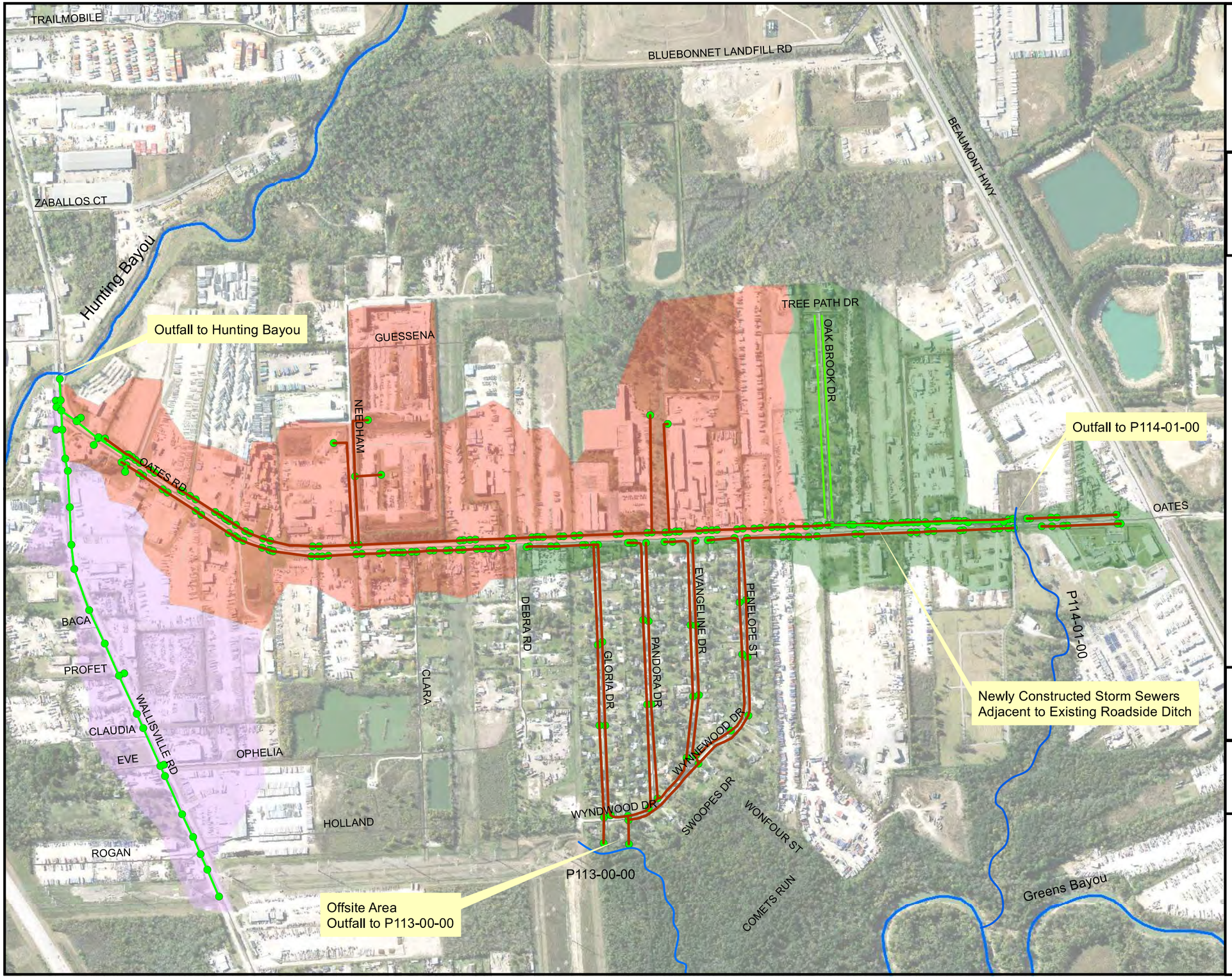

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HOUSTON PUBLIC WORKS

Legend

- Ditches & Culverts
- Storm Sewer
- Node
- Drainage Areas in Greens Bayou Watershed
- Drainage Areas in Hunting Bayou Watershed
- Offsite Drainage Areas
- Street

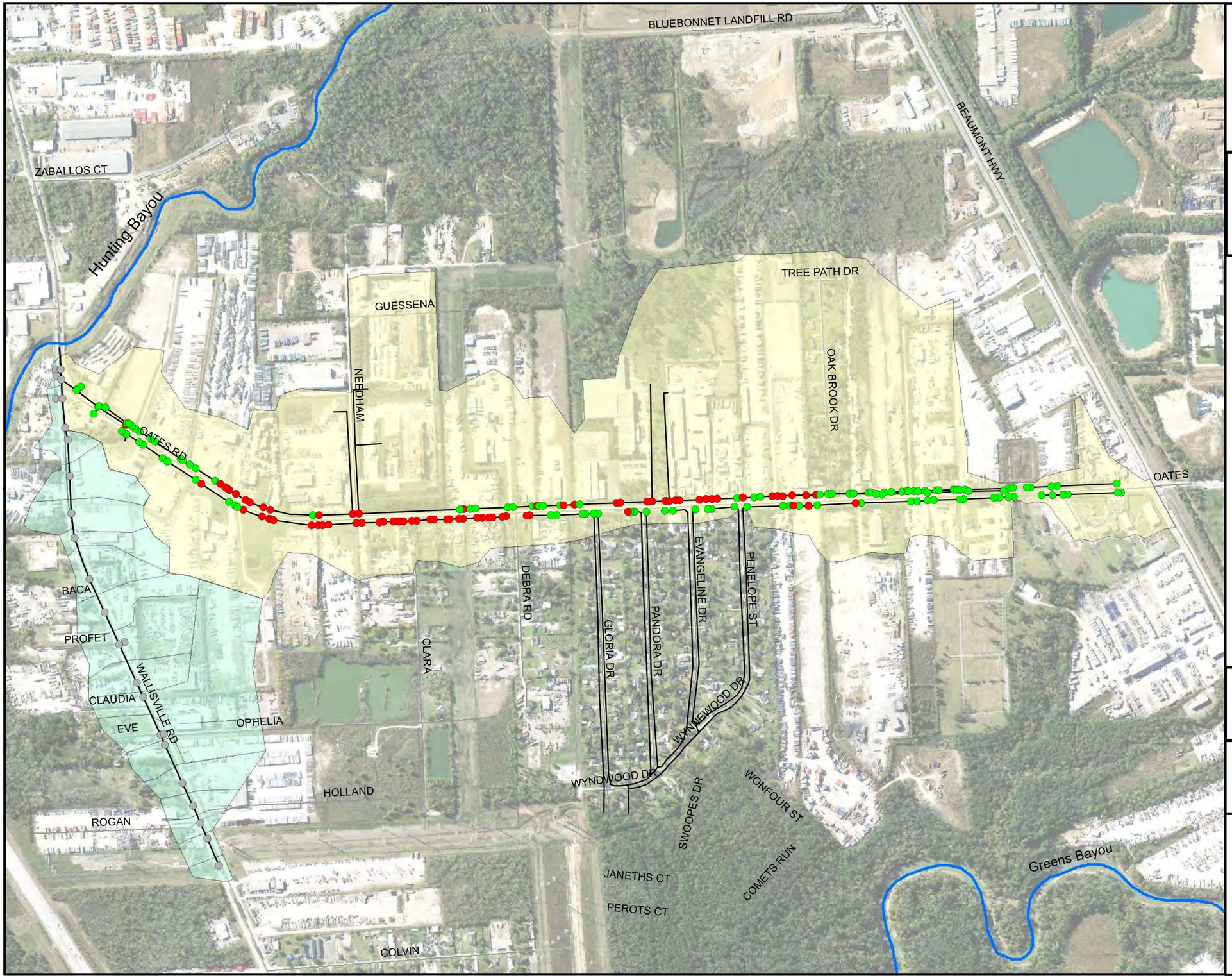
Coordinate System:
StatePlane Texas S Central FIPS 4204

0 800 1,600 Feet

1 in = 800 ft

PRE-ENGINEERING SERVICES OF THOROUGHFARE IMPROVEMENTS ON OATES ROAD
WBS NO. M-320100-0018-3

EXHIBIT 3.5
EXISTING DRAINAGE SYSTEM



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HOUSTON PUBLIC WORKS

Legend

Ponding Analysis 2YR

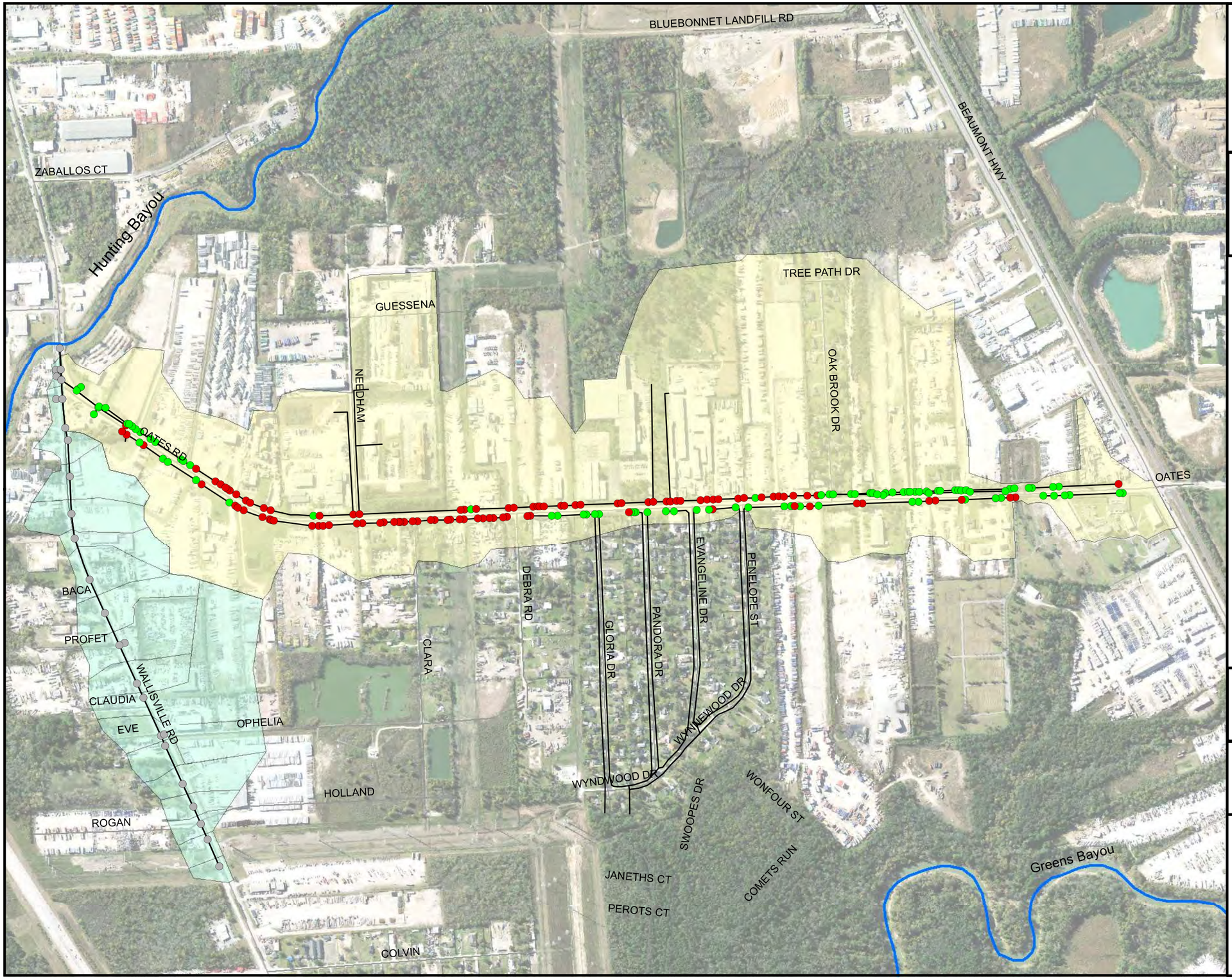
- Ponding Above Critical Elevation
- No Ponding Above Critical Elevation
- Node Outside Project Area
- Link
- Oates Road Drainage Areas
- Offsite Drainage Areas
- Street

Coordinate System:
StatePlane Texas S Central FIPS 4204

0 800 1,600 Feet

1 in = 800 ft

PRE-ENGINEERING SERVICES OF THOROUGHFARE IMPROVEMENTS ON OATES ROAD
WBS NO. M-320100-0018-3
EXHIBIT 3.6
NODE-LINK ANALYSIS
2-YR EXISTING CONDITIONS



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HOUSTON PUBLIC WORKS

Legend

Ponding Analysis 10YR

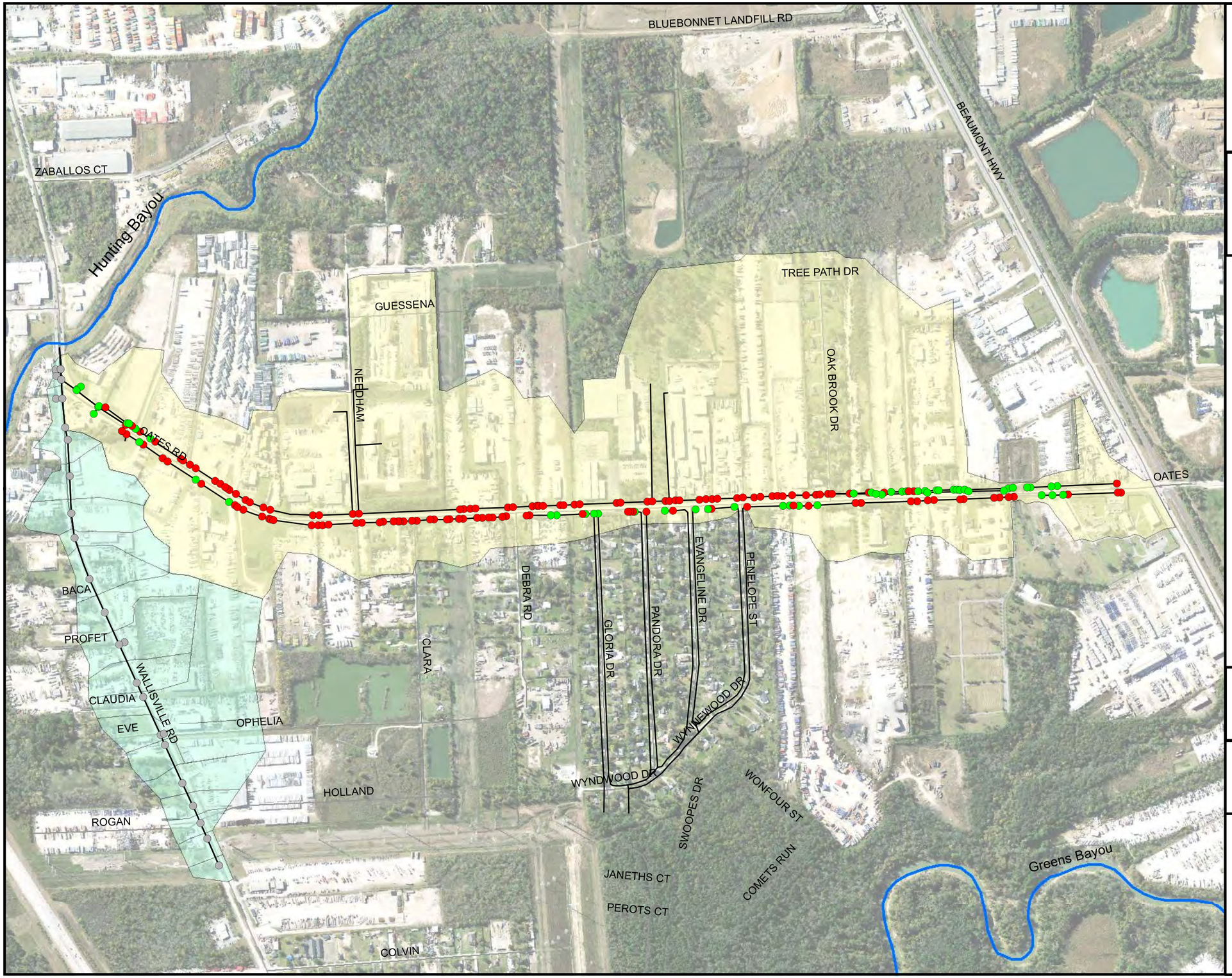
- Ponding Above Critical Elevation
- No Ponding Above Critical Elevation
- Node Outside Project Area
- Link
- Oates Road Drainage Areas
- Offsite Drainage Areas
- Street

Coordinate System:
StatePlane Texas S Central FIPS 4204

0 800 1,600 Feet

1 in = 800 ft

PRE-ENGINEERING SERVICES OF THOROUGHFARE IMPROVEMENTS ON OATES ROAD
WBS NO. M-320100-0018-3
EXHIBIT 3.7
NODE-LINK ANALYSIS
10-YR EXISTING CONDITIONS



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HOUSTON PUBLIC WORKS

Legend

Ponding Analysis

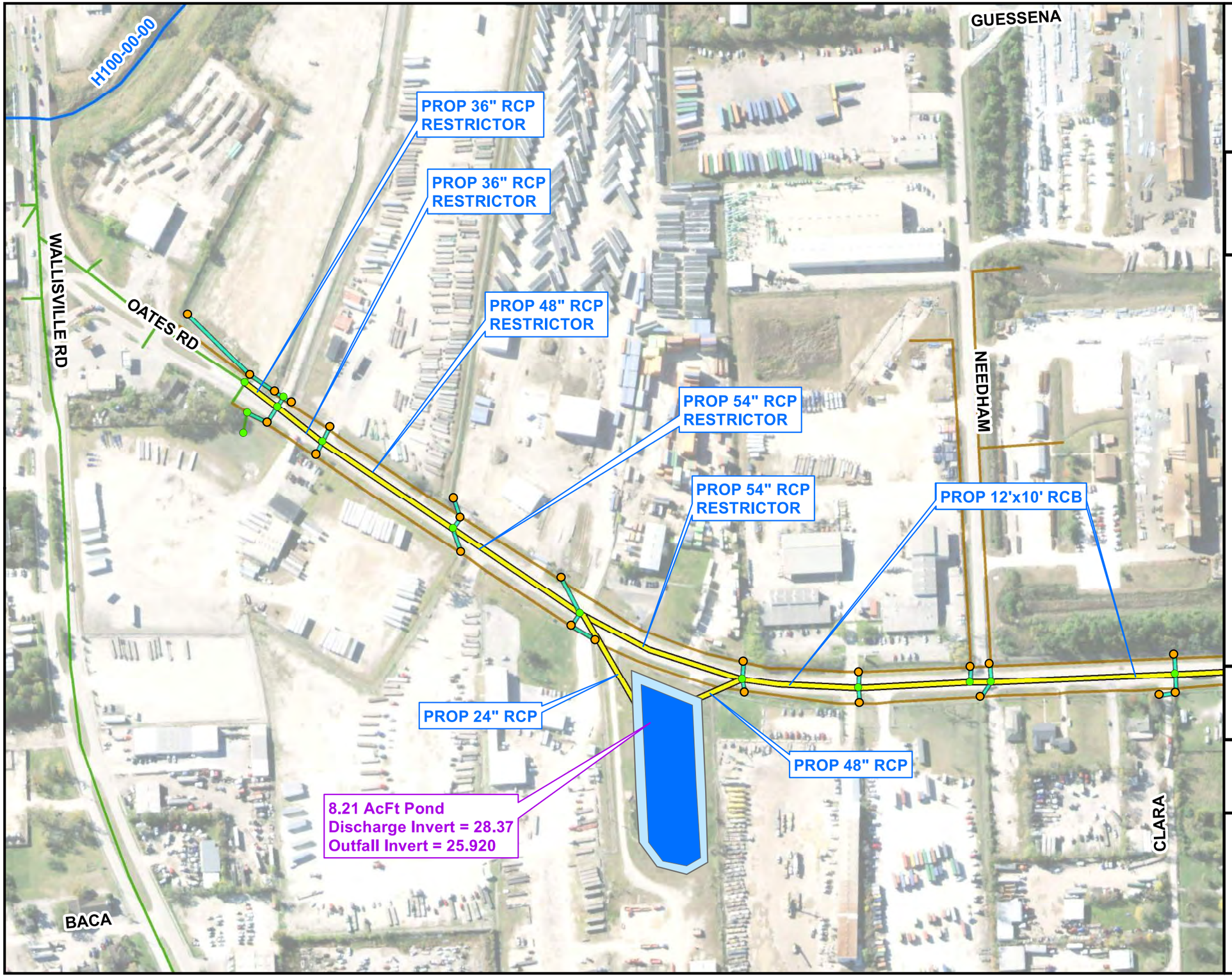
- Ponding Above Critical Elevation
- No Ponding Above Critical Elevation
- Node Outside Project
- Link
- Oates Road Drainage Areas
- Offsite Drainage Areas
- Street

Coordinate System:
StatePlane Texas S Central FIPS 4204

0 800 1,600 Feet

1 in = 800 ft

PRE-ENGINEERING SERVICES OF THOROUGHFARE IMPROVEMENTS ON OATES ROAD
WBS NO. M-320100-0018-3
EXHIBIT 3.8
NODE-LINK ANALYSIS
100-YR EXISTING CONDITIONS



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HOUSTON PUBLIC WORKS

Legend

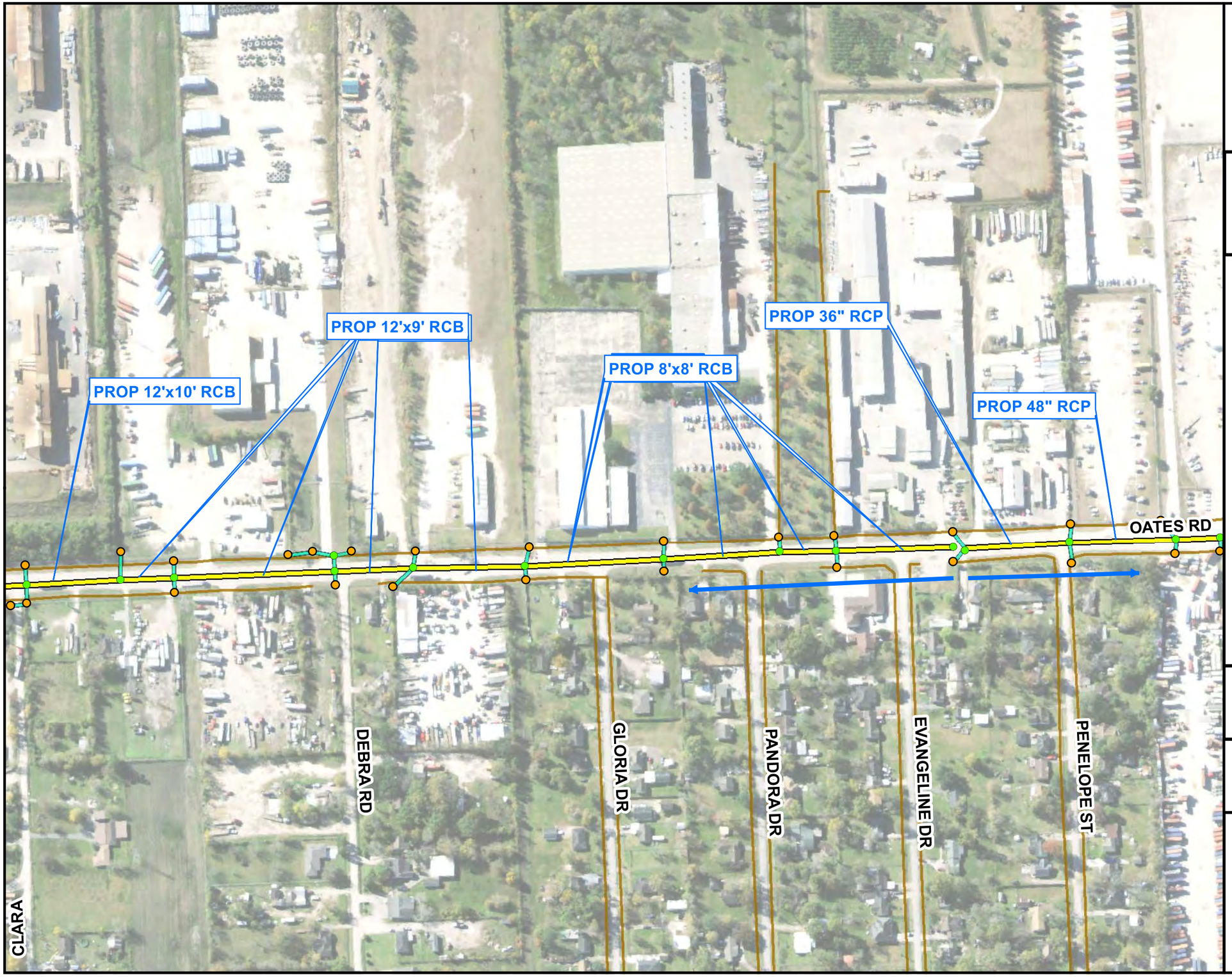
- Proposed Type 'BB' Storm Inlet
- Proposed Manhole
- Proposed 24" Lateral Pipes
- Proposed Storm Sewer
- Existing roadside ditches (Along Oates Rd to be filled)
- Existing Storm Sewer (to be retained)

Coordinate System:
StatePlane Texas S Central FIPS 4204

0 250 500 Feet

1 in = 250 ft

PRE-ENGINEERING SERVICES OF THOROUGHFARE IMPROVEMENTS ON OATES ROAD
WBS NO. M-320100-0018-3
EXHIBIT 4.1
PROPOSED DRAINAGE SYSTEM
ROADWAY ALTERNATIVE 3 - 1 OF 3



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HOUSTON PUBLIC WORKS

Legend

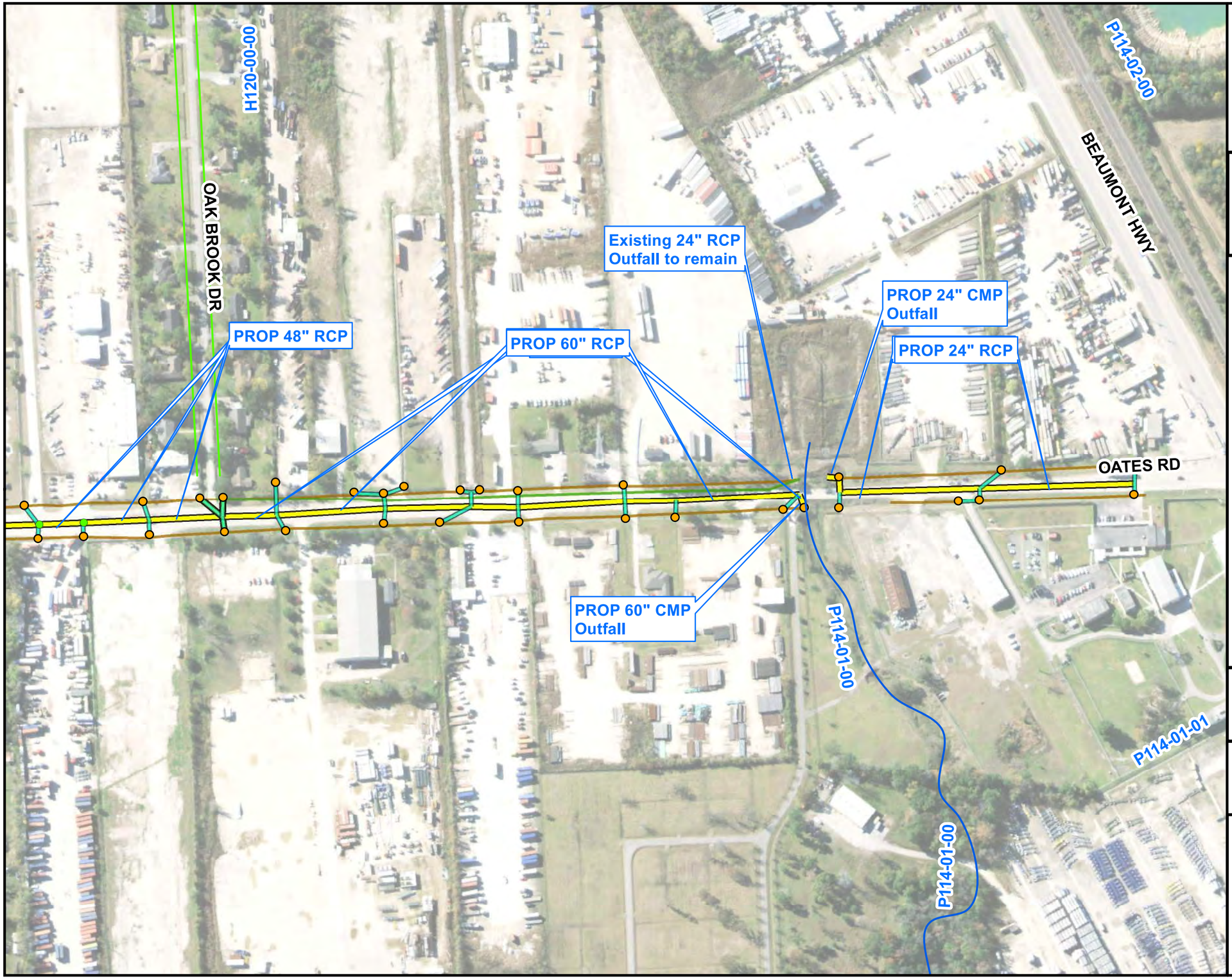
- Proposed Type 'BB' Storm Inlet
- Proposed Manhole
- Proposed 24" Lateral Pipes
- Proposed Storm Sewer
- Existing roadside ditches (Along Oates Rd to be filled)
- Existing Storm Sewer (to be retained)

Coordinate System:
StatePlane Texas S Central FIPS 4204

0 250 500 Feet

1 in = 250 ft

PRE-ENGINEERING SERVICES OF THOROUGHFARE IMPROVEMENTS ON OATES ROAD
WBS NO. M-320100-0018-3
EXHIBIT 4.2
PROPOSED DRAINAGE SYSTEM
ROADWAY ALTERNATIVE 3 - 2 OF 3



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HOUSTON PUBLIC WORKS

Legend

- Proposed Type 'BB' Storm Inlet
- Proposed Manhole
- Proposed 24" Lateral Pipes
- Proposed Storm Sewer
- Existing roadside ditches (Along Oates Rd to be filled)
- Existing Storm Sewer (to be retained)

Coordinate System:
StatePlane Texas S Central FIPS 4204

0 250 500 Feet

1 in = 250 ft

PRE-ENGINEERING SERVICES OF THOROUGHFARE IMPROVEMENTS ON OATES ROAD
WBS NO. M-320100-0018-3
EXHIBIT 4.3
PROPOSED DRAINAGE SYSTEM
ROADWAY ALTERNATIVE 3 - 3 OF 3

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HOUSTON PUBLIC WORKS

Legend

Nodes

- Ponding Above Critical Elevation
- No Ponding Above Critical Elevation
- Node Outside Project

Link

Oates Road Drainage

Offsite Drainage Areas

Coordinate System:
StatePlane Texas S Central FIPS 4204

0 800 1,600 Feet

1 in = 800 ft

PRE-ENGINEERING SERVICES OF THOROUGHFARE IMPROVEMENTS ON OATES ROAD
WBS NO. M-320100-0018-3
EXHIBIT 4.4
NODE-LINK ANALYSIS
2-YR PROPOSED CONDITIONS
ROADWAY ALTERNATIVE 3

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HOUSTON PUBLIC WORKS

Legend

Nodes

- Ponding Above Critical Elevation
- No Ponding Above Critical Elevation
- Node Outside Project

Link

Oates Road Drainage

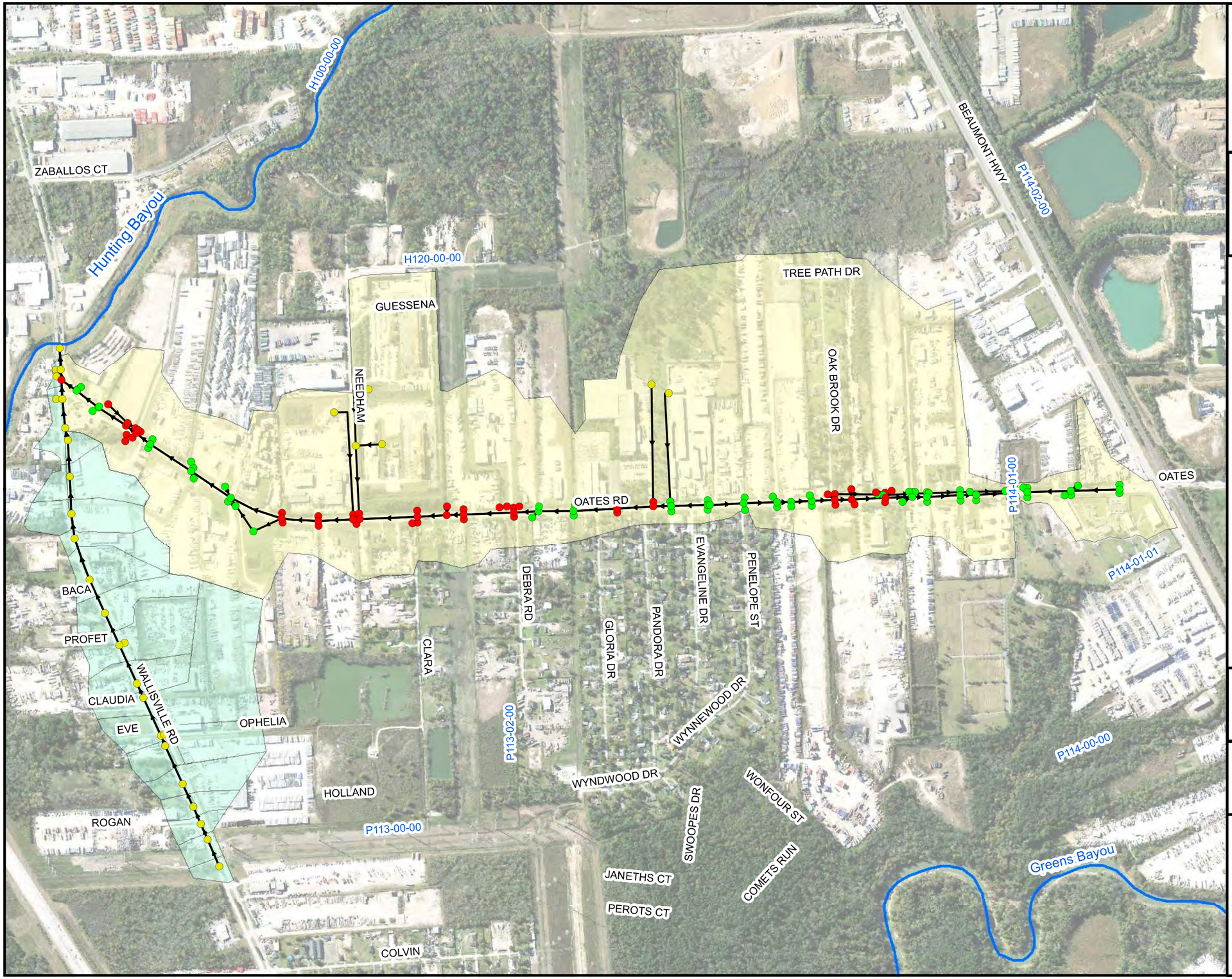
Offsite Drainage

Coordinate System:
StatePlane Texas S Central FIPS 4204

0 800 1,600 Feet

1 in = 800 ft

PRE-ENGINEERING SERVICES OF THOROUGHFARE IMPROVEMENTS ON OATES ROAD
WBS NO. M-320100-0018-3
EXHIBIT 4.5
NODE-LINK ANALYSIS
25-YR PROPOSED CONDITIONS
ROADWAY ALTERNATIVE 3



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HOUSTON PUBLIC WORKS

Legend

Nodes

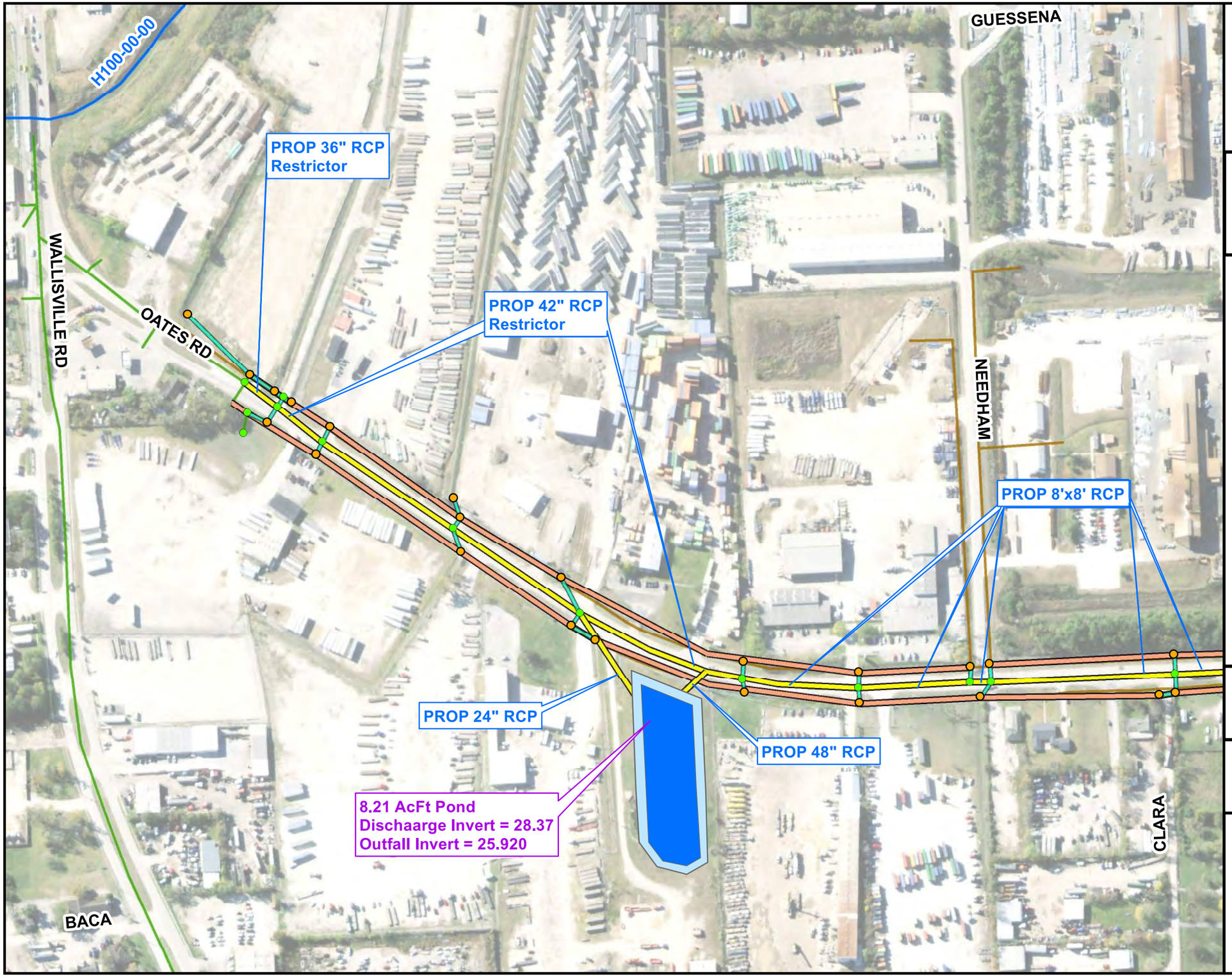
- Ponding Above Critical Elevation
- No Ponding Above Critical Elevation
- Node Outside Project
- Link
- Oates Road Drainage
- Offsite Drainage

Coordinate System:
StatePlane Texas S Central FIPS 4204

0 800 1,600 Feet

1 in = 800 ft

PRE-ENGINEERING SERVICES OF THOROUGHFARE IMPROVEMENTS ON OATES ROAD
WBS NO. M-320100-0018-3
EXHIBIT 4.6
NODE-LINK ANALYSIS
100-YR PROPOSED CONDITIONS
ROADWAY ALTERNATIVE 3



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HOUSTON PUBLIC WORKS

Legend

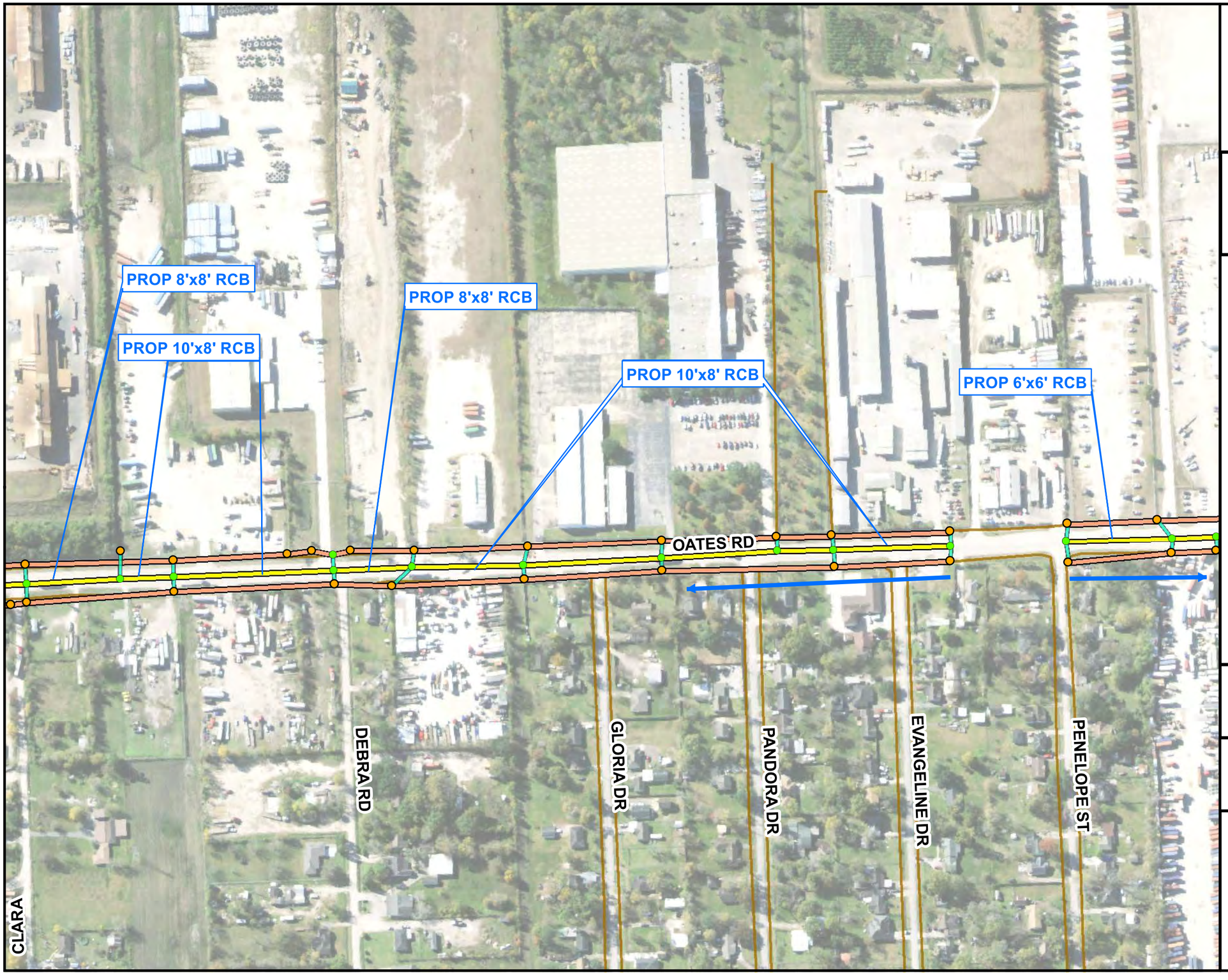
- Proposed Type 'BB' Storm Inlet
- Proposed Manhole
- Proposed 24" Lateral Pipes
- Proposed Storm Sewer
- Proposed Ditch & Culverts
- Existing Ditches & Culverts
- Existing Storm Sewer

Coordinate System:
StatePlane Texas S Central FIPS 4204

0 250 500 Feet

1 in = 250 ft

PRE-ENGINEERING SERVICES OF THOROUGHFARE IMPROVEMENTS ON OATES ROAD
WBS NO. M-320100-0018-3
EXHIBIT 4.7
PROPOSED DRAINAGE SYSTEM
ROADWAY ALTERNATIVE 1 - 1 OF 3



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HOUSTON PUBLIC WORKS

Legend

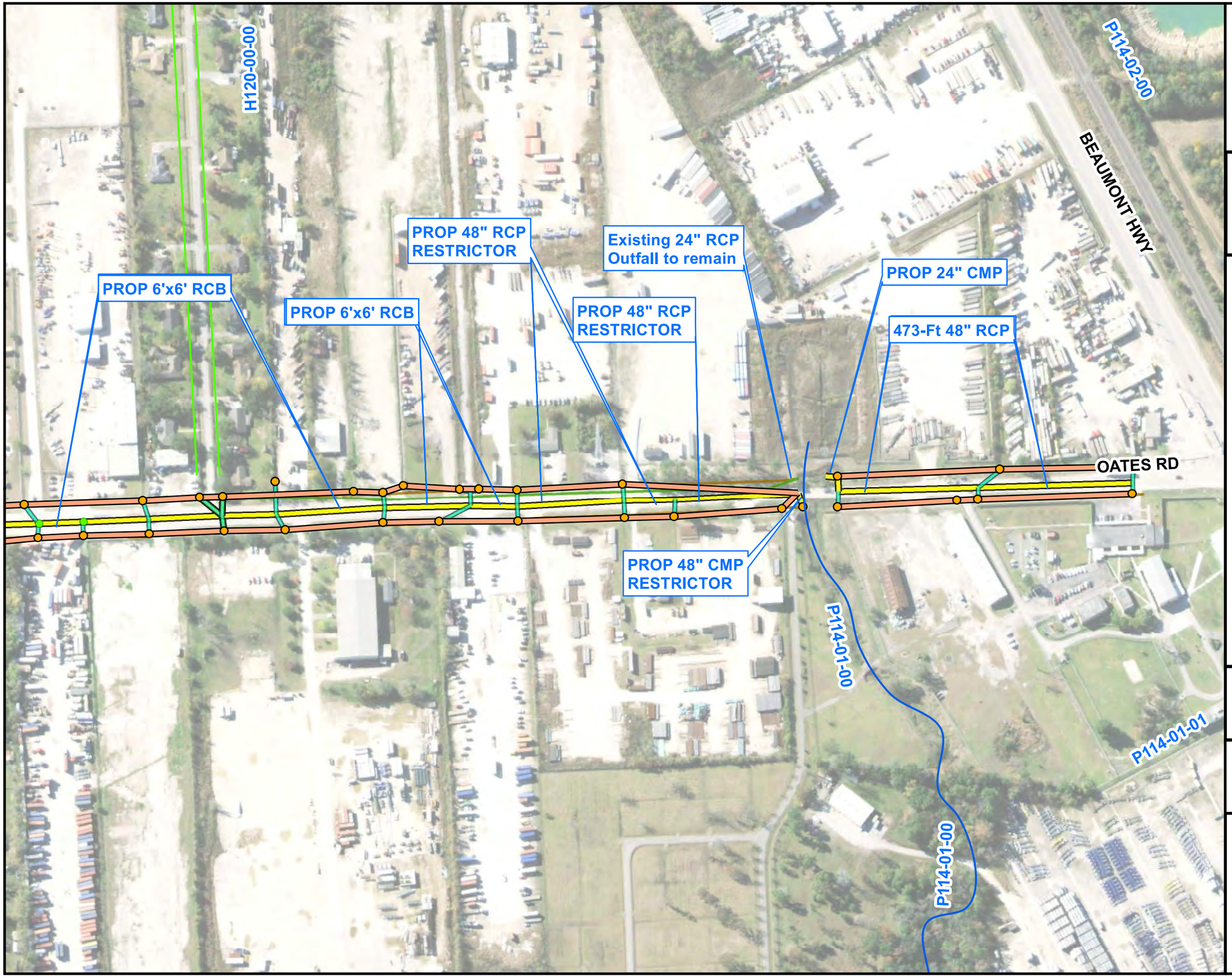
- Proposed Type 'BB' Storm Inlet
- Proposed Manhole
- Proposed 24" Lateral Pipes
- Proposed Storm Sewer
- Proposed Ditch & Culverts
- Existing Ditches & Culverts
- Existing Storm Sewer

Coordinate System:
StatePlane Texas S Central FIPS 4204

0 250 500 Feet

1 in = 250 ft

PRE-ENGINEERING SERVICES OF THOROUGHFARE IMPROVEMENTS ON OATES ROAD
WBS NO. M-320100-0018-3
EXHIBIT 4.8
PROPOSED DRAINAGE SYSTEM
ROADWAY ALTERNATIVE 1 - 2 OF 3



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HOUSTON PUBLIC WORKS

Legend

- Proposed Type 'BB' Storm Inlet
- Proposed Manhole
- Proposed 24" Lateral Pipes
- Proposed Storm Sewer
- Proposed Ditch & Culverts
- Existing Ditches & Culverts
- Existing Storm Sewer

Coordinate System:
StatePlane Texas S Central FIPS 4204

0 250 500 Feet

1 in = 250 ft

PRE-ENGINEERING SERVICES OF THOROUGHFARE IMPROVEMENTS ON OATES ROAD
WBS NO. M-320100-0018-3
EXHIBIT 4.9
PROPOSED DRAINAGE SYSTEM
ROADWAY ALTERNATIVE 1 - 3 OF 3

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HOUSTON PUBLIC WORKS

Legend

Nodes

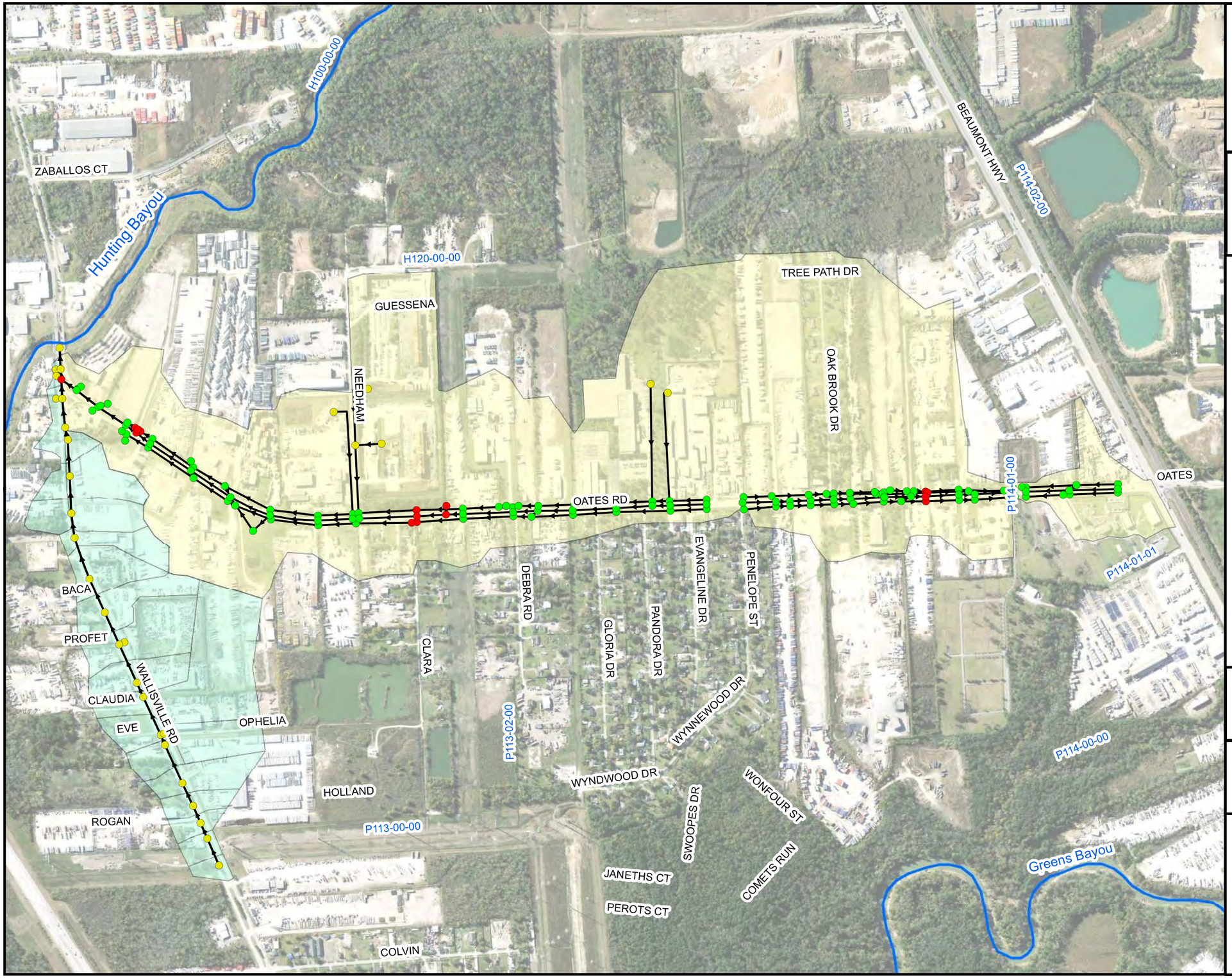
- Ponding Above Critical Elevation
- No Ponding Above Critical Elevation
- Node Outside Project
- Link
- Oates Road Drainage Areas
- Offsite Drainage Areas

Coordinate System:
StatePlane Texas S Central FIPS 4204

0 800 1,600 Feet

1 in = 800 ft

PRE-ENGINEERING SERVICES OF THOROUGHFARE IMPROVEMENTS ON OATES ROAD
WBS NO. M-320100-0018-3
EXHIBIT 4.10
NODE-LINK ANALYSIS
2-YR PROPOSED CONDITIONS
ROADWAY ALTERNATIVE 1



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HOUSTON PUBLIC WORKS

Legend

Nodes

- Ponding Above Critical Elevation
- No Ponding Above Critical Elevation
- Node Outside Project
- Link
- Oates Road Drainage Areas
- Offsite Drainage Areas

Coordinate System:
StatePlane Texas S Central FIPS 4204

0 800 1,600 Feet

1 in = 800 ft

PRE-ENGINEERING SERVICES OF THOROUGHFARE IMPROVEMENTS ON OATES ROAD
WBS NO. M-320100-0018-3
EXHIBIT 4.11
NODE-LINK ANALYSIS
10-YR PROPOSED CONDITIONS
ROADWAY ALTERNATIVE 1

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HOUSTON PUBLIC WORKS

Legend

Nodes

- Ponding Above Critical Elevation
- No Ponding Above Critical Elevation
- Node Outside Project

Link

Oates Road Drainage

Offsite Drainage

Coordinate System:
StatePlane Texas S Central FIPS 4204

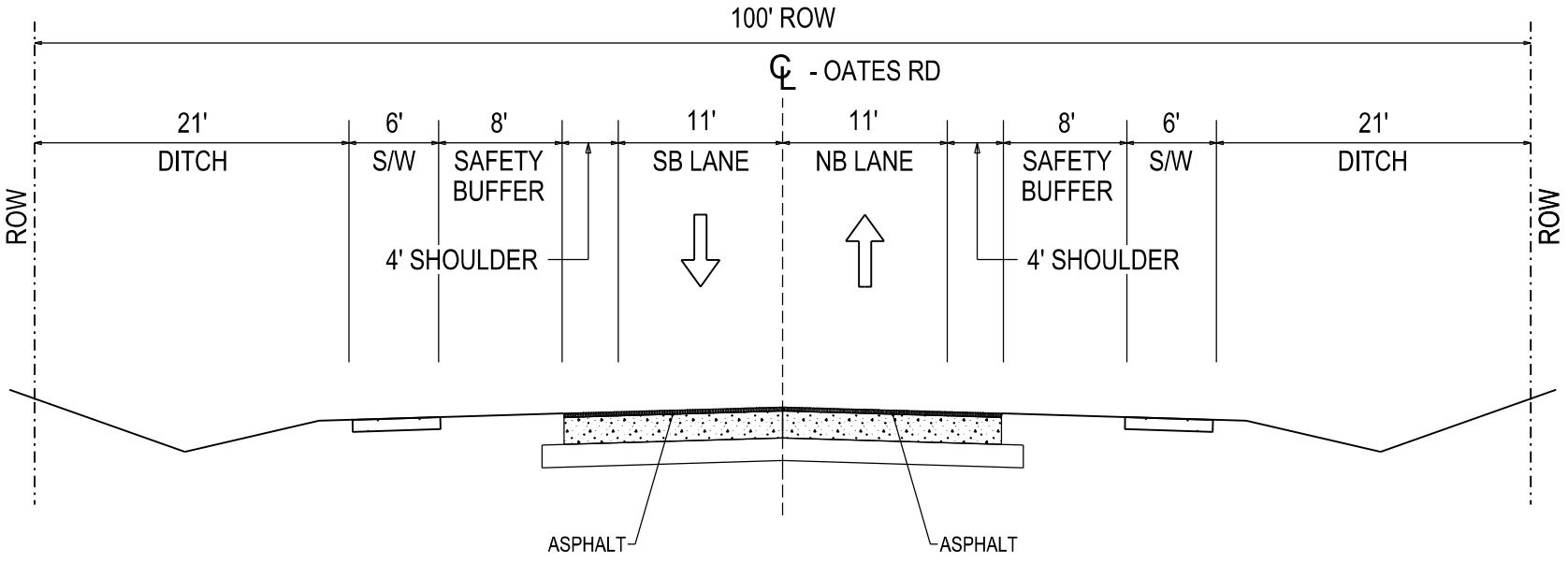
0 800 1,600 Feet

1 in = 800 ft

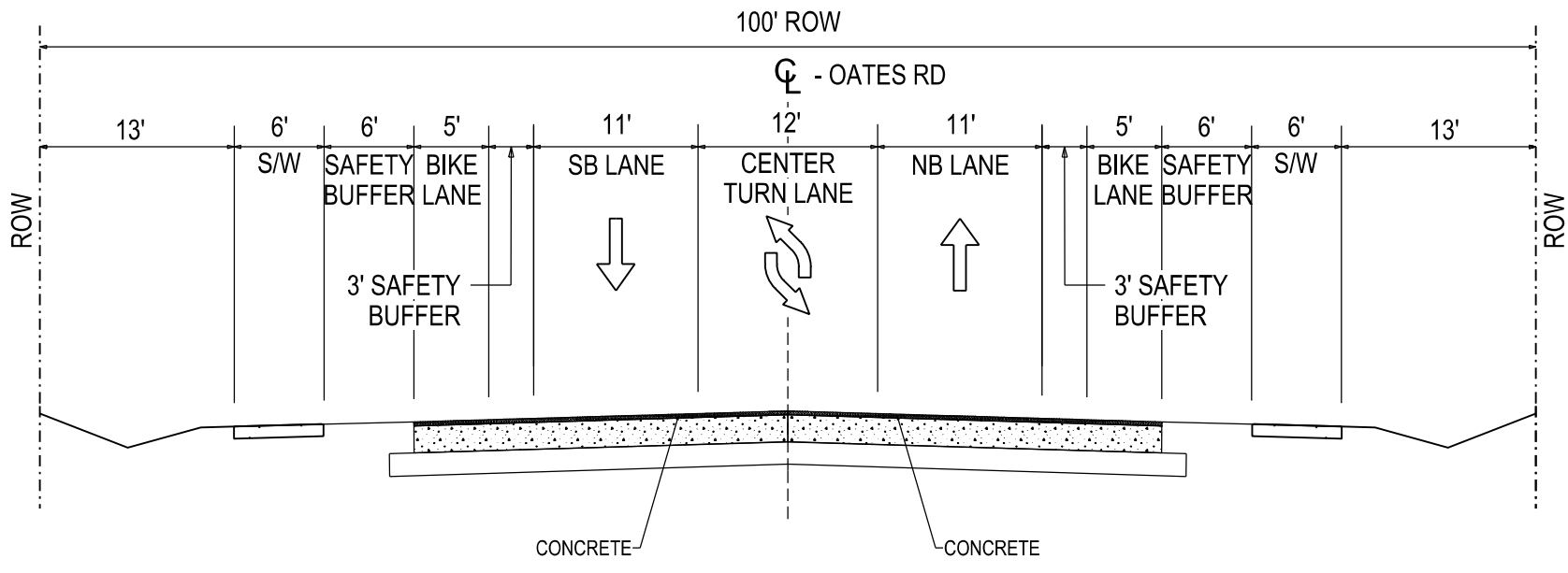
PRE-ENGINEERING SERVICES OF THOROUGHFARE IMPROVEMENTS ON OATES ROAD
WBS NO. M-320100-0018-3
EXHIBIT 4.12
NODE-LINK ANALYSIS
100-YR PROPOSED CONDITIONS
ROADWAY ALTERNATIVE 1

Appendix A

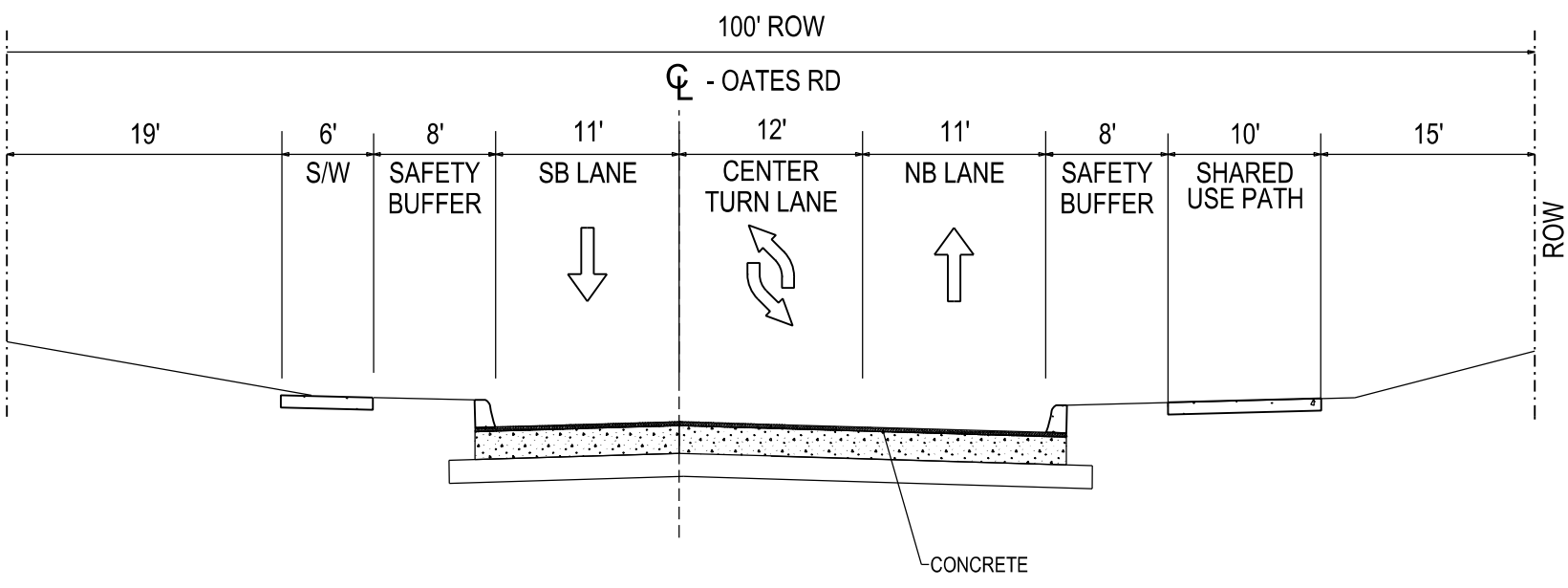
Proposed Condition Roadway Alternatives - Typical Sections



ALTERNATIVE 1 TYPICAL SECTION
OATES RD
(N.T.S)



ALTERNATIVE 2 TYPICAL SECTION
OATES RD
(N.T.S)



ALTERNATIVE 3 TYPICAL SECTION
OATES RD
(N.T.S)

FINAL

09/22/2021

Appendix B

Existing Condition Peak Flow Calculations

TABLE - OATES ROAD EXISTING PEAK FLOW CALCULATIONS

SUB-AREA	AREA (Ac)	Tc (min)	RUNOFF COEFF. C										INTENSITY			RUNOFF		
			0.2 0 AREA (AC)	0.32 0.2 AREA (AC)	0.44 0.4 AREA (AC)	0.55 0.58 AREA (AC)	0.65 0.75 AREA (AC)	0.71 0.85 AREA (AC)	0.8 1 AREA (AC)	% IMPERV.	WGH'T RUNOFF COEFF	CA	2-YR i IN/HR	10-YR i IN/HR	100-YR i IN/HR	2-YR Q CFS	10-YR Q CFS	100-YR Q CFS
G1	2.83	27.0	2.30						0.53	18.9%	0.313	0.89	3.60	5.29	8.22	3.19	4.69	7.28
G2	1.86	26.2	0.00					1.63	0.23	86.9%	0.721	1.34	3.66	5.38	8.35	4.91	7.22	11.20
G3	4.41	28.0	0.00					3.91	0.50	86.7%	0.720	3.17	3.53	5.20	8.07	11.21	16.49	25.62
G4	3.67	27.6	0.00				3.25		0.42	77.9%	0.667	2.45	3.56	5.24	8.13	8.71	12.81	19.90
G5	2.94	27.1	0.00		2.15				0.79	56.1%	0.537	1.58	3.59	5.29	8.21	5.67	8.34	12.95
G6	1.72	26.0	0.00				1.63		0.09	76.3%	0.658	1.13	3.67	5.40	8.37	4.16	6.11	9.47
G7	16.17	31.3	0.00		1.39		14.38		0.40	72.6%	0.636	10.28	3.32	4.89	7.63	34.10	50.27	78.40
G8	1.38	25.6	0.00		0.45			0.65	0.28	73.5%	0.641	0.88	3.71	5.45	8.44	3.27	4.81	7.45
G9	4.06	27.8	0.00					3.79	0.26	86.0%	0.716	2.90	3.54	5.21	8.10	10.29	15.14	23.52
G10	4.53	28.0	0.00			2.30		1.83	0.39	72.8%	0.637	2.88	3.53	5.19	8.06	10.16	14.96	23.24
G11	12.27	30.6	0.00			9.18		2.85	0.24	65.4%	0.592	7.27	3.36	4.96	7.72	24.45	36.04	56.15
G12	5.93	28.7	5.28						0.66	11.1%	0.267	1.58	3.48	5.13	7.97	5.51	8.11	12.61
G13	17.76	31.6	8.43			9.00			0.33	31.5%	0.389	6.91	3.30	4.87	7.59	22.80	33.63	52.46
G14	2.21	26.5	0.65				1.14		0.43	57.9%	0.547	1.21	3.64	5.35	8.30	4.41	6.48	10.06
G15	13.33	30.8	7.65					5.52	0.16	36.4%	0.419	5.58	3.35	4.94	7.70	18.69	27.54	42.93
H1	1.75	26.0	0.77					0.55	0.43	51.1%	0.506	0.89	3.67	5.40	8.37	3.26	4.79	7.42
H2	2.03	26.3	0.00			0.29		1.09	0.65	86.1%	0.716	1.46	3.65	5.37	8.32	5.32	7.81	12.12
H3	6.19	28.8	4.51					1.27	0.41	24.0%	0.344	2.13	3.48	5.12	7.96	7.41	10.90	16.95
H4	2.42	26.7	0.79			0.60		0.82	0.20	51.9%	0.511	1.24	3.62	5.33	8.27	4.48	6.58	10.22
H5	4.81	28.2	0.00					4.57	0.23	85.7%	0.714	3.43	3.52	5.18	8.04	12.08	17.77	27.63
H6	6.34	28.8	0.00					6.00	0.34	85.8%	0.715	4.53	3.47	5.11	7.95	15.74	23.17	36.04
H7	5.31	28.4	0.00					5.06	0.25	85.7%	0.714	3.79	3.50	5.15	8.01	13.28	19.54	30.38
H8	9.38	29.8	0.00				9.15		0.23	75.6%	0.654	6.13	3.41	5.02	7.82	20.90	30.79	47.93
H9	5.80	28.6	0.00				5.53		0.27	76.2%	0.657	3.81	3.49	5.13	7.98	13.29	19.56	30.41
H10	3.02	27.1	2.85						0.17	5.6%	0.234	0.71	3.59	5.28	8.20	2.53	3.72	5.78
H11	15.05	31.1	0.00					14.11	0.94	85.9%	0.716	10.77	3.33	4.91	7.65	35.87	52.88	82.45
H12	3.08	27.2	1.14					1.72	0.22	54.6%	0.528	1.63	3.59	5.28	8.19	5.83	8.58	13.32
H13	3.73	27.6	1.65					1.85	0.23	48.4%	0.490	1.83	3.56	5.23	8.13	6.50	9.57	14.86
H14	18.85	31.8	0.00				18.85			75.0%	0.650	12.25	3.29	4.85	7.57	40.32	59.47	92.78
H15	12.26	30.5	0.00				12.26			75.0%	0.650	7.97	3.36	4.96	7.72	26.81	39.51	61.56
H16	2.15	26.4	1.69						0.46	21.4%	0.328	0.71	3.64	5.35	8.30	2.58	3.79	5.88
H17	2.81	27.0	0.00	1.83				0.77	0.22	43.9%	0.463	1.30	3.60	5.30	8.22	4.69	6.90	10.71
H18	1.83	26.1	0.00			1.32		0.40	0.11	66.7%	0.600	1.10	3.67	5.39	8.35	4.03	5.92	9.19
H19	7.75	29.3	0.00				7.66		0.09	75.3%	0.652	5.05	3.44	5.07	7.88	17.37	25.58	39.81
H20	6.99	29.1	0.00	2.02		4.27			0.69	51.4%	0.508	3.55	3.46	5.09	7.92	12.29	18.09	28.14
H21	9.57	29.9	2.04					7.17	0.37	67.5%	0.605	5.79	3.41	5.02	7.81	19.72	29.05	45.23
H22	3.91	27.7	0.00	0.70	1.12			1.63	0.46	62.2%	0.573	2.24	3.55	5.22	8.11	7.96	11.71	18.19
H23	4.02	27.8	0.00			3.89			0.13	59.7%	0.558	2.25	3.55	5.22	8.10	7.96	11.72	18.20
H24	5.71	28.6	0.00			5.44			0.27	60.4%	0.562	3.21	3.49	5.14	7.99	11.21	16.49	25.64
H25	20.09	32.0	6.48					13.21	0.40	57.9%	0.547	11.00	3.28	4.84	7.55	36.07	53.20	83.02
H26	1.40	25.6	0.00			1.13			0.27	66.4%	0.598	0.84	3.71	5.44	8.44	3.10	4.55	7.05
H27	28.59	33.0	12.71					15.48	0.40	47.4%	0.484	13.85	3.22	4.75	7.42	44.59	65.81	102.82
H28	1.18	25.3	0.00			0.92			0.26	67.7%	0.606	0.72	3.73	5.48	8.49	2.68	3.93	6.09
H29	20.07	32.0	0.00					19.57	0.50	85.4%	0.712	14.30	3.28	4.84	7.55	46.89	69.16	107.93
H30	1.04	25.1	0.00			0.80			0.24	68.2%	0.609	0.63	3.75	5.50	8.53	2.38	3.49	5.41

TABLE - OATES ROAD EXISTING PEAK FLOW CALCULATIONS

SUB-AREA	AREA (Ac)	Tc (min)	RUNOFF COEFF. C										INTENSITY			RUNOFF		
			0.2 0 AREA (AC)	0.32 0.2 AREA (AC)	0.44 0.4 AREA (AC)	0.55 0.58 AREA (AC)	0.65 0.75 AREA (AC)	0.71 0.85 AREA (AC)	0.8 1 AREA (AC)	% IMPERV.	WGH'T RUNOFF COEFF	CA	2-YR i IN/HR	10-YR i IN/HR	100-YR i IN/HR	2-YR Q CFS	10-YR Q CFS	100-YR Q CFS
O1	0.43	23.6	0.00					0.20	0.22	92.8%	0.757	0.32	3.87	5.68	8.78	1.25	1.83	2.83
O2	1.86	26.2	0.00				1.21		0.66	83.8%	0.703	1.31	3.66	5.38	8.35	4.80	7.05	10.94
O3	1.12	25.2	0.00				0.81		0.30	81.8%	0.691	0.77	3.74	5.49	8.51	2.88	4.23	6.56
O4	1.16	25.3	0.00				0.89		0.27	80.9%	0.685	0.80	3.73	5.48	8.49	2.98	4.38	6.78
O5	4.41	28.0	0.00					4.06	0.35	86.2%	0.717	3.16	3.53	5.20	8.07	11.16	16.42	25.52
O6	2.07	26.4	0.00			1.82			0.25	63.4%	0.580	1.20	3.65	5.36	8.32	4.38	6.44	9.99
O7	3.61	27.5	0.00					3.29	0.32	86.3%	0.718	2.59	3.56	5.24	8.14	9.23	13.57	21.08
O8	0.45	23.7	0.00			0.29			0.16	73.2%	0.639	0.29	3.86	5.67	8.76	1.12	1.65	2.55
O9	3.17	27.3	0.00					3.01	0.16	85.7%	0.714	2.26	3.58	5.27	8.18	8.10	11.92	18.51
O10	4.84	28.2	0.00	0.68				3.21	0.95	78.9%	0.673	3.26	3.52	5.17	8.04	11.45	16.85	26.19
O11	5.71	28.6	0.00			1.53		3.40	0.78	79.9%	0.679	3.88	3.49	5.14	7.99	13.54	19.93	30.99
O12	8.15	29.5	0.00					7.48	0.67	86.2%	0.717	5.85	3.43	5.05	7.87	20.07	29.56	46.01
O13	4.69	28.1	0.00					3.96	0.74	87.4%	0.724	3.40	3.52	5.18	8.05	11.97	17.61	27.37
O14	17.54	31.6	0.00				15.29	1.65	0.60	76.8%	0.661	11.59	3.30	4.87	7.60	38.29	56.47	88.08
O15	7.98	29.4	0.00	2.43				5.07	0.48	66.1%	0.597	4.76	3.44	5.06	7.87	16.36	24.09	37.49
O16	2.37	26.6	0.00			1.78			0.59	68.8%	0.613	1.45	3.63	5.33	8.27	5.27	7.75	12.02
O17	4.68	28.1	0.96					3.08	0.65	69.7%	0.618	2.89	3.52	5.18	8.05	10.19	14.99	23.29
O18	2.35	26.6	0.00				0.88	0.99	0.48	84.3%	0.706	1.66	3.63	5.33	8.28	6.01	8.83	13.70
O19	1.61	25.9	0.00				0.85	0.36	0.40	83.5%	0.701	1.13	3.68	5.41	8.39	4.16	6.12	9.48
O20	1.48	25.7	0.00			0.98			0.51	72.7%	0.636	0.94	3.70	5.43	8.42	3.49	5.13	7.95
O21	1.16	25.3	0.65						0.51	43.7%	0.462	0.53	3.73	5.48	8.50	1.99	2.93	4.54
GO1	21.57	32.2	0.00			21.57				58.4%	0.550	11.87	3.27	4.82	7.52	38.80	57.24	89.34
GO2	18.38	31.7	0.00			18.38				58.4%	0.550	10.12	3.30	4.86	7.58	33.34	49.17	76.71
GO3	16.86	31.4	0.00			16.86				58.4%	0.550	9.28	3.31	4.88	7.61	30.71	45.28	70.63
GO4	14.28	31.0	0.00			14.28				58.4%	0.550	7.86	3.34	4.92	7.67	26.25	38.69	60.31

Appendix C

Proposed Condition Peak Flow Calculations

TABLE - OATES ROAD PROPOSED PEAK FLOW CALCULATIONS

SUB-AREA	AREA (Ac)	AREA (SqM)	Tc (min)		RUNOFF COEFF. C										INTENSITY					RUNOFF				
					0.2 0 AREA (AC)	0.32 0.2 AREA (AC)	0.44 0.4 AREA (AC)	0.55 0.58 AREA (AC)	0.65 0.75 AREA (AC)	0.71 0.85 AREA (AC)	0.8 1 AREA (AC)	% IMPERV.	WGH'T RUNOFF COEFF	CA	2-YR i IN/HR	10-YR i IN/HR	25-YR i IN/HR	50-YR i IN/HR	100-YR i IN/HR	2-YR Q CFS	10-YR Q CFS	25-YR Q CFS	50-YR Q CFS	100-YR Q CFS
OATES ROAD PROPOSED PEAK FLOW CALCULATIONS																								
G1	2.83	0.00441980	27.0	0.450	1.88						0.95	33.6554%	0.402	1.14	3.60	5.29	6.41	7.31	8.22	4.09	6.02	7.29	8.31	9.34
G2	1.86	0.00290606	26.2	0.436	0.00					1.40	0.46	88.6696%	0.732	1.36	3.66	5.38	6.52	7.43	8.35	4.99	7.33	8.87	10.12	11.37
G3	4.41	0.00688528	28.0	0.466	0.00					3.86	0.55	86.8577%	0.721	3.18	3.53	5.20	6.29	7.18	8.07	11.22	16.51	20.00	22.82	25.66
G4	3.67	0.00573013	27.6	0.460	0.00				3.15		0.52	78.5099%	0.671	2.46	3.56	5.24	6.34	7.23	8.13	8.76	12.89	15.61	17.80	20.02
G5	2.94	0.00459317	27.1	0.452	0.00		2.15				0.79	56.1210%	0.537	1.58	3.59	5.29	6.40	7.30	8.21	5.67	8.34	10.10	11.52	12.95
G6	1.72	0.00268798	26.0	0.433	0.00				1.52		0.20	77.9498%	0.668	1.15	3.67	5.40	6.54	7.45	8.37	4.22	6.20	7.51	8.56	9.62
G7	16.17	0.02526422	31.3	0.522	0.00		1.35		14.35		0.47	72.7890%	0.637	10.30	3.32	4.89	5.93	6.77	7.63	34.15	50.35	61.08	69.75	78.52
G8	1.38	0.00215333	25.6	0.426	0.00		0.43			0.62	0.33	74.4893%	0.647	0.89	3.71	5.45	6.59	7.51	8.44	3.31	4.86	5.88	6.70	7.53
G9	4.06	0.00633648	27.8	0.463	0.00					3.74	0.31	86.1577%	0.717	2.91	3.54	5.21	6.32	7.20	8.10	10.30	15.16	18.37	20.95	23.55
G10	4.53	0.00707228	28.0	0.467	0.00			2.22		1.76	0.55	73.7508%	0.643	2.91	3.53	5.19	6.29	7.17	8.06	10.26	15.09	18.28	20.86	23.45
G11	12.27	0.01917250	30.6	0.509	0.00			9.14		2.80	0.33	65.5767%	0.593	7.28	3.36	4.96	6.01	6.86	7.72	24.50	36.10	43.78	49.98	56.25
G12	5.93	0.00927106	28.7	0.478	5.18						0.75	12.6568%	0.276	1.64	3.48	5.13	6.21	7.09	7.97	5.70	8.40	10.17	11.61	13.06
G13	17.76	0.02775594	31.6	0.527	8.37			8.94			0.45	31.9333%	0.392	6.96	3.30	4.87	5.91	6.74	7.59	22.96	33.86	41.08	46.92	52.82
G14	2.21	0.00346006	26.5	0.442	0.58				1.13		0.51	61.2287%	0.567	1.26	3.64	5.35	6.47	7.38	8.30	4.57	6.72	8.13	9.27	10.42
G15	13.33	0.02082719	30.8	0.513	7.59					5.51	0.22	36.8447%	0.421	5.61	3.35	4.94	5.99	6.84	7.70	18.80	27.71	33.61	38.37	43.19
H1	1.75	0.00273639	26.0	0.434	0.77					0.55	0.43	51.0730%	0.506	0.89	3.67	5.40	6.53	7.45	8.37	3.26	4.79	5.79	6.60	7.42
H2	2.03	0.00317677	26.3	0.439	0.00			0.29		1.09	0.65	86.0705%	0.716	1.46	3.65	5.37	6.50	7.41	8.32	5.32	7.81	9.46	10.79	12.12
H3	6.19	0.00966748	28.8	0.480	4.36					1.27	0.56	26.5098%	0.359	2.22	3.48	5.12	6.20	7.08	7.96	7.72	11.37	13.78	15.72	17.68
H4	2.42	0.00377663	26.7	0.445	0.75			0.50		0.80	0.37	55.4877%	0.533	1.29	3.62	5.33	6.45	7.36	8.27	4.67	6.86	8.31	9.47	10.65
H5	4.81	0.00751086	28.2	0.470	0.00					4.25	0.55	86.7260%	0.720	3.46	3.52	5.18	6.27	7.15	8.04	12.18	17.92	21.71	24.77	27.86
H6	6.34	0.00990627	28.8	0.481	0.00					5.66	0.68	86.6111%	0.720	4.56	3.47	5.11	6.20	7.07	7.95	15.85	23.33	28.27	32.26	36.28
H7	5.31	0.00829436	28.4	0.474	0.00					4.78	0.52	86.4828%	0.719	3.82	3.50	5.15	6.24	7.12	8.01	13.36	19.67	23.83	27.18	30.57
H8	9.38	0.01465370	29.8	0.497	0.00				8.97		0.41	76.0905%	0.657	6.16	3.41	5.02	6.09	6.95	7.82	20.99	30.92	37.48	42.78	48.14
H9	5.80	0.00906166	28.6	0.477	0.00				5.33		0.47	77.0184%	0.662	3.84	3.49	5.13	6.22	7.10	7.98	13.39	19.71	23.88	27.25	30.65
H10	3.02	0.00471344	27.1	0.452	0.62						2.40	79.4580%	0.677	2.04	3.59	5.28	6.39	7.29	8.20	7.33	10.78	13.05	14.89	16.73
H11	15.05	0.02352328	31.1	0.519	0.00					13.80	1.26	86.2509%	0.718	10.80	3.33	4.91	5.95	6.80	7.65	35.96	53.02	64.31	73.43	82.66
H12	3.08	0.00481317	27.2	0.453	0.93					1.71	0.44	61.4315%	0.569	1.75	3.59	5.28	6.39	7.29	8.19	6.28	9.24	11.19	12.76	14.34
H13	3.73	0.00582478	27.6	0.460	1.50					1.79	0.43	52.4778%	0.515	1.92	3.56	5.23	6.34	7.23	8.13	6.83	10.04	12.17	13.88	15.60
H14	18.85	0.02945391	31.8	0.530	0.00				18.85			75.0000%	0.650	12.25	3.29	4.85	5.89	6.73	7.57	40.32	59.47	72.15	82.40	92.78
H15	12.26	0.01915516	30.5	0.509	0.00				12.26			75.0000%	0.650	7.97	3.36	4.96	6.01	6.86	7.72	26.81	39.51	47.91	54.69	61.56
H16	2.15	0.00336628	26.4	0.441	1.33						0.82	38.2870%	0.430	0.93	3.64	5.35	6.48	7.39	8.30	3.37	4.96	6.00	6.84	7.69
H17	2.81	0.00439727	27.0	0.450	0.00	1.66				0.77	0.39	48.7036%	0.492	1.39	3.60	5.30	6.41	7.31	8.22	4.99	7.34	8.88	10.13	11.39
H18	1.83	0.00286230	26.1	0.435	0.00			1.26		0.40	0.17	68.0783%	0.608	1.11	3.67	5.39	6.52	7.43	8.35	4.09	6.00	7.27	8.29	9.31
H19	7.75	0.01210689	29.3	0.489	0.00				7.60		0.15	75.4824%	0.653	5.06	3.44	5.07	6.14	7.01	7.88	17.40	25.63	31.06	35.45	39.88
H20	6.99	0.01092208	29.1	0.485	0.00	1.87		3.95			1.17	55.0644%	0.530	3.71	3.46	5.09	6.17	7.04	7.92	12.82	18.87	22.87	26.10	29.36
H21	9.57	0.01495894	29.9	0.498	1.95					7.02	0.61	68.6562%	0.612	5.86	3.41	5.02	6.08	6.94	7.81	19.95	29.39	35.63	40.67	45.76
H22	3.91	0.00611603	27.7	0.462	0.00	0.64	0.99			1.47	0.81	66.0260%	0.596	2.33	3.55	5.22	6.33	7.21	8.11	8.28	12.19	14.76	16.84	18.93
H23	4.02	0.00628395	27.8	0.463	0.00			3.81			0.21	60.5879%	0.564	2.27	3.55	5.22	6.32	7.21	8.10	8.04	11.82	14.32	16.33	18.37
H24	5.71	0.00892314	28.6	0.477	0.00			5.27			0.44	61.5802%	0.569	3.25	3.49	5.14	6.22	7.10	7.99	11.35	16.71	20.24	23.10	25.98
H25	20.09	0.03138969	32.0	0.533	6.45					13.02	0.62	58.1595%	0.549	11.03	3.28	4.84	5.87	6.70	7.55	36.17	53.35	64.73	73.94	83.26
H26	1.40	0.00218348	25.6	0.427	0.00			0.97			0.43	71.0654%	0.626	0.88	3.71	5.44	6.59	7.51	8.44	3.24	4.77	5.77	6.57	7.39
H27	28.59	0.04467844	33.0	0.551	12.71					15.29	0.59	47.5150%	0.485	13.87	3.22	4.75	5.77	6.59	7.42	44.64	65.89	79.98	91.38	102.95
H28	1.18	0.00185019	25.3	0.422	0.00			0.79			0.40	72.4011%	0.634	0.75	3.73	5.48	6.63	7.56	8.49	2.80	4.12	4.98	5.68	6.38
H29	20.07	0.03136031	32.0	0.533	0.00					19.32	0.75	85.5606%	0.713	14.32	3.28	4.84	5.87	6.70	7.55	46.96	69.27	84.04	96.00	108.10
H30	1.04	0.00162909	25.1	0.418	0.00			0.62			0.42	75.1905%	0.651	0.68	3.75	5.50	6.66	7.59	8.53	2.54	3.74	4.52	5.15	5.79
O1	0.43	0.00066488	23.6	0.393	0.00					0.20	0.22	92.8404%	0.757	0.32	3.87	5.68	6.87	7.82	8.78	1.25	1.83	2.21	2.52	2.83
O2	1.86	0.00291178	26.2	0.436	0.00				1.21		0.66	83.8153%	0.703	1.31	3.66	5.38	6.52	7.43	8.35	4.80	7.05	8.54	9.73	10.94
O3	1.12	0.00174379	25.2	0.420	0.00				0.81		0.30	81.8320%	0.691	0.77	3.74	5.49	6.64	7.57	8.51	2.88	4.23	5.12	5.84	6.56
O4	1.16	0.00181990	25.3	0.421	0.00				0.89		0.27	80.8907%	0.685	0.80	3.73	5.48	6.63	7.56	8.49	2.98	4.38	5.30	6.03	6.78
O5	4.41	0.00688745	28.0	0.466	0.00					4.06	0.35	86.1744%	0.717	3.16	3.53	5.20	6.29	7.18	8.07	11.16	16.42	19.89	22.69	25.52
O6	2.07	0.00323353	26.4	0.439	0.00			1.82			0.25	63.4049%	0.580	1.20	3.65	5.36	6.49	7.40	8.32	4.38	6.44	7.80	8.89	9.99
O7	3.61	0.00563826	27.5	0.459	0.00					3.29	0.32	86.3106%	0.718	2.59	3.56	5.24	6.35	7.24	8.14	9.23	13.57	16.44	18.75	21.08
O8	0.45	0.00070965	23.7	0.395	0.00			0.29			0.16	73.2476%	0.639	0.29	3.86	5.67	6.85	7.81	8.76	1.12	1.65	1.99	2.27	2.55
O9	3.17	0.00494686	27.3	0.454	0.00					3.01	0.16	85.7475%	0.714	2.26	3.58	5.27	6.38	7.28	8.18	8.10	11.92	14.44	16.46	18.51
O10	4.84	0.00755838	28.2	0.470	0.00	0.68				3.21	0.95	78.8584%	0.673	3.26	3.52	5.17	6.27	7.15	8.04	11.45	16.85	20.41	23.29	26.19
O11	5.71	0.00892148	28.6	0.477	0.00			1.53		3.40	0.78	79.9110%	0.679	3.88	3.49	5.14	6.22	7.10	7.99	13.54	19.93	24.15	27.55	30.99
O12	8.15	0.01273801	29.5	0.491	0.00					7.48	0.67	86.2412%	0.717	5.85	3.43	5.05	6.13	6.99	7.87	20.07	29.56	35.83	40.89	46.01
O13	4.69	0.00733285	28.1	0.469	0.00					3.96	0.74	87.3569%	0.724	3.40	3.52	5.18	6.28	7.16	8.05	11.97	17.61	21.33	24.34	27.37
O14	17.54	0.02741329	31.6	0.526	0.00				15.29	1.65	0.60	76.7940%	0.661	11.59	3.30	4.87	5.91	6.75	7.60	38.29	56.47	68.50	78.23	88.08
O15	7.98	0.01246647	29.4	0.490	0.00	2.43				5.07	0.48	66.1405%	0.597	4.76	3.44	5.06	6.13	7.00	7.87	16.36	24.09	29.20	33.33	37.49
O16	2.37	0.00370437	26.6	0.444	0.00			1.78			0.59	68.8017%	0.613	1.45	3.63	5.33	6.46	7.36	8.27	5.27	7.75	9.38	10.69	12.02
O17	4.68	0.00731350	28.1	0.469	0.96					3.08	0.65	69.6595%	0.618	2.89	3.52	5.18	6.28	7.16	8.05	10.19	14.99	18.16	20.71	23.29
O18	2.35	0.00366463	26.6	0.444	0.00				0.88	0.99	0.48	84.3245%	0.706	1.66	3.63	5.33	6.46	7.36	8.28	6.01	8.83	10.69	12.19	13.70
O19	1.61	0.00251954	25.9	0.431	0.00				0.85	0.36	0.40	83.4567%	0.701	1.13	3.68	5.41	6.55	7.47	8.39	4.16	6.12	7.41	8.44	9.48

TABLE - OATES ROAD PROPOSED PEAK FLOW CALCULATIONS

SUB-AREA	AREA (Ac)	AREA (SqM)	Tc (min)			RUNOFF COEFF. C										INTENSITY					RUNOFF				
						0.20 AREA (AC)	0.32 0.2 AREA (AC)	0.44 0.4 AREA (AC)	0.55 0.58 AREA (AC)	0.65 0.75 AREA (AC)	0.71 0.85 AREA (AC)	0.81 AREA (AC)	% IMPERV.	WGH'T RUNOFF COEFF	CA	2-YR i IN/HR	10-YR i IN/HR	25-YR i IN/HR	50-YR i IN/HR	100-YR i IN/HR	2-YR Q CFS	10-YR Q CFS	25-YR Q CFS	50-YR Q CFS	100-YR Q CFS
OATES ROAD PROPOSED PEAK FLOW CALCULATIONS																									
O20	1.48	0.00232029	25.7	0.429		0.00			0.98			0.51	72.6642%	0.636	0.94	3.70	5.43	6.57	7.49	8.42	3.49	5.13	6.21	7.08	7.95
O21	1.16	0.00180539	25.3	0.421		0.65						0.51	43.7074%	0.462	0.53	3.73	5.48	6.64	7.56	8.50	1.99	2.93	3.54	4.04	4.54
GO1	21.57	0.03370812	32.2	0.536		0.00			21.57				58.4000%	0.550	11.87	3.27	4.82	5.85	6.68	7.52	38.80	57.24	69.45	79.33	89.34
GO2	18.38	0.02872263	31.7	0.528		0.00			18.38				58.4000%	0.550	10.12	3.30	4.86	5.90	6.73	7.58	33.34	49.17	59.65	68.13	76.71
GO3	16.86	0.02633865	31.4	0.524		0.00			16.86				58.4000%	0.550	9.28	3.31	4.88	5.92	6.76	7.61	30.71	45.28	54.93	62.73	70.63
GO4	14.28	0.02232004	31.0	0.516		0.00			14.28				58.4000%	0.550	7.86	3.34	4.92	5.97	6.81	7.67	26.25	38.69	46.92	53.58	60.31

Appendix D

Preliminary Cost Estimate for

Recommended Drainage Improvements

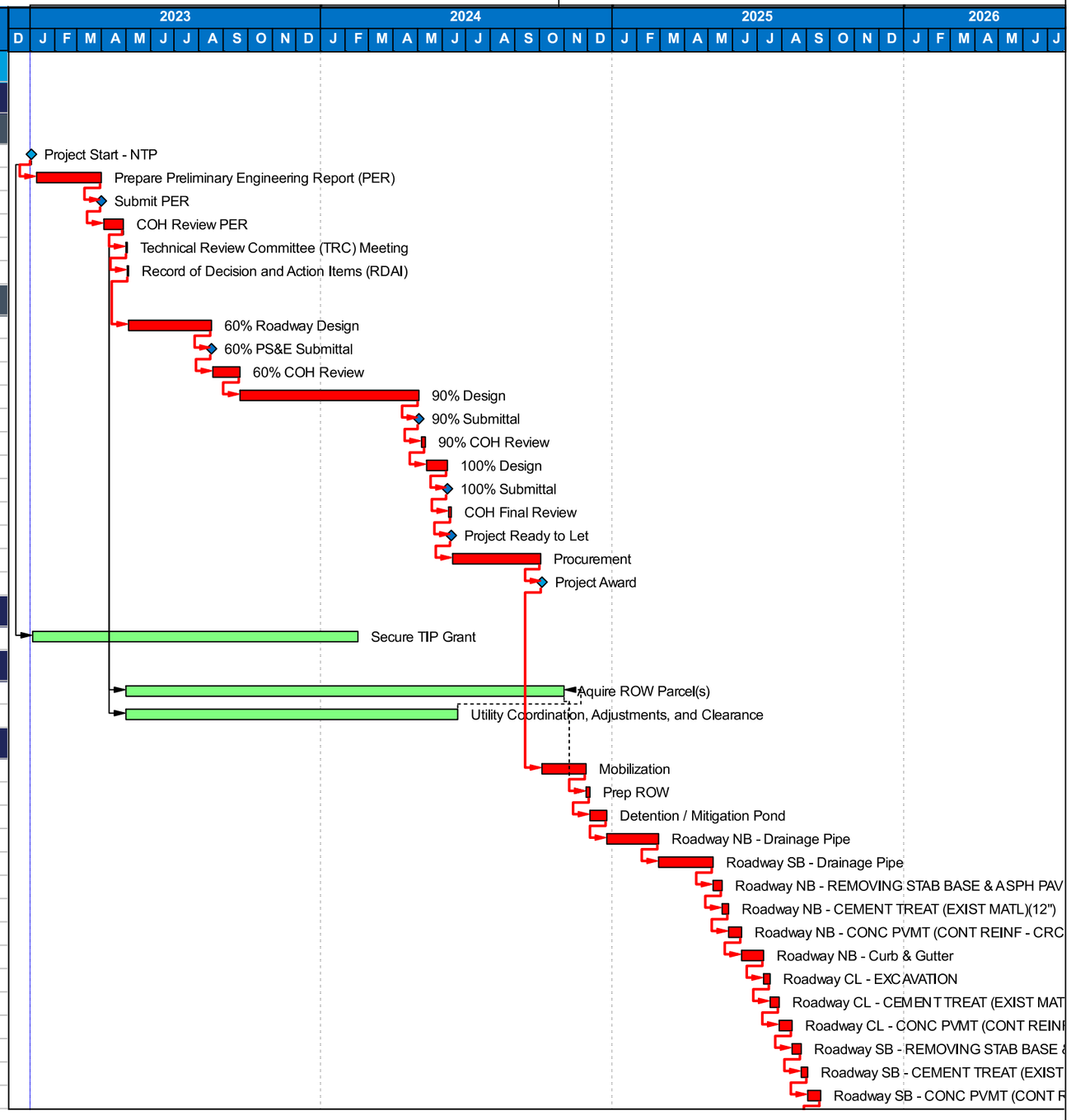
CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING
PRE-ENGINEERING SERVICES OF THOROUGHFARES IMPROVEMENTS ON OATES ROAD
PRELIMINARY CONSTRUCTION COST ESTIMATE
WBS NO. N-320100-0018-3

ISANI civil | design | engineers

SPEC NO.	ITEM DESCRIPTION	UNIT	UNIT PRICE	UNIT QUANTITY	TOTAL COST
A. GENERAL ITEMS					
01502	Mobilization	LS	SEE BOTTOM	SEE BOTTOM	
01740	Site Restoration	LF	$4.00	12212	$48,848.00
02221	Remove and Dispose of Existing Inlets	EA	$350.00	5	$1,750.00
02221	Remove and Dispose of Existing 15" Stm Pipe All Types	LF	$7.00	29	$203.00
02221	Remove and Dispose of Existing 18" Stm Pipe All Types	LF	$8.00	568	$4,541.68
02221	Remove and Dispose of Existing 24" Stm Pipe All Types	LF	$15.00	2616	$39,234.60
02221	Remove and Dispose of Existing 30" Stm Pipe All Types	LF	$30.00	612	$18,372.60
02222	Remove and Dispose of 6'x3' Box Culvert	LF	$52.50	83	$4,374.83
02223	Remove and Dispose of 6'x4' Box Culvert	LF	$52.50	321	$16,868.25
02221	Remove Storm Manhole (All Depths)	EA	$400.00	1	$400.00
02922	Remove and Dispose of Existing Concrete Pavements (including all thickness, w/ or w/o asphalt overlay, including base & subgrade w/ or w/o curb, all depths)	SY	$8.00	27138	$217,102.22
SUB-TOTAL GENERAL ITEMS					**$351,695.18**
C. STORM SEWER ITEMS					
02081	Conflict Manhole	EA	$10,000.00	0	$0.00
02082/ 02087	Type 'C' Manhole for 42-inch Diameter and Smaller Storm Sewers (up to 8' Depth)	EA	$4,000.00	10	$40,000.00
02082/ 02087	Type 'C' Manhole for 48-inch Diameter and Larger Storm Sewers (up to 8' Depth)	EA	$6,000.00	15	$90,000.00
02082/ 02087	Junction Boxes	EA	$30,000.00	16	$480,000.00
	Proposed Detention Pond w/ 3:1 slopes	Ac-Ft	$32,000.00	8.21	$262,720.00
02260	Trench Safety System, All Soil Types, All Depths Over 5 Feet	LF	$2.00	12212	$24,424.00
02631	Reinforced Concrete Box, C1433 (All Depths) - (12'x10')	LF	$1,850.00	1355	$2,506,750.00
02631	Reinforced Concrete Box, C1433 (All Depths) - (12'x9')	LF	$1,750.00	1043	$1,825,250.00
02631	Reinforced Concrete Box, C1433 (All Depths) - (8'x8')	LF	$1,000.00	1106	$1,106,000.00
02631	Reinforced Concrete Pipe, C76, Class III, Rubber Gasket (60")	LF	$250.00	1523	$380,750.00
02632	Reinforced Concrete Pipe, C76, Class III, Rubber Gasket (54")	LF	$230.00	850	$195,500.00
02631	Reinforced Concrete Pipe, C76, Class III, Rubber Gasket (48")	LF	$210.00	1309	$274,890.00
02631	Reinforced Concrete Pipe, C76, Class III, Rubber Gasket (36")	LF	$125.00	518	$64,750.00
02632	Reinforced Concrete Pipe, C76, Class III, Rubber Gasket (24")	LF	$110.00	4508	$495,880.00
02632/ 02633	Type BB Inlet, Cast-in-Place or Precast	EA	$3,000.00	69	$207,000.00
SUB-TOTAL STORM SEWER ITEMS					**$7,953,914.00**
TOTAL PROJECT CONSTRUCTION COST SUMMARY					
SUB-TOTAL GENERAL ITEMS					**$351,695.18**
SUB-TOTAL STORM SEWER ITEMS					**$7,953,914.00**
SUB-TOTAL CONSTRUCTION COSTS					**$8,305,609.18**
MOBILIZATION					**$332,224.37**
REAL ESTATE ACQUISITION					**$179,593.46**
CONTINGENCIES (20%)					**$1,727,566.71**
TOTAL CONSTRUCTION					**$10,544,993.71**

APPENDIX F:
Project Schedule

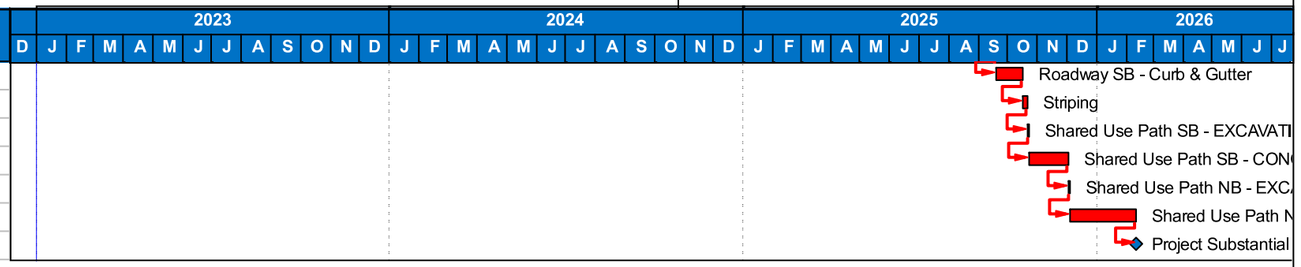
Activity ID	Activity Name	Remaining Duration	Start	Finish
Oates Road Project Schedule		812	02-Jan-23	10-Feb-26
Design		459	02-Jan-23	04-Oct-24
Phase I Preliminary Design		89	02-Jan-23	04-May-23
100	Project Start - NTP	0	02-Jan-23	
150	Prepare Preliminary Engineering Report (PER)	60	09-Jan-23	31-Mar-23
170	Submit PER	0		31-Mar-23
200	COH Review PER	20	03-Apr-23	28-Apr-23
220	Technical Review Committee (TRC) Meeting	2	01-May-23	02-May-23
240	Record of Decision and Action Items (RDAI)	2	03-May-23	04-May-23
Phase II Final Design		370	05-May-23	04-Oct-24
210	60% Roadway Design	75	05-May-23	17-Aug-23
230	60% PS&E Submittal	0		17-Aug-23
250	60% COH Review	25	18-Aug-23	21-Sep-23
260	90% Design	161	22-Sep-23	03-May-24
270	90% Submittal	0		03-May-24
290	90% COH Review	5	06-May-24	10-May-24
300	100% Design	20	13-May-24	07-Jun-24
310	100% Submittal	0		07-Jun-24
320	COH Final Review	3	10-Jun-24	12-Jun-24
330	Project Ready to Let	0		13-Jun-24
335	Procurement	80	14-Jun-24	03-Oct-24
340	Project Award	0	04-Oct-24	
Funding		240	04-Jan-23	16-Feb-24
A1000	Secure TIP Grant	240	04-Jan-23	16-Feb-24
ROW		395	01-May-23	01-Nov-24
A1030	Aquire ROW Parcel(s)	395	01-May-23	01-Nov-24
A1200	Utility Coordination, Adjustments, and Clearance	300	01-May-23	21-Jun-24
Construction		353	04-Oct-24	10-Feb-26
A1010	Mobilization	40	04-Oct-24	28-Nov-24
A1020	Prep ROW	3	29-Nov-24	03-Dec-24
A1025	Detention / Mitigation Pond	15	03-Dec-24	24-Dec-24
A1040	Roadway NB - Drainage Pipe	48	24-Dec-24	28-Feb-25
A1050	Roadway SB - Drainage Pipe	48	28-Feb-25	07-May-25
A1080	Roadway NB - REMOVING STAB BASE & ASPH PAV (12")	8	07-May-25	19-May-25
A1090	Roadway NB - CEMENT TREAT (EXIST MATL)(12")	6	19-May-25	27-May-25
A1100	Roadway NB - CONC PVMT (CONT REINF - CRCP) (12")	12	27-May-25	12-Jun-25
A1105	Roadway NB - Curb & Gutter	19	12-Jun-25	09-Jul-25
A1110	Roadway CL - EXCAVATION	7	09-Jul-25	18-Jul-25
A1120	Roadway CL - CEMENT TREAT (EXIST MATL)(12")	6	18-Jul-25	28-Jul-25
A1130	Roadway CL - CONC PVMT (CONT REINF - CRCP) (12")	13	28-Jul-25	14-Aug-25
A1140	Roadway SB - REMOVING STAB BASE & ASPH PAV (12")	8	14-Aug-25	26-Aug-25
A1150	Roadway SB - CEMENT TREAT (EXIST MATL)(12")	6	26-Aug-25	03-Sep-25
A1160	Roadway SB - CONC PVMT (CONT REINF - CRCP) (12")	12	03-Sep-25	19-Sep-25



Critical Remaining Work | Actual Work | Actual Level of Effort | Finish Milestone
Remaining Work | Remaining Level of Effort | Start Milestone

Oates Road from Wallisville Road to Beaumont Hwy
RS&H, Inc.

Activity ID	Activity Name	Remaining Duration	Start	Finish
A1165	Roadway SB - Curb & Gutter	19	19-Sep-25	16-Oct-25
A1190	Striping	3	16-Oct-25	21-Oct-25
A1052	Shared Use Path SB - EXCAVATION	2	21-Oct-25	23-Oct-25
A1054	Shared Use Path SB - CONC SIDEWALKS (4")	28	23-Oct-25	02-Dec-25
A1060	Shared Use Path NB - EXCAVATION	3	02-Dec-25	05-Dec-25
A1070	Shared Use Path NB - CONC SIDEWALKS (4")	47	05-Dec-25	10-Feb-26
A1170	Project Substantial Completion	0		10-Feb-26



Critical Remaining Work | Actual Work | Actual Level of Effort | Finish Milestone
Remaining Work | Remaining Level of Effort | Start Milestone

STAGE 3

DESIGN CONCEPT REPORT

OATES ROAD

NEED AREA N-2016T-I01

APRIL 2022

RS&H

HOUSTON PUBLIC WORKS