteria cited on page 115 of the Dade County Manatee Protection Plan and summarized in this report. The criteria exclude essential manatee habitat from

consideration for expanded facilities. Of the canals within the study area, only the Currently Navigable section of the Cutler Canal and the Miami River downstream of the NW 5th Street Bridge are not considered Essential Manatee Habitat and could be considered for expansion of docking facilities. Each of the remaining four canals are designated Essential Manatee Habitat within their Currently Navigable portions. The Miami River upstream of the NW 5th Street Bridge is also designated as Essential Manatee Habitat to approximately SR 112, a distance of approximately four and one-quarter miles from its confluence with Biscayne Bay

Docks constructed pursuant to permits that allow commercial or transient use can be used by the county for waterborne transit service subject to the negotiation of use agreements with the individual permit holder. Consistency with the conditions of the authorizing permit should be verified on a permit-by-permit basis. Use of existing facilities would require the acquisition of leases/agreements for use and an assessment for impacts to natural resources. The DCMPP and ACOE do not regulate the use of existing facilities for transient use; the transient use would be required to be consistent with the conditions under which the permit for the facility was issued. Permit limitations within the Aquatic Preserve may change in the future. An assessment of the potential for additional access locations should be performed prior to service planning for waterways transportation.

For this study, access to existing dock facilities (other than single-family and industrial purpose) are assumed to be available for public water transportation service.

#### **Currently Non-Navigable Waterways**

The network of canals that drain into Biscayne Bay was constructed in the early 1900's by the U.S. Army Corp of Engineers (ACOE) primarily for drainage to provide land for agriculture and other development. Canals are maintained (cleaned and dredged as required) by the Miami-Dade County Public Works Department (Secondary Canals) and the South Florida Water Management District (Primary Canals). All canals included in the evaluation of feasibility for waterways travel are Primary Canals maintained by the SFWMD except the Coral Gables Canal, which is maintained by the City of Coral Gables.

Maintenance operations are dependant upon water levels within each canal; the draft on the maintenance dredge employed by SFWMD is 3 feet and vertical clearance is as low 6 inches. Maintenance dredge operations are suspended as required when the water depth in a canal falls below the level required to perform maintenance operations or high water conditions reduce the vertical clearance below the required clearance.

Subsequent to the installation of the original control structures, barriers or dams were installed on the coastal canals to prevent salinity intrusion and excessive drainage. The original structures were replaced with remotely operated hydraulic gates operated and maintained by the SFWMD.

Operating constraints within the Currently Non-Navigable Waters consist of:

water depth	control	structure	locations

□ vertical clearance □ speed zones

#### **Water Depth and Vertical Clearance**

Water depth within the seven canals included in the study is a function of the elevation of the groundwater and flows into the canal. Flows into a canal consist of stormwater flows and controlled releases through the gates and control structures managed by the SFWMD. The SFWMD schedules upstream releases into Biscayne Bay daily. Water levels within the canals vary by season and storm event: prior to anticipated rainfall, the District will draw down the water depth so as to establish freeboard in anticipation of the storm event.

Water depth plays two roles in the determination of the feasibility of waterborne transportation on the Non-Navigational sections of the seven canals under study. Water depth must be great enough to permit the vessel to pass and must be low enough to maintain adequate vertical clearance for the vessel to pass beneath vertical obstructions.

No data is collected or maintained that monitors the water depth within the Non-Navigational Waterways included in the study except at the control structures, where record of the headwater and tailwater elevations are maintained by the SFWMD. Because the maintenance dredges operated by the SFWMD have a 3 foot draft, this study assumes that the minimum water depth in all of the Currently Non-Navigational sections of the canals under evaluation is 3 feet. This is the minimum required for Class I Service.

Vertical clearance is a function of the elevation of the water depth/elevation. In high water situations, such as when water flows are increased in the canals temporarily by the SFWMD to release water into Biscayne Bay in anticipation of a hurricane, adequate vertical clearance may be reduced below minimum requirements for waterborne transportation. Of the 7 Non-Navigational canals under evaluation, vertical clearance data is available only for the Coral Gables Waterway/Canal. The vertical clearance is seven feet or greater at mean low water on all sections of the Coral Gables Waterway/Canal within the study limits.

The elevation (NVGD) of the lowest member of the vertical obstructions within the remaining 7 Currently Non-Navigational canals is available from the permit records of the SFWMD, which is incomplete. The elevation of the lowest member of all vertical obstructions within the 7 canals is not available.

Contributing flows from stormwater or controlled releases cannot be determined from available data. Despite the gaps in data, the available lowest member elevation data can be compared to the U.S. Geological Service (USGS) Average Groundwater levels for Miami-Dade County to determine if any portion of the Currently Non-Navigable canals under evaluation cannot support waterborne transportation. This analysis does not include the effect of any contributing stormwater or controlled release flows into these canal. These additional flows would only increase the elevation of the water over that of the average groundwater elevation. If the vertical clearance is inadequate based on the average groundwater elevation, contributing flows would only further reduce the clearance.

**Table 2. Availability of Low Member Elevation Data** 

Canal	Name	Lowest Member Elevation Not Available
C-2	Snapper Creek Canal	15 Locations
C-4	Coral Gables Waterway/Canal	0 Locations
C-6	Tamiami Canal	10 Locations
C-7	Miami River/Canal	8 Locations
C-8	Little River Canal	11 Locations
C-9	Snake Creek	8 Locations
C-100	Cutler Canal	14 Locations

**Table 3** identifies sections of the seven Currently Non-Navigable Waterways under evaluation for waterborne transportation that have inadequate vertical clearance based on the Average Groundwater Elevation (USGS).

Table 3. Currently Non-Navigable Waterways, Inadequate Vertical Clearance

Canal	Name		earance from Average Clevation <sup>1</sup>	
C-2	Snapper Creek	S22 Control Structure	to	SW 107th Avenue/SR 985 Bridge
C-2	Canal	SW 40th St/Bird Road Bridge	to	Urban Growth Boundary
C-4	Tamiami Canal	Robert King Park Dr Pedestrian Bridge	to	Urban Growth Boundary
C-7	Little River Canal	S 27 Control Structure	to	Urban Growth Boundary
C-9	Snake Creek Canal	S 29 Control Structure	to	SB Turnpike Off-Ramp Bridges
C-100	Cutler Canal	S118 Control Structure	to	SB Heft/SR 821 Bridges

<sup>&</sup>lt;sup>1</sup> USGS Average Groundwater Map

Map Series 1 in Appendix A depicts the location of the each obstruction that creates insufficient vertical clearance to support commuter service. Low member data is not available for all vertical obstructions within the canals and additional limitations to commuter service may be identified once all low member data is available.

Even where low member data is available and has been compared to the average groundwater elevation, the assessment that the canal is suitable for waterborne commuter transportation service is preliminary. The effect of stormwater flows, controlled releases by the SFWMD and the influence of the tide will impact the assessment of suitability for commuter service. Prior to developing a waterborne transit service on any canal other than the Coral Gables Waterway/Canal that is Currently Non-Navigable, a hydrological study of the canals prioritized for service is required to confirm suitability for waterborne transportation purposes.

The sections of the Currently Non-Navigable Waterways identified in Table 3 are not suitable for commuter transportation service.

#### **Control Structures**

The discharge rate in each of the seven Currently Non-Navigable Waterways into Biscayne Bay is remotely controlled by hydraulic gates. Each control structure represents an obstruction to navigation. Salinity control structures are also located on each of the seven canals to limit salt water intrusion into the canals from Biscayne Bay. These structures are also obstructions to navigation. Within the segments of the Currently Non-Navigable Waterways with sufficient vertical clearance, control structures represent an obstruction between the Currently Navigable and Currently Non-Navigable sections of the canal.

Connection to Biscayne Bay is not obstructed from the Coral Gables Waterway/Canal or the Miami River/Canal. All other canals have control structures within close proximity to the Bay (the control structures define the boundary between the Currently Navigable and Currently Non-Navigable segments of the canals for the purpose of this study). If service is provided on the canal and connection to the Bay is desired, passengers would be required to disembark one vessel and board another, crossing a platform that spans the control structure. Lands adjacent to the control structures are owned and maintained by the SFWMD. Each structure is currently secured to prevent public access.

#### **No Entry/ Speed Zones**

The DCMPP imposes operating constraints on five of the canals that are classified as Currently Non-Navigable. Snapper Creek Canal and Miami River/Canal are not constrained by No Entry or Speed Zones within the sections of the canal that are Currently Non-Navigable.

Portions of the Currently Non-Navigable section of the Coral Gables Waterway is subject to No Entry Zones between November 15 and April 30. All of the waterway is subject to Idle Speed Zones. Those segments of the Coral Gables Waterway subject to the No Entry restrictions are not suitable for commuter travel.

The Tamiami Canal is subject to Slow Speed restrictions in the Non-Navigable section between Glide Angel Lake and the S25B Control Structure.

#### **Existing Dock Locations**

Segments of the Currently Non-Navigable Waterways have been determined to be suitable commuter transportation after an assessment of the vertical clearance and water depth. Service within these segments may be further limited by restrictions of the construction of new dock facilities established in the DCMPP.

The Miami Canal, upstream of the S26 Control Structure to SR 112 and the entire Coral Gables waterway is limited by the designation as an Essential Manatee Habitat (warm water refuge). These canals are not identified in the County's Marina Siting Criteria as suitable for the expansion of transient dock facilities and are designated as warm water refuges. The designation as a warm water refuge for the West Indian Manatee would preclude the construction of new docks within these limits.

The location of existing docks/marinas for which the permit was issued for other than single-family use represents a constraint to commuter service within Biscayne Bay and the Currently Navigable segments of the seven canals within the study. The location of these facilities are depicted on **Maps 5-1** through **5-4** and in **Map Series 2** found in **Appendix A** (canals). The list and map of facilities was developed from data available through the Florida Department of Environmental Protection (FDEP), the Miami-Dade County Department of Resources Management (DERM) and the Florida Marine Research Institute.

# **Feasible Waterways Network Currently Navigable Waterways**

Service within the Currently Navigable Waterways may be Class I, Class II or Class III. Landward constraints to the provision of facilities and parking has not been assessed.

Within the Currently Navigational Waterways, waterborne commuter transportation is generally feasible throughout Biscayne Bay, traveling north and south along the western and eastern banks of the Bay or traveling east and west to serve the two sides of the Bay. While most of the Bay is subject to limits associated with speed zones, seagrass beds, and the construction of new or the expansion of existing dock facilities, only the area northwest of Virginia Key and a section of the Little River Canal are subject to No Entry restrictions.

#### **Currently Non-Navigable Waterways**

Due to the limited availability and reliability of data, 3 assumptions are required to identify a Feasible Waterways Network within the Currently Non-Navigable Waterways:

- water depth is three feet or greater in all sections of the Currently Non-Navigable Waterways;
- vertical clearance determined using Average Groundwater Elevations from USGS sources is the best available data and is used to determine suitablility; and,
- □ the available lowest member data represents all vertical obstructions.

The limits to these assumptions are obvious; as additional data is developed, the segments of the Currently Non-Navigable Waterways that are determined under the assumptions to be suitable for waterborne commuter service may be eliminated from consideration. The assumptions do limit the scope of future studies to those waterways determined to be feasible under the assumptions.

Sections of the Currently Non-Navigable Waterways that are not suitable for commuter travel based on inadequate vertical clearance, the location of control structures, and No Entry Zones are listed in Table 3. The locations of these constraints are depicted in Map Series 1 in Appendix A.

**Map 6** depicts the opportunities within Biscayne Bay and the seven canals included in the study for waterborne commuter transportation requiring minimum vertical clearance and draft similar to the successful operations surveyed.

# UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 6. FEASIBLE WATERWAYS NETWORK **MIAMI-DADE COUNTY 2015 URBAN AREA** C e S335 a n G119 S120 G211 \$338 BISCAYNE S194 Jan 3, 2003 Legend Study Canal All Other Canals Metrorail Stations within 1/4 mile Navigable Waterways **SFWMD Structures** Navigable Culvert Spillway 1:155,000 State Named Local Roads Not Navigable Metrorail Stations ← Lock ← SPlock Railroads Unknown Plug Temp Pump Tri-Rail Station 2015 Urban Area Boundary Gannett Fleming MUNICIPALITY

#### **Connectivity**

#### **Access**

Successful waterborne commuter transit service must provide access to desired origins and destinations. Access can be on foot (pedestrian), by automobile or by land-based transit. Access to waterborne transit occurs at a stop location defined by a dock. Accessibility for pedestrians is defined by a walking distance of one-quarter mile, the distance identified in the 2000 Highway Capacity Manual as the walking distance a person will travel to transit. Pedestrian access can be limited by land ownership and physical barriers. Upon selection of preliminary stop locations, an assessment of the land ownership and physical barriers to an individual stop (dock) location will be required. If federal grant funds are used to support the service, compliance with ADA requirements for access will be necessary.

Accessibility to the stop for automobiles is available if the road network lies within the one-quarter mile walking distance for pedestrian access. Access to a particular stop location may require the construction of access drives and parking facilities. All segments of the Feasible Waterways Network lie within one-quarter mile of the roadway network. Accessibility becomes access for the pedestrian from the automobile.

Access to fixed route transit service can be accomplished through expansion of the existing bus routes if demand is demonstrated. With road access to all segments of the Feasible Waterways Network, access to bus transit is assumed. Access to Tri-Rail and/or MetroRail stations was evaluated. The following Tri-Rail and MetroRail stations lie within one-quarter mile of the Feasible Waterways Network:

- Dadeland North Metrorail Station
   Snapper Creek Canal
- University Metrorail Station@ Coral Gables Waterway/Canal
- Okeechobee Metrorail Station @ Miami Canal
- Miami Airport Tri-Rail Station@ Miami and Tamiami Canals

#### **Land Use**

A component of planning a successful waterborne transportation includes identification of residential densities and non-residential activity centers within one-quarter mile of the planned service. This information can guide the general location of stops by identifying where population and employment is great enough to support transit.

The lands adjacent to the Feasible Waterways Network are identified as Transit Supportive or Not Transit Supportive based on the residential and employment density of the adjacent Traffic Analysis Zone (TAZ). Transit Supportive is defined as a residential density of 3 units per gross acre or 4 employees per gross acre, based on the 1999 Base Year Socioeconomic Data developed by the Metropolitan Planning Organization for use in the 2025 Update to the Long Range Transportation Plan. The transit supportive status of lands adjacent to the Feasible Waterways Network is depicted on **Maps 7-1** through **7-4** for Biscayne Bay and on **Map Series 2** in **Appendix A** for the segments of the Cutler Canal, Coral Gables Waterway/Canal and Miami River/Canal included in the Feasible Waterways Network.

# UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 7 - 1. OPPORTUNITIES FOR WATERBORNE TRANSPORTATION **BISCAYNE BAY SHEET 1** FROM GOLDEN BEACH TO MIAMI BEACH BISCAYNE <mark>Park</mark> NE 103 ST MIAMI SHORES

MIAMI BEACH

Type of Facility

Multi-Family

Public / Parks Unknown

Other

Industrial / Commercial

Marinas / Docks / Yacht Clubs

Hotel

Employment within 1/4 Mile Smaller Employer

Metrorail Stations within 1/4 mile

Metrorail Stations

Tri-Rail Station

Employer of 100 or more

Legend

Study Canal

- Railroads

2015 Urban Area Boundary
MUNICIPALITY

State Named Local Roads



# UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 7 - 2. OPPORTUNITIES FOR WATERBORNE TRANSPORTATION **BISCAYNE BAY SHEET 2** FROM MIAMI BEACH TO MIAMI 魚 Jan 2, 2003 Legend Employment within 1/4 Mile Type of Facility Study Canal **Transit Supportive TAZs** Smaller Employer Hotel Not Transit Supportive Employer of 100 or more Industrial / Commercial State Named Local Roads **Employment Supportive Only** Metrorail Stations within 1/4 mile Household Supportive Only Marinas / Docks / Yacht Clubs Railroads Both Transit Supportive Multi-Family 2015 Urban Area Boundary Metrorail Stations Other MUNICIPALITY Gannett Fleming Tri-Rail Station Public / Parks Unknown

## UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 7 - 3. OPPORTUNITIES FOR WATERBORNE TRANSPORTATION **BISCAYNE BAY SHEET 3** FROM MIAMI TO CORAL GABLES an 2, 2003 Legend Employment within 1/4 Mile Type of Facility Study Canal Transit Supportive TAZs Smaller Employer Hotel Not Transit Supportive Employer of 100 or more Industrial / Commercial State Named Local Roads **Employment Supportive Only** Metrorail Stations within 1/4 mile 1:45,000 Household Supportive Only Marinas / Docks / Yacht Clubs Railroads Both Transit Supportive Multi-Family 2015 Urban Area Boundary Metrorail Stations Other MUNICIPALITY Gannett Fleming Tri-Rail Station Public / Parks Unknown

## UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 7 - 4. OPPORTUNITIES FOR WATERBORNE TRANSPORTATION **BISCAYNE BAY SHEET 4** FROM CORAL GABLES TO BLACK CREEK AREA SOUTH MIAMI PINECRE SW 112 ST SW 120 ST CHAPMAN FIELD DR SW 128 S SW 67 AVE CORAL REEF RD UNINCORPORATED EUREKA DR/SW 184 ST Jan 2, 2003 Legend Employment within 1/4 Mile Transit Supportive TAZs Type of Facility Study Canal Smaller Employer Hotel Not Transit Supportive Employer of 100 or more Industrial / Commercial State Named Local Roads **Employment Supportive Only** Metrorail Stations within 1/4 mile 1:45,000 Household Supportive Only Marinas / Docks / Yacht Clubs - Railroads Both Transit Supportive Multi-Family 2015 Urban Area Boundary Metrorail Stations Other MUNICIPALITY Gannett Fleming Public / Parks Tri-Rail Station Unknown

The Miami-Dade County Future Land Use Map depicts the location of Urban Centers at the Community, Metropolitan and Regional levels. Urban Centers located within one-quarter mile of the Feasible Waterways Network are also depicted in **Map Series 2.** 

Non-residential employment centers are defined as employers with 100 employees or greater or clusters of smaller employers. Employers included in the InfoUSA® database that lie within one-quarter mile of the Feasible Waterways Network are also depicted on **Maps 7-1** through **7-4** and in **Map Series 2.** 

#### **Characterization of Connectivity**

The connectivity of the Feasible Waterways Network can be characterized as very high, high, moderate or low based on the type and density of land use adjacent to the Network. Connectivity is the extent to which the Feasible Waterways Network provides connection between trip origins and destinations.

The density of development adjacent to a corridor is predictor of transit use. Defined in the 2000 Highway Capacity Manual as Transit Supportive, residential land use that is developed at a density of three (3) units per acre or greater and non-residential land use with four (4) employees per acre greater are indicators of transit use.

The Miami-Dade County Future Land Use Map designates Urban Centers that will act as hubs for future urban development, intensifying the existing pattern to a more compact and efficient structure. Three levels of Urban Center are designated: Regional, Metropolitan and Community. These areas are characterized by physical cohesiveness, direct access to mass transit and high quality urban design. The centers are designed to include business, employment, civic and/or high/moderate-density residential uses. Physical design and the location of the urban centers are intended to encourage convenient alternatives to travel by automobile and to create an identity and sense of place. The County has committed to give special emphasis to providing a high level of public mass transit service to all planned Urban Centers.

The location of individual larger employers and clusters of smaller employers within the one-quarter mile walking distance of a corridor/waterway is another indicator of latent demand for transit.

Segments of the Feasible Waterways Network characterized as Very Highly Connective have Transit Supportive Residential or Employment densities adjacent (within one-quarter mile) to the segment, lie within one-quarter mile of a designated Urban Center and, have one or more employers with 100 employees or greater within the one-quarter mile walking distance. Highly Connective segments have Transit Supportive densities within one quarter-mile of the segment and at least one employer with 100 or greater employees. Segments of the Feasible Waterways Network characterized as Moderately Connective have Transit Supportive densities adjacent to the segment and those characterized with Low Connectivity do not have Transit Supportive densities adjacent to the segment.

The following summary identifies the level of connectivity for the Feasible Waterways Network.

#### **Biscayne Bay**

*Area 1. Moderately Connective:* Biscayne Bay immediately south of the Cutler Canal is Moderately Connective, with Transit Supportive densities for employment and one employer with 100 employees or greater located within one-quarter mile of the canal and the Bay.

Between the Cutler Canal and the Coral Gables Canal, Transit Supportive land uses are not located within a mile of Biscayne Bay.

Area 2: Very Highly and Highly Connective: Biscayne Bay north of the Coral Gables Waterway, from Grand Avenue (extended) to the northern county line Very Highly or Highly Connective. Transit Supportive densities for both residential and employment are located within one-quarter mile of the shore of the Bay and for several miles inland. Small employers and those with 100 employee or greater are located along this area of Biscayne Bay. Urban Centers are designated by the County within one-quarter mile of the shore at Dinner Key, the Rickenbacker Causeway, south of Downtown, Downtown (Regional Urban Center) and south of the Snake Creek Canal.

#### **Cutler Canal (C-100)**

Segment 1. Highly Connective: From the Urban Growth Boundary (west) to SW 122nd Street, the Cutler Canal is Highly Connective, with Transit Supportive densities for both residential use and employment. Small employers are clustered in this segment and two employers with 100 employees or greater are located within one-quarter mile of the segment. This segment is approximately 1.25 miles in length, too short to meet a commuter trip purpose.

Segment 2. Highly Connective: From approximately SW 103rd Street to Richmond Drive, the Cutler Canal is Highly Connective with Transit Supportive densities for both residential use and employment. Small employers are clustered in this segment and five employers with 100 employees or greater are located within one-quarter mile of the segment. This segment is approximately 1.4 miles in length, too short to meet a commuter trip purpose.

#### **Coral Gables Canal (C-3)**

Segment 1. Highly Connective: From the Tamiami Canal to Red Road, the Coral Gables Waterway is Highly Connective with Transit Supportive densities for both residential use and employment. Small employers are clustered in this segment and four employers with 100 employees or greater are located within one-quarter mile of the segment. This segment is approximately 3 miles in length. Commuter trip purposes may be met within this segment based on the land use types and densities adjacent to the canal.

Segment 2. Moderately Connective: Ponce de Leon Boulevard is the location of a Metropolitan Urban Center and multiple small employers. Residential densities are Transit Supportive from South Le Jeune Road to Biscayne Bay. This segment is approximately 1.5

miles in length. Commuter trip purposes may be met if waterborne service within this segment is connected to service within Biscayne Bay or represents the initial segment of service within the Bay.

#### Miami River/Canal (C-6)

Segment 1. Very Highly and Highly Connective: The Miami River/Canal is Very Highly or Highly Connective between the Little River Canal (approximately NW 87th Avenue) and Biscayne Bay with Transit Supportive densities for both residential use and employment. Small employers are clustered along this entire segment and approximately 70 employers with 100 employees or greater are located within one-quarter mile of the segment. The County has designated the Okeechobee Metrorail Station as a Metropolitan Urban Center and the Miami Airport Tri-Rail Station as a Community Urban Center. Both are located within one-quarter mile of the corridor, southeast of Palm Avenue. This entire segment is approximately 11.3 miles in length.

Continuous waterborne service within this segment is not possible; the S26 Control Structure is located immediately south of the Hialeah Expressway and represents a barrier to navigation. This barrier is approximately 7 miles from the confluence of the Miami River with Biscayne Bay. Commuter trip purposes may be met in each of the approximately two segments of the Miami River/Canal, with service extended to include travel within Biscayne Bay from the southeast segment of the River.

#### Tamiami Canal (C- 4)

Segment 1. Highly Connective: From SW 87th Avenue to SW 72nd Avenue, the Tamiami Canal is Highly Connective with Transit Supportive densities for both residential use and employment. Small employers are clustered along this segment and two employers with 100 employees or greater are located within one-quarter mile of the segment. This segment is approximately 1 mile in length, too short to meet a commuter trip purpose.

Segment 2. Highly Connective: From the S 25B Control Structure (MIA) to the Miami River, the Tamiami Canal is Highly Connective with Transit Supportive densities for both residential use and employment. Small employers are clustered along this segment and nine employers with 100 employees or greater are located within one-quarter mile of the segment. This segment is approximately 1.25 miles in length. While this length is too short to meet a commuter trip purpose, commuter service could be extended along the Miami River, increasing the trip length to approximately 8.5 miles within the Tamiami Canal and Miami River, with further connection to service in Biscayne Bay.

#### **Snapper Creek Canal (C-2)**

Segment 1. Moderately Connective: From SW 56th Street at the HEFT to SW 107th Avenue the Snapper Creek Canal is Moderately Connective. Transit Supportive residential densities are located in this segment as well as clusters of small employers. One employer with 100 or greater employees is located within one-quarter mile of this segment. This segment is approximately 1.25 miles in length, too short to meet a commuter trip purpose.

#### **Snake Creek Canal (C-9)**

Segment 1. Moderately Connective: From NW 47th Avenue to NW 27th Avenue, the Snake Creek Canal is Moderately Connective. Transit Supportive residential densities are located in this segment as well as clusters of small employers. One employer with 100 or greater employees is located within one-quarter mile of this segment. This segment is approximately 2 miles in length, too short to meet a commuter trip purpose.

Segment 2. Highly Connective: From NW 27th Avenue to the Turnpike, the Snake Creek Canal is Highly Connective. Transit Supportive residential densities are located in this segment as well as clusters of small employers. Two employers with 100 or greater employees are located within one-quarter mile of this segment. This segment is approximately 0.7 miles in length, too short to meet a commuter trip purpose.

#### **Preliminary Service Routes and Termini**

The preliminary service routes and termini consider the physical and operating constraints within the waterways evaluated and the characteristics of the adjacent land use. Termini identified represent a general location. Specific docking locations cannot be recommended because landward constraints associated with access, ownership, and use (zoning and land use) have not been determined. Where constraints to the construction of docks for commuter transportation service is limited by the County's Marina Siting Plan or the designation of Biscayne Bay as an Aquatic Preserve, no assessment of the right to access an existing dock within the area of the terminus has been performed and no assessment of the terms that may be required by the permitee for access has been undertaken.

Each preliminary service route represents travel between a series of preliminary termini. Each terminus is located in an area with a mix of residential and non-residential land uses at transit supportive densities. This mix of uses makes each terminus a potential trip origin and destination.

Five preliminary routes have been identified for further analysis. Eleven preliminary termini are identified in Biscayne Bay, four within the Coral Gables Waterway/Canal and five within the Miami River. Travel on a short segment of the Tamiami Canal is included as a travel on the Coral Gables Waterway/Canal and the Miami River/Canal. One terminus on each the Coral Gables Waterway and the Miami River are located at the confluence of Biscayne Bay.

Preliminary service routes and termini are depicted on **Map 8**.

### UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 8. POTENTIAL ROUTES **BISCAYNE BAY AREA** FROM GOLDEN BEACH TO CORAL GABLES 5 · · · · · · B10 **B9 B8** a n **B7** В6 М6 **₿**В3 M5 C e М4 **B4** М3 a M2 n М1 **B2** S335 **B**5 MO G119 CG3 5336 CG2 В1 CG1 CG0 BISCAYNE BAY G211 5338 S123 S194 Jan 3, 2003 Legend 2015 Urban Area **Potential Routes Route Stops** Large Culvert 20x15 SFWMD Structures Culvert Spillway Bay Routes Stops in the Bay 1:155,000 All Other Culverts ← Lock ← SPlock Airport Major Roads Coral Gables Routes Stops for Coral Gables Plug Temp Pump Bridges Seaplane Base Miami River Routes Stops for Miami River Pump 💮 Weir Study Canals 🙇 Gannett Fleming Seaport All Other Canals

#### **Travel Time Analysis**

To be successful, waterborne commuter service in Miami-Dade County must compete effectively with other modes. Currently commuter trips within the county are made by single occupancy vehicle, high occupancy vehicle, and land-based transit. The travel time associated with each mode is a key component in the selection of a mode to meet the commute trip purpose. Mass transit, whether on land or water, must compete with the automobile as a mode of transportation. Congestion and to some extent, speed limits, affect the auto travel time for the commuter. On a waterway, speed limits play a large role in travel time. Slow Speed and Idle Speed zones are in effect in portions of Biscayne Bay and the adjacent canals significantly increasing the travel time on the waterways.

Auto travel time is calculated between the preliminary termini identified for waterborne transit service for single occupancy vehicles (SOV) and high occupancy vehicles (HOV). When travel times are rounded to the nearest minute, auto travel time between the termini are the same for both single occupancy vehicles and high occupancy vehicles. Land-based transit travel times are calculated for connection to transit by automobile or by walking. Travel between some preliminary termini is not available by land-based transit. Auto and transit travel times are calculated for peak and off-peak periods using the 1999 Base Year Network developed for the 2025 Update to the Miami-Dade County Long Range Transportation Plan.

For comparison to the travel time between the preliminary termini identified for waterborne commuter service, the Traffic Analysis Zone (TAZ) associated with the location of each preliminary terminus was identified. The Miami-Dade Transportation Model is used to calculate the auto and transit travel times between the TAZs in which the preliminary termini are located.

Travel time between the preliminary termini for travel by waterborne commuter service is calculated based on the speed of travel permitted times the distance between specific termini. An average travel speed is associated with each speed zone within the study area and each segment of the route is assigned the applicable speed. The average speed will vary by specific vessel design; the average travel speeds are for planning purposes only:

Zone	Average Travel Speed
30-35 MPH	30 miles per hour
Slow Speed	8 miles per hour
Idle Speed	2 miles per hour

Speed zones are implemented in Miami-Dade County primarily to protect the West Indian Manatee. Hovercraft is an alternative technology that would eliminate the constraints associated with the speed zones established in the DCMPP. Hovercraft USA currently provides tourism-based service in the St. Petersburg, Florida area. Average speeds of operation for a hovercraft can be in excess of 60 miles per hour and are usually limited by

safety issues related to maneuverability and the operations of other vessels. For this study, the average travel speed for the hovercraft alternative is assumed to be 30 miles per hour. For both the propeller-driven vessel (conventional) alternative and the hovercraft alternative, the calculated "in vehicle" time is increased to recognize the access time for waterborne service. Travel time for trips that begin and end in the Central Business District are increased by 10 minutes (5 minutes added to each trip end). Travel time for trips that begin or end in the CBD and have one trip end outside the CBD is increased by 8 minutes (5 minutes for the CBD end of the trip and 3 minutes for the other). Travel time for trips that begin and end outside the CBD are increased by 6 minutes. Travel time calculated for waterborne commuter service includes the dwell time at the stop when the total time to travel a route is represented. Dwell time at each preliminary terminus is assumed to be 2 minutes for conventional vehicles and 10 minutes for hover crafts, and is included in the calculation of time to travel a route.

An increase in the number of termini on a route will increase the travel time for waterborne transit by the dwell time at the stop and to recognize changes in the actual route between termini. Route changes may place a greater portion of the trip within a speed zone with a lower average speed. The travel times between the preliminary termini depicted in **Tables 4.2** through **4.7** represent the likely route, diverting from the shortest route when speed restrictions warrant a longer route to produce a shorter travel time. Waterborne travel is limited to travel paths that are defined by regulations to protect natural resources, property values, and commercial use of the waterway for commerce. Because speed zones are more restrictive close to shore, efficient travel may require a longer route to limit the portion of the trip within Slow Speed or Idle Speed zones.

The travel path assumed in the calculation of travel time for the conventional alternative and the hovercraft alternative are the same in this analysis. Travel times between the preliminary termini for waterborne transit is the same for peak and off-peak periods.

The decision to use transit of any type is based on many factors, including the travel time. The following comparison of travel times is intended to guide the identification of service routes for additional analysis. The location of the preliminary termini are depicted on Map 8 and listed in Table 4.1.

**Tables 4.2** through **4.4** compare the travel time between the preliminary termini for the auto, transit and conventional waterborne alternative in the peak and off-peak periods. In the peak period, travel by waterborne commuter service is accomplished in the same time or less time than auto between the following preliminary termini:

B5 to B2	C2 to C3
B3 to B6	M4 to M5

In the peak period, travel by waterborne commuter service is within 10 minutes of travel by auto (SOV or HOV) between the following preliminary termini:

> □ B2 to B3 □ M5 to M6

$\sim$	7 .	$\mathbf{n}$
•	7 to	$\nu$
•		11

Travel by waterborne commuter service	is comparable (wit	thin 1 minute) or fa	ster in the peak
period than transit with walk access betw	veen all preliminar	y termini except:	

□ C1 to C0 □ M2 to M3
□ M0 to M1 □ M5 to M6
□ M1 to M2

Travel by waterborne commuter service is comparable (within 1 minute) or faster in the peak period than transit with auto access between all preliminary termini except:

□ B1 to B2 □ M0 to M1 □ C1 to C0 □ M1 to M2

In the off-peak period, travel time for waterborne commuter service is slower than by auto between all but two pairs of preliminary termini: between B2 and B6 and between M4 and M5. Travel by water is approximately 1 minute faster between these termini. The difference in travel time is less than ten minutes in the off-peak period between an additional four pairs of preliminary termini.

In the off-peak period, travel time by water is within 2 minutes of travel by transit with walk access between all preliminary termini except:

□ B6 and B7 □ M0 and M1 □ C1 to C0 □ M1 to M2

In the off-peak period, travel by water is faster than travel by transit with auto access between all preliminary termini <u>except</u>:

□ B1 to B2 □ M0 to M1
□ B9 to B8 □ M1 to M2
□ C1 to C0

 Table 4.1. Waterways Feasibility Evaluation - Potential Termini

Route #	Termini	TAZ							
Biscayne Ba	Biscayne Bay								
B1	Coral Gables Urban Center	1073							
B2	Downtown Miami	560							
В3	Little River Urban Center	378							
B4	Alton Road and W 47th St (Miami Beach)	612							
В5	Alton Road and 1st Street (S. Miami Beach)	641							
В6	NE 135th St @ Biscayne Bay (end of road)	190							
В7	Bay Harbor Islands (95th St/Broad Causeway) at Biscayne Bay	599							
В8	Biscayne Blvd/US 1 @ East Greynolds Park (US 1 & 165th Terr)	98							
В9	Island Blvd @ Dumfoundling Bay	81							
B10	Maule Lake Urban Center (Point East Drive at north end Maule Lake)	94							
Coral Gables Canal									
C0	CG Canal @ Bay	1114							
C1	Ponce de Leon Blvd @ Granada Blvd	1083							
C2	Red Road @ Bird Road	1064							
С3	SW 82nd Ave @ SW 8th St (Tamiami Canal)	1013							
Miami Rive	r								
<b>M</b> 0	Mouth of River	569							
M1	NW 17th Ave @ NW 14th Street	746							
M2	Tamiami Canal	746							
М3	NW 37th Ave @ NW 33rd Street	690							
M4	SE Le Jeune Road	690							
M5	Red Road	660							
M6	NW 87th Ave	654							

Table 4.2. Waterways Feasibility Evaluation - Waterway Conventional Vessel vs. Auto Travel Times

				Ti	RAVEL TIME (N	In.)	COMPARISON (Water minus Auto)	
					uto	Water		
	TAZ		TAZ	Peak	Off -Peak	Peak/Off	Peak	Off-Peak
ROUTE	1 Biscay	yne Bay	y					
<b>B1</b>	1073	<b>B2</b>	560	21	13	38	17	25
<b>B2</b>	560	В3	378	19	15	30	11	15
В3	378	<b>B4</b>	612	17	15	35	18	20
<b>B4</b>	612	B5	641	10	7	29	19	22
B5	641	B2	560	18	12	18	0	6
STOP D	WELL TIMI	E: 4 @ 2 ]	MINUTES			8	8	8
TOTAL	TRAVEL T	IME		85	62	158		
COMPA	RISON OF	TOTAL 7	TRAVEL TIME		·		+73	+96
ROUTE	2 Biscay	yne Bay	у					
<b>B</b> 1	1073	B2	560	21	13	38	17	25
<b>B2</b>	560	В3	378	19	15	23	4	8
В3	378	<b>B6</b>	190	16	14	12	-4	-2
В6	190	B7	599	15	15	44	29	29
B7	599	В3	378	19	16	29	10	13
В3	378	B2	560	19	15	30	11	15
STOP DWELL TIME: 5 @ 2 MINUTES						10	10	10
TOTAL TRAVEL TIME				109	88	186		'
COMPA	RISON OF	TOTAL 7	TRAVEL TIME				+77	+98

**Table 4.2. Waterways Feasibility Evaluation - Waterway Conventional Vessel vs. Auto Travel Times** 

				TR	AVEL TIME (M	In.)	COMP	ARISON
				Au	ıto	Water	(Water m	inus Auto)
	TAZ		TAZ	Peak	Off -Peak	Peak/Off	Peak	Off-Peak
ROUTI	E 3 Bisca	yne Ba	ıy					
B8	98	В9	81	6	5	19	13	14
В9	81	B10	94	3	3	15	12	12
B10	94	В9	81	3	3	15	12	12
В9	81	<b>B8</b>	98	6	6	19	13	13
STOP D	WELL TIMI	E: 2 @ 2 ]	MINUTES			4	4	4
TOTAL	TRAVEL T	IME		18	17	72		
COMPA	RISON OF	TOTAL 7	TRAVEL TIME				+54	+55
ROUTI	E 4 Coral	Gables	Canal					
C1	1083	C0	1114	10	6	51	41	45
TOTAL	TRAVEL T	IME		10	6	51		
COMPA	RISON OF	TOTAL 7	TRAVEL TIME				+41	+45
ROUTE 4 Coral Gables Canal								
С3	1013	C2	1064	13	8	12	-1	4
TOTAL	TOTAL TRAVEL TIME			13	8	12		
COMPA	RISON OF	TOTAL 7	TRAVEL TIME				-1	+4

**Table 4.2. Waterways Feasibility Evaluation - Waterway Conventional Vessel vs. Auto Travel Times** 

			TRAVEL TIME (Min.)	Ain.)	COMP	ARISON		
				A	uto	Water	(Water minus Auto)	
	TAZ		TAZ	Peak	Off -Peak	Peak/Off	Peak	Off-Peak
ROUTE 5 Miami River								
M0	569	M1	746	18	13	78	60	65
M1	746	M2	744	2	2	44	42	42
M2	746	M3	690	16	8	42	26	34
STOP D	WELL TIM	E: 2 @ 2 ]	MINUTES			4	4	4
TOTAL	TRAVEL T	IME		36	23	168		
COMPA	RISON OF	TOTAL 7	TRAVEL TIME				+132	+145
ROUTI	E 5 Miam	i River						
M4	690	M5	660	19	12	11	-8	-1
M5	660	M6	654	9	9	13	4	4
STOP DWELL TIME: 1 @ 2 MINUTES					2	2	2	
TOTAL TRAVEL TIME			28	21	26			
COMPA	RISON OF	TOTAL 1	TRAVEL TIME				-2	+5

Table 4.3. Waterways Feasibility Evaluation - Waterway Conventional Vessel vs. Peak Transit Travel Times

				TR	AVEL TIME (I	Min.)	COMPARISON		
					it Peak	Water	(Water mi	ninus Transit)	
	TAZ		TAZ	Walk	Auto	Peak/Off	Walk	Auto	
ROUTE	1 Biscay	ne Bay	<i>,</i>						
<b>B</b> 1	1073	<b>B2</b>	560	37	30	38	1	8	
B2	560	В3	378	42	53	30	-12	-23	
В3	378	B4	612	36	N/A	35	-1	N/A	
B4	612	B5	641	31	N/A	29	-2	N/A	
В5	641	B2	560	45	N/A	18	-27	N/A	
STOP D'	WELL TIMI	E: 4@2	MINUTES			8	8	8	
TOTAL '	TRAVEL T	ME		191	N/A	158			
COMPA	RISON OF	TOTAL T	RAVEL TI	ME			-33	N/A	
ROUTE	2 Biscay	ne Bay	•						
<b>B1</b>	1073	<b>B2</b>	560	37	30	38	1	8	
B2	560	В3	378	42	53	23	-19	-30	
В3	378	<b>B6</b>	190	44	N/A	12	-32	N/A	
В6	190	B7	599	39	N/A	44	5	N/A	
В7	599	В3	378	39	N/A	29	-10	N/A	
В3	378	<b>B2</b>	560	43	N/A	30	-13	N/A	
STOP DWELL TIME: 5 @ 2 MINUTES			10		10	10	10		
TOTAL TRAVEL TIME				244	N/A	186		•	
COMPA	RISON OF	TOTAL T	RAVEL TI	ME			-58	N/A	

 Table 4.3. Waterways Feasibility Evaluation - Waterway Conventional Vessel vs. Peak Transit Travel Times

				TRAVEL TIME (M Transit Peak		lin.)	COMPARISON (Water minus Transit)	
						Water		
	TAZ		TAZ	Walk	Auto	Peak/Off	Walk	Auto
ROUTE 3 Biscayne Bay								
В8	98	В9	81	35	24	19	-16	-5
В9	81	B10	94	30	22	15	-15	-7
B10	94	В9	81	30	21	15	-15	-6
В9	81	<b>B8</b>	98	35	28	19	-16	-9
STOP DWELL TIME: 2 @ 2 MINUTES						4	4	4
TOTAL TRAVEL TIME				130	95	72		
COMPARISON OF TOTAL TRAVEL TI			ME			-58	-23	
ROUTE 4 Coral Gables Canal								
<b>C1</b>	1083	C0	1114	40	40	51	11	11
TOTAL TRAVEL TIME				40	40	51		
COMPARISON OF TOTAL TRAVEL TI				ME			+11	+11
ROUTE 4 Coral Gables Canal								
C3	1013	C2	1064	35	28	12	-23	-16
TOTAL TRAVEL TIME				35	28	12		
COMPARISON OF TOTAL TRAVEL TI				ME			-23	-16

Table 4.3. Waterways Feasibility Evaluation - Waterway Conventional Vessel vs. Peak Transit Travel Times

				TRAVEL TIME (Min.)			COMPARISON	
			TAZ	Transit Peak		Water	(Water minus Transit)	
	TAZ			Walk	Auto	Peak/Off	Walk	Auto
ROUTE	5 Miam	ni River						
<b>M</b> 0	569	M1	746	49	55	78	29	23
M1	746	M2	744	26	20	44	18	24
M2	746	M3	690	82	74	42	-40	-32
STOP D	WELL TIM	E: 2 @ 2 N	MINUTES		·	4	4	4
TOTAL TRAVEL TIME				157	149	168		
COMPARISON OF TOTAL TRAVEL TI				ME			+11	+19
ROUTE	5 Miam	ni River						
<b>M4</b>	690	M5	660	N/A	56	11	N/A	-45
M5	660	M6	654	N/A	N/A	13	N/A	N/A
STOP DWELL TIME: 1 @ 2 MINUTES						2	2	2
TOTAL	TOTAL TRAVEL TIME				N/A	26		
COMPARISON OF TOTAL TRAVEL TI				ME	·		N/A	N/A

<sup>\*</sup>N/A - land-based travel is not available.

Table 4.4. Waterways Feasibility Evaluation - Waterway Conventional Vessel vs. Off-Peak Transit Travel Times

				TRAVEL TIME (Min.)			COMPARISON	
				Transit Off-Peak		Water	(Water minus Transit)	
	TAZ		TAZ	Walk	Auto	Peak/Off	Walk	Auto
ROUTE 1 Biscayne Bay								
<b>B</b> 1	1073	<b>B2</b>	560	36	29	38	2	9
<b>B2</b>	560	В3	378	42	55	30	-12	-25
В3	378	B4	612	38	N/A	35	-3	N/A
B4	612	B5	641	28	N/A	29	1	N/A
В5	641	B2	560	35	N/A	18	-17	N/A
STOP DWELL TIME: 4 @ 2 MINUTES						8	8	8
TOTAL TRAVEL TIME				179	N/A	158		
COMPARISON OF TOTAL TRAVEL TI			МЕ			-21	N/A	
ROUTE	2 Biscay	ne Bay	•					
<b>B1</b>	1073	<b>B2</b>	560	36	29	38	2	9
<b>B2</b>	560	В3	378	42	55	23	-19	-32
В3	378	B6	190	44	N/A	12	-32	N/A
В6	190	B7	599	40	N/A	44	4	N/A
В7	599	В3	378	40	N/A	29	-11	N/A
В3	378	B2	560	40	N/A	30	-10	N/A
STOP DWELL TIME: 5 @ 2 MINUTES					10	10	10	
TOTAL TRAVEL TIME				242	N/A	186		•
COMPARISON OF TOTAL TRAVEL TI				МЕ			-56	N/A

Table 4.4. Waterways Feasibility Evaluation - Waterway Conventional Vessel vs. Off-Peak Transit Travel Times

				TRAVEL TIME (Mi		Min.)	COMPARISON (Water minus Transit)	
				Transit Off-Peak		Water		
	TAZ		TAZ	Walk	Auto	Peak/Off	Walk	Auto
ROUTE 3 Biscayne Bay								
B8	98	В9	81	24	23	19	-5	-4
В9	81	B10	94	30	21	15	-15	-6
B10	94	В9	81	30	21	15	-15	-6
В9	81	B8	98	24	15	19	-5	4
STOP DWELL TIME: 2 @ 2 MINUTES						4	4	4
TOTAL TRAVEL TIME				108	80	72		
COMPARISON OF TOTAL TRAVEL TI			RAVEL TI	ME			-36	-8
ROUTE	4 Coral	Gables	Canal					
C1	1083	C0	1114	33	35	51	18	16
TOTAL TRAVEL TIME				33	35	51		
COMPARISON OF TOTAL TRAVEL TI				ME			+18	+11
ROUTE	4 Coral	Gables	Canal					
С3	1013	C2	1064	28	24	12	-16	-12
TOTAL TRAVEL TIME				28	24	12		
COMPARISON OF TOTAL TRAVEL TI			ME			-16	-12	

 Table 4.4. Waterways Feasibility Evaluation - Waterway Conventional Vessel vs. Off-Peak Transit Travel Times

				TR	AVEL TIME (I	Min.)	COMPA	ARISON
				Transit	Off-Peak	Water	(Water minus Transit)	
	TAZ		TAZ	Walk	Auto	Peak/Off	Walk	Auto
ROUTE	5 Miam	i River						
<b>M</b> 0	569	M1	746	45	50	78	33	28
M1	746	M2	744	26	20	44	18	24
M2	746	М3	690	52	57	42	-10	-15
STOP D	WELL TIMI	E: 2 @ 2 N	MINUTES		<u> </u>	4	4	4
TOTAL	TRAVEL T	IME		123	127	168		
COMPA	RISON OF	TOTAL T	RAVEL TI	ME			+45	+41
ROUTE	5 Miam	i River						
<b>M4</b>	690	M5	660	N/A	49	11	N/A	-38
M5	660	M6	654	N/A	N/A	13	N/A	N/A
STOP D	WELL TIMI	E: 1 @ 2 N	MINUTES			2	2	2
TOTAL	TRAVEL T	IME		N/A	N/A	26		
COMPARISON OF TOTAL TRAVEL TI				ME			N/A	N/A

<sup>\*</sup>N/A - land-based travel is not available.

**Tables 4.5** through **4.7** compare the travel time between the preliminary termini for the auto, transit and hovercraft waterborne alternative in the peak and off-peak periods. In the peak period, travel by the hovercraft alternative of waterborne commuter service is accomplished in the same time or less time than auto between all but six pairs of preliminary termini:

B4 to B5	B9 to B10
B6 to B7	M1 to M2
B8 to B9	M5 to M6

Travel by the hovercraft alternative is faster than by land-based transit (walk or auto access) to all preliminary termini in the peak and off-peak periods.

In the off-peak period, travel time for waterborne commuter service is approximately 5 minutes slower than by auto between all preliminary termini except M1 and M2. Travel between M1 and M2 in the off-peak period is approximately 10 minutes slower by the hovercraft alternative than by auto.

In the off-peak period, travel time using the hovercraft alternative is significantly faster between all preliminary termini than by land-based transit.

 Table 4.5. Waterways Feasibility Evaluation - Waterway Hovercraft vs. Auto Travel Times

				TI	RAVEL TIME (N	Iin.)	COMPARISON	
					uto	Water	(Water n	ninus Auto)
	TAZ		TAZ	Peak	Off -Peak	Peak/Off	Peak	Off-Peak
ROUTE	1 Biscay	yne Ba	y					
<b>B1</b>	1073	B2	560	21	13	18	-3	5
<b>B2</b>	560	В3	378	19	15	18	-1	3
В3	378	<b>B4</b>	612	17	15	14	-3	-1
<b>B4</b>	612	В5	641	10	7	12	2	5
B5	641	B2	560	18	12	16	-2	4
STOP D	WELL TIMI	E: 4 @ 10	MINUTES			40	40	40
TOTAL	TRAVEL T	IME		85	62	118		
COMPA	RISON OF	TOTAL 7	TRAVEL TIME		·		+33	+56
ROUTE	2 Biscay	yne Ba	у					
B1	1073	<b>B2</b>	560	21	13	18	-3	5
<b>B2</b>	560	В3	378	19	15	16	-3	1
В3	378	В6	190	16	14	8	-8	-6
В6	190	В7	599	15	15	18	3	3
B7	599	В3	378	19	16	12	-7	-4
В3	<b>B3</b> 378 <b>B2</b> 560				15	18	-1	3
STOP DWELL TIME: 5 @ 10 MINUTES				-	50	50	50	
TOTAL TRAVEL TIME				109	88	140		•
COMPA	RISON OF	TOTAL 7	TRAVEL TIME		<u> </u>		+31	+52

 Table 4.5. Waterways Feasibility Evaluation - Waterway Hovercraft vs. Auto Travel Times

				TR	AVEL TIME (N	Iin.)	COMP	ARISON
				Au	ıto	Water	(Water n	ninus Auto)
	TAZ		TAZ	Peak	Off -Peak	Peak/Off	Peak	Off-Peak
ROUTE	3 Bisca	yne Ba	У					
B8	98	В9	81	6	5	10	4	5
В9	81	B10	94	3	3	8	5	5
B10	94	В9	81	3	3	8	5	5
В9	81	<b>B8</b>	98	6	6	10	4	4
STOP D	WELL TIMI	E: 2 @ 2 ]	MINUTES			20	20	20
TOTAL	TRAVEL T	IME		18	17	56		
COMPA	RISON OF	TOTAL 7	RAVEL TIME				+38	+39
ROUTE	4 Coral	Gables	Canal					
C1	1083	C0	1114	10	6	9	-1	3
TOTAL	TRAVEL T	IME		10	6	9		
COMPA	RISON OF	TOTAL 7	RAVEL TIME				-1	+3
ROUTE 4 Coral Gables Canal								
С3	1013	C2	1064	13	8	6	-7	-2
TOTAL	TRAVEL T	IME		13	8	6		
COMPA	RISON OF	TOTAL 7	TRAVEL TIME		-	-	-7	-2

 Table 4.5. Waterways Feasibility Evaluation - Waterway Hovercraft vs. Auto Travel Times

				Tl	RAVEL TIME (M	Iin.)	COMPARISON		
				A	Auto		(Water m	inus Auto)	
	TAZ		TAZ	Peak	Off -Peak	Peak/Off	Peak	Off-Peak	
ROUTE	5 Miam	i River							
<b>M</b> 0	569	M1	746	18	13	15	-3	2	
M1	746	M2	744	2	2	12	10	10	
M2	746	M3	690	16	8	8	-8	0	
STOP D	STOP DWELL TIME: 2 @ 10 MINUTES					20	20	20	
TOTAL	TRAVEL T	IME		36	23	55			
COMPA	RISON OF	TOTAL T	RAVEL TIME				+19	+32	
ROUTE	5 Miam	i River							
<b>M4</b>	690	M5	660	19	12	11	-8	-1	
M5	660	M6	654	9	9	13	4	4	
STOP D	WELL TIMI	E: 1 @ 10	MINUTES			10	10	10	
TOTAL TRAVEL TIME				28	21	34			
COMPARISON OF TOTAL TRAVEL TIME							+6	+13	

Table 4.6. Waterways Feasibility Evaluation - Waterway Hovercraft vs. Peak Transit Travel Times

				TR	AVEL TIME (N	Min.)	COMP	ARISON
					sit Peak	Water	(Water mi	nus Transit)
	TAZ		TAZ	Walk	Auto	Peak/Off	Walk	Auto
ROUTE	1 Biscay	ne Bay	/					
B1	1073	<b>B2</b>	560	37	30	18	-19	-12
B2	560	В3	378	42	53	18	-24	-35
В3	378	<b>B4</b>	612	36	N/A	14	-22	N/A
B4	612	B5	641	31	N/A	12	-19	N/A
В5	641	B2	560	45	N/A	16	-29	N/A
STOP D	WELL TIME	E: 4 @ 10	) MINUTES			40	40	40
TOTAL '	TRAVEL TI	ME		191	N/A	118		
COMPA	RISON OF	TOTAL T	RAVEL TIN	ME			-73	N/A
ROUTE	2 Biscay	ne Bay	/					
B1	1073	B2	560	37	30	18	-19	-12
B2	560	В3	378	42	53	16	-26	-37
В3	378	<b>B6</b>	190	44	N/A	8	-36	N/A
В6	190	B7	599	39	N/A	18	-21	N/A
B7	599	В3	378	39	N/A	12	-27	N/A
<b>B3</b> 378 <b>B2</b> 560			560	43	N/A	18	-25	N/A
STOP D	STOP DWELL TIME: 5 @ 10 MINUTES			'		50	50	50
TOTAL '	TRAVEL TI	ME		244	N/A	140		
COMPA	RISON OF	TOTAL T	RAVEL TIN	МE		·	-104	N/A

Table 4.6. Waterways Feasibility Evaluation - Waterway Hovercraft vs. Peak Transit Travel Times

				TR	AVEL TIME (	Min.)	COMP	ARISON
				Trans	sit Peak	Water	(Water mi	nus Transit)
	TAZ		TAZ	Walk	Auto	Peak/Off	Walk	Auto
ROUTE	3 Bisca	yne Ba	У					
B8	98	В9	81	35	24	10	-25	-14
В9	81	B10	94	30	22	8	-22	-14
B10	94	В9	81	30	21	8	-22	-13
В9	81	B8	98	35	28	10	-25	-18
STOP D'	WELL TIME	E: 2 @ 10	MINUTES			20	20	20
TOTAL '	TRAVEL TI	ME		130	95	56		
COMPA	RISON OF	TOTAL T	RAVEL TII	ME			-74	-39
ROUTE	4 Coral	Gables	Canal					
C1	1083	C0	1114	40	40	9	-31	-31
TOTAL '	TRAVEL TI	ME		40	40	9		
COMPA	RISON OF	TOTAL T	RAVEL TII	ME			-31	-31
ROUTE	4 Coral	Gables	Canal					
С3	1013	C2	1064	35	28	6	-29	-22
TOTAL '	TRAVEL TI	ME		35	28	6		
COMPA	RISON OF	TOTAL T	RAVEL TI	ME		-	-29	-22

Table 4.6. Waterways Feasibility Evaluation - Waterway Hovercraft vs. Peak Transit Travel Times

				TR	RAVEL TIME (	Min.)	COMPA	ARISON
				Trans	sit Peak	Water	(Water min	nus Transit)
	TAZ		TAZ	Walk	Auto	Peak/Off	Walk	Auto
ROUTE	5 Miam	ni River						
<b>M</b> 0	569	M1	746	49	55	15	-34	-40
M1	746	M2	744	26	20	12	-14	-8
M2	746	М3	690	82	74	8	-74	-66
STOP D	WELL TIM	E: 2 @ 10	MINUTES			20	20	20
TOTAL	TRAVEL T	IME		157	149	55		
COMPA	RISON OF	TOTAL T	RAVEL TI	ME			-102	-94
ROUTE	5 Miam	ni River						
<b>M4</b>	690	M5	660	N/A	56	11	N/A	-45
M5	660	M6	654	N/A	N/A	13	N/A	N/A
STOP D	WELL TIM	E: 1 @ 10	MINUTES			10	10	10
TOTAL	TRAVEL T	IME		N/A	N/A	34		
COMPA	RISON OF	TOTAL T	RAVEL TI	МЕ	-		N/A	N/A

<sup>\*</sup>N/A - land-based travel is not available.

Table 4.7. Waterways Feasibility Evaluation - Waterway Hovercraft vs. Off-Peak Transit Travel Times

				TR	AVEL TIME (I	Min.)	COMP	ARISON
					Off-Peak	Water	(Water mi	nus Transit)
	TAZ		TAZ	Walk	Auto	Peak/Off	Walk	Auto
ROUTE	1 Biscay	ne Bay	,					
<b>B</b> 1	1073	<b>B2</b>	560	36	29	18	-18	-11
<b>B2</b>	560	В3	378	42	55	18	-24	-37
В3	378	B4	612	38	N/A	14	-24	N/A
B4	612	B5	641	28	N/A	12	-16	N/A
В5	641	B2	560	35	N/A	16	-19	N/A
STOP D'	WELL TIMI	E: 4 @ 10	MINUTES			40	40	40
TOTAL '	TRAVEL T	ME		179	N/A	118		
COMPA	RISON OF	TOTAL T	RAVEL TIN	ИE			-61	N/A
ROUTE	2 Biscay	ne Bay	1					
<b>B1</b>	1073	<b>B2</b>	560	36	29	18	-18	-11
B2	560	В3	378	42	55	16	-26	-39
В3	378	В6	190	44	N/A	8	-36	N/A
В6	190	<b>B</b> 7	599	40	N/A	18	-22	N/A
В7	599	В3	378	40	N/A	12	-28	N/A
В3	<b>B3</b> 378 <b>B2</b> 560			40	N/A	18	-22	N/A
STOP DWELL TIME: 5 @ 10 MINUTES			MINUTES			50	50	50
TOTAL '	TRAVEL T	ME		242	N/A	140		
COMPA	RISON OF	TOTAL T	RAVEL TIN	ИE			-102	N/A

Table 4.7. Waterways Feasibility Evaluation - Waterway Hovercraft vs. Off-Peak Transit Travel Times

				TR	AVEL TIME (I	Min.)	COMP	ARISON
				Transit	Off-Peak	Water	(Water mi	nus Transit)
	TAZ		TAZ	Walk	Auto	Peak/Off	Walk	Auto
ROUTE	3 Bisca	yne Ba	У					
B8	98	В9	81	24	23	10	-14	-13
В9	81	B10	94	30	21	8	-22	-13
B10	94	В9	81	30	21	8	-22	-13
В9	81	B8	98	24	15	10	-14	-5
STOP D'	WELL TIME	E: 2 @ 10	MINUTES			20	20	20
TOTAL '	TRAVEL TI	ME		108	80	56		
COMPA	RISON OF	TOTAL T	RAVEL TI	ME			-52	-24
ROUTE	4 Coral	Gables	Canal					
C1	1083	CO	1114	33	35	9	-24	-26
TOTAL '	TRAVEL TI	ME		33	35	9		
COMPA	RISON OF	TOTAL T	RAVEL TI	ME			-24	-26
ROUTE	4 Coral	Gables	Canal					
C3	1013	C2	1064	28	24	6	-22	-18
TOTAL '	TRAVEL TI	ME		28	24	6		
COMPA	RISON OF	TOTAL T	RAVEL TI	МE	<u> </u>		-22	-18

 Table 4.7. Waterways Feasibility Evaluation - Waterway Hovercraft vs. Off-Peak Transit Travel Times

				TR	AVEL TIME (I	Min.)	COMPA	ARISON
				Transit Off-Peak		Water	(Water minus Transit)	
	TAZ		TAZ	Walk	Auto	Peak/Off	Walk	Auto
ROUTE	5 Miam	i River						
<b>M</b> 0	569	M1	746	45	50	15	-30	-35
M1	746	M2	744	26	20	12	-14	-8
M2	746	M3	690	52	57	8	-44	-49
STOP D	WELL TIMI	E: 2 @ 10	MINUTES		<u> </u>	20	20	20
TOTAL	TRAVEL T	ME		123	127	55		
COMPA	RISON OF	TOTAL T	RAVEL TI	ME	<u> </u>	·	-68	-72
ROUTE	5 Miam	i River						
<b>M4</b>	690	M5	660	N/A	49	11	N/A	-38
M5	660	M6	654	N/A	N/A	13	N/A	N/A
STOP D	WELL TIMI	E: 1 @ 10	MINUTES		<u> </u>	10	10	10
TOTAL	TRAVEL T	IME		N/A	N/A	34		•
COMPARISON OF TOTAL TRAVEL TIN				ME			N/A	N/A

<sup>\*</sup>N/A - land-based travel is not available.

## **Summary of Travel Time Comparison for the Peak Hour**

### **Conventional Waterborne Alternative vs. Auto**

In the peak period, travel between only one pair of preliminary termini on Biscayne Bay is faster by waterborne commuter travel than by auto. Travel by waterborne commuter service exceeds the auto travel time between each pair of preliminary termini by an average of 11 minutes. In the off-peak period, this average increases to 14 minutes.

Because of the Idle Speed Zones within the Coral Gables Waterway and Miami River, travel time for waterborne travel using conventional vessels is not comparable to travel by auto between Ponce de Leon Boulevard and Biscayne Bay on the Coral Gables Waterway and between the Tamiami Canal and Biscayne Bay on the Miami River.

Between Le Jeune Road and NW 87th Avenue, travel by waterborne commuter service is comparable to travel by auto in both the peak and off-peak periods.

#### Conventional Waterborne Alternative vs. Land-based Transit

Waterborne commuter travel on Biscayne Bay on Preliminary Service Routes 1, 2 or 3 is comparable to travel by land-based transit in the peak and off-peak periods between all termini.

Because of the Idle Speed Zones within the Coral Gables Waterway and Miami River, travel time for waterborne travel using conventional vessels is not comparable to land-based transit between Ponce de Leon Boulevard and Biscayne Bay on the Coral Gables Waterway and between the Tamiami Canal and Biscayne Bay on the Miami River.

Travel by waterborne commuter service is faster than travel by land-based transit on the Miami River/Canal between the Tamiami Canal and NW 37th Ave and between Le Jeune Road and Red Road. Travel on the western limits of the Coral Gables Canal is faster than by land based-transit.

#### **Hovercraft Alternative vs. Auto**

The hovercraft alternative eliminates the constraint of speed imposed by the Speed Zones in the DCMPP. The peak hour travel times for the hovercraft alternative are faster between all preliminary termini than land-based transit and within 5 minutes of most auto travel times.

# **Priority Waterways Commuter Service Opportunities**

This study evaluates the physical and operating constraints to the provision of urban commuting transportation n the waterways in Miami-Dade County. The availability of data required to fully identify the constraints within the Currently Non-Navigable portions of the waterways included in the study is limited. Notably, low member data associated with the vertical obstructions within each waterway is incomplete and water depth/elevation data is available only from planning-level sources. While recognizing the limited availability of engineering -level data, this study identifies a feasible waterways network on which commuter service by vessels similar in specification to those providing service to successful operations in the United States could operate.

The vessel type for service within the Currently Navigable Waterways including Biscayne Bay may be Class I Service (passenger vessel with a capacity of less than 100), Class II Service (passenger vessels with a capacity of greater than 100) or Class III (vessels serving passengers and vessels).

The recommended vessel type for service solely within the Non-Navigable Waterways is Class I or II.

Travel time comparisons between waterborne service by conventional vessel and the auto and transit modes indicate that conventional vessels are competitive in Biscayne Bay and the western portions of the Coral Gables Canal and Miami Canal, but are not competitive in the Coral Gables Waterway east of Ponce de Leon Boulevard or in the Miami River east of the Miami International Airport (Tamiami Canal). Waterborne commuter travel is not obstructed by control structures between Biscayne Bay and the Coral Gables Waterway or Miami River; if routes are selected that provide for travel on these two waterways into Biscayne Bay, hovercraft are recommended to facilitate competitive travel times within the eastern portions of these two waterways. Commuter routes that do not provide service in the Miami River east of the Tamiami Canal or in the Coral Gables Waterway east of Ponce de Leon Boulevard exhibits competitive travel times using conventional vessels. Hovercraft as a technology exhibits better travel times than conventional vessels between most preliminary termini.

Potential Routes for commuter service are identified, recognizing the adjacent land use and intensity, connections to existing Urban Centers designated by the County in its comprehensive plan and the number of employers located adjacent to the Feasible Waterways Network. Preliminary stops along each route have been identified for the purpose of comparing travel time by mode in the peak and off-peak periods. Waterborne commuter service is recommended to be limited stop or express service, consistent with the service plans of successful operations surveyed for this study. Opportunities for multiple stop service to serve trip purposes other than the commuter trip (home -based work) are available on the Feasible Waterways Network but have not been evaluated in this study.

Additional service planning should be undertaken for all Potential Routes depicted on **Map 8**. In addition to transit service planning to evaluate demand and establish routes and

schedules, the development and collection of additional data will be required. This additional effort includes development of the engineering data required to assess the physical constraints to commuter service on the Currently Non-Navigable Waterways and an analysis of the land-based constraints associated with a preliminary stop location.

The "next step" planning efforts should include:

At the policy level the County should identify the proposed organizational structure for operation of a waterborne transit system. The organizational structure of all successful operations included a public operator. The County should identify the public agency that would serve as the public operator if service were to be initiated and include the selected agency in further planning and technical efforts.

Data deficiencies required that the identification of the Feasible Waterways Network be based on some assumptions related to vertical clearance and water depth within the Currently Non-Navigable Waterways. Efforts should be initiated to develop the necessary data to confirm the Feasible Waterways Network:

- 1. Coordination with the South Florida Water Management District to initiate hydrological modeling of the Currently Non-Navigable Waterways that are included in the Feasible Waterways Network to establish mean high water elevations.
- 2. Survey of the Currently Non-Navigable Waterways to confirm low member elevations obtained from the records of the South Florida Water Management District and to document the bottom elevation.

Transit service planning should be undertaken to estimate demand, establish preliminary headways and estimate ridership on the Potential Routes. The location of the preliminary termini should be adjusted to match demand.

In areas where the construction of new docking facilities are limited by regulation, coordination with the regulatory agencies should be initiated to determine the opportunities for access to existing facilities and the conditions associated with the permitting of new facilities. If new facilities cannot be constructed, access will be limited to existing facilities authorized by permits that would allow access by transient vessels. The County should identify those existing facilities authorized for said access and contact the permitees to initiate discussion of access.

Unlike transit within the roadway where stops may be located within public right-of-way, stops that serve the waterways' service will be likely be located on private property. Within the vicinity of the preliminary termini, the County should evaluate the landward constraints to access including parking, security. ADA compliance and pedestrian access to proposed stop locations.

Coordination with the regulatory agencies should be initiated if the construction of new docking facilities is identified as necessary to meet service goals.

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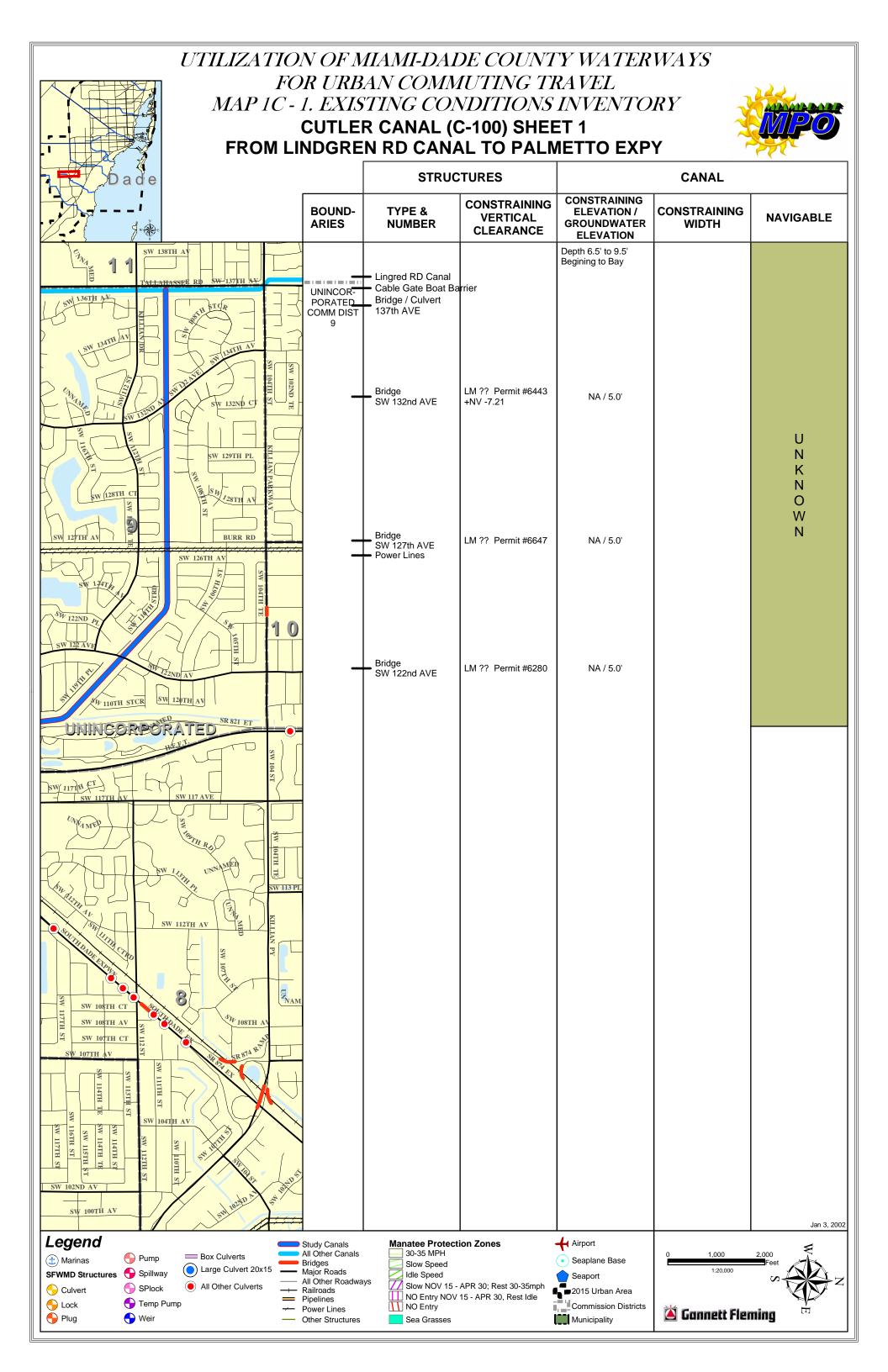
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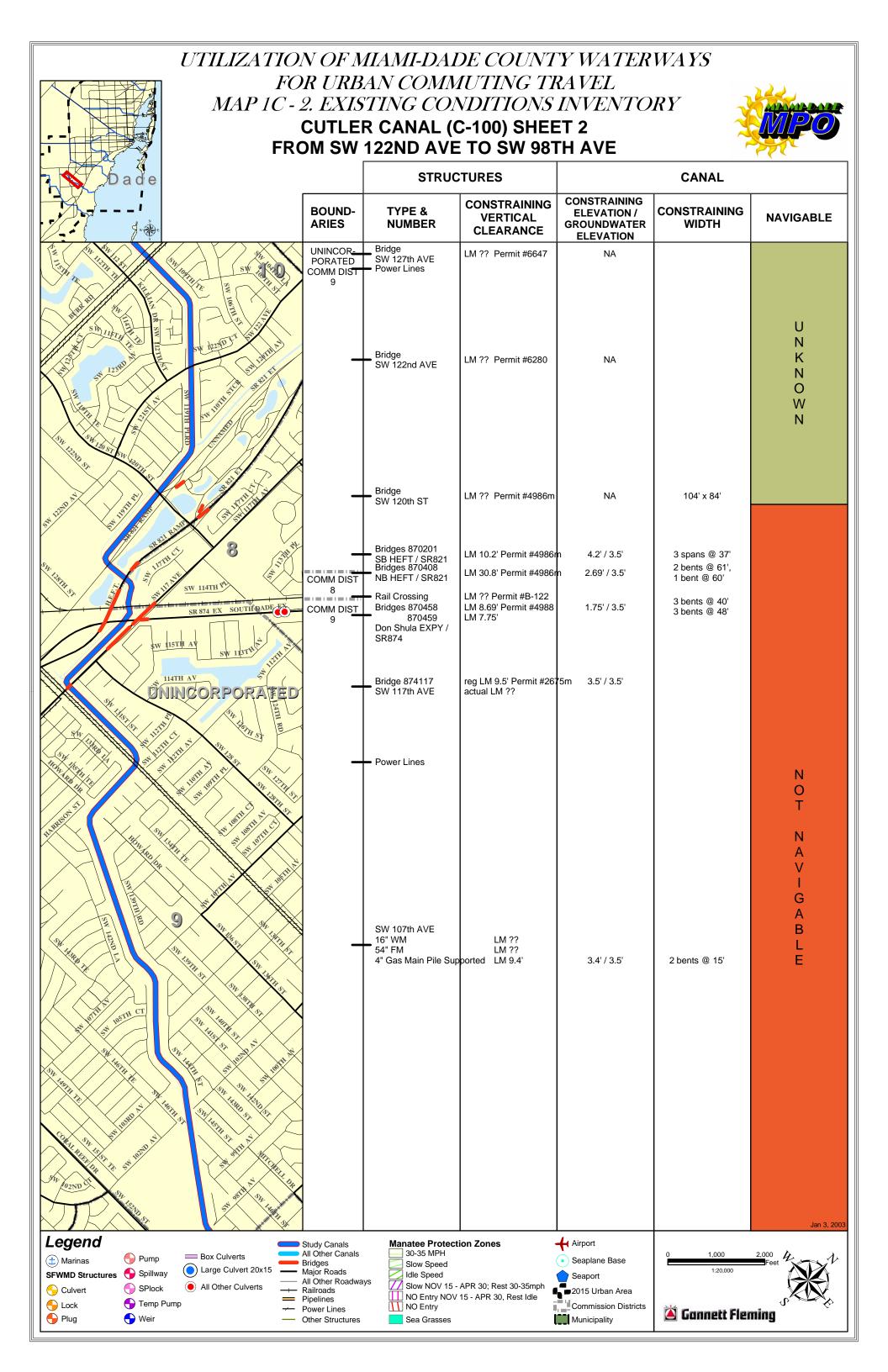
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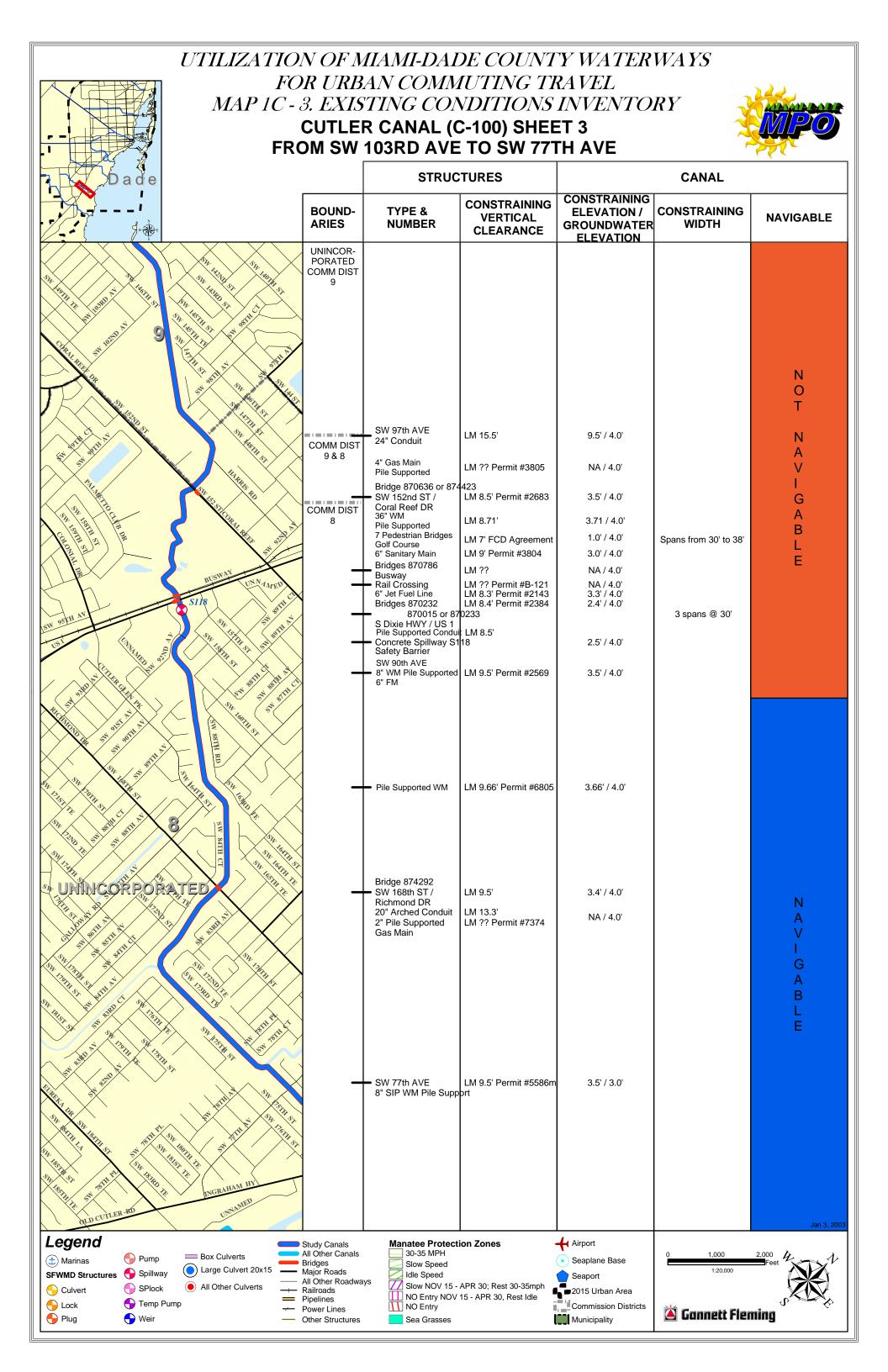
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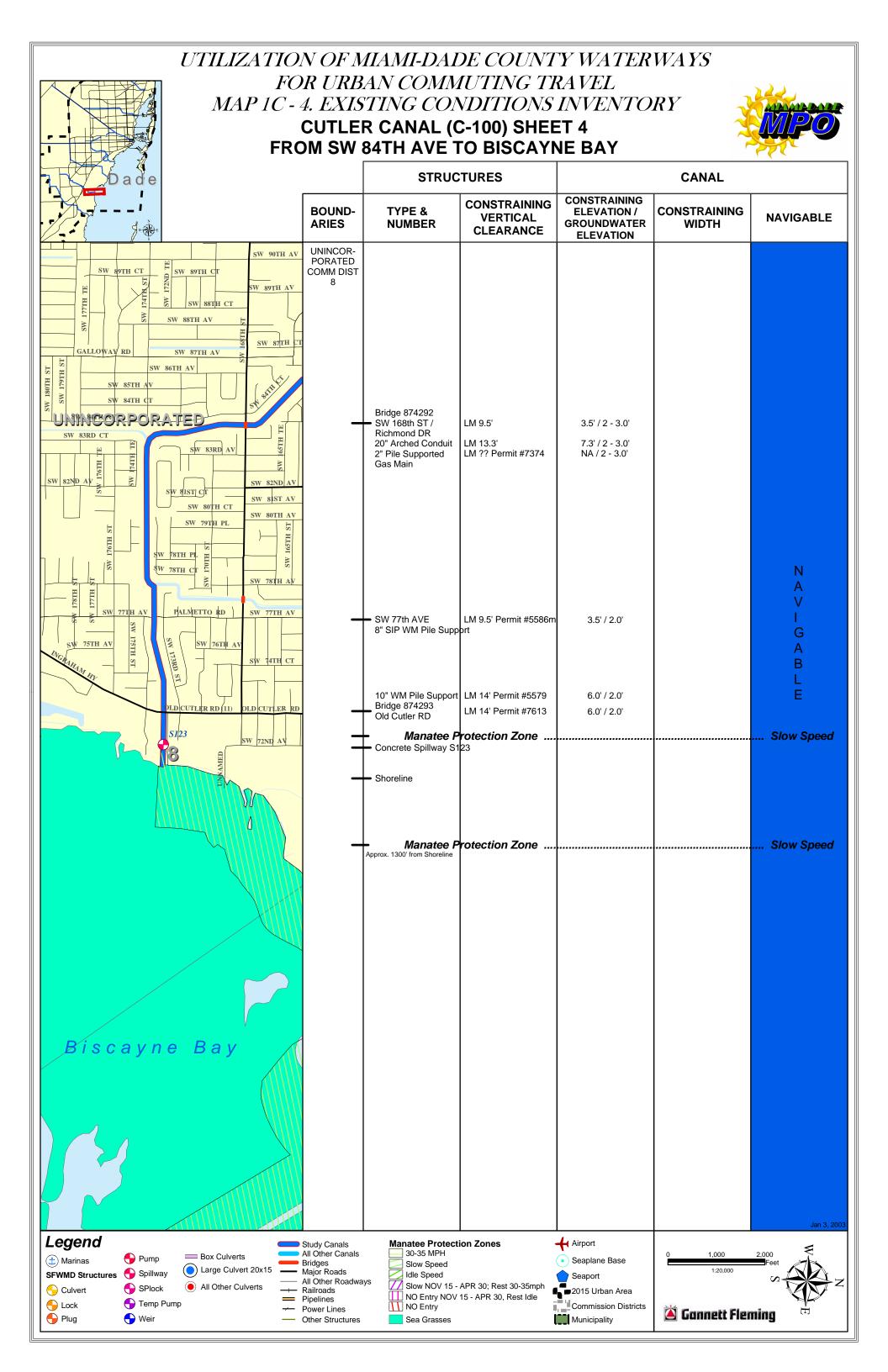
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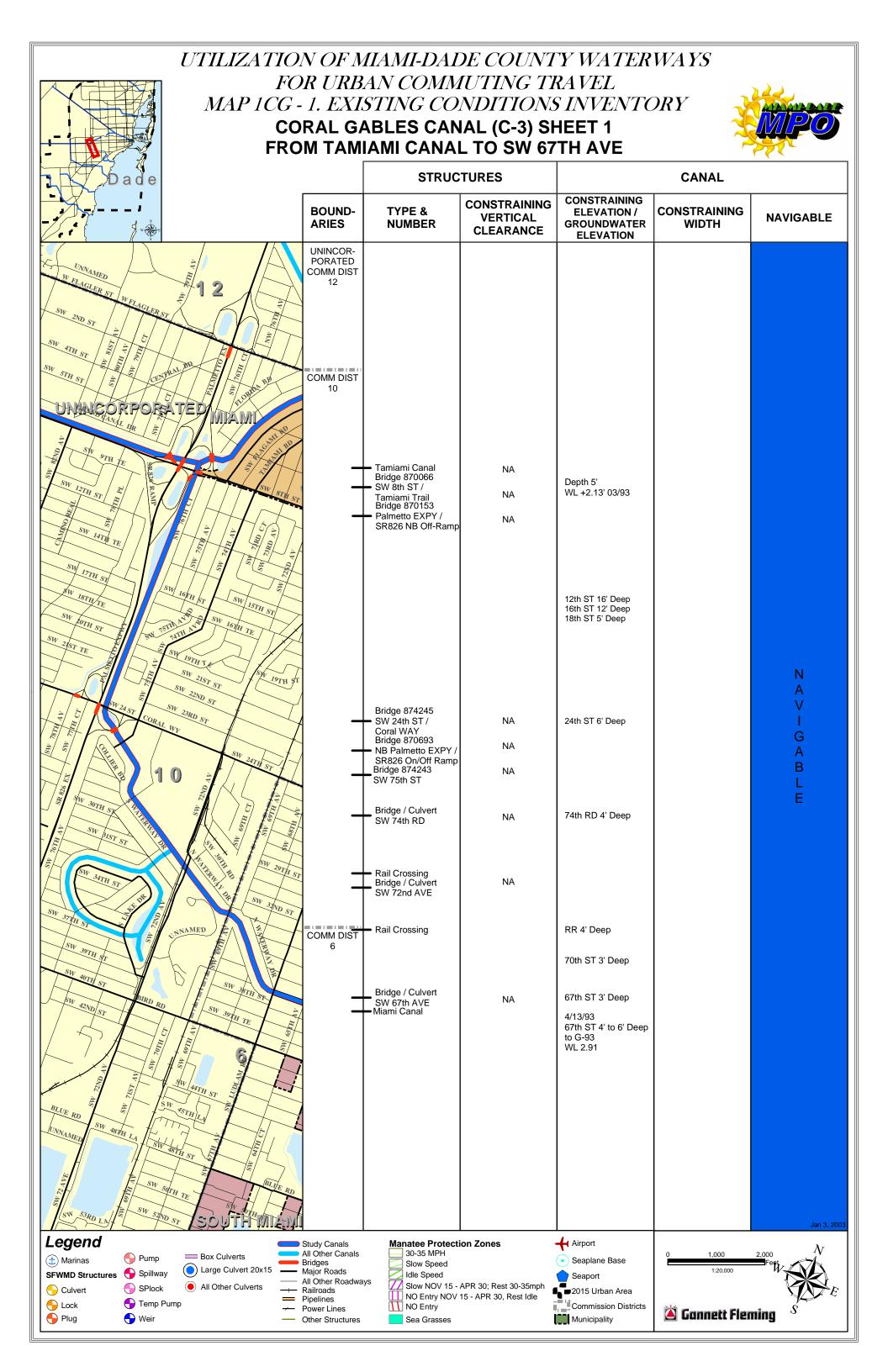
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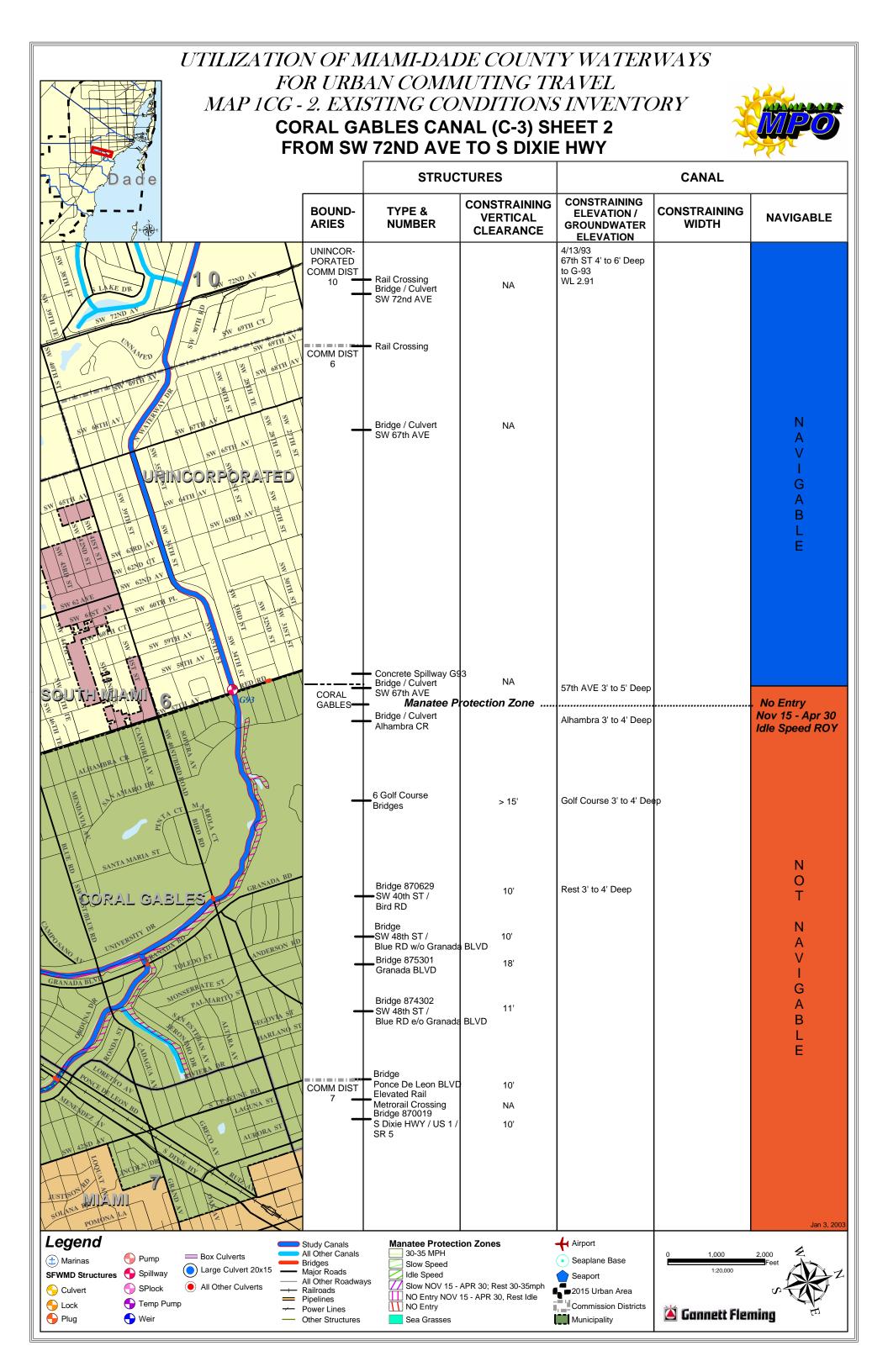


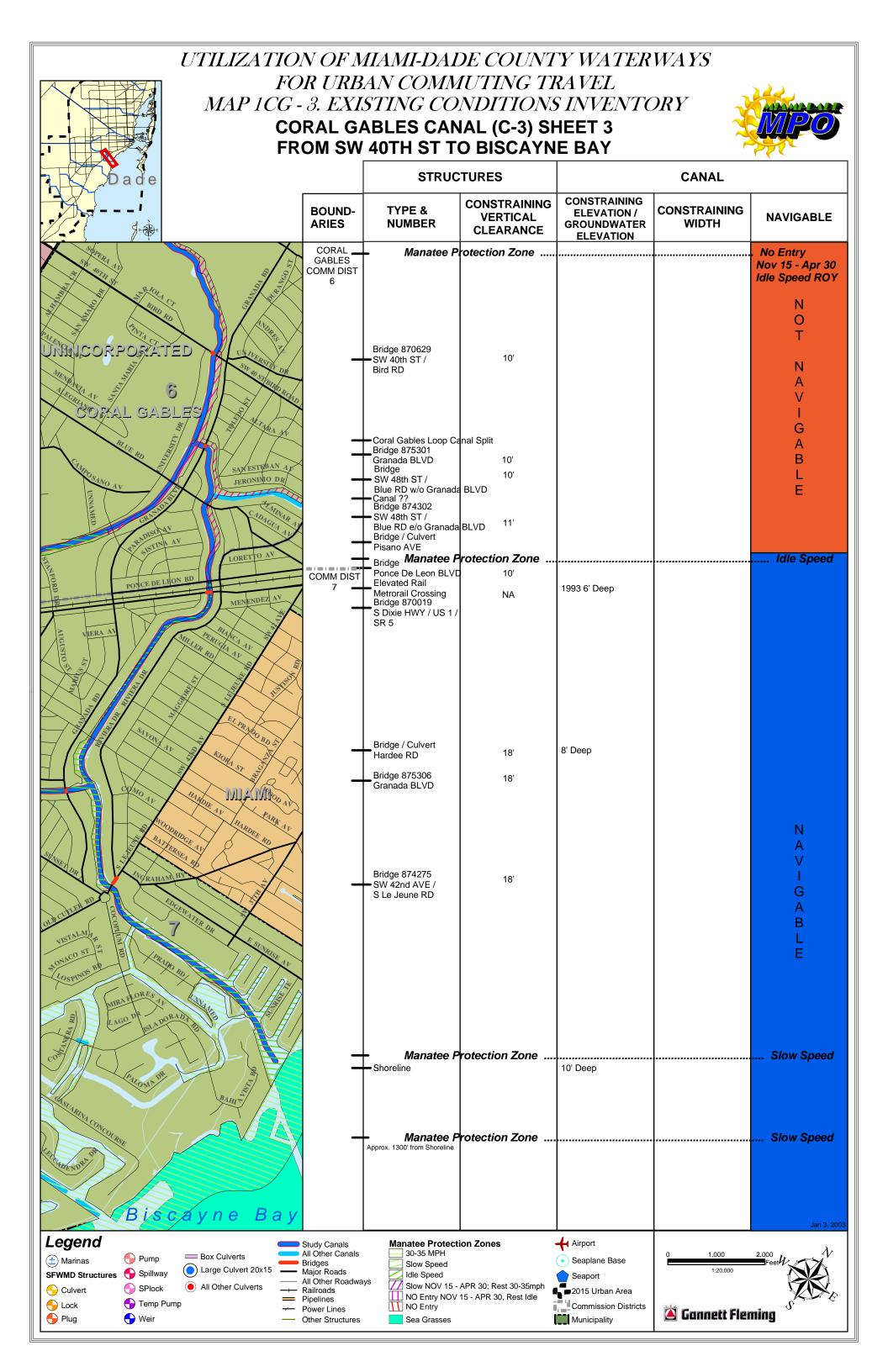


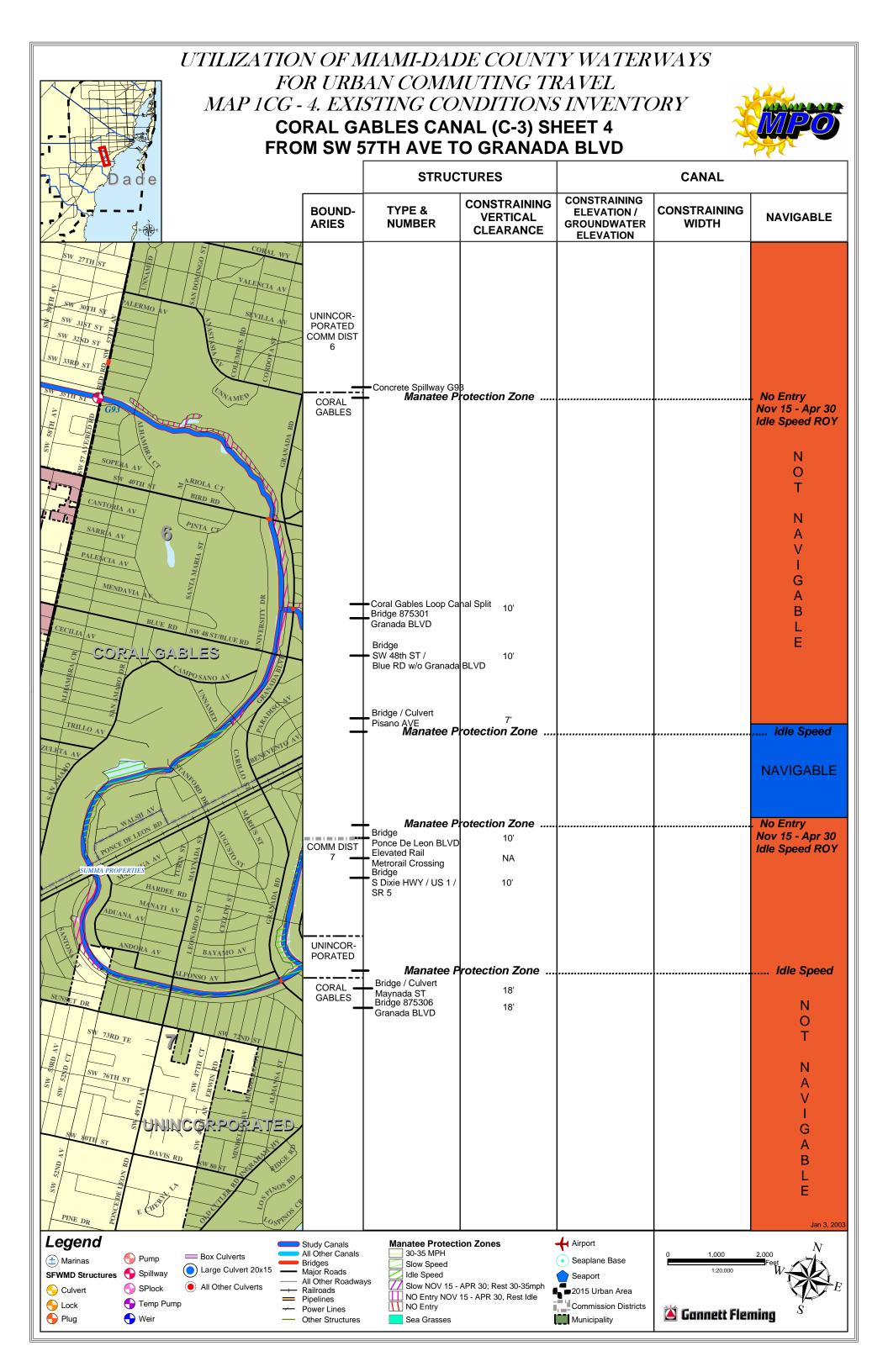


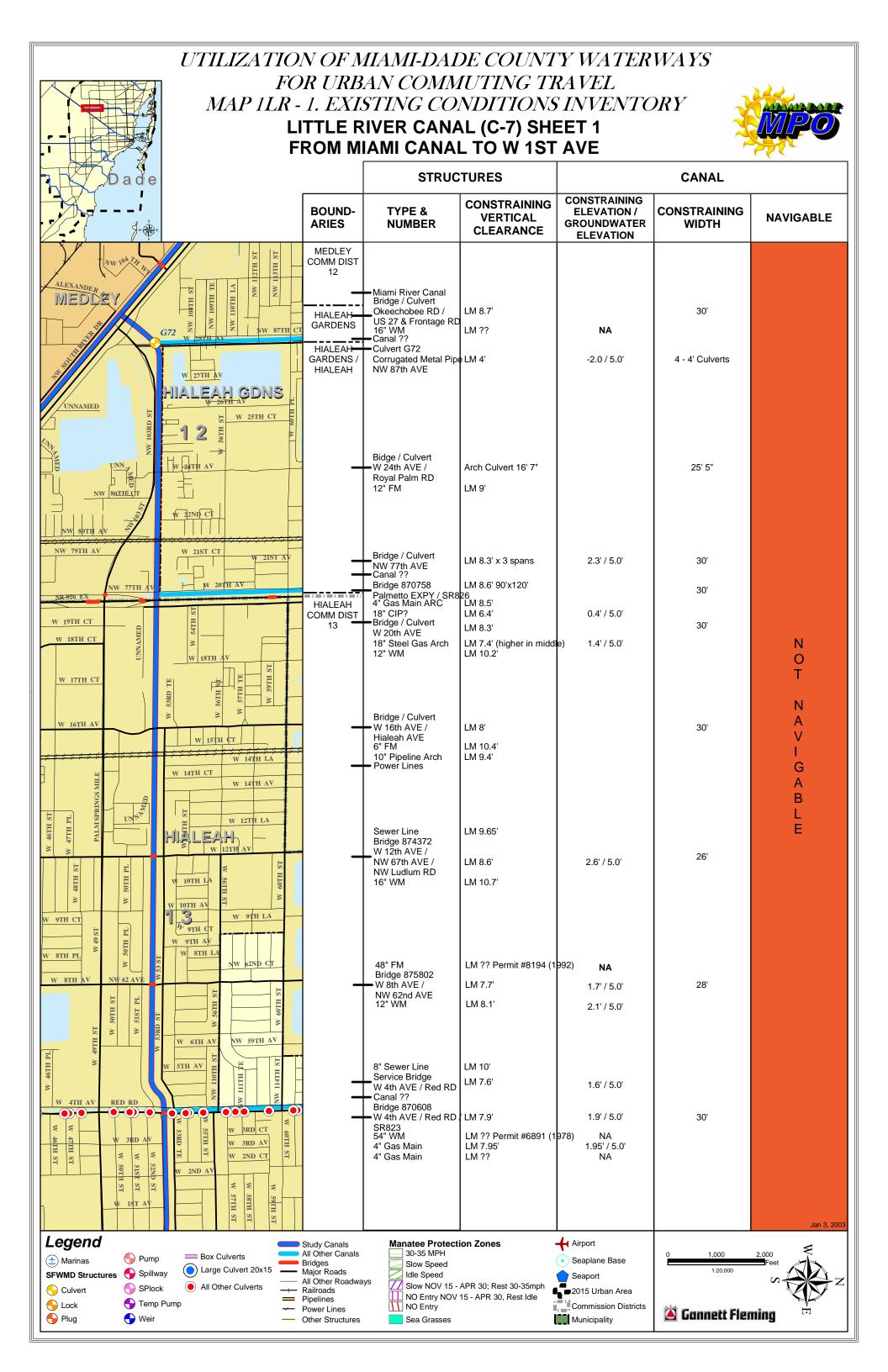


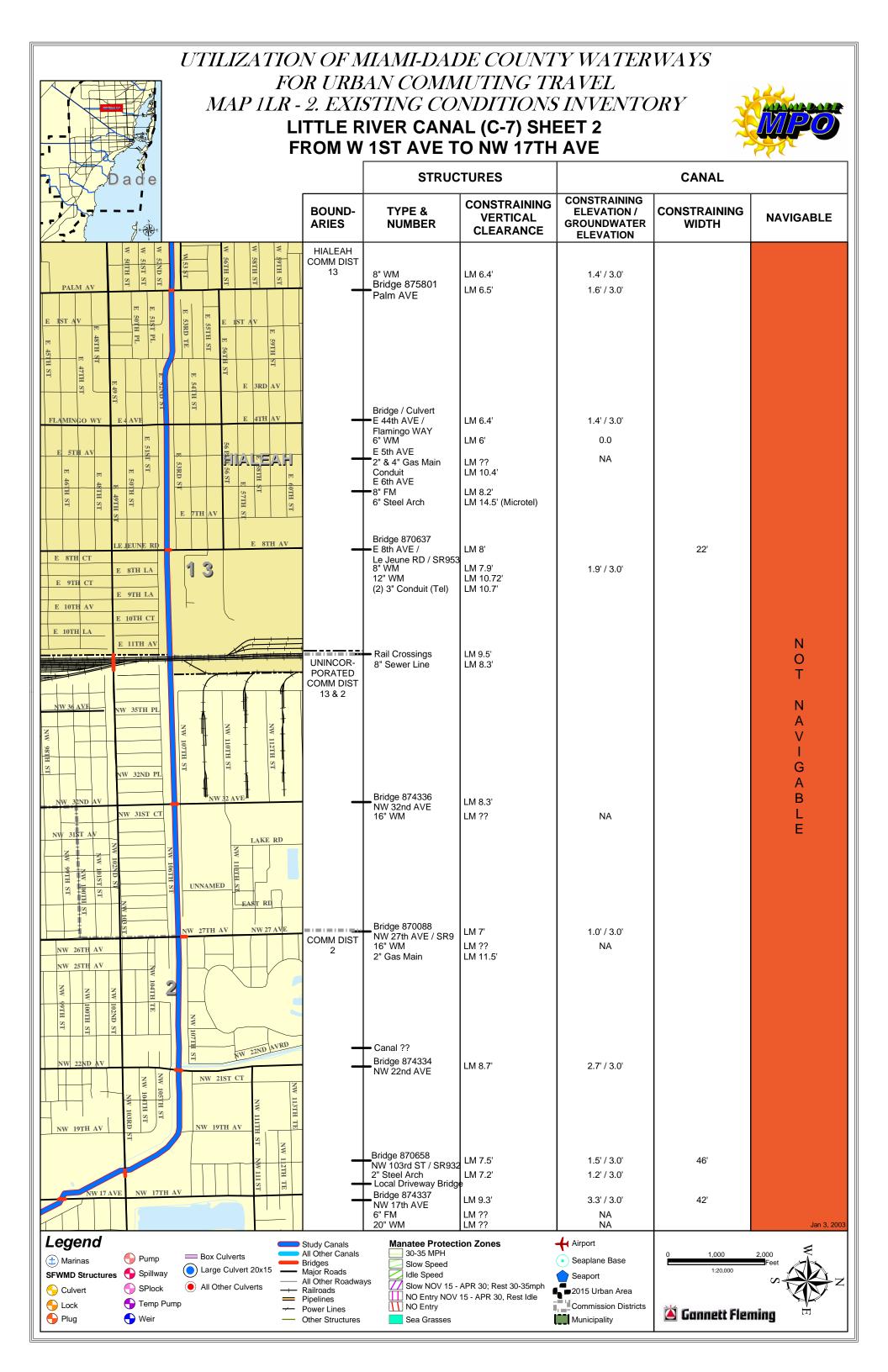


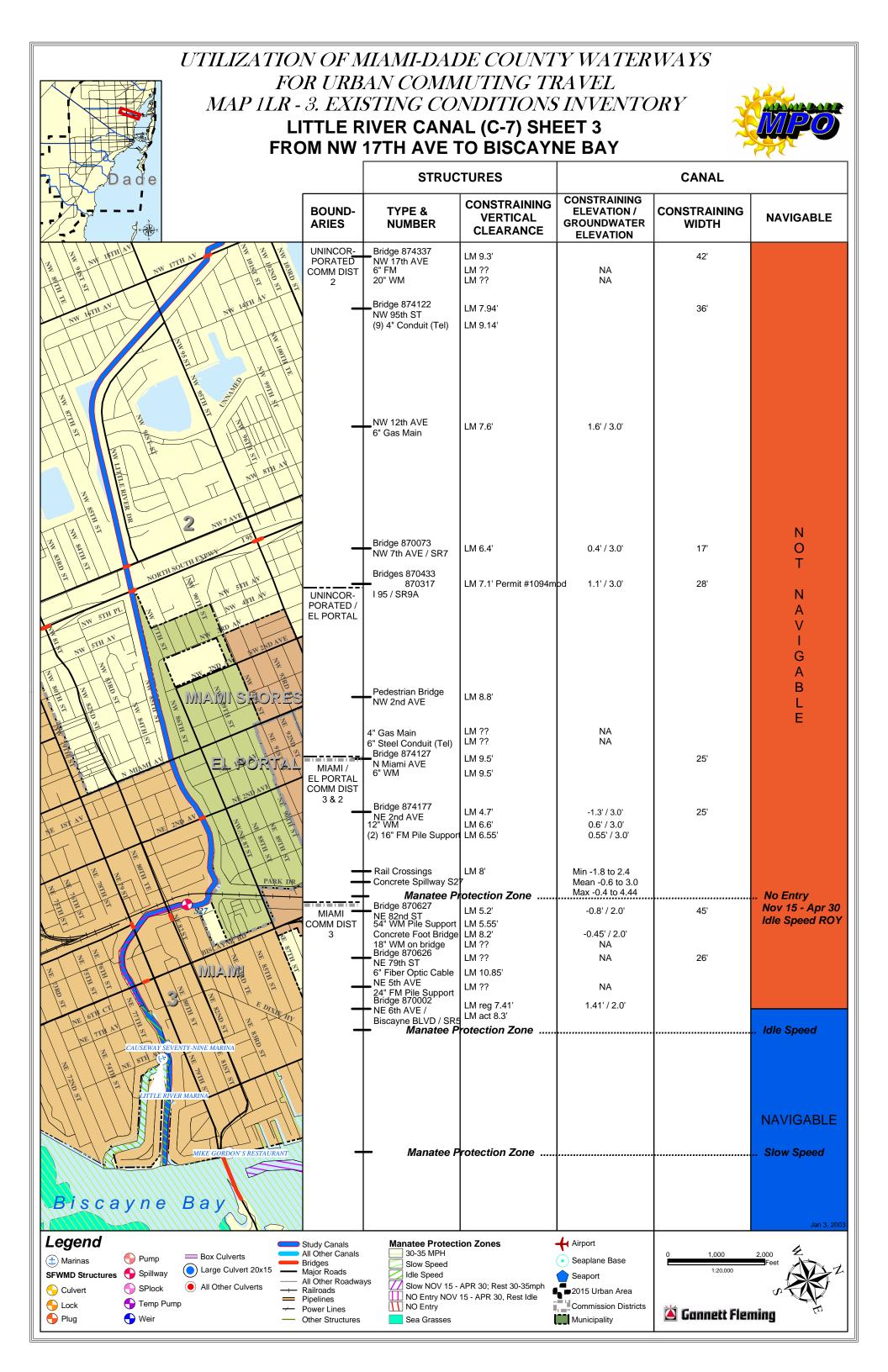


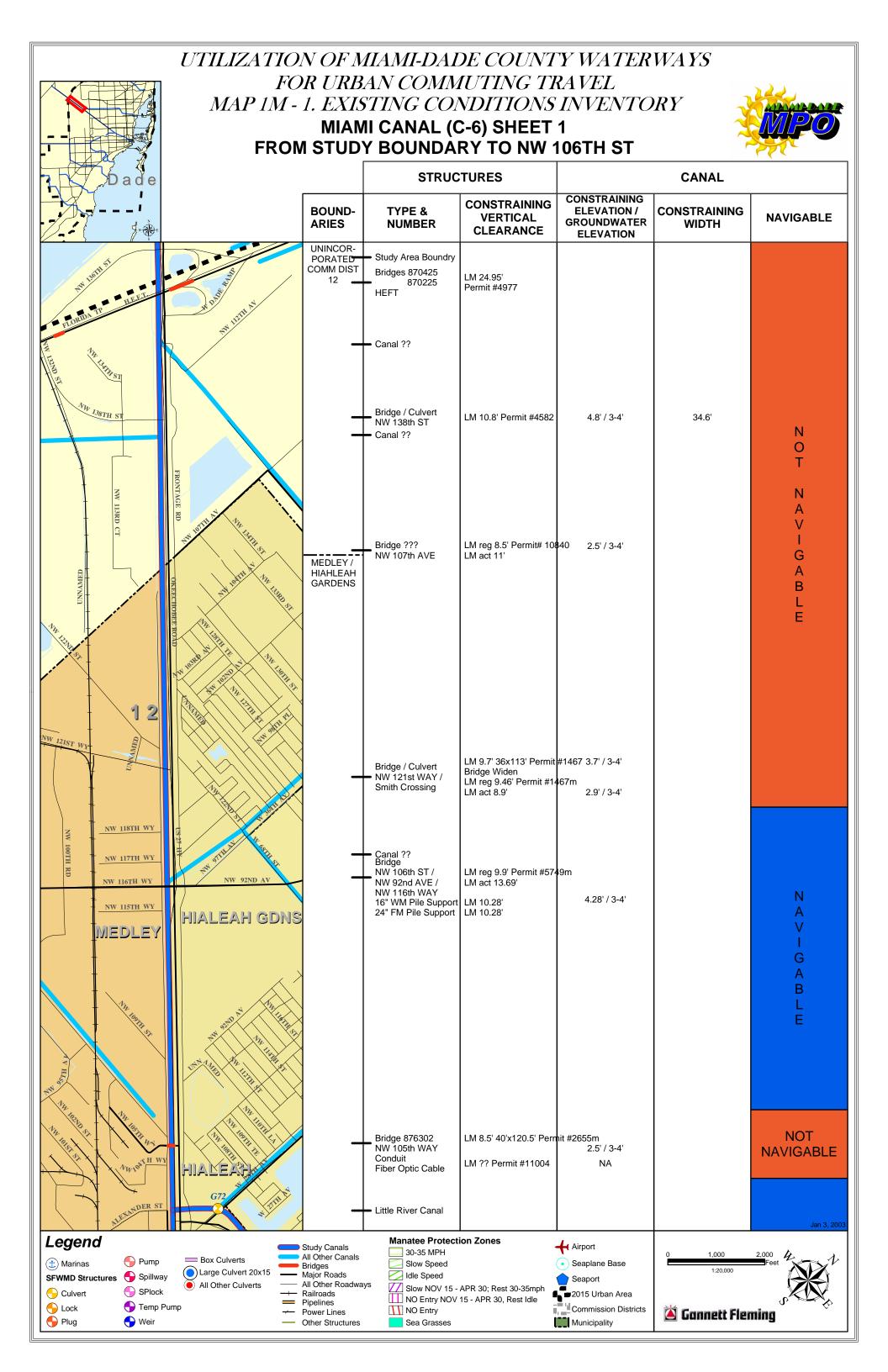


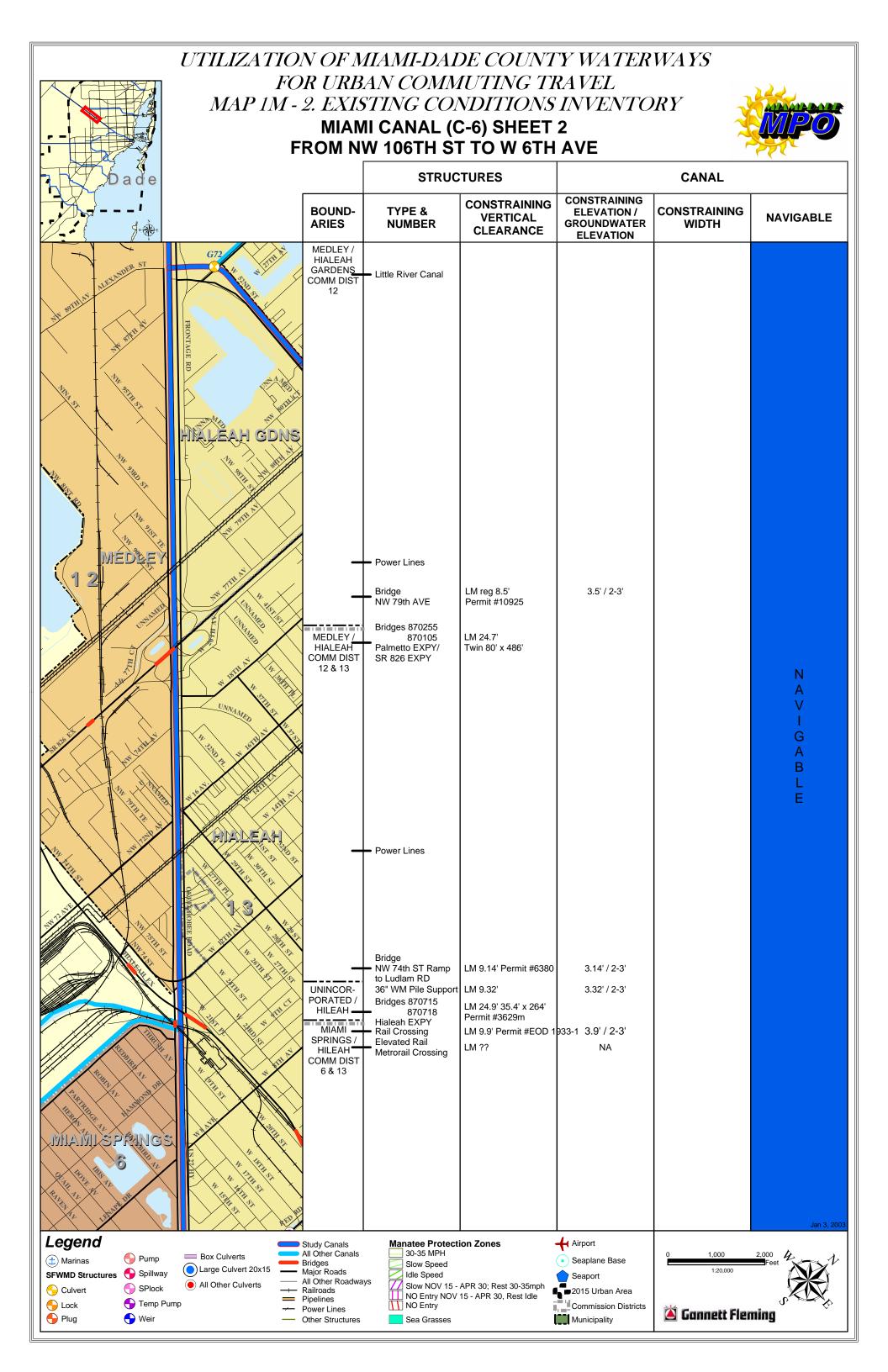


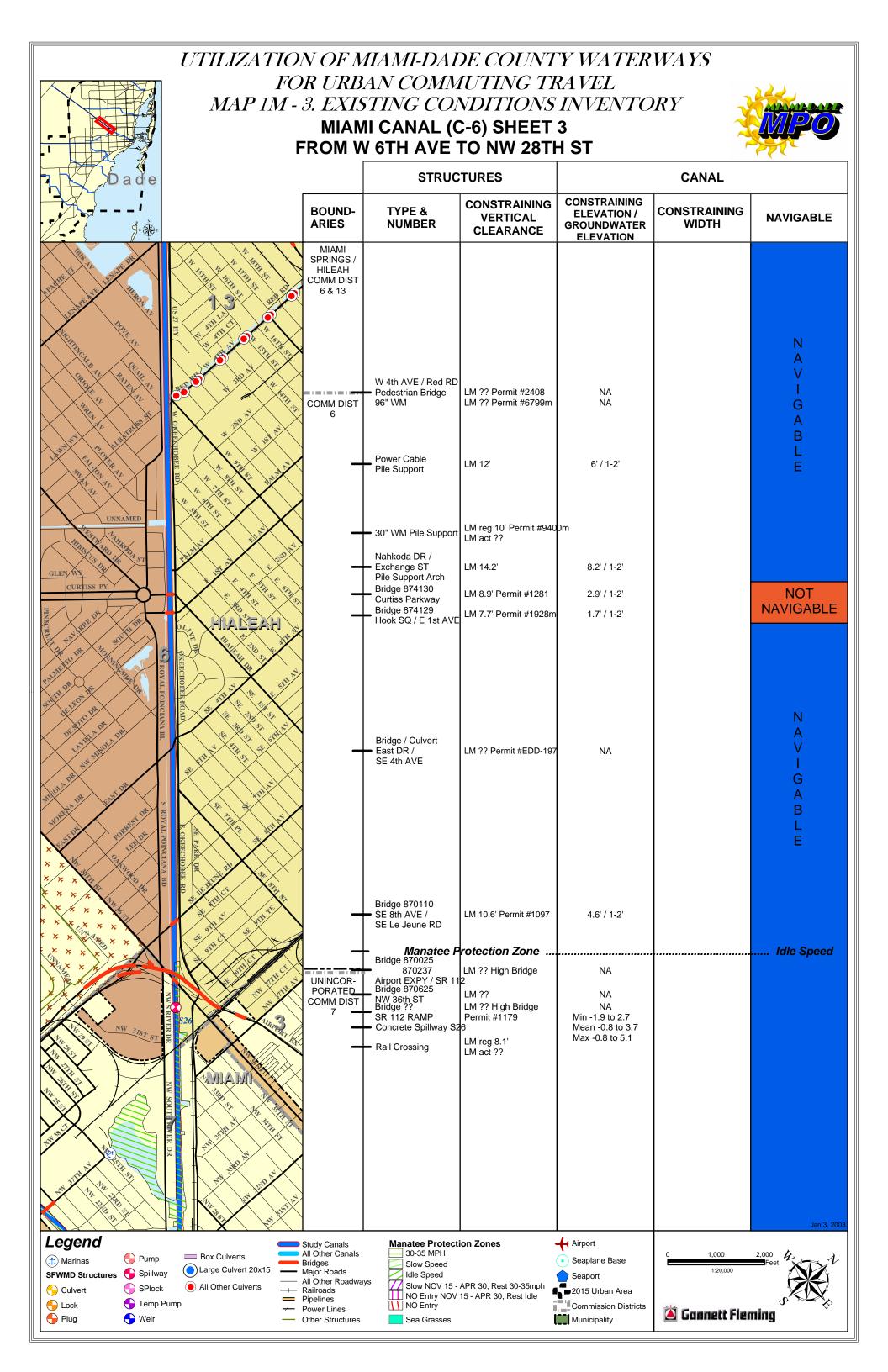


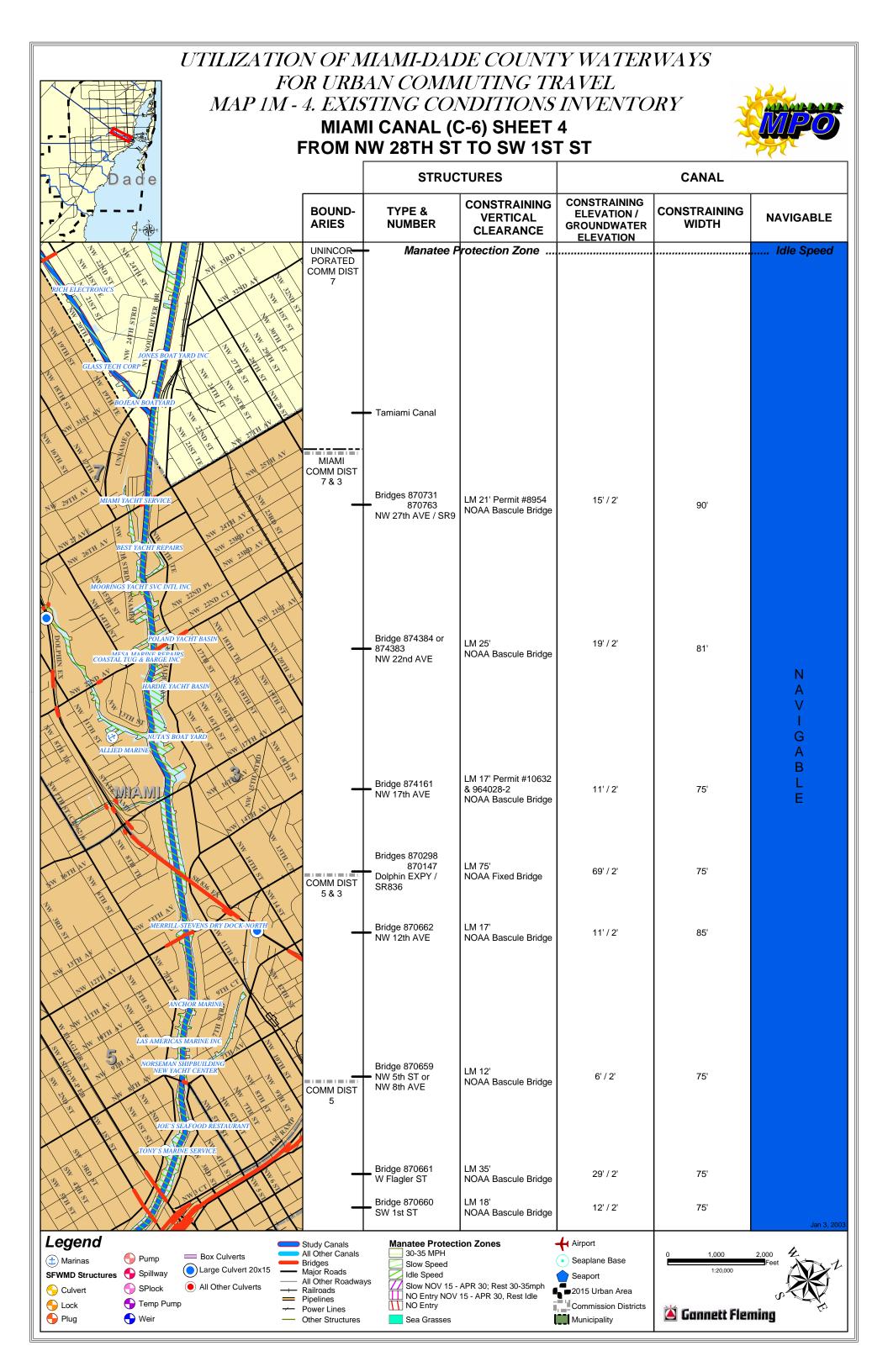


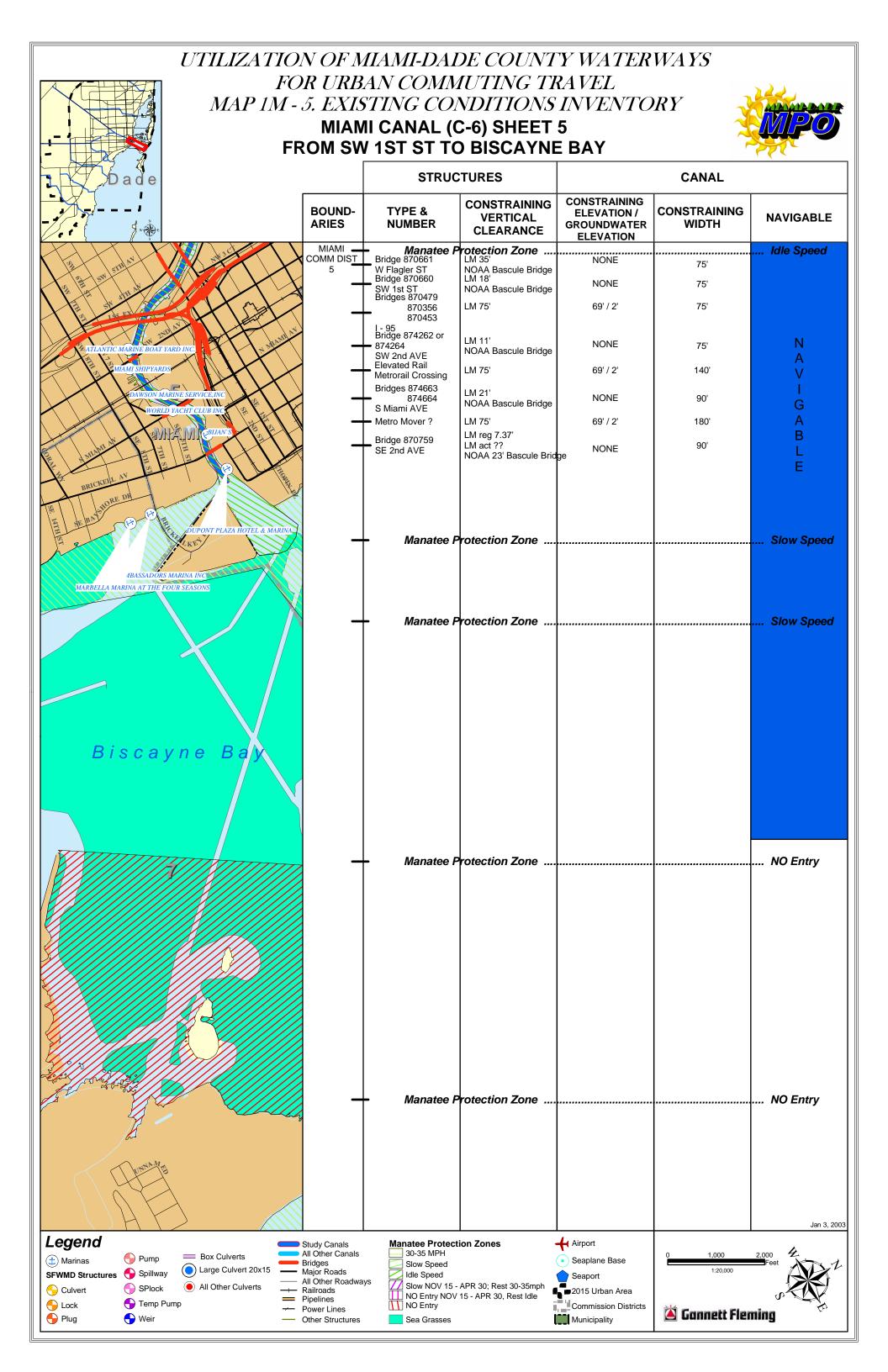


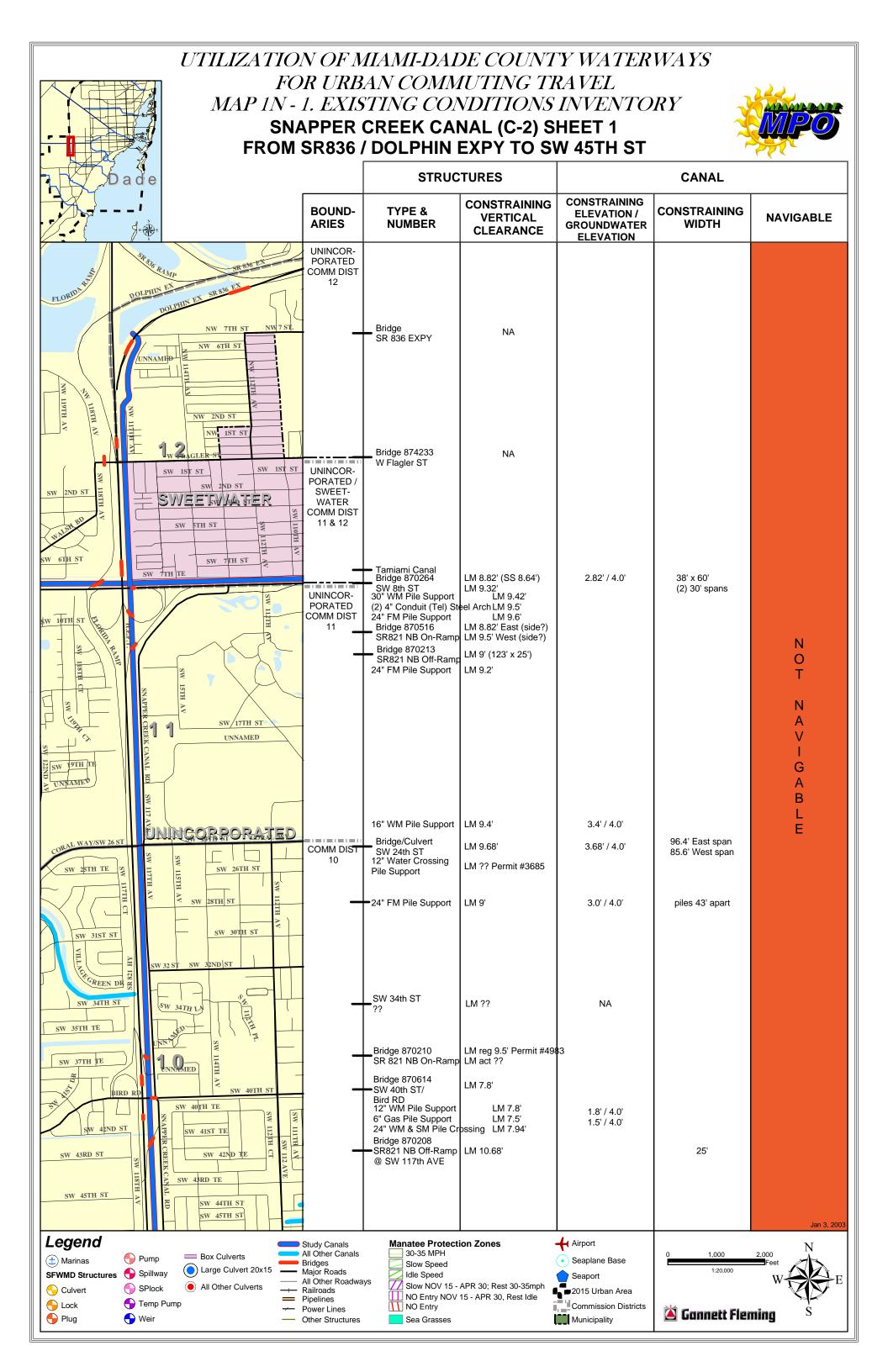


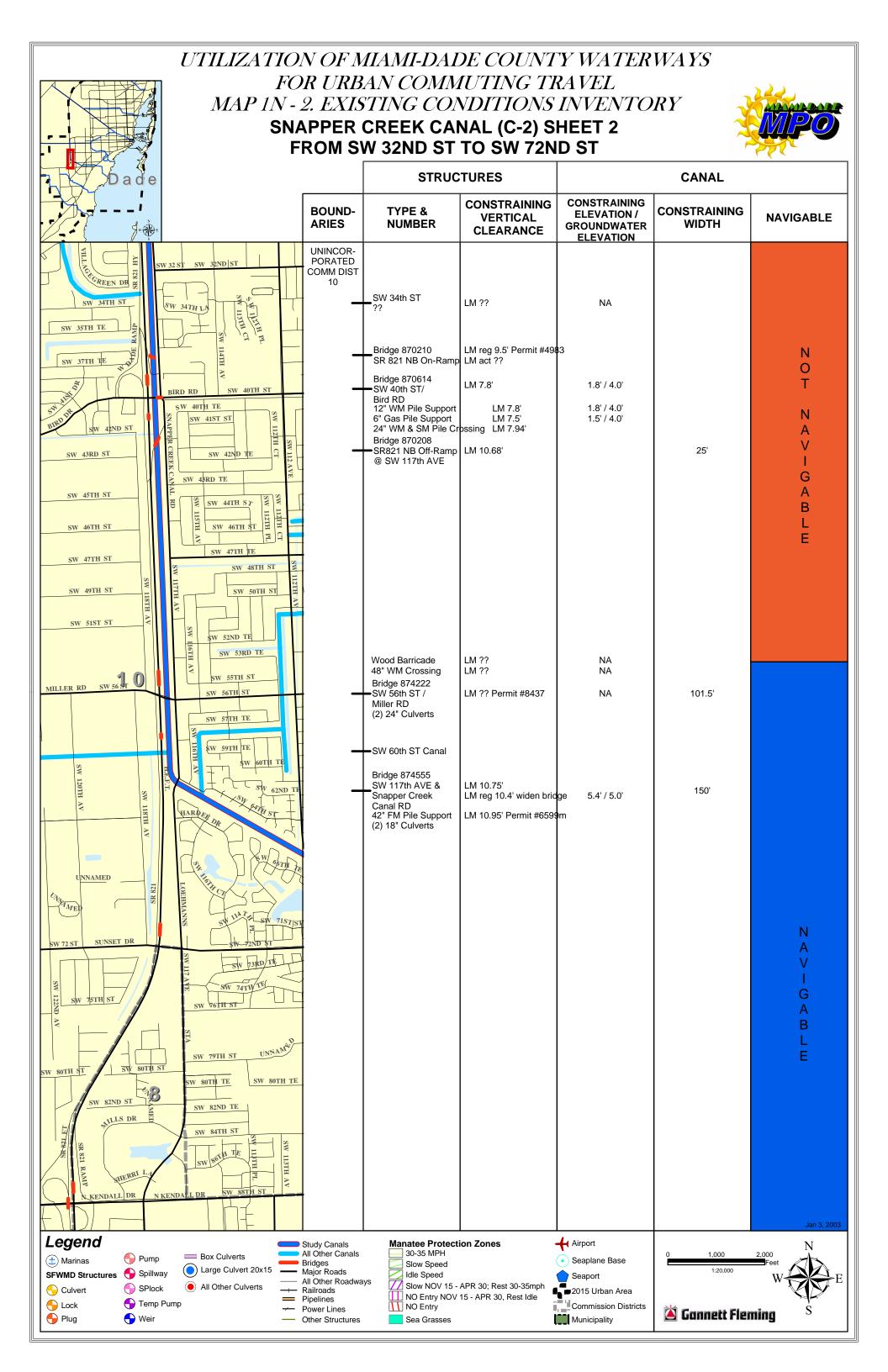


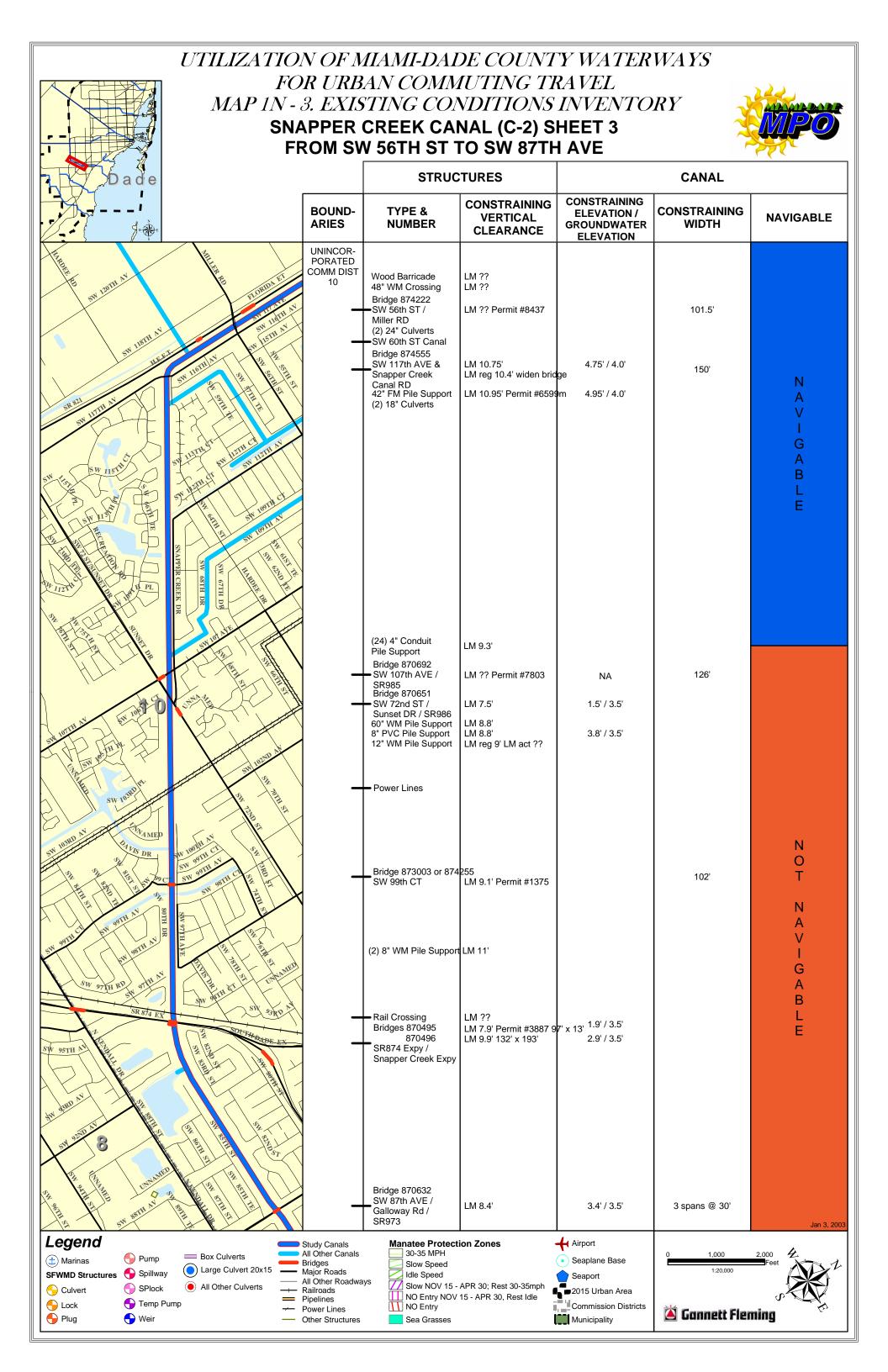


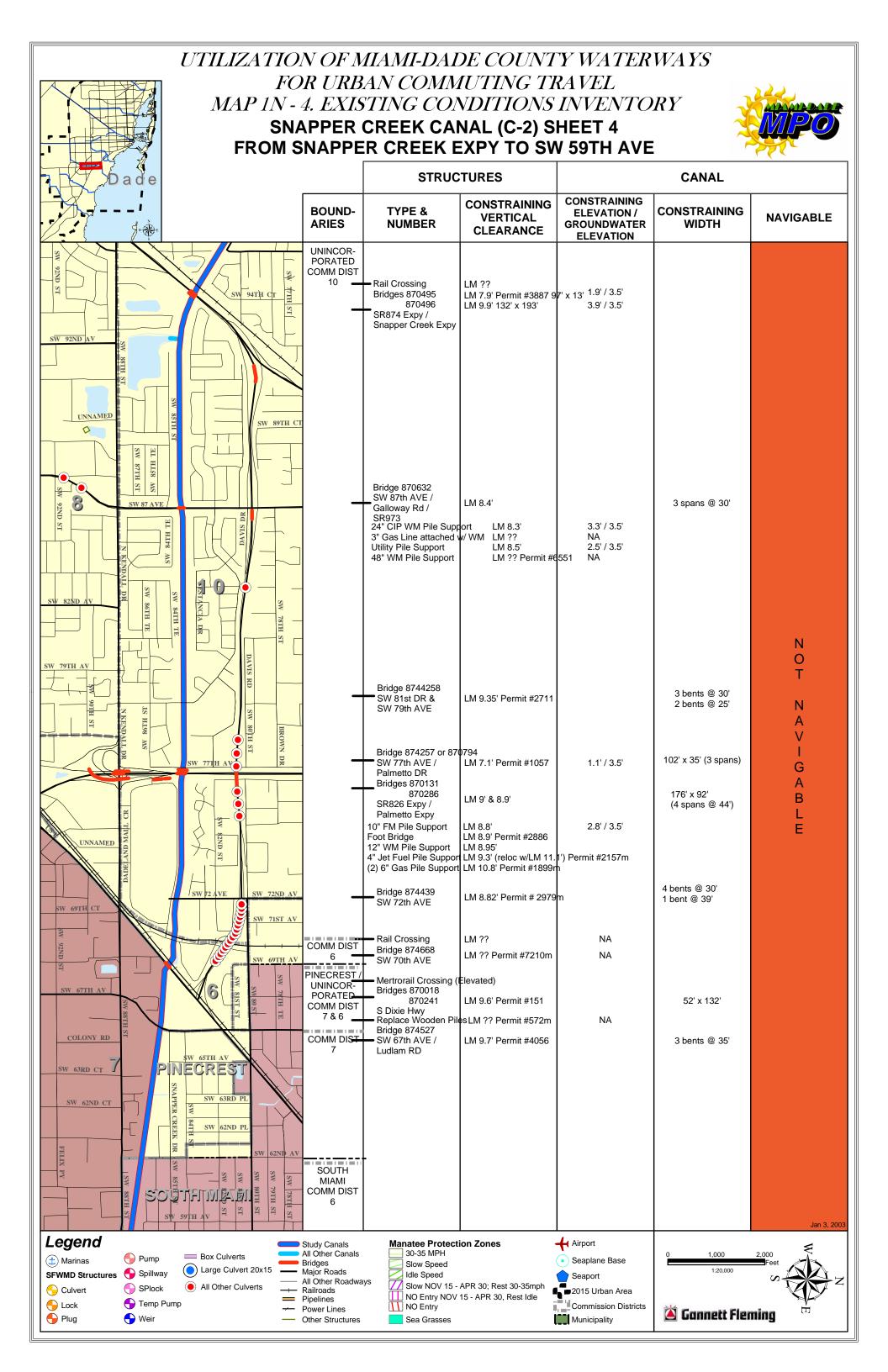


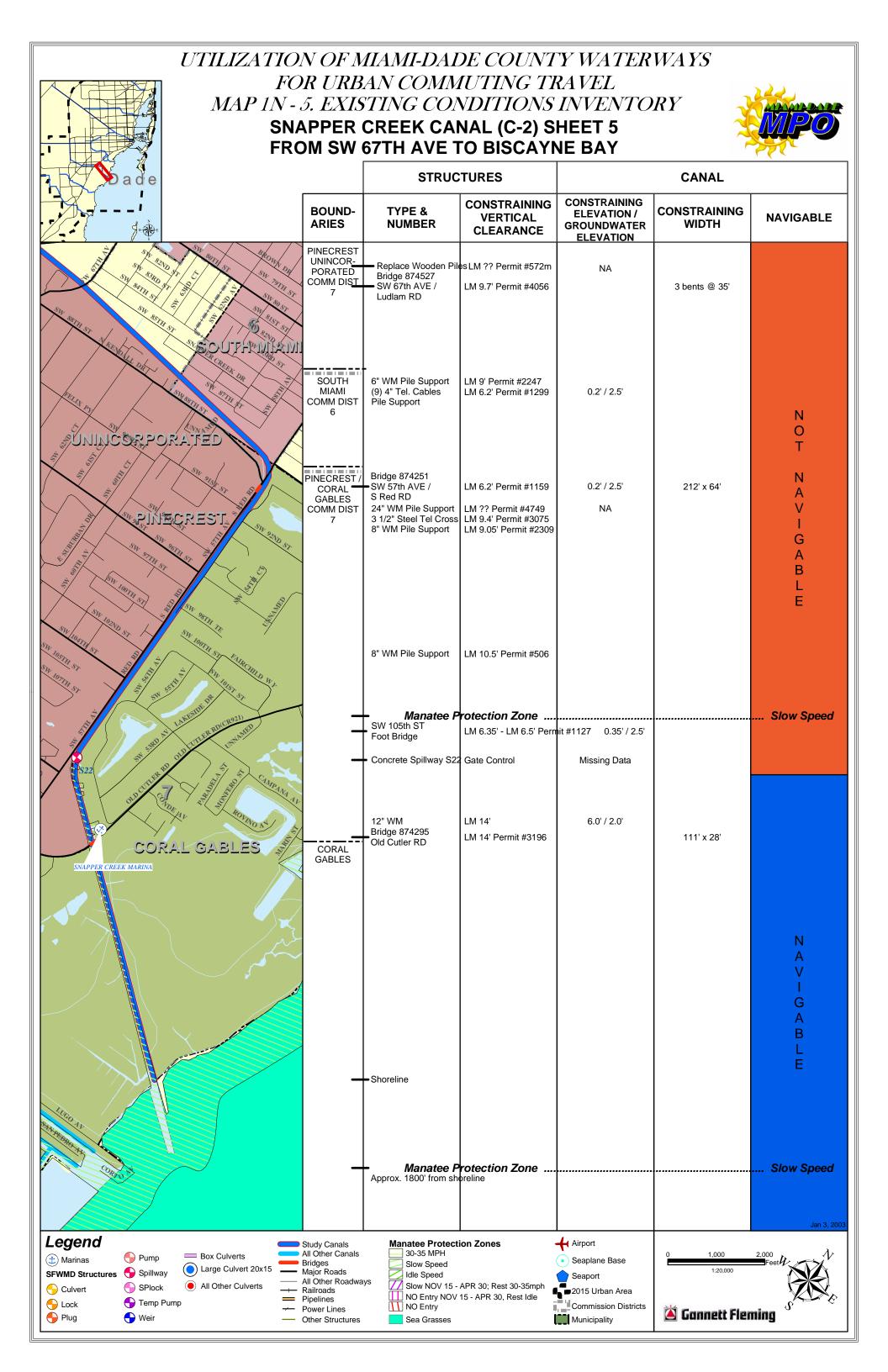


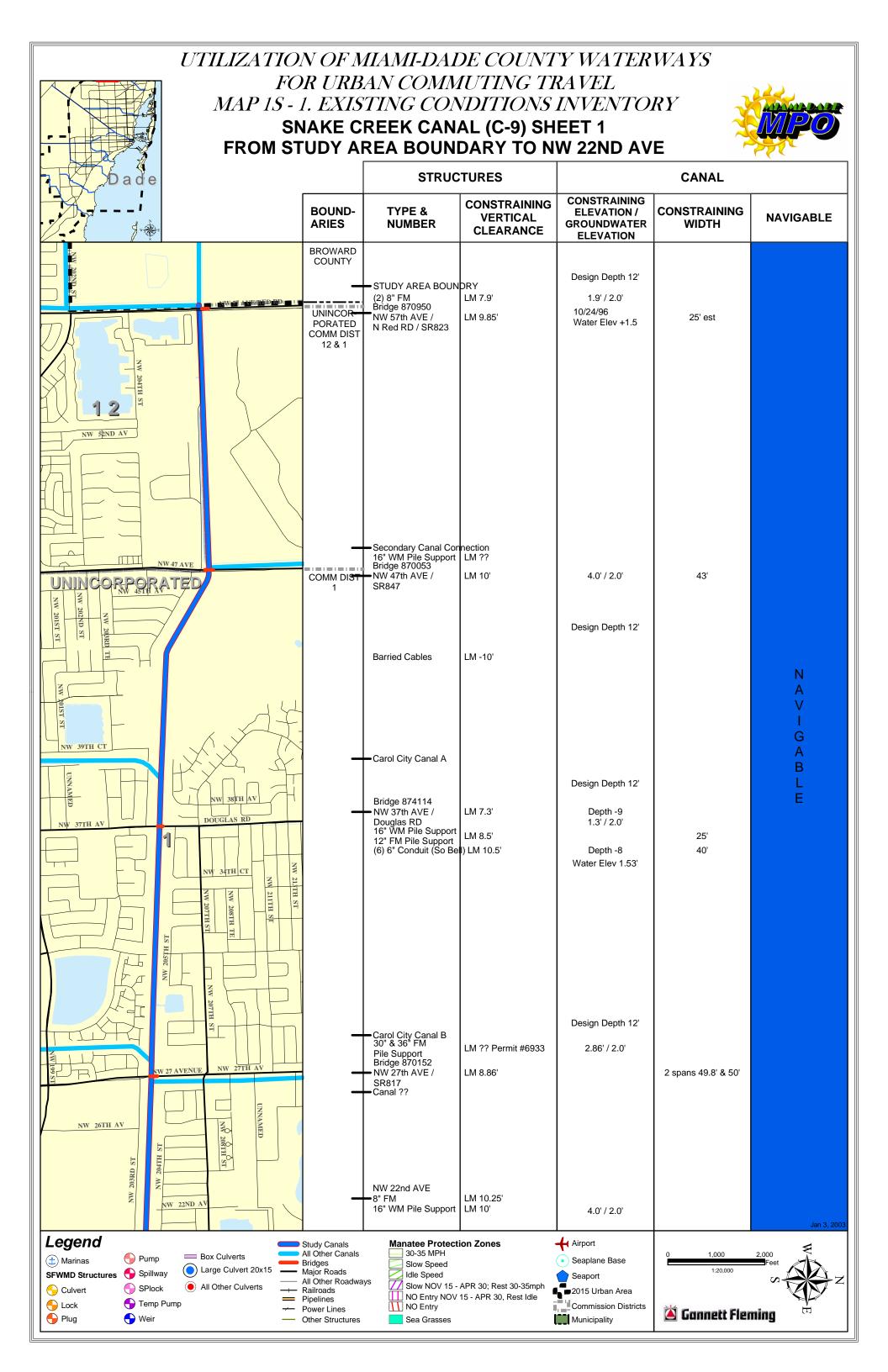


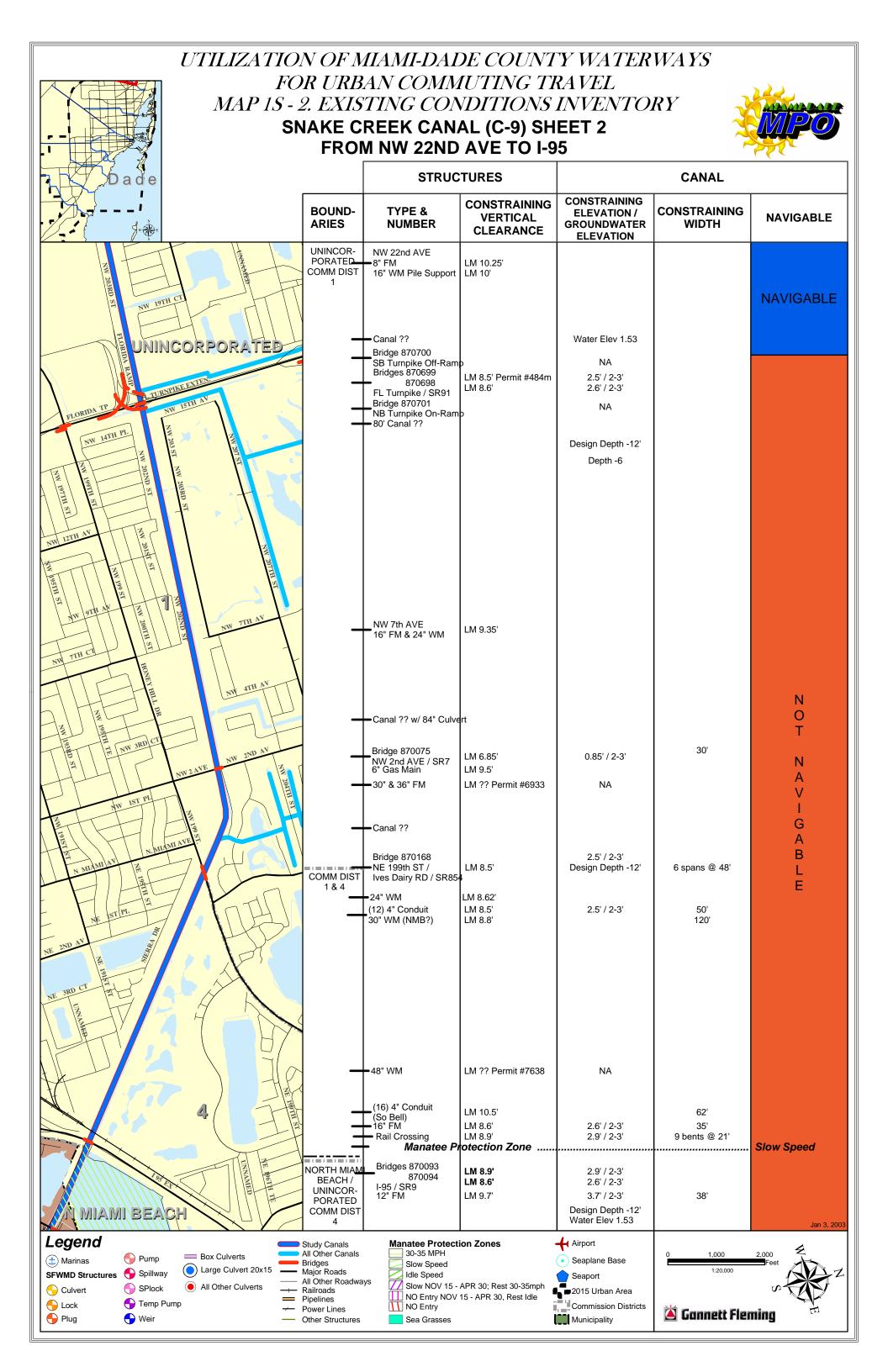


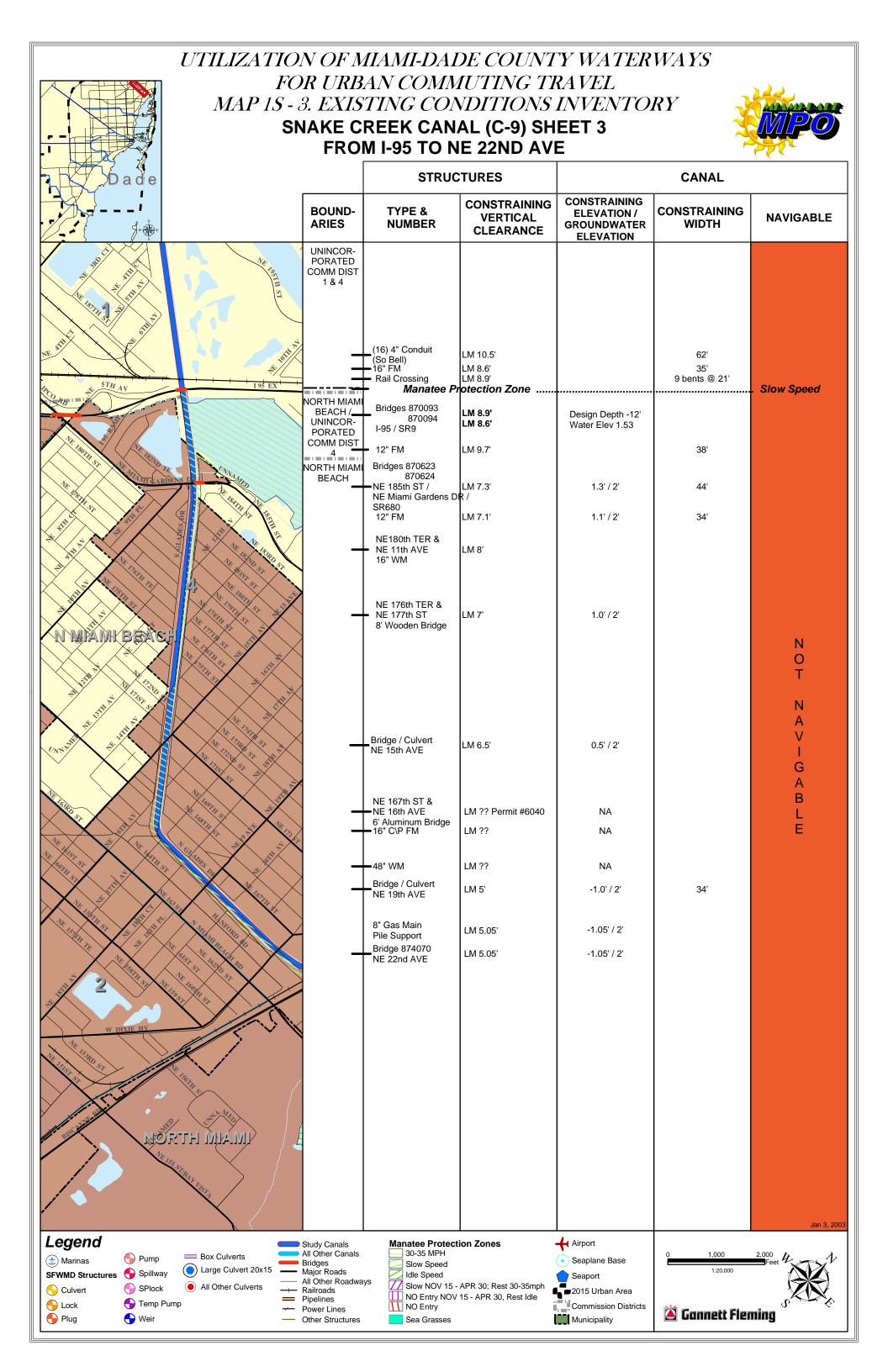


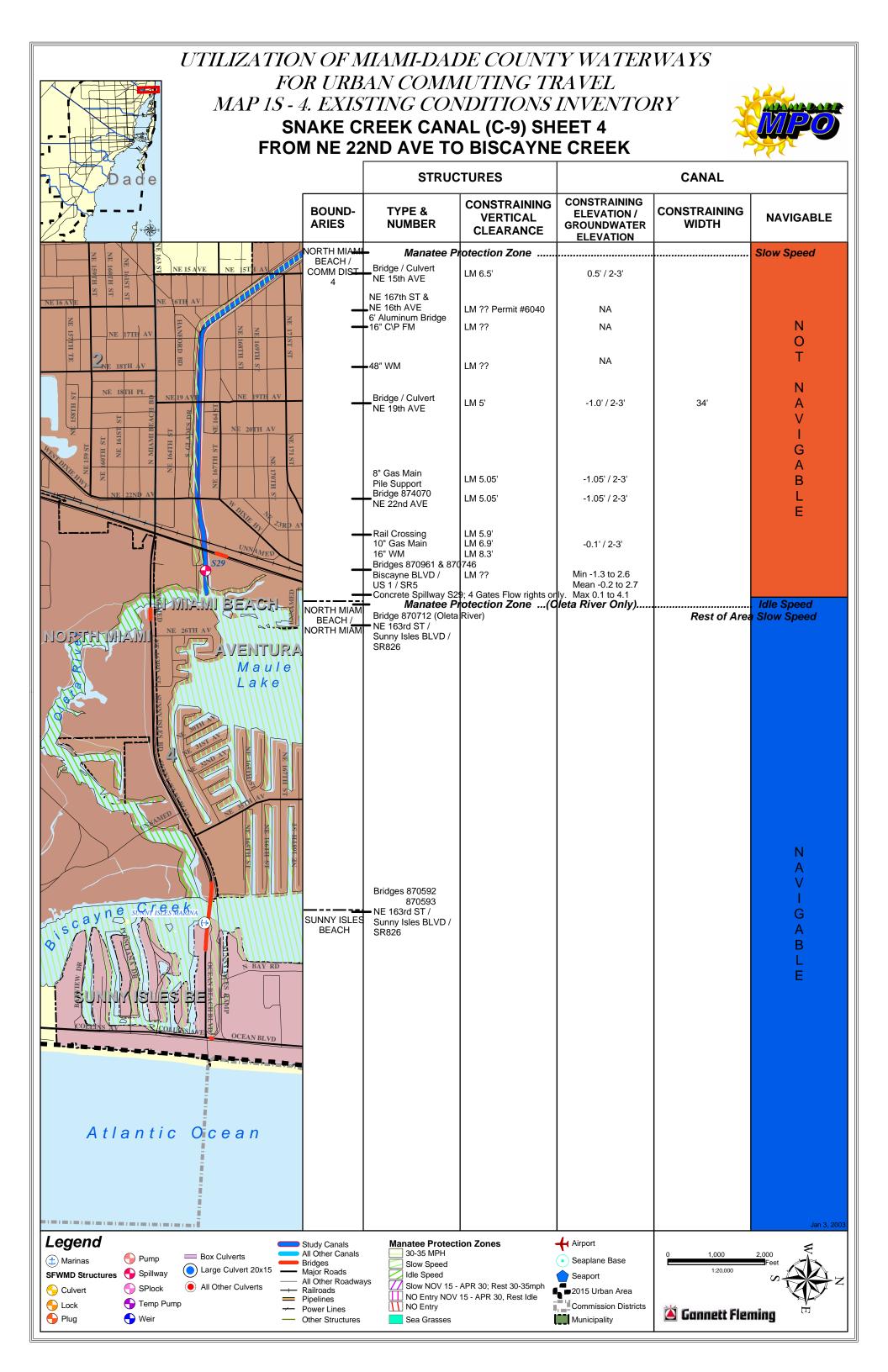


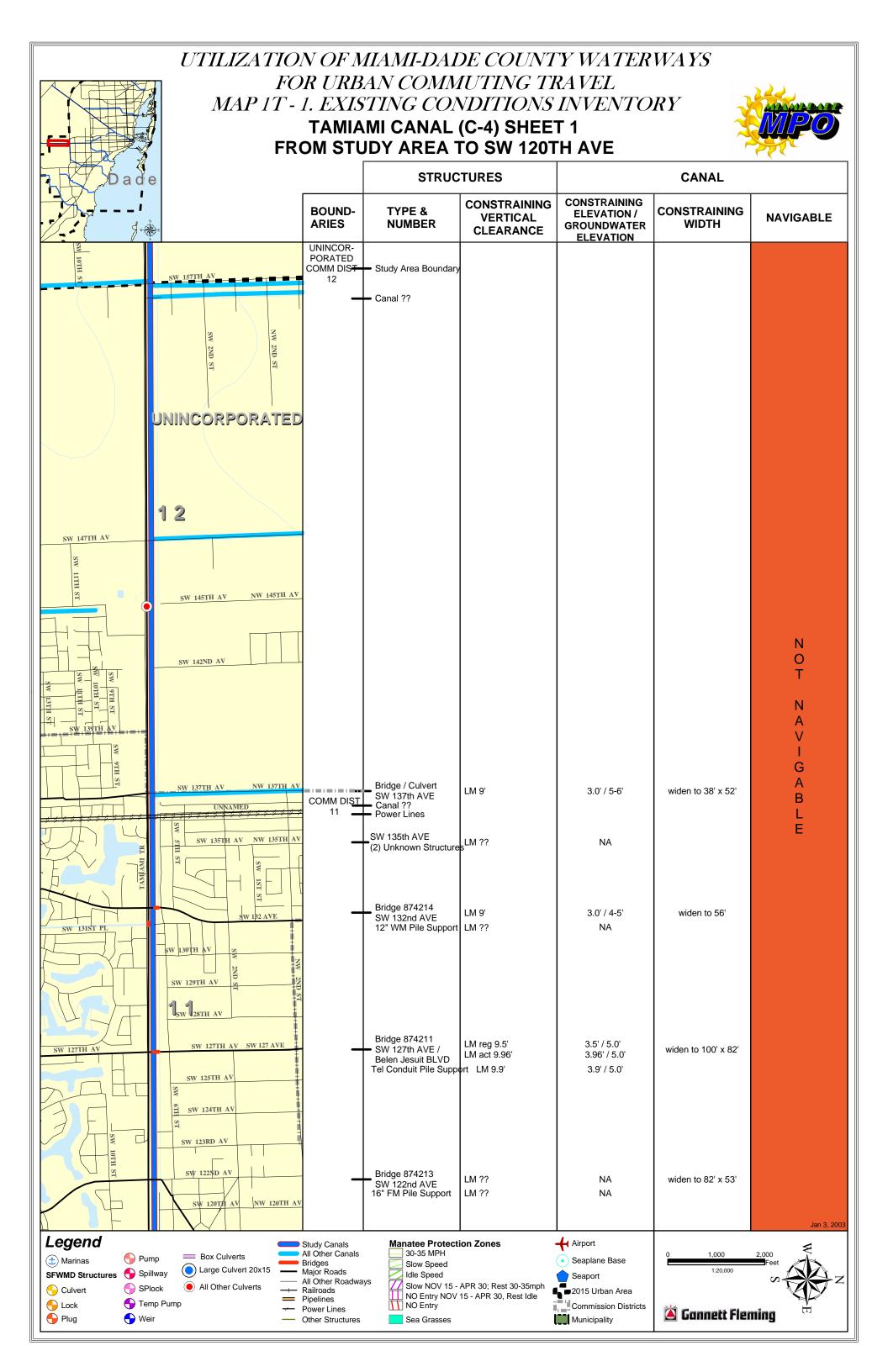


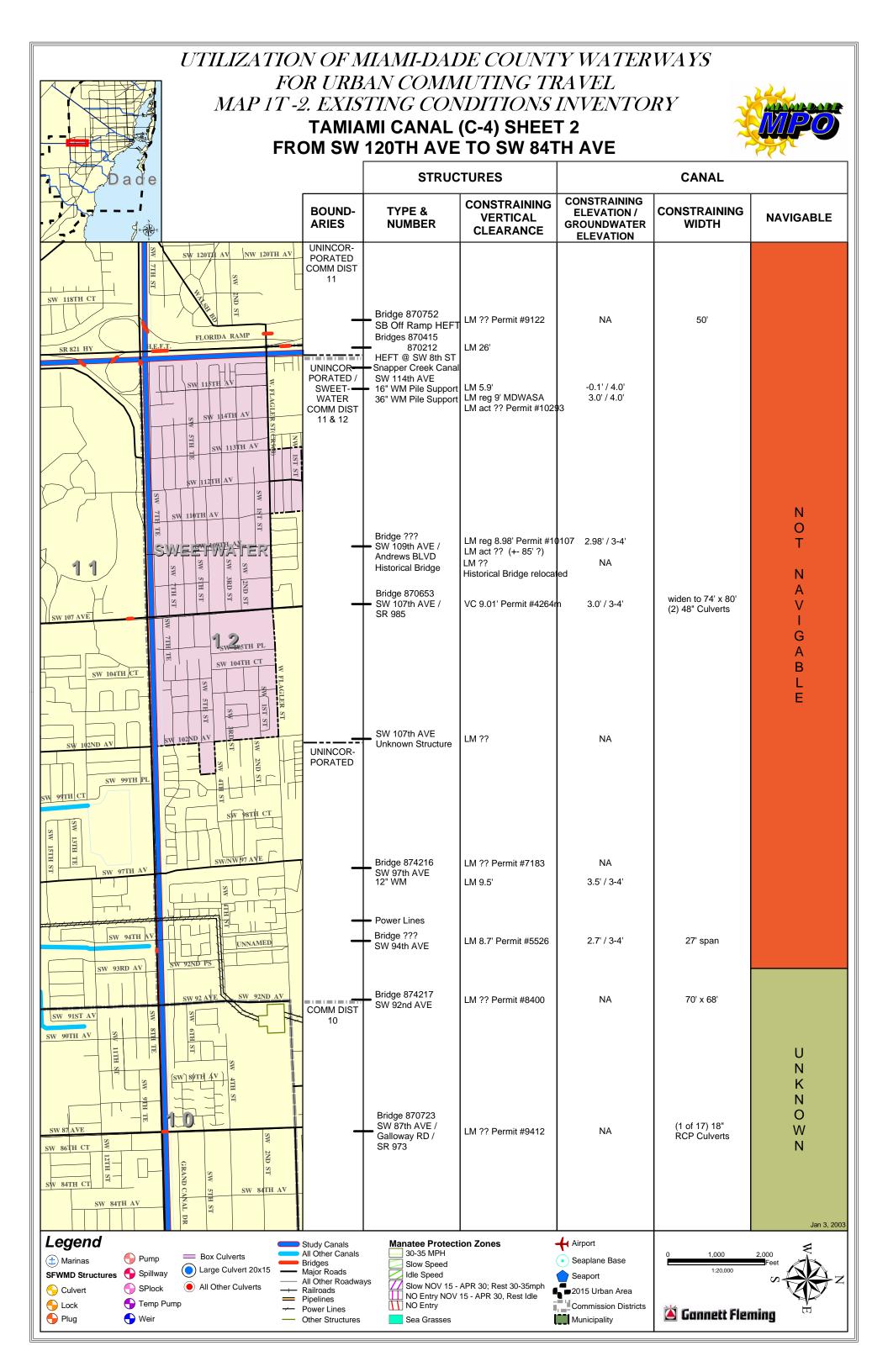


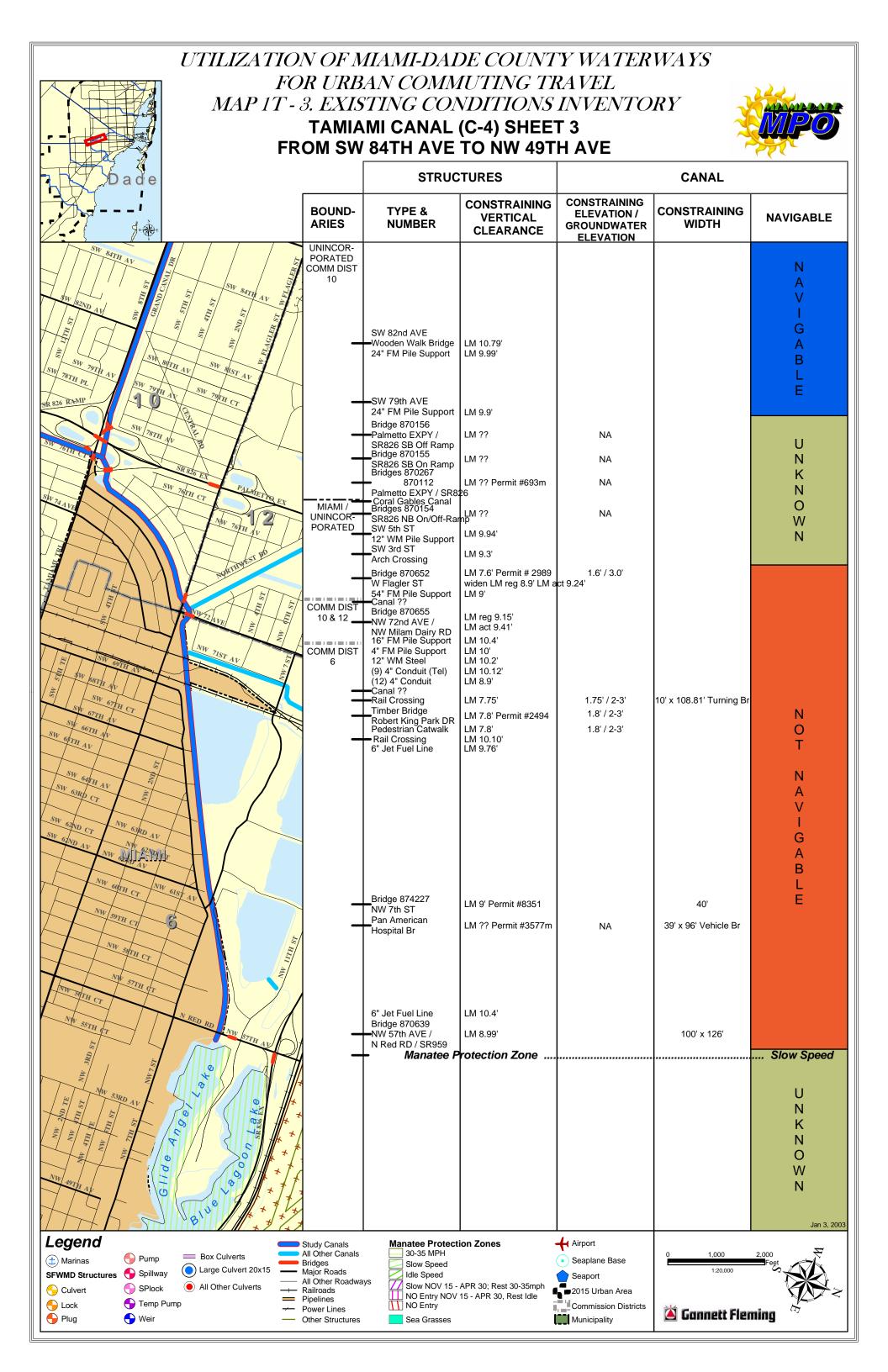


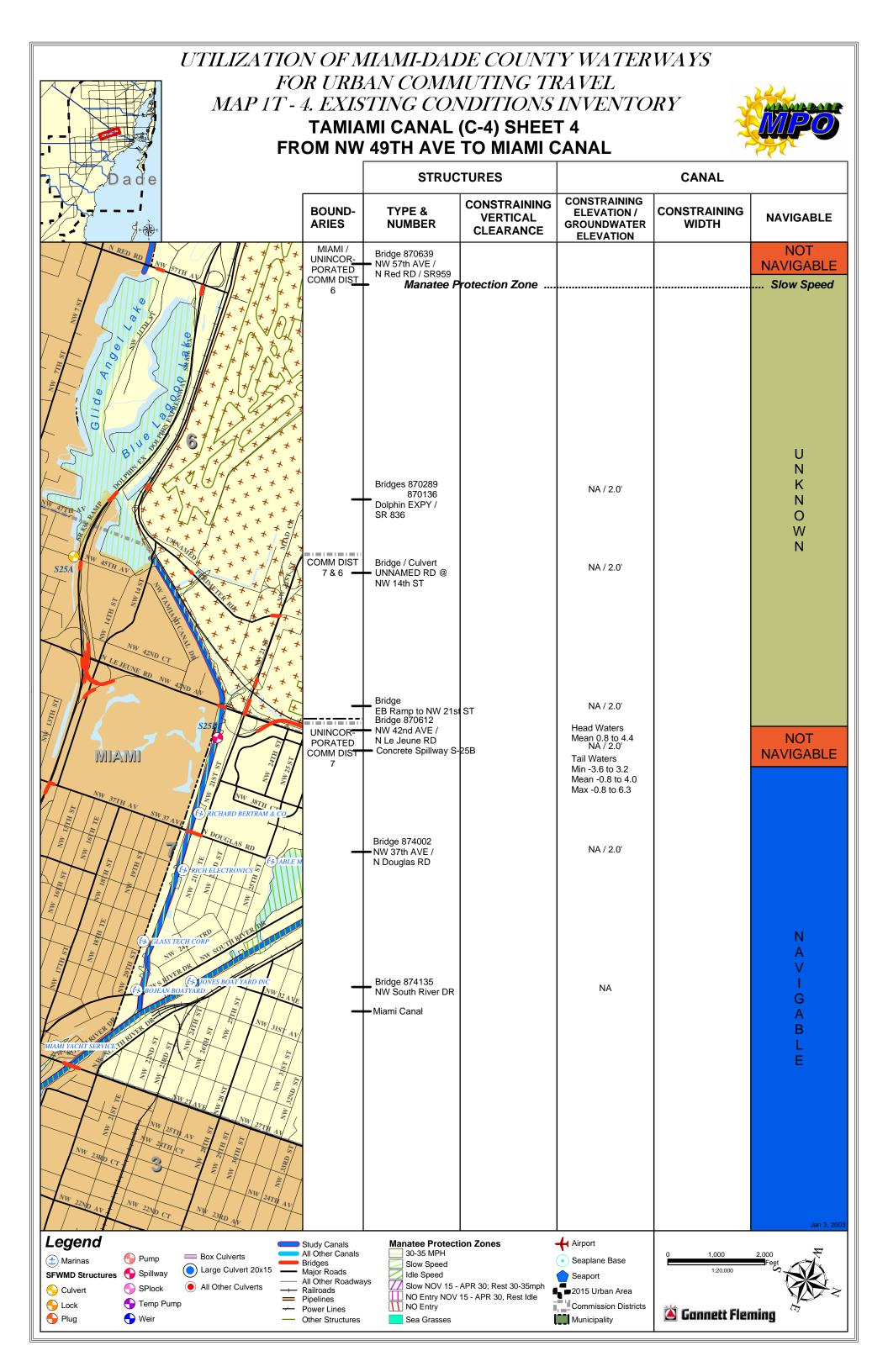








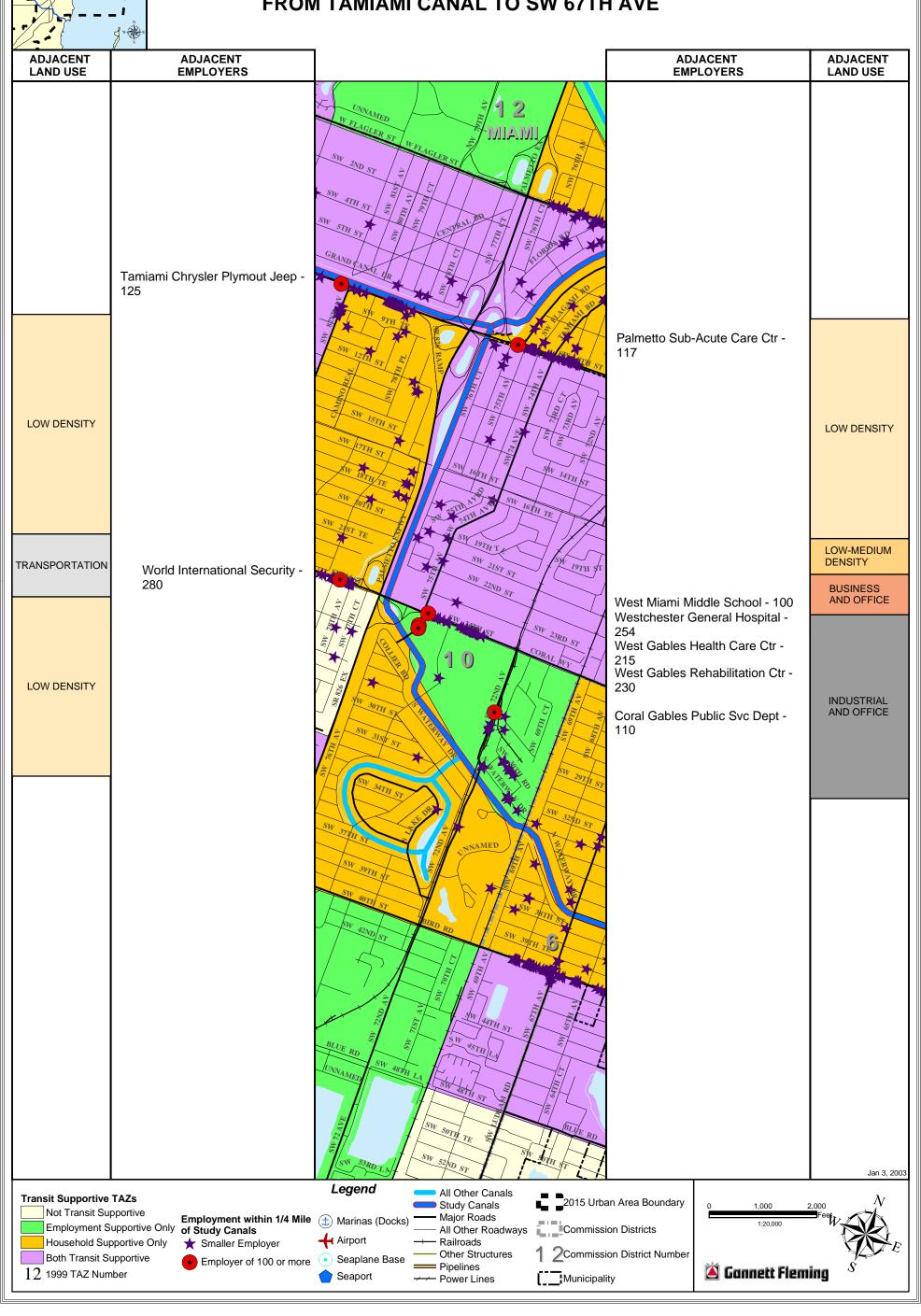




### UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 2CG - 1. LANDUSE AND EMPLOYERS



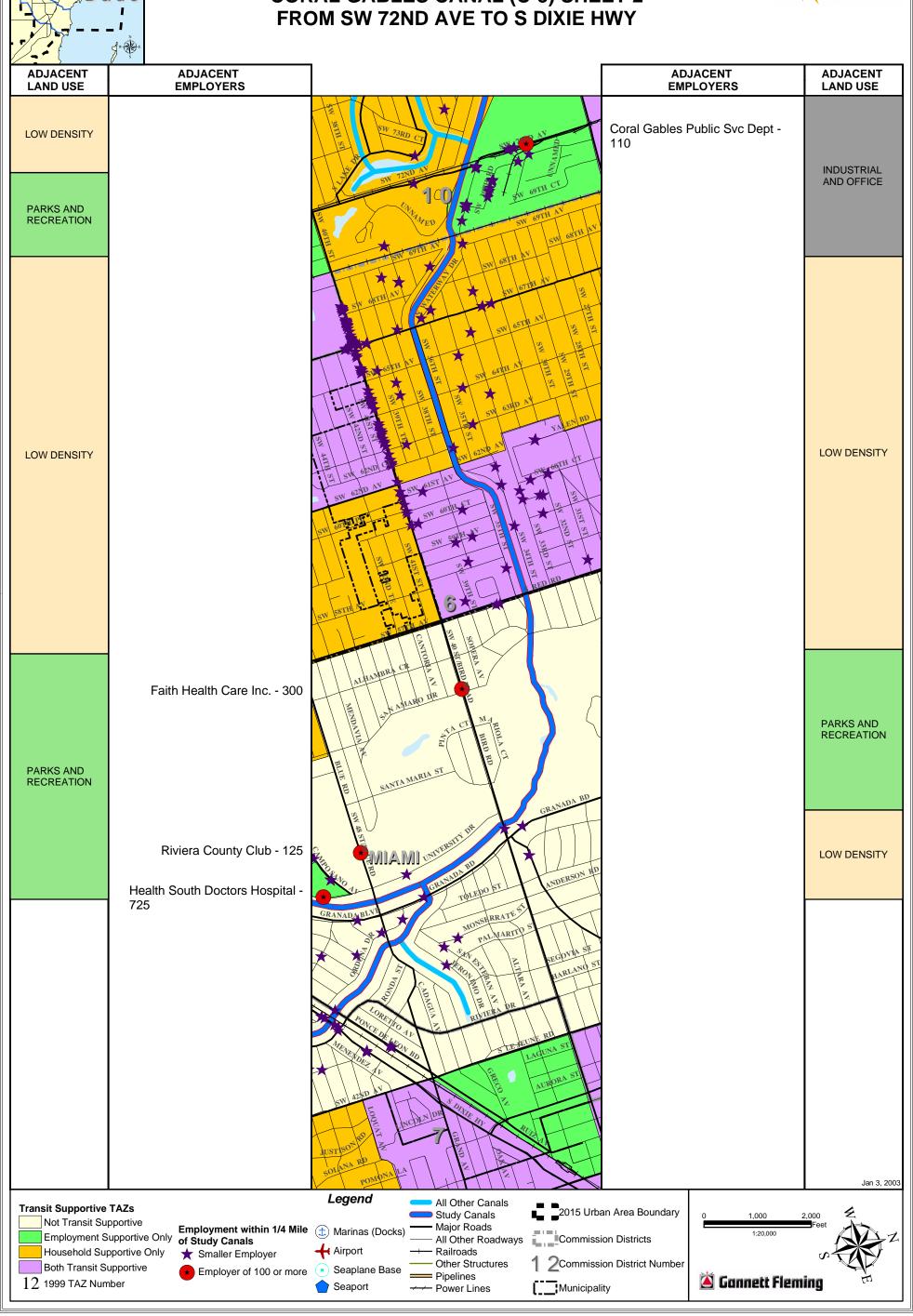
## CORAL GABLES CANAL (C-3) SHEET 1 FROM TAMIAMI CANAL TO SW 67TH AVE



#### UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 2CG - 2. LANDUSE AND EMPLOYERS



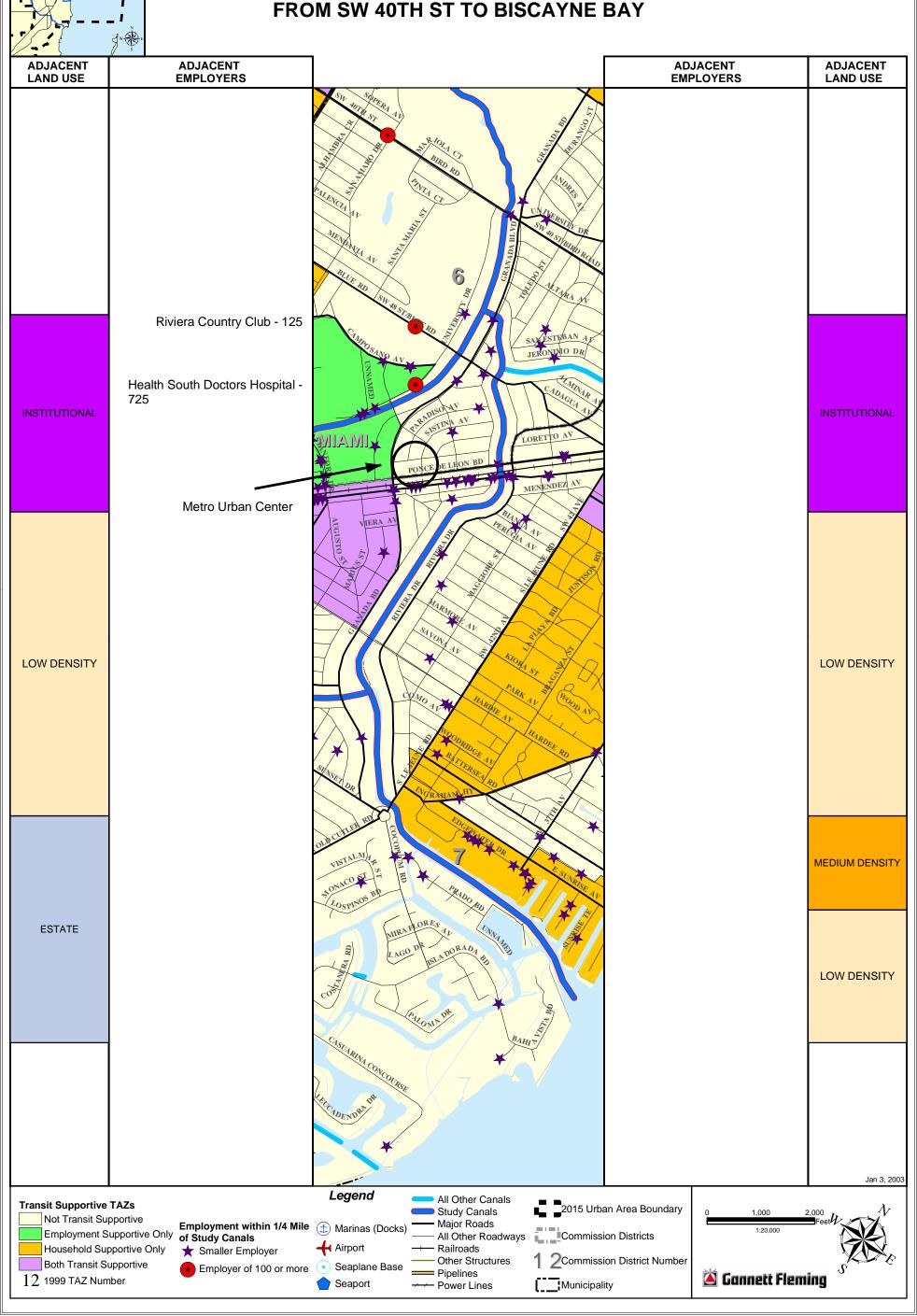
## **CORAL GABLES CANAL (C-3) SHEET 2**



## UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 2CG - 3. LANDUSE AND EMPLOYERS



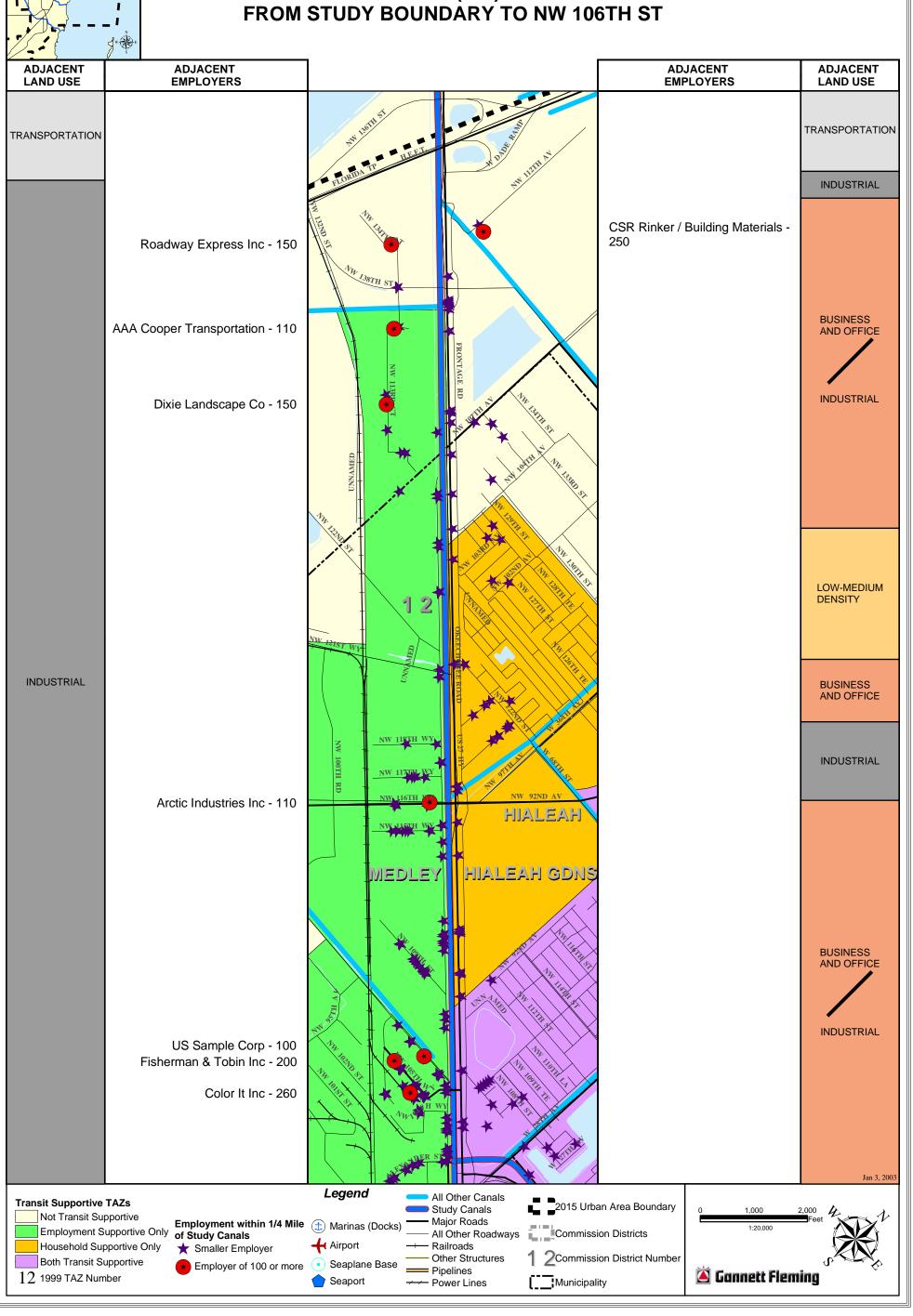
## CORAL GABLES CANAL (C-3) SHEET 3 FROM SW 40TH ST TO BISCAYNE BAY



### UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 2M - 1. LANDUSE AND EMPLOYERS



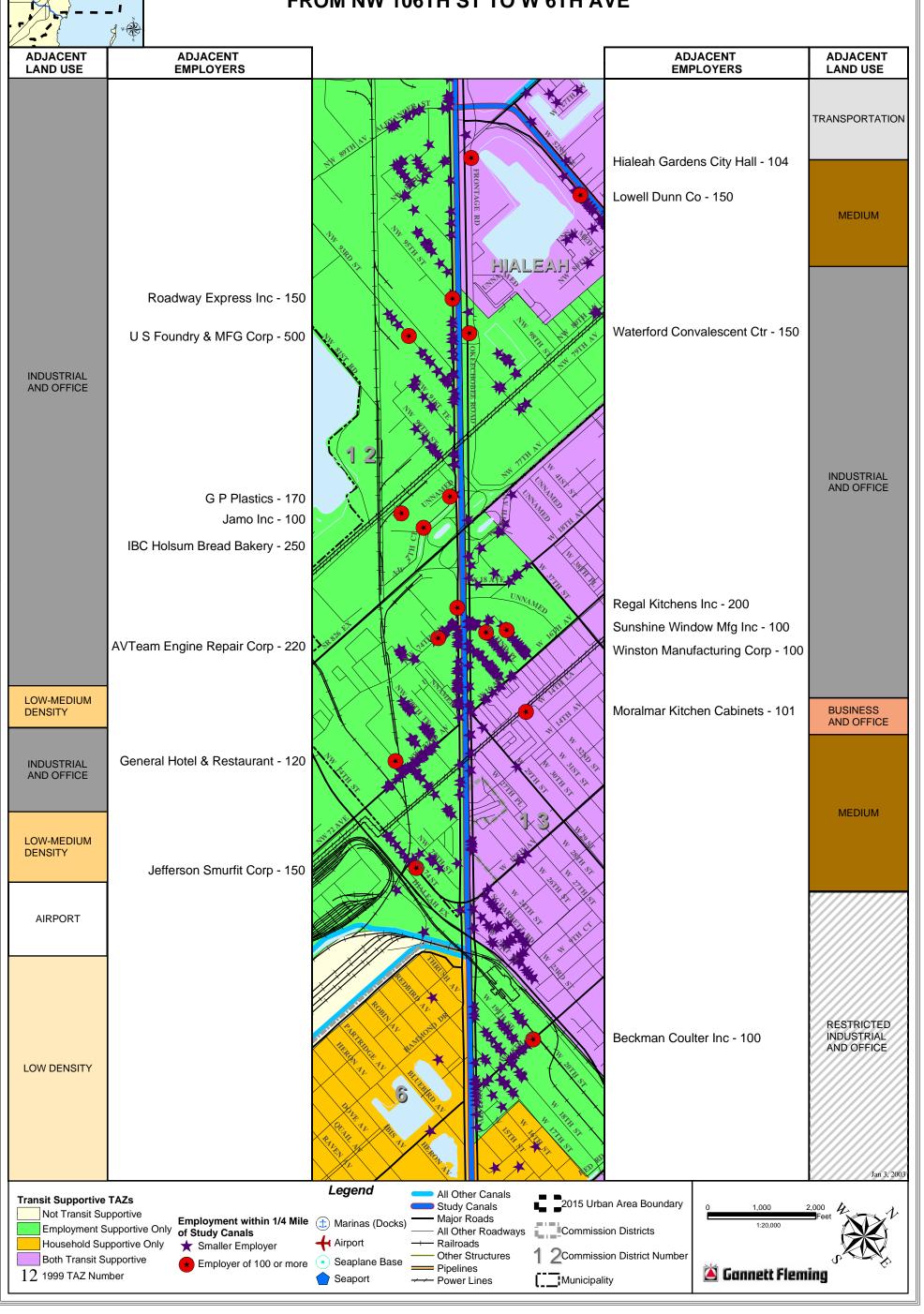
### MIAMI CANAL (C-6) SHEET 1 FROM STUDY BOUNDARY TO NW 106TH ST



### UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 2M - 2. LANDUSE AND EMPLOYERS



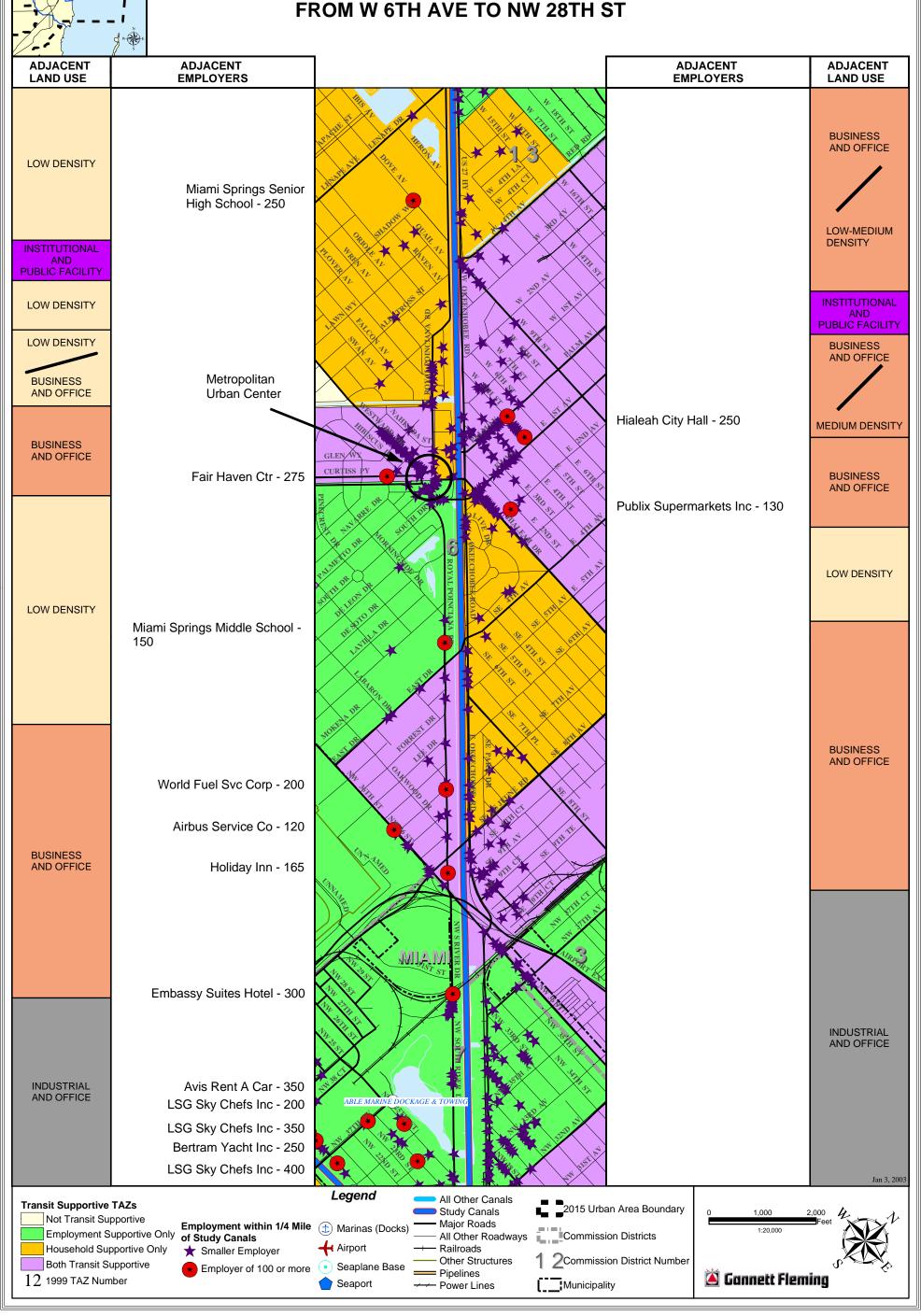
#### MIAMI CANAL (C-6) SHEET 2 FROM NW 106TH ST TO W 6TH AVE



### UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 2M - 3. LANDUSE AND EMPLOYERS



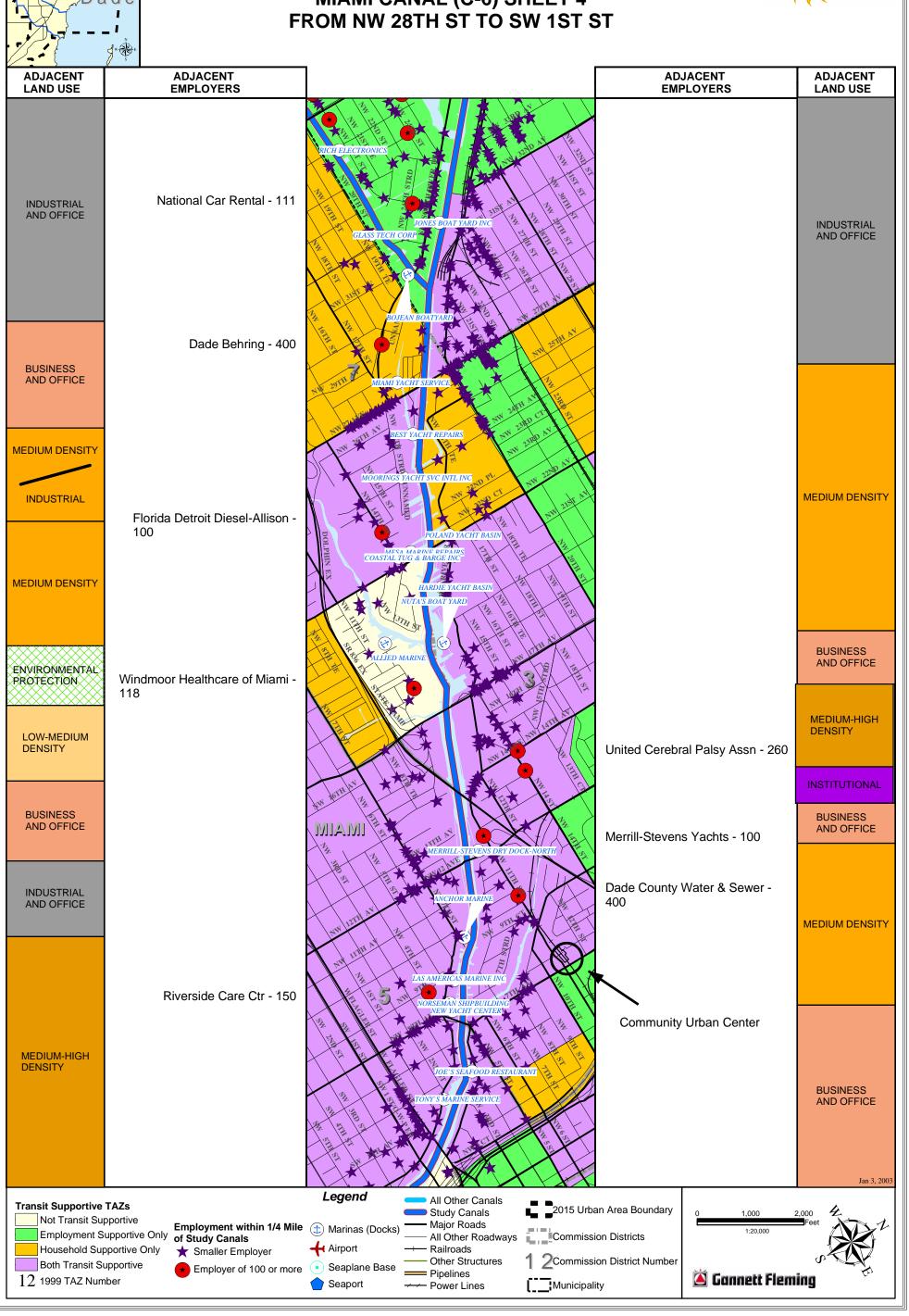
#### MIAMI CANAL (C-6) SHEET 3 FROM W 6TH AVE TO NW 28TH ST



### UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 2M - 4. LANDUSE AND EMPLOYERS



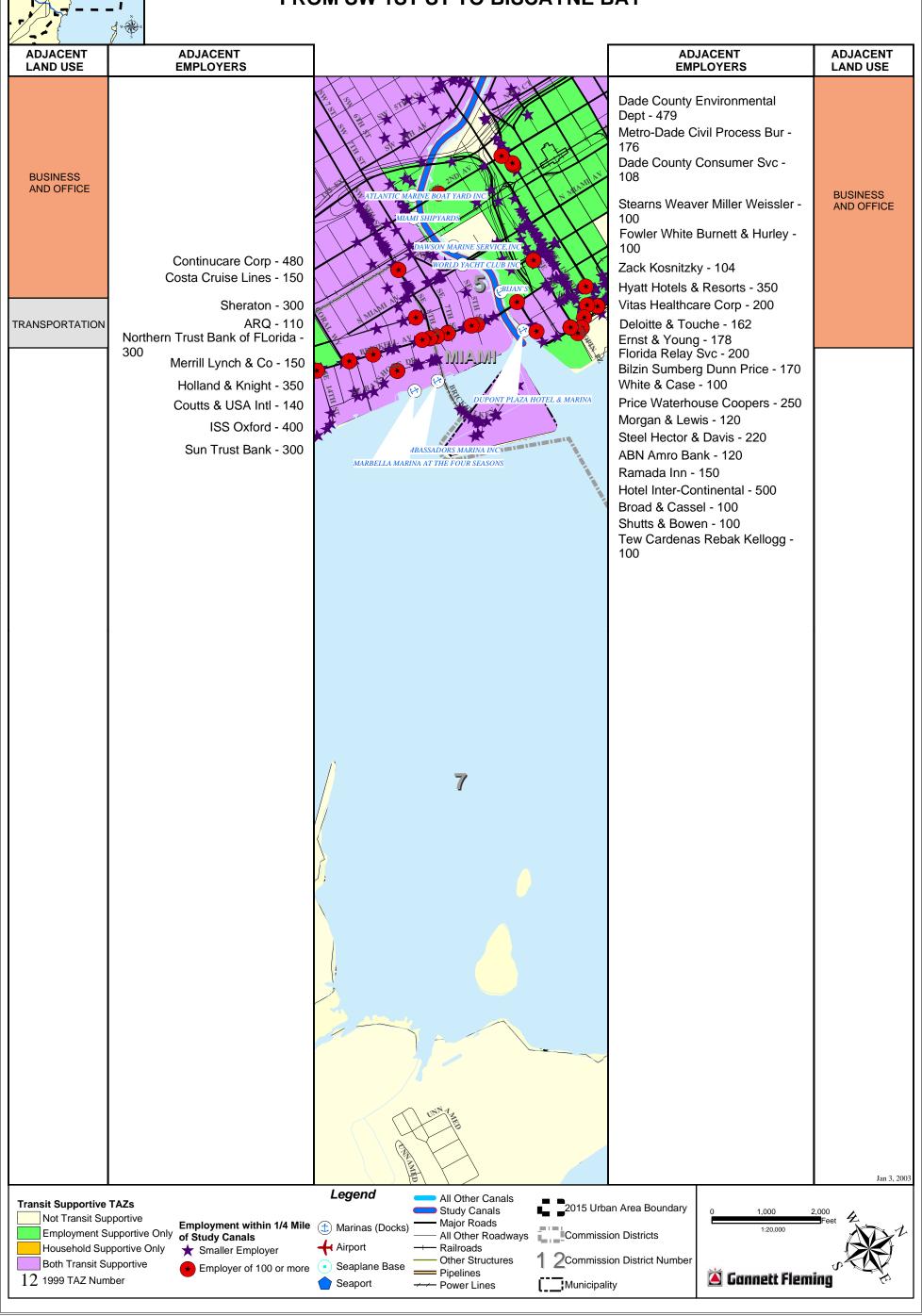
## MIAMI CANAL (C-6) SHEET 4



#### UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 2M - 5. LANDUSE AND EMPLOYERS



#### MIAMI CANAL (C-6) SHEET 5 FROM SW 1ST ST TO BISCAYNE BAY

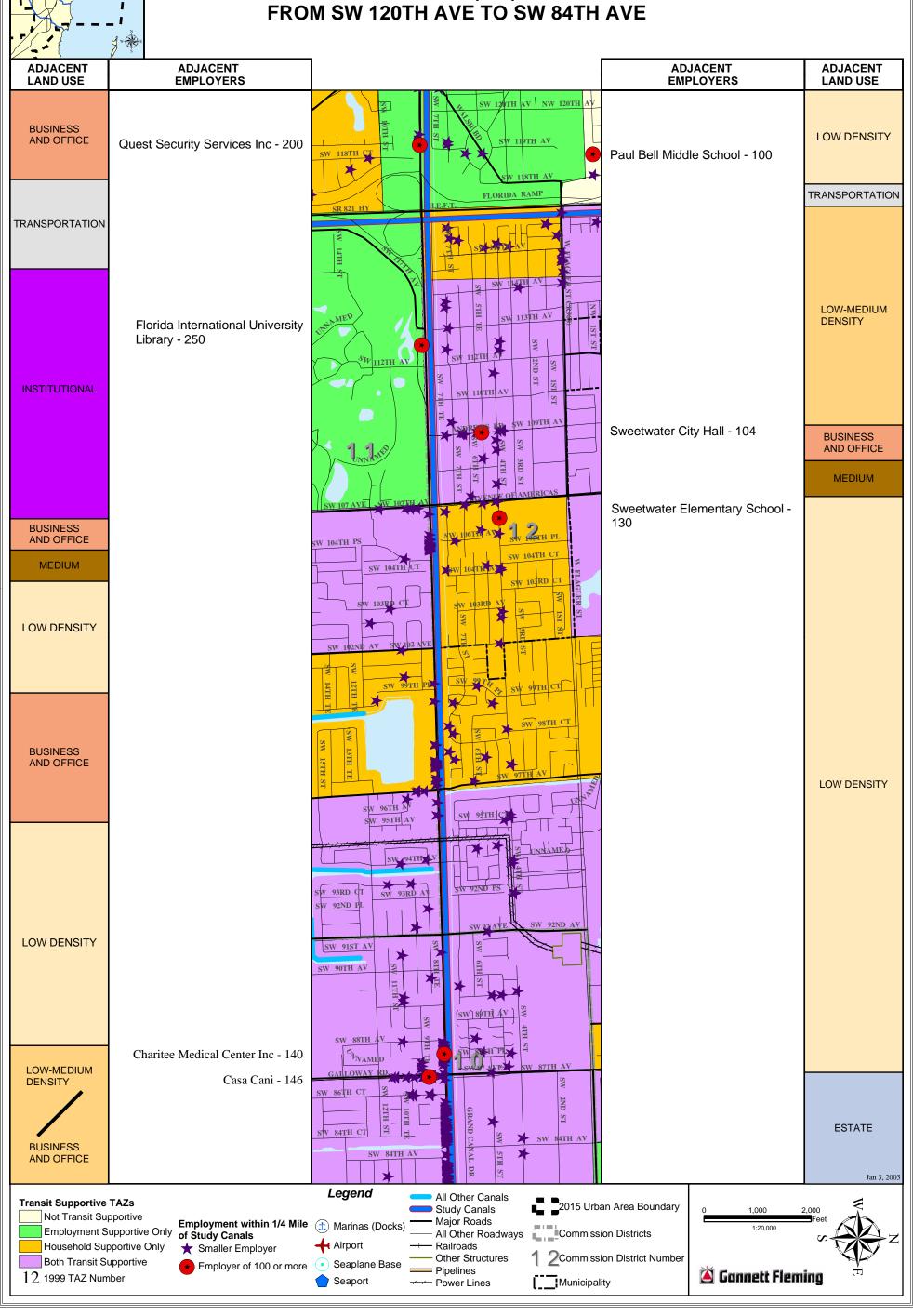


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### UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 2T - 2. LANDUSE AND EMPLOYERS



#### TAMIAMI CANAL (C-4) SHEET 2 FROM SW 120TH AVE TO SW 84TH AVE

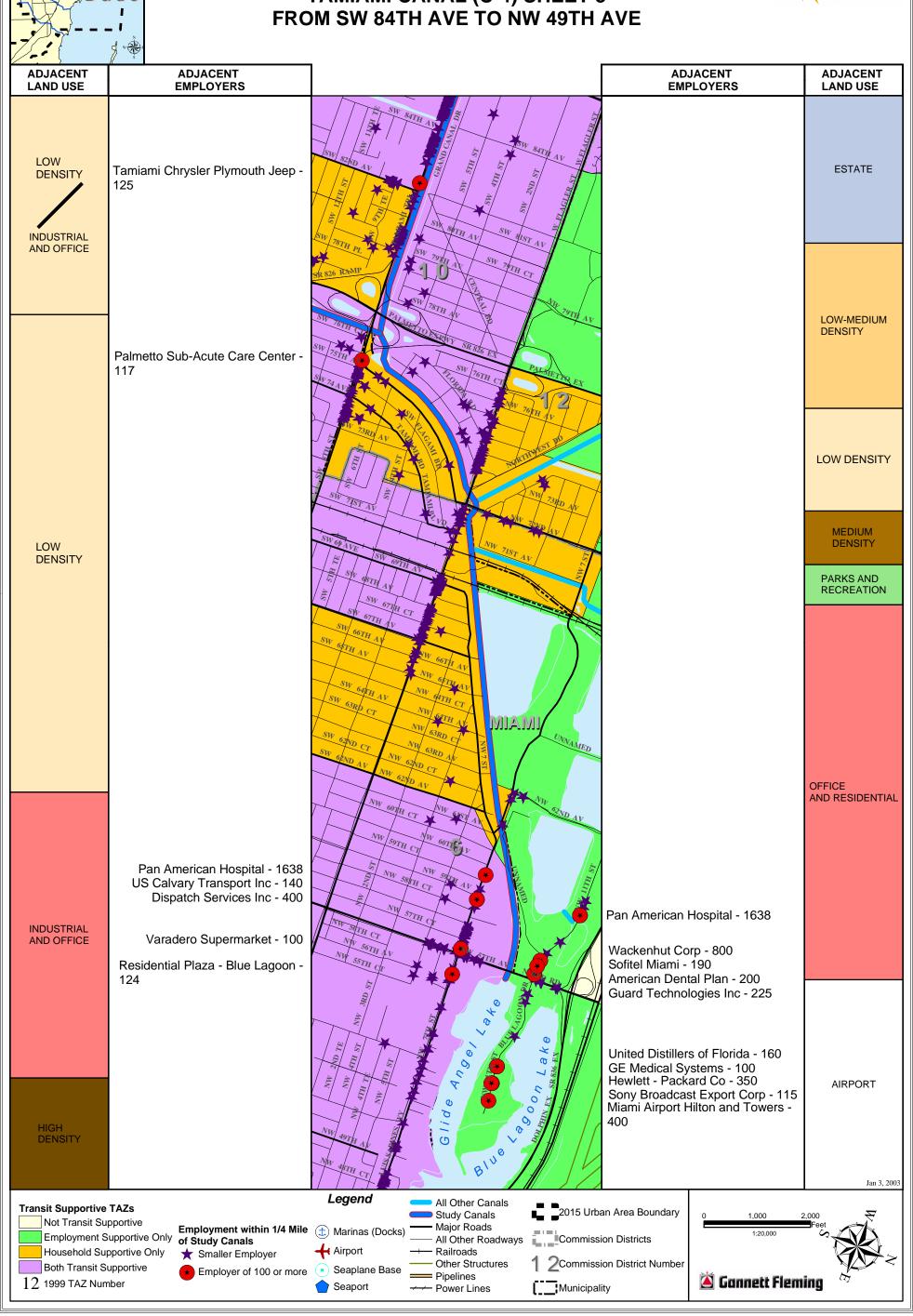




#### UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 2T - 3. LANDUSE AND EMPLOYERS



## **TAMIAMI CANAL (C-4) SHEET 3**



### UTILIZATION OF MIAMI-DADE COUNTY WATERWAYS FOR URBAN COMMUTING TRAVEL MAP 2T - 4. LANDUSE AND EMPLOYERS



## TAMIAMI CANAL (C-4) SHEET 4

