



Miami Dade County Water and Sewer Department Engineering & Construction

Large-Diameter Force Main (LDFM) Rehabilitation/ Replacement Program Work Plan

AUGUST 2022





VERSION CONTROL DOCUMENTATION

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Initial Draft	6/16/2022	Amaury P. Betancourt	
Second Draft	7/20/2022	Amaury P. Betancourt	
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LIST OF ACRONYMS

Abbreviation	Definition
AWWA	American Water Works Association
AWIA	America's Water Infrastructure Act
CD	Consent Decree
CDWWTP	Central District Wastewater Treatment Plant
CMOM	Capacity, Management, Operations, and Maintenance
DERM	Miami-Dade County Department of Environmental Resources Management
DOH	Department of Health
EOC	Emergency Operations Center
EPA	U.S. Environmental Protection Agency
ERP	Emergency Response Plan
FDEP	Florida Department of Environmental Protection
FEMA	Federal Emergency Management Agency
FlaWARN	Florida's Water/Wastewater Agency Response Network
FMCAPR	Force Main Criticality Assessment and Prioritization Report
FMOPMARF	Force Main Operations, Preventative Maintenance, and Assessment/Rehabilitation Program
FMRRP	Force Main Repair and Rehabilitation Program
FPL	Florida Power & Light
gpm	gallon(s) per minute
HMA	Hazard Mitigation Assistance
hp	horsepower
kVA	kilovolt-amperes
LDFM	Large-Diameter Force Main
MDWASD	Miami-Dade Water and Sewer Department
MG	million gallon
mph	mile(s) per hour
N/A	not applicable
No.	number
OSHA	Occupational Safety and Health Administration
PO	purchase order
psi	pounds per square inch
PWD	Public Works Department
Qty	quantity
ROW	Right-of-Way



1. PURPOSE

The purpose of the Force Main Rehabilitation/Replacement Program (FMRRP) is to repair or replace the county's most vulnerable force mains, i.e., those at highest risk of failure. A subset of high-risk force mains includes large-diameter force mains (LDFMs) [defined as having a diameter of at least thirty-six (36) inches] aged fifty (50) years and older, as well as large-diameter canal crossing force mains aged forty (40) years and older. While WASD is currently developing an updated Force Main Criticality Assessment and Prioritization Report (FMCAPR) to assess risk of failure of all force mains throughout the County, the above-described subset of force mains (i.e., the oldest large-diameter force mains and canal crossings) will be prioritized initially. As such, the purpose of the present document is to identify this subset of force mains geographically throughout the County, assess expected costs for rehabilitation/replacement projects (i.e., including pre-design, design, construction, and project close-out), and propose a schedule for implementation of these projects.



2. BACKGROUND

In accordance with the Consent Decree (CD) between Miami-Dade Water and Sewer Department (WASD), the Florida Department of Environmental Protection (FDEP), and the United States Environmental Protection Agency (EPA), WASD developed plans for the Force Main Operations, Preventative Maintenance, and Assessment/Rehabilitation Program (FMOPMARP) and for the Force Main Rehabilitation/Replacement Program (FMRRP). The FMOPMARP and FMRRP are part of the larger Capacity, Management, Operations and Maintenance (CMOM) program under the CD. The FMOPMARP and FMRRP Plans were approved by EPA on October 17, 2017 and September 28, 2017, respectively.

Following approval of the FMOPMARP and FMRRP Plans, WASD developed and submitted to FDEP and EPA the Force Main Criticality Assessment and Prioritization Report (FMCAPR) on July 17, 2018. The report outlines the results of WASD's risk matrix, with the risk derived from a combination of probability of failure (POF) and consequence of failure (COF). The 2018 FMCAPR provides details on the methodology for assessing risk of each force main segment in the County and the results of the assessment.



3. METHODOLOGY

Using WASD's geographic information system (GIS) data on force mains throughout the County, ageing large-diameter force mains that meet the criteria outlined above were identified and mapped. These maps are shown below as distributed by age range (**Figure 1**) and diameter (**Figure 2**).

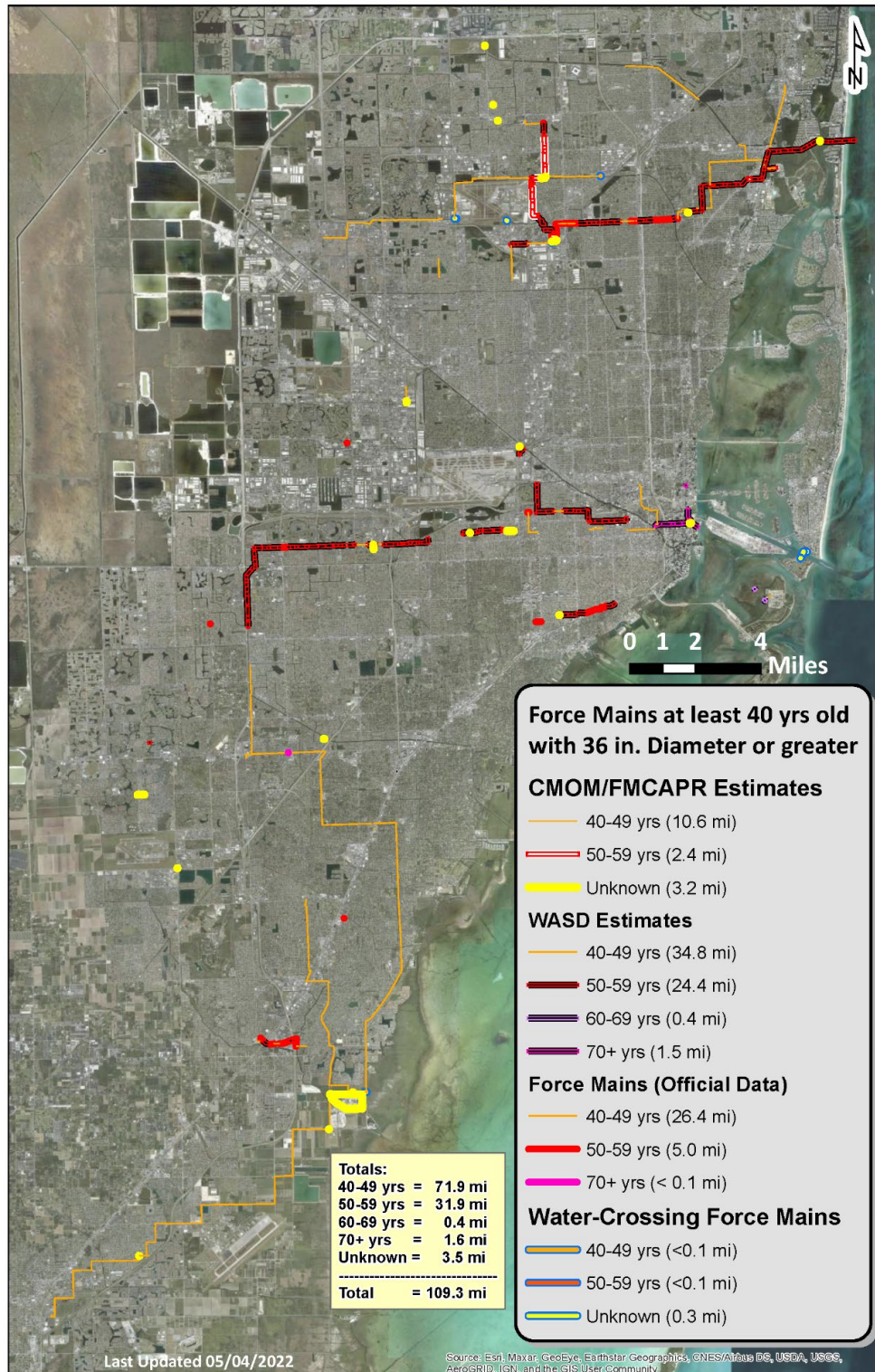


Figure 1: Map highlighting large-diameter ($\geq 36"$) force mains that are 50 years old or older.

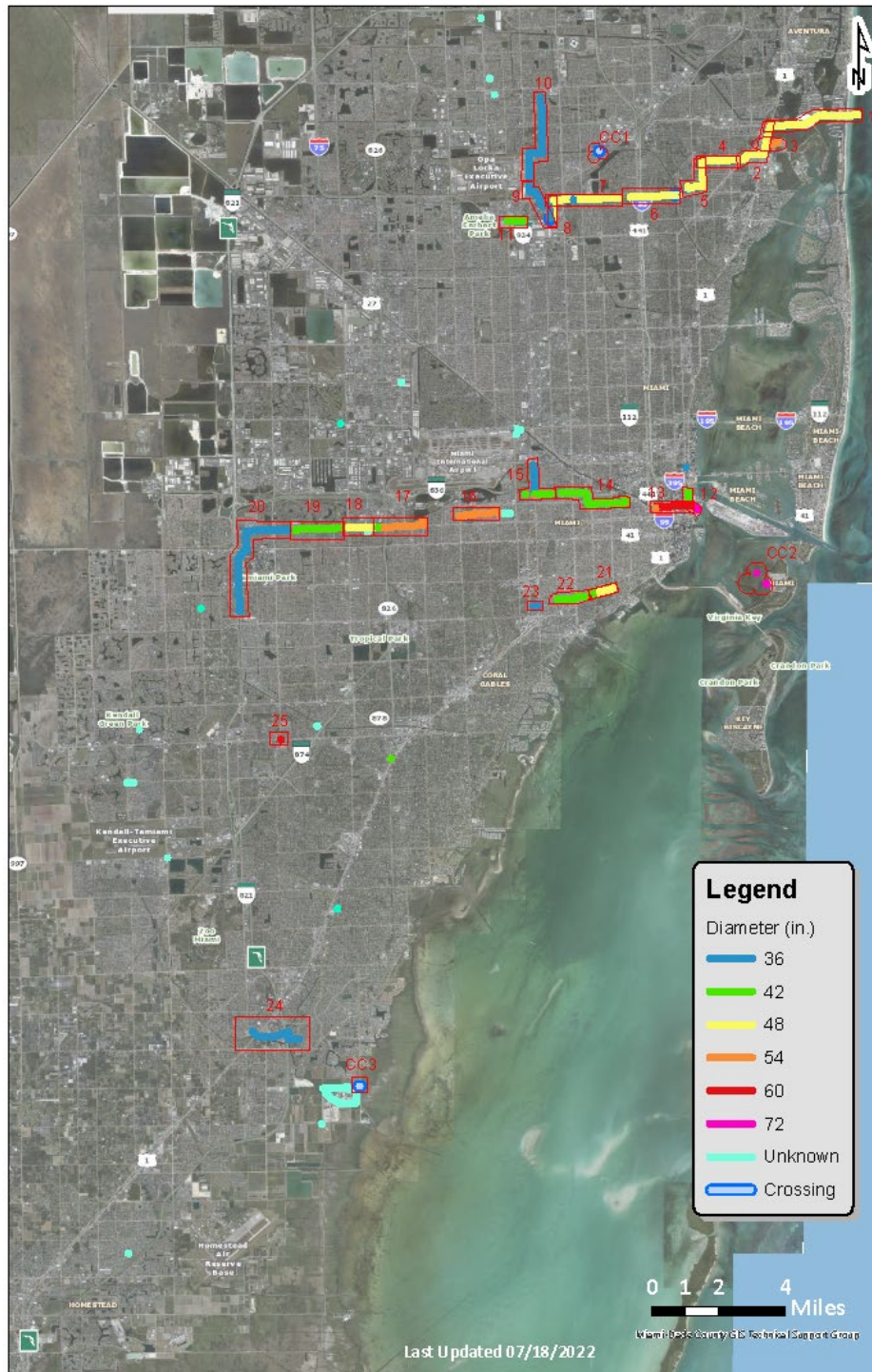


Figure 2: Distribution of large-diameter force mains aged at least 50 years, and large-diameter canal crossing force mains aged at least 40 years, based on diameter size.



4. PROPOSED PROJECTS

Total linear footage and estimated costs for rehabilitation/replacement is shown below in

Table 1: County-wide distribution of total lengths, by diameter, of force mains (on land) aged 50 years and older, and canal crossing force mains aged 40 years and older, and cost estimates for rehabilitation/repair.

Force Mains (on land)			Canal Crossings		
	Total Length	Cost		Total Length	Cost
Diameter	(LF)	(\$)	Diameter	(LF)	(\$)
36"	52,775	\$48,000,000	36"	246	\$1,000,000
42"	36,968	\$42,000,000	42"	0	\$0
48"	62,953	\$87,000,000	48"	0	\$0
54"	16,430	\$28,000,000	54"	228	\$1,000,000
60"	4,251	\$9,000,000	60"	1,537	\$4,000,000
66"	0	\$0	66"	0	\$0
72"	2,273	\$7,000,000	72"	234	\$1,000,000
78"	0	\$0	78"	0	\$0
84"	0	\$0	84"	0	\$0
96"	0	\$0	96"	0	\$0
0" (Unknown)	1,080		0" (Unknown)	0	
TOTALS	176,730	\$221,000,000	TOTALS	2,245	\$7,000,000

The total costs estimated per pipe diameter are an estimate for planning purposes. **Figure 3** below shows the distribution of proposed projects, and **Table 2** shows the diameters and the estimated lengths and costs for each proposed project. Details, divvyed out by individual projects, are provided in Appendix A. The projects are estimated to be distributed between consultants, and completed over the next five to seven years.

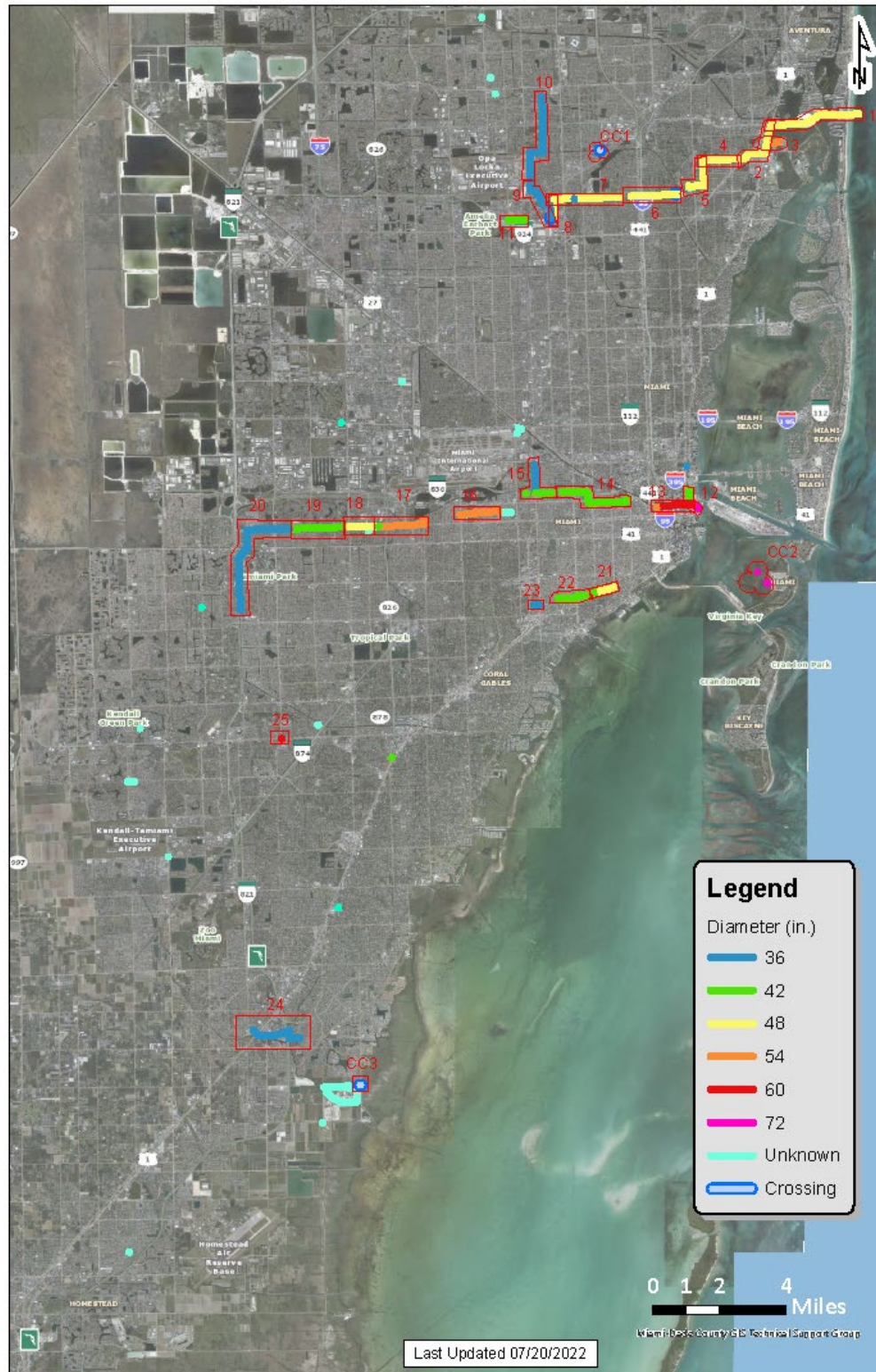


Figure 3: Map of proposed project distributions for force main rehabilitations/repairs.



Table 2: Estimated details for proposed projects (diameters, lengths, and costs)

Project	Dia (in.)	Length (LF)	Total Cost	Design Cost*
1	48	14,000	\$19,292,000	\$1,929,200
2	48	6,700	\$9,232,600	\$923,260
3	54	1,900	\$3,167,300	\$316,730
4	48	6,300	\$8,681,400	\$868,140
5	48	9,700	\$13,366,600	\$1,336,660
6	48	7,600	\$10,472,800	\$1,047,280
7	48	10,100	\$13,917,800	\$1,391,780
8	48	2,700	\$3,720,600	\$372,060
9	36	6,500	\$5,811,000	\$581,100
10	36	15,200	\$13,588,800	\$1,358,880
11	42	2,700	\$3,026,700	\$302,670
12a**	42	2,000	\$2,242,000	\$224,200
12b**	72	1,150	\$3,128,000	\$312,800
13a**	60	5,550	\$11,027,850	\$1,102,785
13b**	54	100	\$166,700	\$16,670
14	42	10,250	\$11,490,250	\$1,149,025
15a	36	4,500	\$4,023,000	\$402,300
15b	42	2,750	\$3,082,750	\$308,275
15c	54	100	\$166,700	\$16,670
16a	54	5,350	\$8,918,450	\$891,845
16b	36	100	\$89,400	\$8,940
17a	54	3,600	\$6,001,200	\$600,120
17b	36	100	\$89,400	\$8,940
18	48	4,700	\$6,476,600	\$647,660
19a	42	8,865	\$9,937,665	\$993,767
19b	36	35	\$31,290	\$3,129
20	36	15,200	\$13,588,800	\$1,358,880
21	48	3,200	\$4,409,600	\$440,960
22	42	5,900	\$6,613,900	\$661,390
23	36	850	\$759,900	\$75,990
24	36	7,000	\$6,258,000	\$625,800
25	60	60	\$119,220	\$11,922
CC1	72	35	\$95,200	\$9,520
CC2	72	225	\$612,000	\$61,200
Totals		165,270	\$204,285,475	\$20,428,548



APPENDIX A: PROPOSED PROJECT DIVISIONS AND COSTS

Project	Dia (in.)	Approx Length (LF)	Total_Cost	Design_Cost*
1	48	14,000	\$19,292,000	\$1,929,200
2	48	6,700	\$9,232,600	\$923,260
3	54	1,900	\$3,167,300	\$316,730
4	48	6,300	\$8,681,400	\$868,140
5	48	9,700	\$13,366,600	\$1,336,660
6	48	7,600	\$10,472,800	\$1,047,280
7	48	10,100	\$13,917,800	\$1,391,780
8	48	2,700	\$3,720,600	\$372,060
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10	36	15,200	\$13,588,800	\$1,358,880
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15c	54	100	\$166,700	\$16,670
16a	54	5,350	\$8,918,450	\$891,845
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18	48	4,700	\$6,476,600	\$647,660
19a	42	8,865	\$9,937,665	\$993,767
19b	36	35	\$31,290	\$3,129
20	36	15,200	\$13,588,800	\$1,358,880
21	48	3,200	\$4,409,600	\$440,960
22	42	5,900	\$6,613,900	\$661,390
23	36	850	\$759,900	\$75,990
24	36	7,000	\$6,258,000	\$625,800
25	60	60	\$119,220	\$11,922
CC1	72	35	\$95,200	\$9,520
CC2	72	250	\$680,000	\$68,000
CC3	72	225	\$612,000	\$61,200
165,270			\$204,285,475	\$20,428,548

*Design cost is estimated to be 10% of total cost.

**Projects in Downtown Miami will likely be more expensive than estimated here due to urban density.

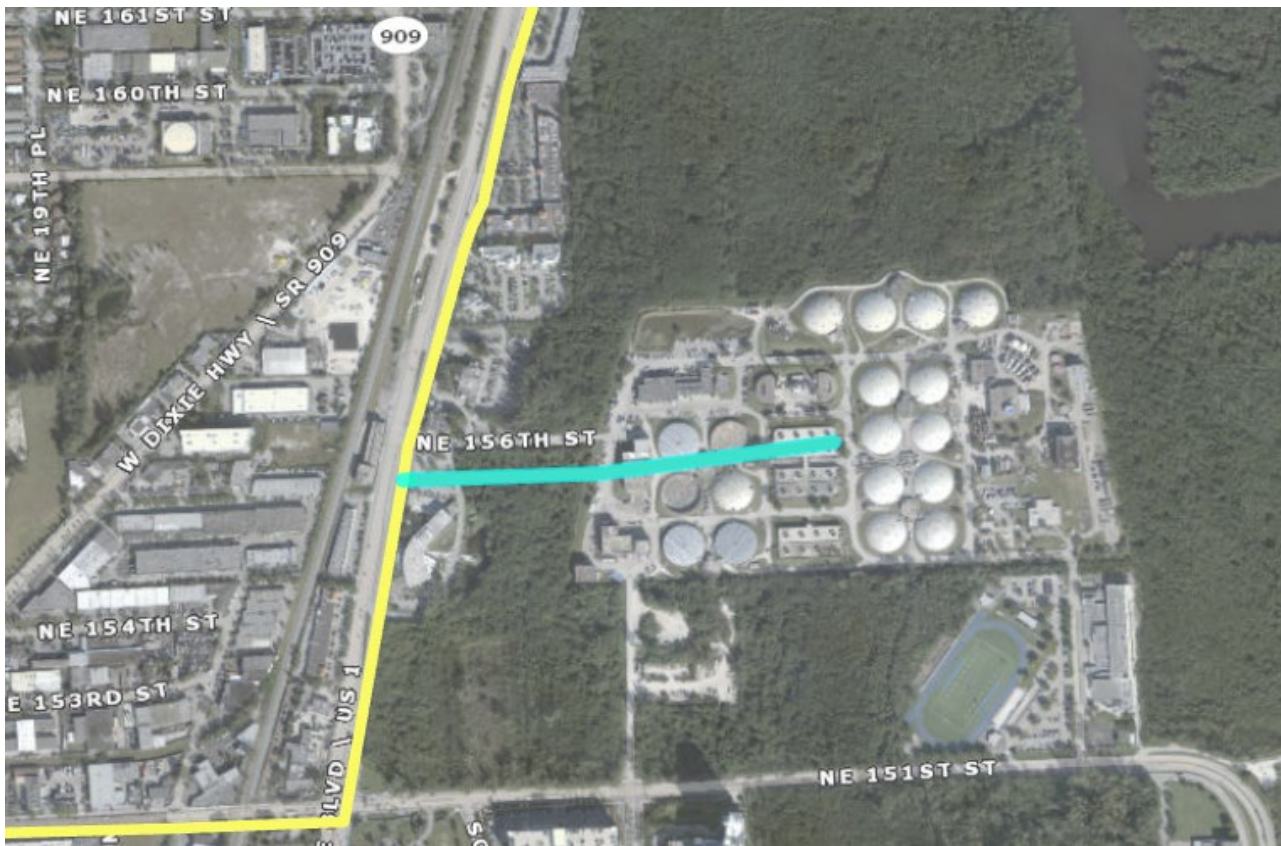
Project Number: 1
Diameter: 48 in
Approx Length: 5,600 LF
Approx Age: 58 yrs
Material(s): Reinforced Concrete
Atlases: A4, B4, C4
Area: North Miami Beach, North Miami, and Sunny Isles Beach
Commission D.: 4
Description: FM along NE 163rd St, between Biscayne Blvd and A1A
Comments: The easternmost 1,700 LF appear to extend into the ocean



Project Number: 2
Diameter: 48 in.
Approx Length: 6,700 LF
Approx Age: 58 yrs
Material(s): Reinforced Concrete
Atlases: C4, C5, D5
Area: North Miami Beach and North Miami
Commission D.: 2,4
Description: FM along Biscayne Blvd (from NE 163rd St to NE 151st St); then along
then along NE 151st St from Biscayne Blvd to W Dixie Hwy;
then along W Dixie Hwy from NE 151st St to NE 149th St
Comments:



Project Number: 3
 Diameter: 54 in
 Approx Length: 1,900 LF
 Approx Age: 58 yrs
 Material(s): Reinforced Concrete
 Atlases: C4
 Area: North Miami
 Commission D.: 4
 Description: FM from Biscayne Blvd near NE 156th St to North District WWTP
 Comments: FM at point of connection to Biscayne Blvd (~60 LF) is 42 in. diameter

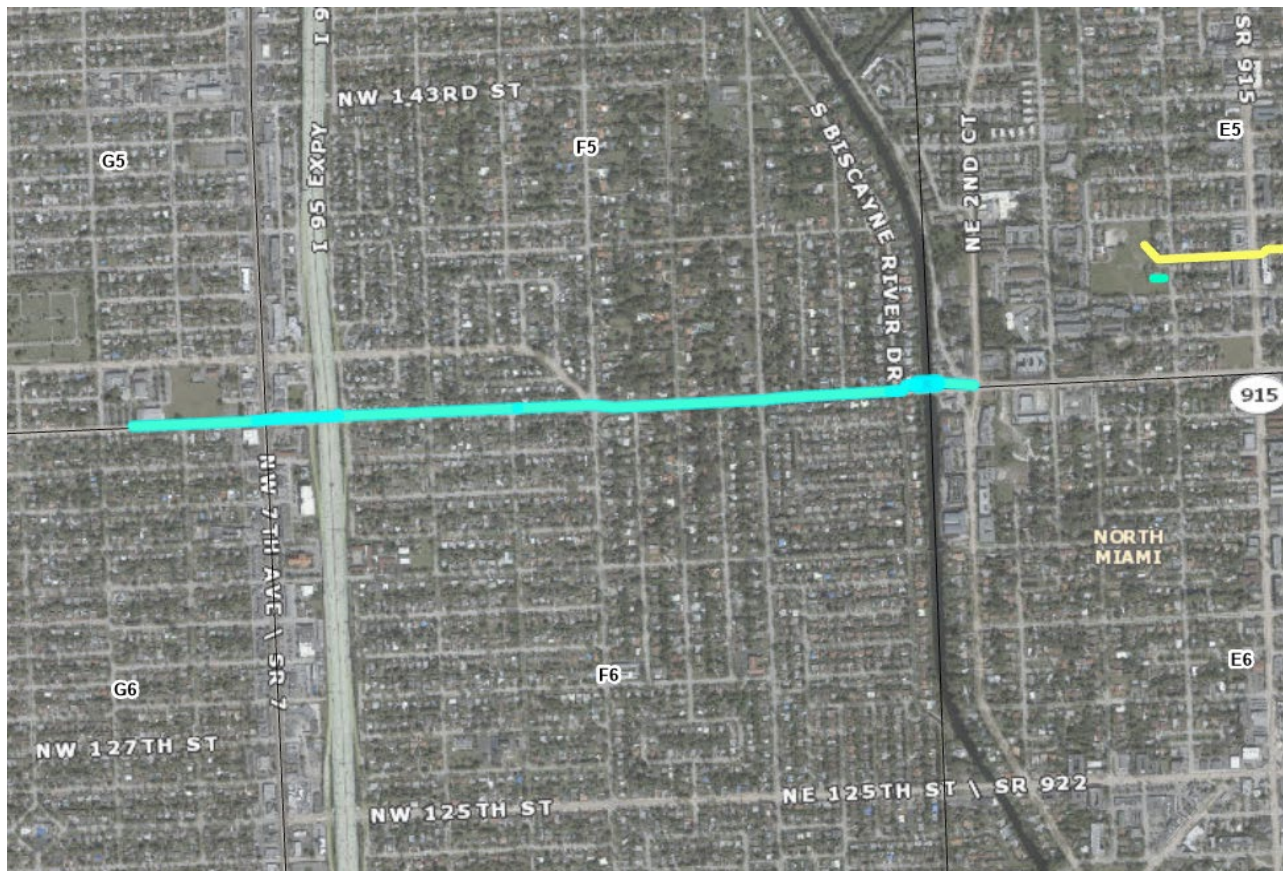


Project Number: 4
 Diameter: 48 in
 Approx Length: 6,300 LF
 Approx Age: 58 yrs
 Material(s): Reinforced Concrete
 Atlases: D5, E5
 Area: Unincorporated Dade and North Miami
 Commission D.: 2
 Description: FM along NE 149th St from Biscayne Blvd to NE 8th Ave
 Comments: A ~300 LF portion of 48in FM, along NE 149th St between NE 9th Ct and NE 10th Ave,





Project Number: 6
 Diameter: 48 in
 Approx Length: 7,600 LF
 Approx Age: 53 yrs
 Material(s): Mixed: Pre-Stressed Concrete & Unknown; Steel for canal crossing.
 Atlases: E5, E6, F5, F6, G5, G6
 Area: North Miami and Unincorporated Dade
 Commission D.: 2
 Description: FM along 135th St from NE 2nd Ave to Biscayne Canal C-8;
 then a 36 in. aerial canal crossing FM;
 then along NE 135th St, from Biscayne Canal C-8 to almost NW 10th Ave
 (FM ends about 275 ft due east of NW 10th Ave).
 Comments: Canal Crossing is ~170 LF and 36 in. diameter.
 FM from NE 2nd Ave to Biscayne Canal C-8 is ~330 LF.



Project Number: 7
 Diameter: 48 in
 Approx Length: 10,100 LF
 Approx Age: 56 yrs
 Material(s): Pre-Stressed Concrete
 Atlases: G5, G6, H5, H6, J5, J6
 Area: Opa-Locka, North Miami, and Unincorporated Dade
 Commission D.: 2
 Description: FM along NW 135th St, between NW 12th Ave and NW 30th Ave (Aswan Rd)
 Comments: A ~200 LF portion of 48 in. FM, along NW 135th St between NW 17th and 18th Ave, is only ~9 yrs old and should not need replacement.



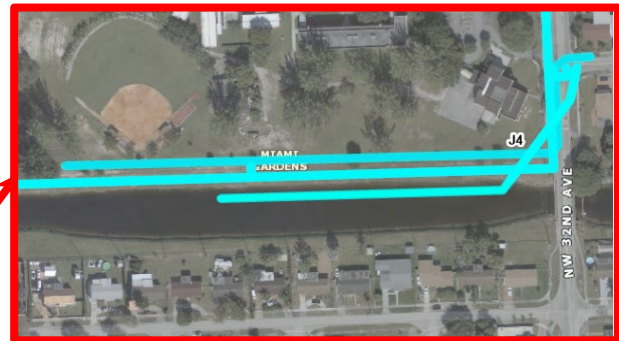
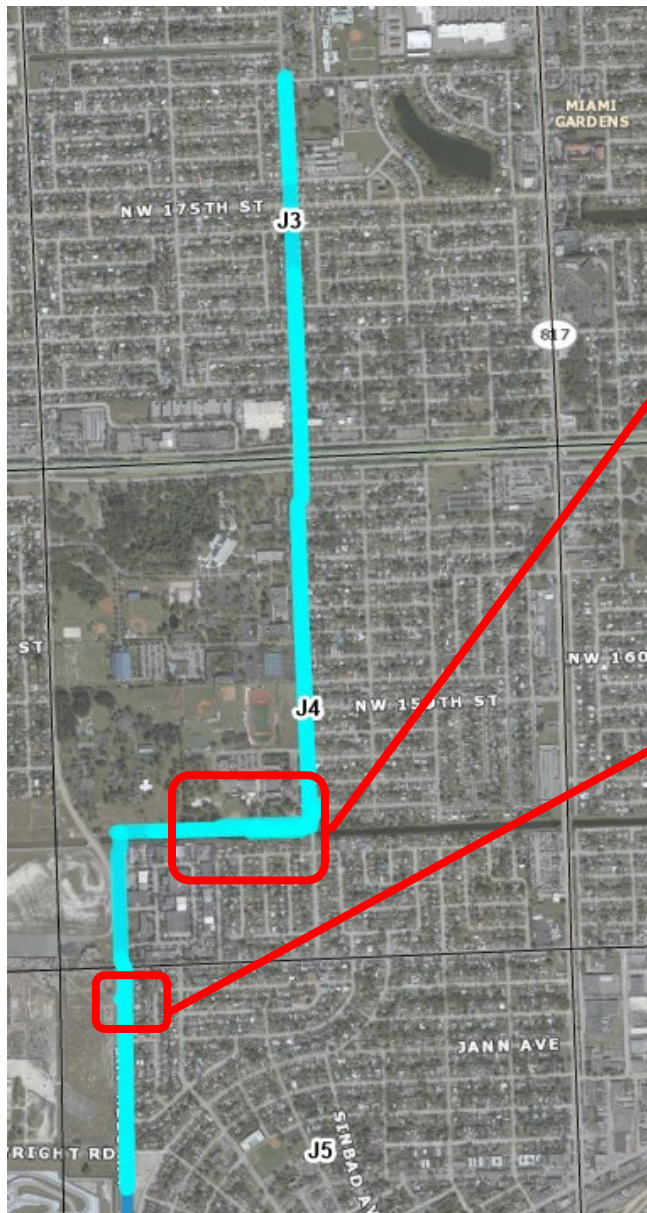
Project Number: 8
Diameter: 48 in
Approx Length: 2,700 LF
Approx Age: 53 yrs
Material(s): Mixed: primarily Pre-Stressed Concrete; Unknown material may be Ductile Iron.
Atlases: J6
Area: Opa-Locka
Commission D.: 2
Description: FM along NW 30th Ave, from NW 135th St to approx. NW 127th St;
then due West approx. 150 ft into property.
Comments: FM turns into property before reaching NW 127th St (~150 ft north of NW 127th St);
There are approximately 350 LF of FM of unknown age, and of mixed diameters
(42 in. and unknown), inside of property near 127th St and NW 30th Ave.
Note that this project could be combined with an adjacent project.



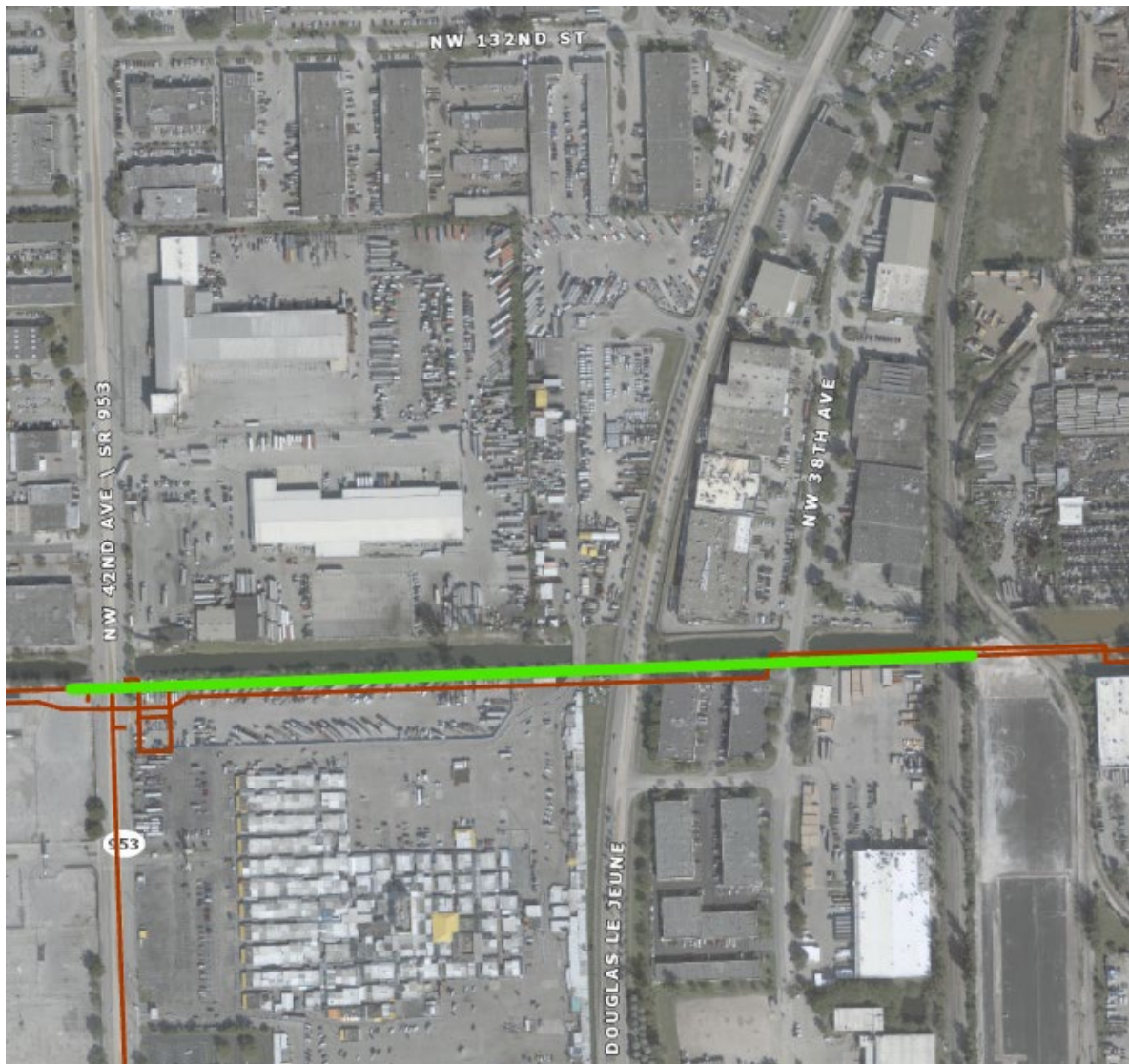
Project Number: 9
 Diameter: 36 in
 Approx Length: 6,500 LF
 Approx Age: 52 yrs
 Material(s): Mixed: Primarily Ductile; some Unknown; Canal Crossing is Steel.
 Atlases: J5, J6
 Area: Opa-Locka and Unincorporated Dade
 Commission D.: 1, 2
 Description: FM along NW 37th Ave, from Sabur Ln to Fisherman St.;
 then along Fisherman St southward to Dunad Ave;
 then along Dunad Ave, southward towards and across Ali Baba Ave to Burlington St;
 then eastward along Superior St to Sesame St;
 then southward along Sesame St to NW 135th St;
 then eastward along NW 135th St to NW 32nd Ct;
 then southward along NW 32nd Ct to NW 132nd Ter;
 then eastward along NW 132nd Ter to NW 31st Ave;
 then southward along NW 31st Ave to approx. NW 128th St
 FM branches here in two segments: one is southward, and inclusive of, canal crossing
 across the NW 127th St Canal; second is eastward for ~600 LF.
 Comments: Additional ~500 LF of FM of unknown age & diameter within property adjacent to canal.



Project Number: 10
 Diameter: 36 in
 Approx Length: 15,200 LF
 Approx Age: 52 yrs
 Material(s): Primarily Ductile Iron; some Pre-Stressed Concrete.
 Atlases: J3, J4, J5
 Area: Miami Gardens, Opa-Locka, and Unincorporated Dade
 Commission D.: 1
 Description: FM along NW 32nd Ave, from NW 179th St southward to Biscayne Canal C8 (north side); then westward along north side of canal to NW 37th Ave; then cross canal and head southward along NW 37th Ave to Sabur Ln.
 Comments: See insets below for closeup of FM segments to be replaced along NW 32nd Ave and Biscayne Canal C8, and along NW 37th Ave between NW 151st St and Sultan Ave



Project Number: 11
 Diameter: 42 in
 Approx Length: 2,700 LF
 Approx Age: 53 yrs
 Material(s): Cast-Iron
 Atlases: K6
 Area: Opa-Locka
 Commission D.: 2
 Description: FM along south side of NW 127th St Canal, from NW 42nd Ave to the railroad tracks east of NW 38th Ave
 Comment: FM connected west of this FM is also >50 yrs, but is 30 in diameter (i.e., not Large Diameter).



Project Number: 12
Diameter: 42 & 72 in
Approx Length: 3,150 LF
Approx Age: 89 yrs
Material(s): Mixed: Concrete and Reinforced Concrete
Atlases: E13, E14
Area: Downtown Miami
Commission D.: 3,5
Description: 42in. FM from Bicentennial Park to Biscayne Blvd, then running southward along Biscayne Blvd to NE 4th St
72in. FM from NE 4th St, running southeast towards Bayfront Park, almost to the Bay.
Comment: 72in. FM at Bayfront Park heads to Central District WWTP. Most of this FM appears to have been replaced in 1997, except for some relatively small portions.
FM at NE 4th St forks westward as well (separate project)



Project Number: 13
Diameter: 60 & 54 in
Approx Length: 5,650 LF
Approx Age: 62 & 89 yrs
Material(s): Primarily Reinforced, and Unknown
Atlases: E14, F14
Area: Downtown Miami
Commission D.: 3, 5
Description: 54in. FM along NE 4th St, from Biscayne Blvd to NW N River Dr;
then relatively short segment (~100 LF) of 60in. FM on riverfront property.
Comment: See inset for details of FM at intersection of NE 4th St and NW N River Dr.



Project Number: 14
 Diameter: 42 in
 Approx Length: 10,250 LF
 Approx Age: 54 yrs
 Material(s): Pre-Stressed Concrete
 Atlases: G14, H14, H13, J13
 Area: Miami
 Commission D.: 5
 Description: FM along NW 13th Ave, from NW 7th St to NW 6th St;
 then westward along NW 6th St, from NW 13th Ave to NW 23rd Ave;
 then northward along NW 23rd Ave, from NW 6th St to NW 7th St;
 then westward along NW 7th St for 200 LF;
 then northward along NW 23rd Ave, from NW 7th St to NW 11th St;
 then westward along NW 11th St, from NW 23rd Ave to NW 30th Ct.
 Comment: Western extent of FM ends just east of NW 30th Ct, and FM that continues westward,
 from NW 30th Ct to just west of NW 32nd Ct, is not as old (42 yrs).





Comment:



Project Number: 16
 Diameter: 54 & 36 in
 Approx Length: 5450 LF
 Approx Age: 51 yrs
 Material(s): Pre-Stressed Concrete (54in. Dia) & Ductile Iron (36in. Dia)
 Atlases: L14
 Area: Miami
 Commission D.: 6
 Description: 54in. FM along NW 4th St, from NW 47th Ave to NW 53rd Ave;
 then along NW 53rd Ave, from NW 4th St to NW 3rd St;
 then along NW 3rd St, from NW 53rd Ave to NW 57th Ave;
 36in. FM loop (two 50LF segments) along NW 3rd St at intersection between
 NW 3rd St and NW 57th Ave;
 then 54in. FM extending approx 50LF past loop.
 Comment: Some portions of FM have been replaced, specifically along NW 4th St at
 NW 52nd Ave; along NW 53rd Ave, between NW 4th and 3rd Streets;
 and along NW 3rd St at NW 5th Ct.



Project Number: 17
 Diameter: 54; 36, 42 in
 Approx Length: 3,700 LF
 Approx Age: 50 yrs
 Material(s): Pre-Stressed Concrete
 Atlases: M14, N14, P14
 Area: Miami and Unincorporated Dade
 Commission D.: 6
 Description: 54in FM running along SW 67th Ave, from NW 2nd St to Flagler St;
 then along Flagler St, from SW67th Ave to SW 78th Pl.
 36in FM structure (approx 100 LF total) along Flagler St at SW 72nd Ave.
 42in blind flange and valve on Flagler St and SW 78th Pl.

Comment:

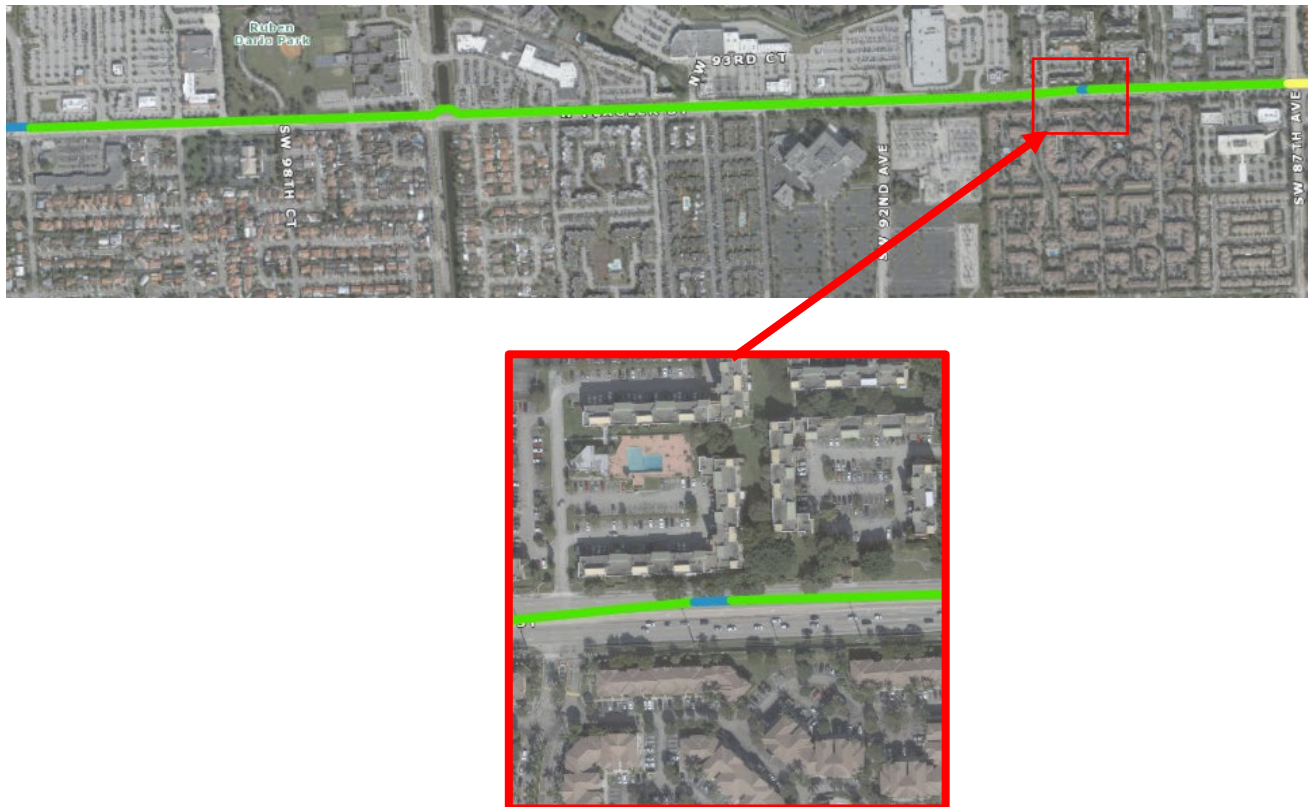


Project Number: 18
 Diameter: 48 in
 Approx Length: 4700 LF
 Approx Age: 51 yrs
 Material(s): Pre-Stressed Concrete
 Atlases: Q14, P14
 Area: Unincorporated Dade
 Commission D.: 6
 Description: FM along Flagler St, from SW 78th Pl to SW 87th Ave
 Comment: Segment of FM, approximately 750 LF of unknown age, along SW 82nd Ave.

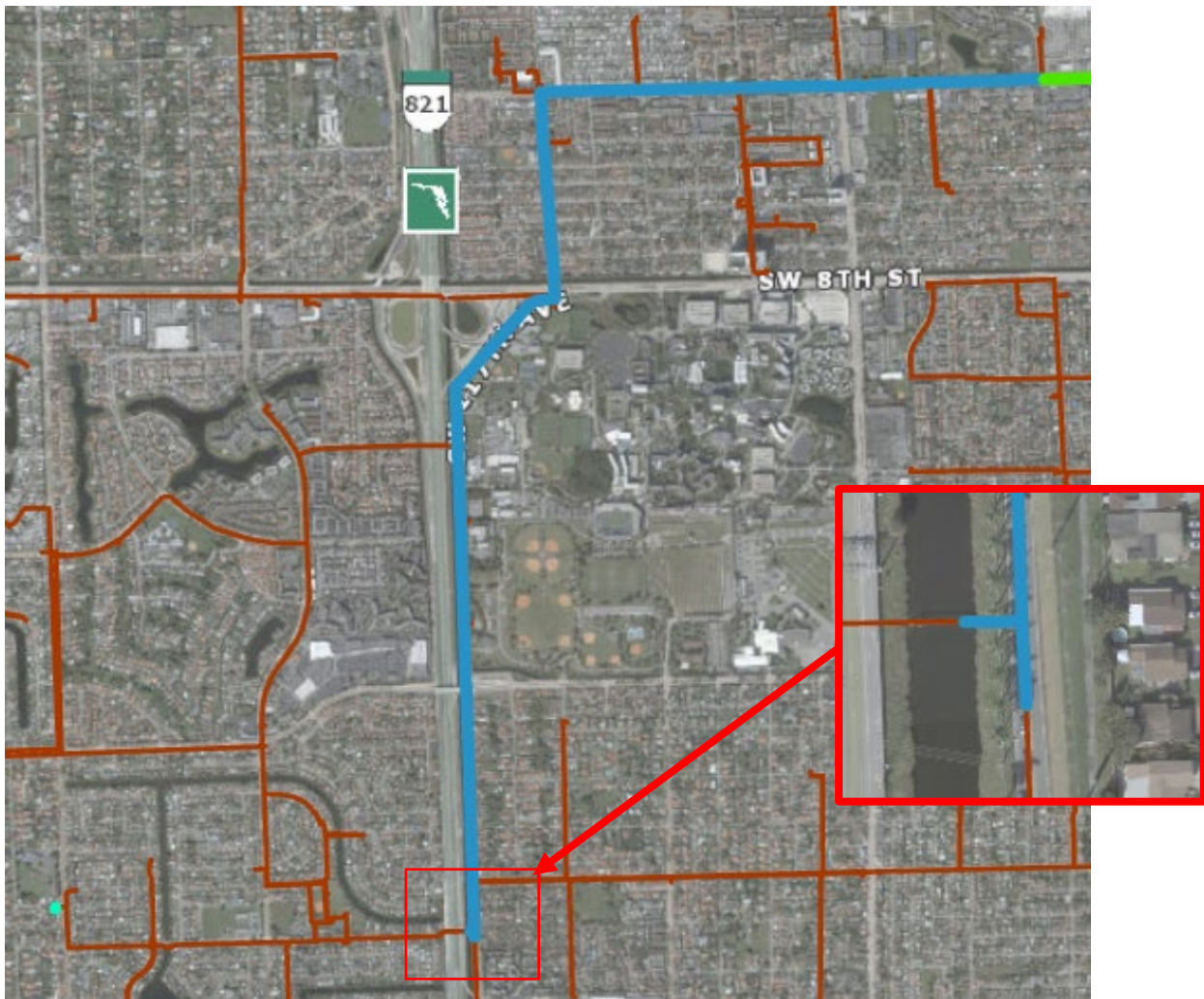


Project Number: 19
 Diameter: 42 & 36 in
 Approx Length: 8,900 LF
 Approx Age: 51 yrs
 Material(s): Ductile Iron
 Atlases: Q14, R14
 Area: Unincorporated Dade
 Commission D.: 10, 6
 Description: FM along Flagler St, from SW 87th Ave to SW 102nd Ave;
 Small portion, approx. 35 LF, of FM is 36in., along Flagler, between Fontainebleu Blvd and SW 92nd Ave.

Comment:



Project Number: 20
 Diameter: 36 in
 Approx Length: 15,200 LF
 Approx Age: 51 yrs
 Material(s): Ductile Iron & Unknown
 Atlases: R14, S14, S15, S16
 Area: Sweetwater & Unincorporated Dade
 Commission D.: 10, 11, 12
 Description: FM along Flagler St, from SW 102nd Ave to SW 114th Ave;
 then along SW 114th Ave, from Flagler St to SW 7th Ter;
 then a canal crossing across the Tamiami Canal C4;
 then across SW 8th St to SW 117th Ave;
 then along SW 117th Ave, from SW 8th St to approx. SW 34th St;
 Comment: At SW 117th Ave and SW 34th St, the FM tees, one segment heading westward and
 the other segment continuing southward.



Project Number: 21
 Diameter: 48 in
 Approx Length: 3,200 LF
 Approx Age: 55 yrs
 Material(s): Pre-Stressed Concrete and Unknown
 Atlases: H16 & G15
 Area: Miami
 Commission D.: 5
 Description: FM along Metrorail alignment, from SW 17th Ave to SW 25th Ter;
 then westward along SW 25th Ter to SW 19th Ave;
 then southward along SW 19th Ave to SW 25th Ter;
 then westward along SW 25th Ter to SW 21st Ave;
 then southward along SW 21st Ave to SW 26th St;
 then westward along SW 26th St to SW 22nd Ave.

Comment:

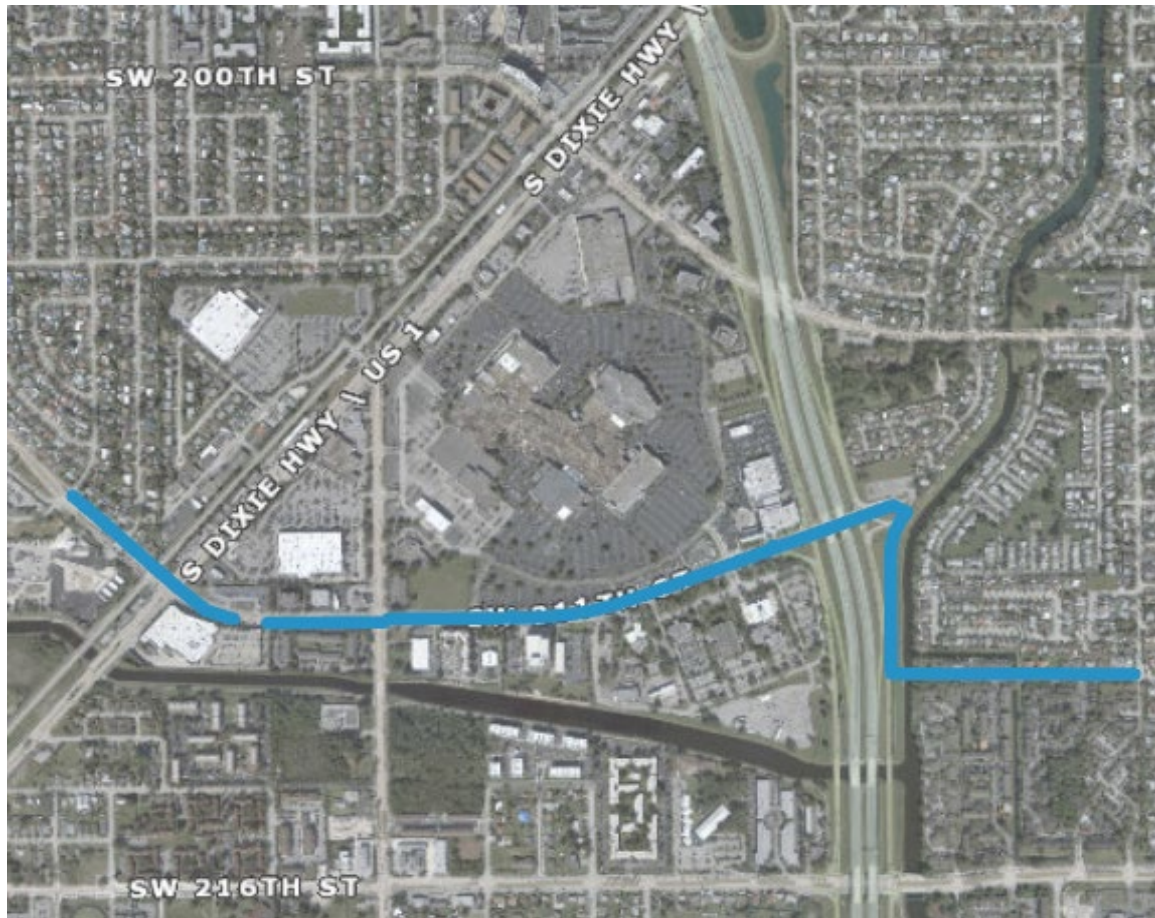




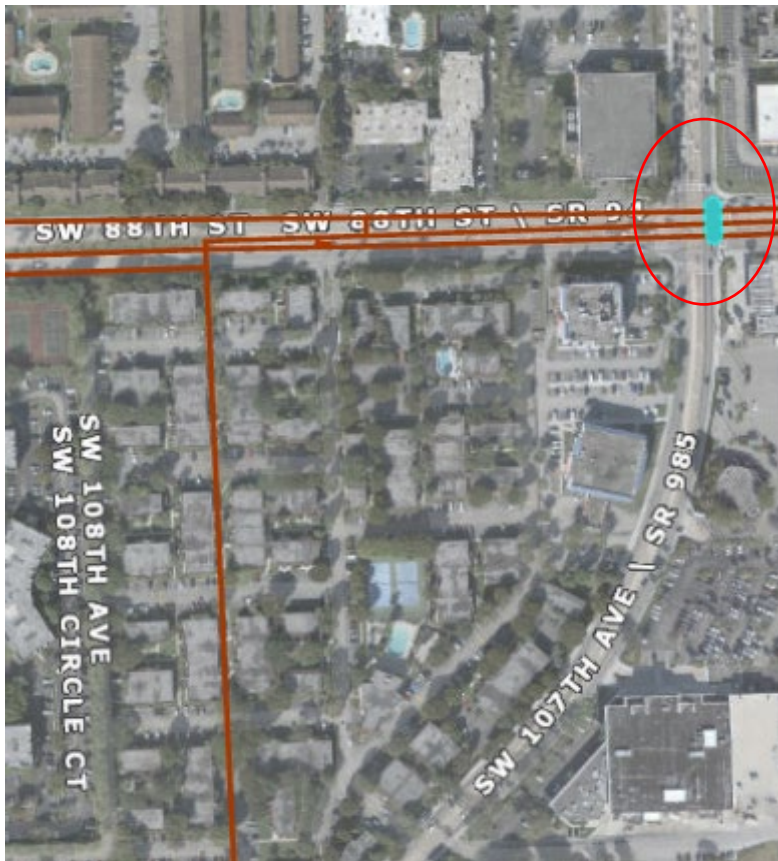
Project Number: 23
Diameter: 36 in
Approx Length: 850 LF
Approx Age: yrs
Material(s): Pre-Stressed Concrete
Atlases: K16
Area: Miami and Coral Gables
Commission D.: 7
Description: FM along SW 28th St, from SW 37th Ave to SW 38th Ave;
then along Cadima Ave, from SW 38th Ave to Monegro St.
Comment:



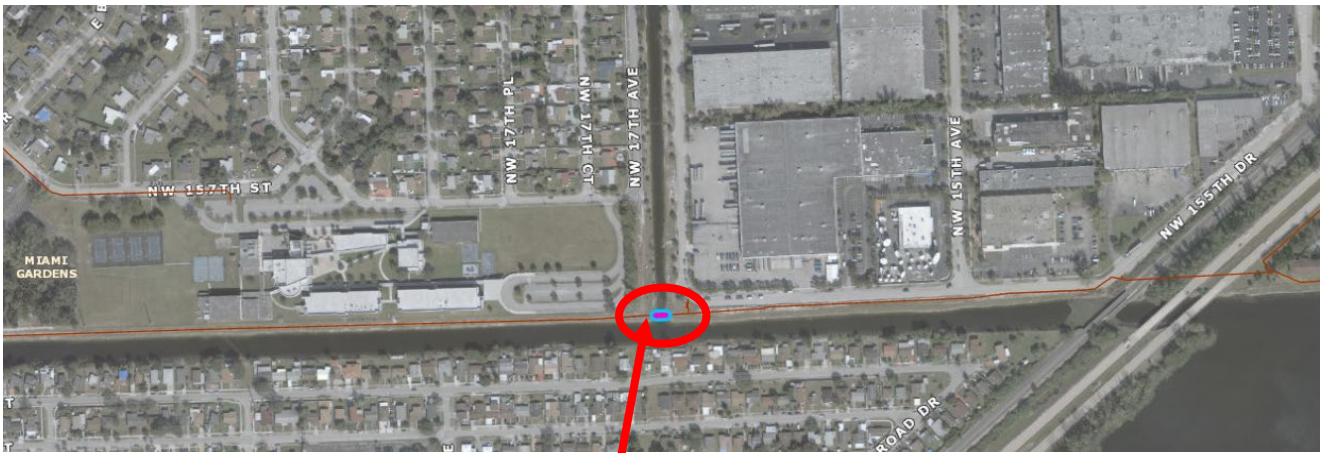
Project Number: 24
Diameter: 36 in
Approx Length: 7,000 LF
Approx Age: 50 yrs
Material(s): Ductile Iron and Cast Iron
Atlases: R27 and S27
Area: Cutler Bay and Unincorporated Dade
Commission D.: 8, 9
Description: FM along 212th St, from Anchor Rd to Canal Crossing at Cutler Ridge Canal;
then from Cutler Ridge Canal to Canal Crossing at Black Creek Canal C1;
then from canal crossing to Florida Turnpike 821;
then northwards and parallel to Florida Turnpike to approx. SW 211th St;
then westward along SW 211th St, from east side of Florida turnpike, crossing to
west side of Florida Turnpike, continuing along SW 211th St to US1, then
crossing from east side of US1 to west side of US1, continuing along
SW 211th St to SW 114th Pl.
Comment: Two canal crossings in this project.
Small segment of FM, approx. 250 LF, between SW 112th Ave and US1, does not
appear as a FM meeting age and diameter criteria; however, FM segments on
either side do meet criteria and, as such, this small segment of FM is also
expected to meet criteria.



Project Number: 25
 Diameter: 60 in
 Approx Length: 60 LF
 Approx Age: 72 yrs
 Material(s): Pre-Stressed Concrete
 Atlases: R19, R20
 Area: Unincorporated Dade
 Commission D.: 7, 10
 Description: Small connector FM, along SW 107th Ave, at the intersection with SW 88th St;
 between two commission districts and two atlases.
 Comment:



Project Number: CC1
 Diameter: 72 in
 Approx Length: 35 LF
 Approx Age: 44 yrs
 Material(s): Steel
 Atlases: G4
 Area: Miami Gardens
 Commission D.: 1
 Description: Canal Crossing over NW 17th Ave Canal, at the intersection of the NW 17th Ave canal and the Biscayne Canal C8
 Comments: Nearest cross-streets NW 17th Ave and NW 155th Dr.
 Canal Crossing is aerial.



[illegible]