FINAL DRAINAGE REPORT

Miller Road:
Lower Buckeye Road to Pima Street
Roadway Improvements

Prepared for:

City of Buckeye

Expires 06/30/2025

Prepared by:
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Phoenix, AZ 85020
602-944-550

191342026
March 2024

DISCLAIMER:

THE CITY APPROVES THIS REPORT FOR CONCEPT ONLY AND ACCEPTS NO LIABILITY FOR ERRORS OR OMISSIONS

BY:_____
BUCKEYE CITY ENGINEER DATE

FINAL DRAINAGE REPORT

MILLER ROAD:

LOWER BUCKEYE ROAD TO PIMA STREET

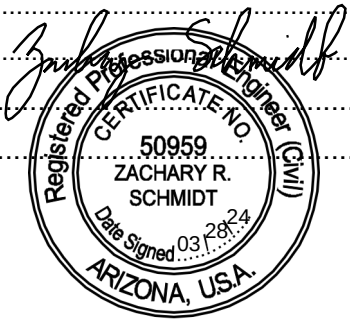
ROADWAY IMPROVEMENTS

MARCH 2024

Prepared By:

Kimley»Horn

Contents



Expires 06/30/2025

Figures

Appendices

1.0 INTRODUCTION

PROJECT LOCATION

This project is located in the City of Buckeye (City) in Maricopa County, Arizona. The project limits of will take place from Lower Buckeye Road to Pima Street. See **Figure 1** and **Figure 2** for the Location and Vicinity Maps.

PURPOSE

The purpose of this report is to document the existing drainage conditions and proposed drainage improvements associated with the Miller Road roadway improvements. The improvements consist of pavement, curb and gutter, and sidewalk improvements along Miller Road. Drainage improvements are minor and consist of catch basins and retention basins. Historical drainage patterns will be maintained with this project.

2.0 ON-SITE DRAINAGE CONDITIONS

EXISTING DRAINAGE FEATURES

Existing roadway runoff along Miller Road from Pima Street to Lower Buckeye Road flows from north to south. Miller Road does not have curb and gutter to manage pavement runoff except for the Speedmart parcel. Tractor Supply Company parcel directs runoff with a drainage swale. Runoff from the right-of-way sheet flows off the road to adjacent properties.

3.0 OFF-SITE DRAINAGE CONDITIONS

EXISTING DRAINAGE FEATURES

Surrounding area runoff flows north to south ultimately reaches the west side of Miller Road just south of Lower Buckeye Road. Off-site runoff on the east side of Miller Road reaches a shotcrete channel north of Lower Buckeye Road that conveys runoff east to a culvert crossing under Lower Buckeye Road. The runoff flows in natural washes to where it overtops Miller Road where it reaches the channel on the west.

The shotcrete channel will be impacted by roadway widening improvements. The shotcrete channel will be relocated and replaced in kind where impacted. No other off-site improvements will be implanted with this project.

4.0 FLOODPLAIN DESIGNATION

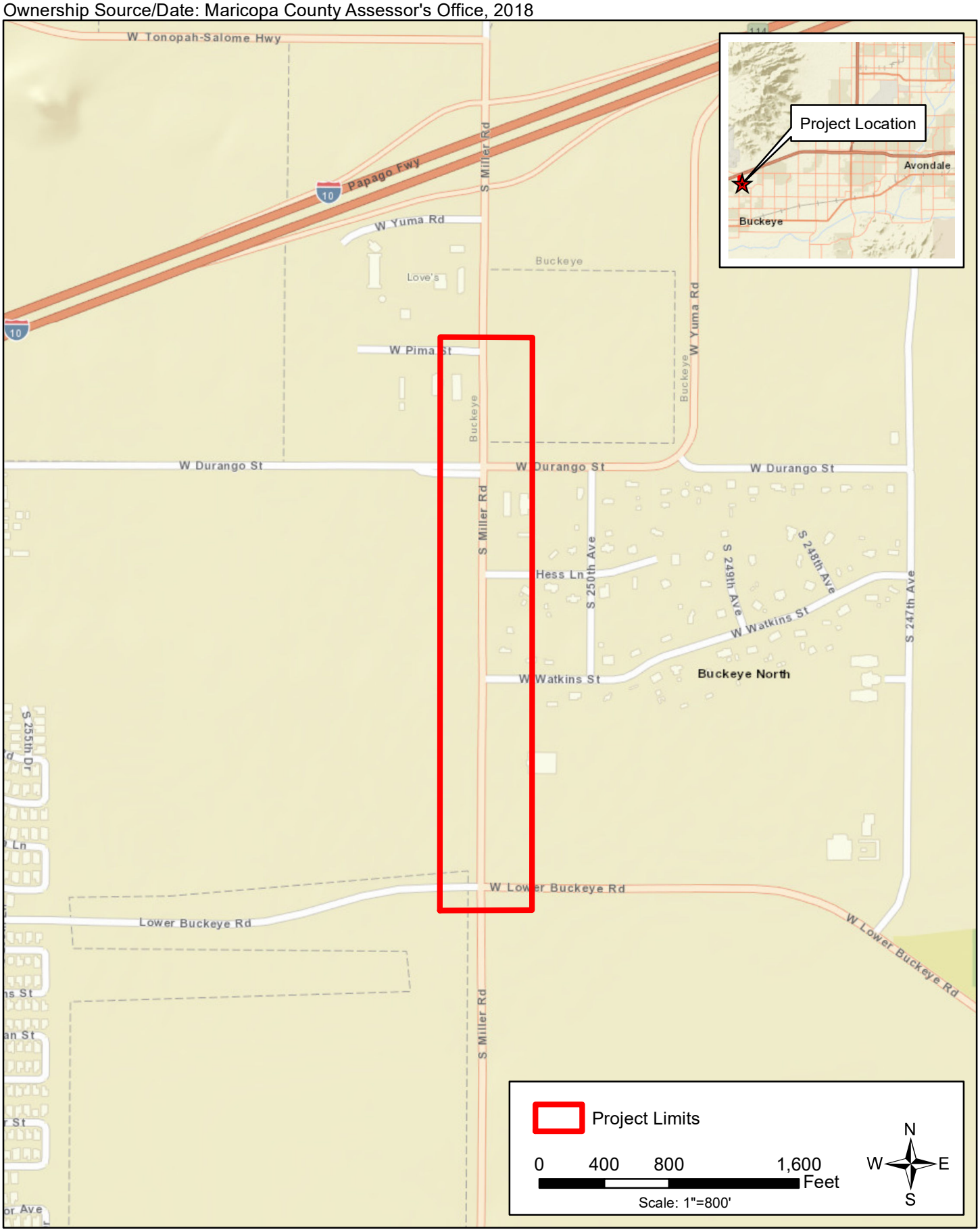
FLOODPLAIN LOCATIONS

The project is in Flood Insurance Rate Maps (FIRM) Panel Number 04013C2115L effective date of panel is October 16, 2013. The improvements associated with this project are located in Zone “X”. The FIRM Panel is included as **Figure 3**.

Zone “X” is defined by FEMA as follows:

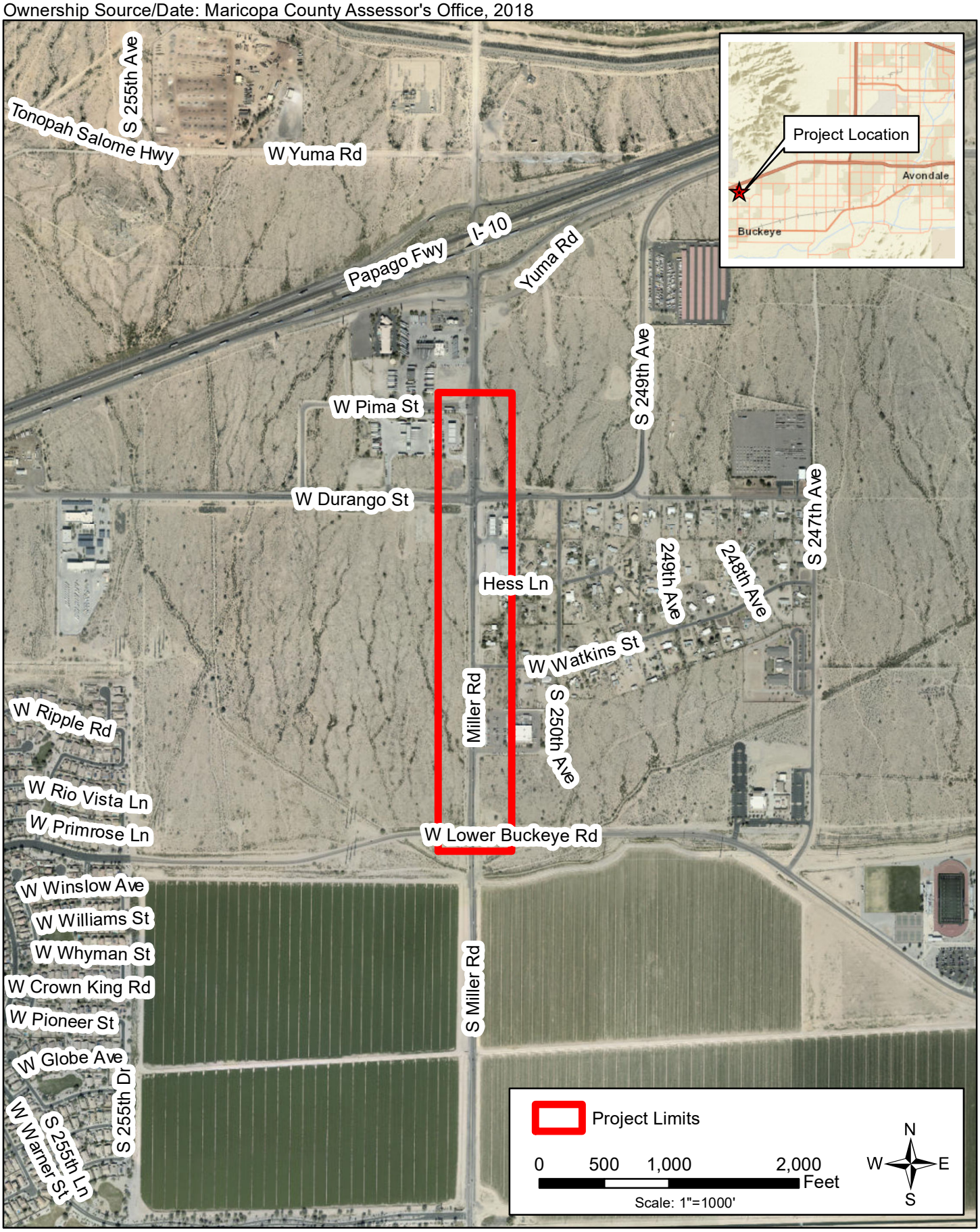
Areas of 0.2% annual chance flood; areas of 1% annual flood chance with average depths of less than 1 foot or with drainage areas 1 square mile; and areas protected by levees from 1% annual chance flood.

Ownership Source/Date: Maricopa County Assessor's Office, 2018



Kimley»Horn Expect More. Experience Better.	Miller Rd - Lower Buckeye to Pima	City of Buckeye, Maricopa County, AZ
	Figure 1. Location Map	

Ownership Source/Date: Maricopa County Assessor's Office, 2018

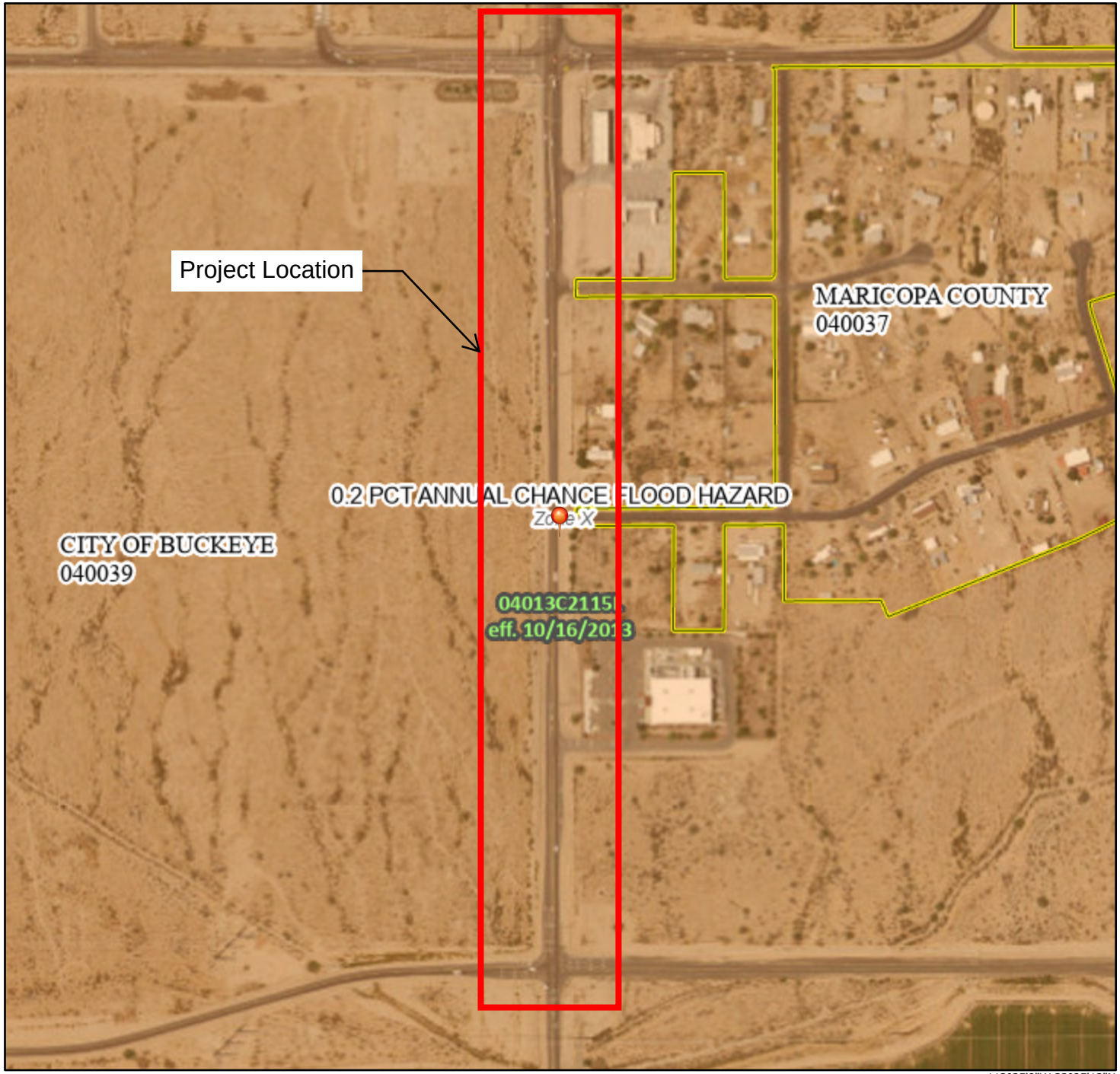


Kimley»Horn Expect More. Experience Better.	Miller Rd - Lower Buckey to Pima	City of Buckeye, Maricopa County, AZ
	Figure 2. Aerial Map	

National Flood Hazard Layer FIRMette Figure 3

FEMA

112°35'46"W 33°25'43"N



112°35'8"W 33°25'13"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 1/11/2022 at 1:41 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

5.0 PROPOSED DRAINAGE PLAN

PROPOSED DRAINAGE FEATURES

The proposed roadway improvements along Miller Road include the addition of pavement, sidewalk and curb and gutter. Historical drainage patterns will be maintained throughout the extents of the project limits. Each parcel on the east side of Miller Road will be responsible with storing their half-street runoff to meet City of Buckeye standards. Speedsmart and Tractor Supply Company will continue to take the runoff in a mix of underground and surface storage. A new catch basin will be installed at Speedsmart that connects to existing drainage system. An existing catch basin with the improvements will be removed and replaced in front of Tractor Supply Company that drains to the underground storage. Five (5) catch basins and five (5) retention basins will be installed along the other parcels on the east side of Miller Road. The retention basins will be within the parcel property in drainage easements. The retention basins on the undeveloped parcels are temporary. The retention basins can be relocated to another part of the parcel when developed. The recently built 10 West Commerce and 5 Below Warehouse capture their half-street runoff on the west side of Miller Road which was completed as part of another project. Refer to **Figure 4** for drainage maps.

The existing off-site shotcrete channel that is impacted by roadway widening improvements will be relocated and replaced in kind as shown in the as-built records. The channel geometry, capacity, and hydraulics will maintained. The off-site historical drainage patterns will be maintained.

6.0 DATA ANALYSIS METHODS

HYDROLOGY

Rainfall intensities for this project were obtained from the National Oceanic and Atmospheric Administration Atlas 14 (NOAA 14) data per City standards. The Rational Method was used to estimate the 10-year storm event peak discharges throughout the project limits. The time of concentration was determined using street flow time of the longest flow path per the FCDMC Drainage Design Manual. The minimum time of concentration used was five minutes. A runoff coefficient of 0.95 was used for all impervious areas per the FCDMC Drainage Design Manual.

HYDRAULICS

The 10-year storm event will meet dry lane and maximum depth of water requirements met per City standards. The 10-year storm event will be contained within the curb and flood only one lane per half-street. The 100-year storm event will be contained within the Right-of-Way and with a max depth of six (6) inches above top of curb. Catch basins were sized to maximize runoff capture efficiency. Bypass runoff is runoff not collected by an inlet. This bypass runoff was calculated and set up to be collected at downstream inlet to account for inlets not that do not have 100% capture efficiency. The storm drain was designed to meet the criteria per City standards. Minimum velocity of two (2) feet per second (fps) and maximum of ten (10) fps will be maintained within storm drain. The minimum velocity could not be achieved for one segment of pipe for the underground retention into Tractor Supply Co. This is because of the backwater effect that was accounted for. This condition would only be if retention was at capacity and additional runoff was entering the system, otherwise velocity would be within COB standards. The hydraulic grade line (HGL) will be contained within the pipe and met minimum freeboard of one (1) foot

below gutter flow line. **Table 1** below is a summary of street hydraulics for Miller Road. See **Appendix A** for additional hydraulic calculations.

Table 1. Runoff Summary

Inlet	Area [ac]	10-Year Runoff [cfs]	10-Year Spread [ft]	100-Year Runoff [cfs]	100-Year Depth [ft]
3204E	0.91	4.0	12.8	6.6	0.3
3718E	0.45	2.2	9.9	3.4	0.3
4011E	1.15	4.8	13.2	7.9	0.4
4679E	0.63	3.1	11.1	4.8	0.3
5025E	0.94	4.2	11.9	7.2	0.3
5755E	0.55	2.7	9.9	4.2	0.3
6080E	0.60	2.9	10.0	4.6	0.3

RETENTION

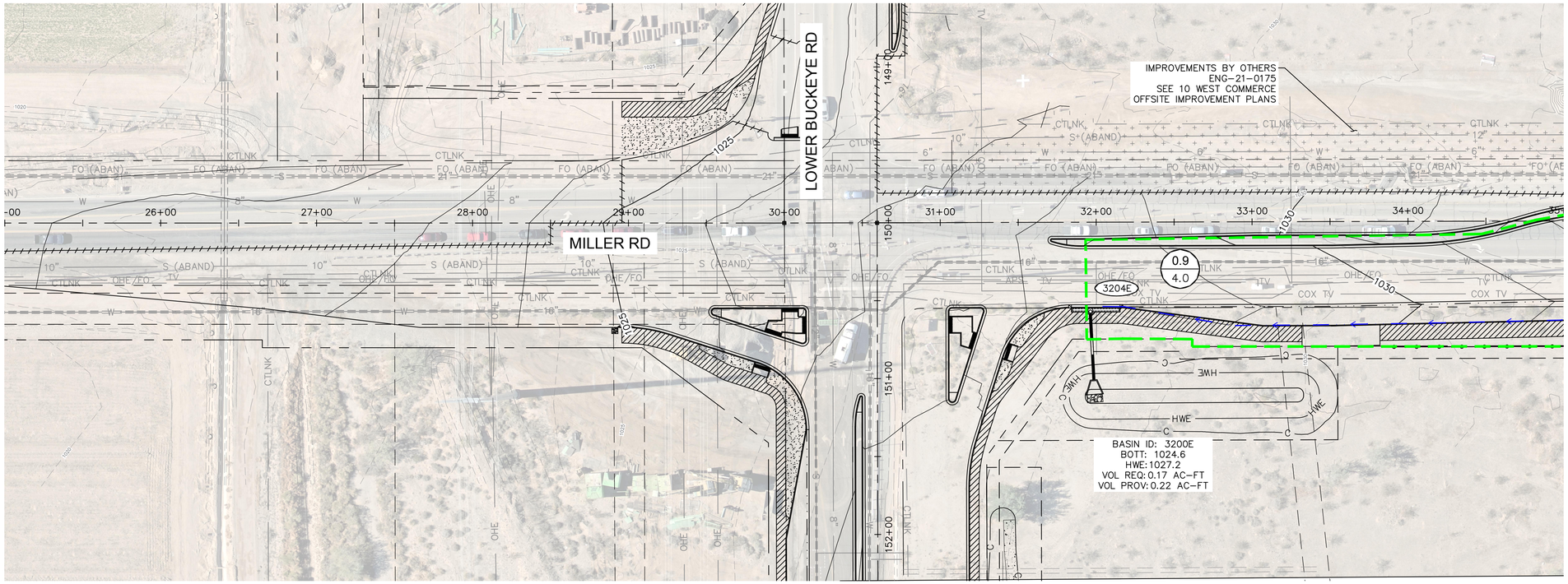
The proposed surface retention basins are sized for the 100-year, 2-hour storm per City standards. A rainfall depth of 2.34-inches was used for this event which was obtained from NOAA 14. The basins are sized to drain within 36-hours through surface infiltration. A percolation rate of 4.2 inches per hour(in/hr) was assumed from a previous project along I-10 located near the project. The temporary retention basins are intended for interim condition and will be relocated when the parcel gets developed. The temporary retention basins will have ponding depths above one (1) foot which per City standards would require a drywell. After discussions with the City, it was decided that the temporary retention basins will not require drywell if retention basin drain within 36- hours. Final percolation rates will need to be confirmed through geotechnical investigation during construction. Each retention basin will be required to achieve minimum percolation rate of 2.1 in/hr. See **Appendix B** for report excerpts. **Table 2** is a summary of the retention of the project. See **Appendix A** for additional retention calculations.

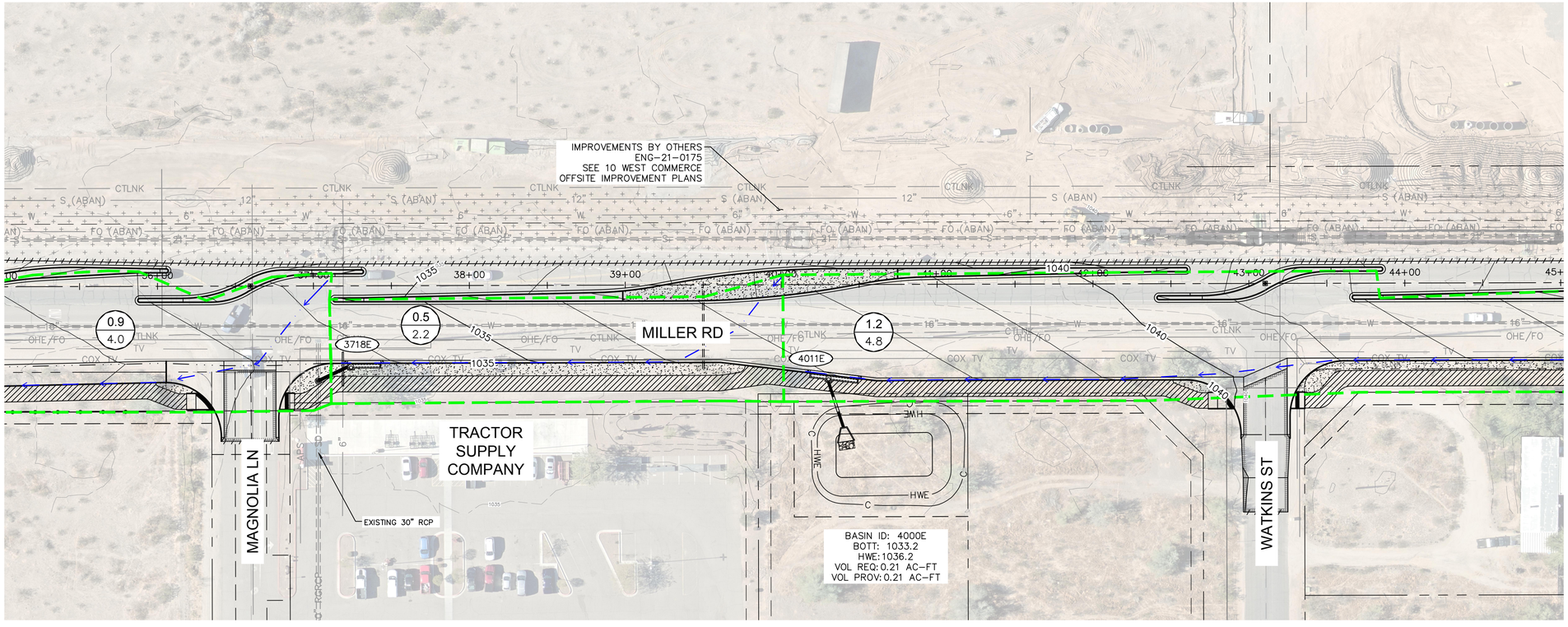
Table 2. Retention Basin Summary

Basin	Area [ac]	Volume Required [ac-ft]	Volume Provided [ac-ft]	Drain Down Time [hrs]
32+00	0.91	0.17	0.22	34
40+00	1.15	0.21	0.21	31
46+75	0.63	0.12	0.15	34
57+50	0.56	0.10	0.14	36
60+75	0.60	0.11	0.15	36

7.0 CONCLUSIONS

- The improvements associated with this project will not impact the existing drainage patterns.
- Proposed catch basins will be installed in locations to capture each parcels half-street runoff on the east side.
- The maximum water depth and dry lane requirements at proposed inlet structures are met for the 10- and 100-year storm events per City of Buckeye standards.
- All proposed retention basins were sized using the 100-year, 2-hour storm event and drain through infiltration within thirty-six hours per City standards.
- Improvements on the west side of Miller will be completed with another project under development.





NORTH

LEGEND:

- XXX — CATCH BASIN ID
- X / XX — DRAINAGE BASIN SIZE (AC) / 10 YR RUNOFF (CFS)
- DRAINAGE BASIN
- FLOW PATH
- PROPOSED CONTOURS
- EXISTING CONTOURS
- PROPOSED STORM DRAIN PIPE

GRAPHIC SCALE IN FEET
0 20 40 80
HORIZONTAL

Contact Arizona 811 at least two full working days before you begin excavation
ARIZONA811
Call 811 or click Arizona811.com

REVISIONS:

1

2

3

PLAN NAME
MILLER ROAD
LOWER BUCKEYE ROAD TO PIMA STREET
ROADWAY IMPROVEMENTS
ONSITE DRAINAGE MAPS

ENGINEER INFORMATION
Kimley»Horn
7740 N 16TH ST, SUITE 300, PHOENIX, AZ 85020 | 602-944-5500

COB PERMITTING APPROVED SEAL	COB ENGINEERING APPROVED SEAL
AS-BUILT SEAL	DESIGN SEAL
ORIGINAL PLAN DATE 1/25/2022	LATEST REVISION DATE
PROJECT NUMBER CIP #105260	SHEET NUMBER 1 OF 2

SUBMITTAL: 100%

COB PLAN TRACKING # N/A

COB PERMIT #

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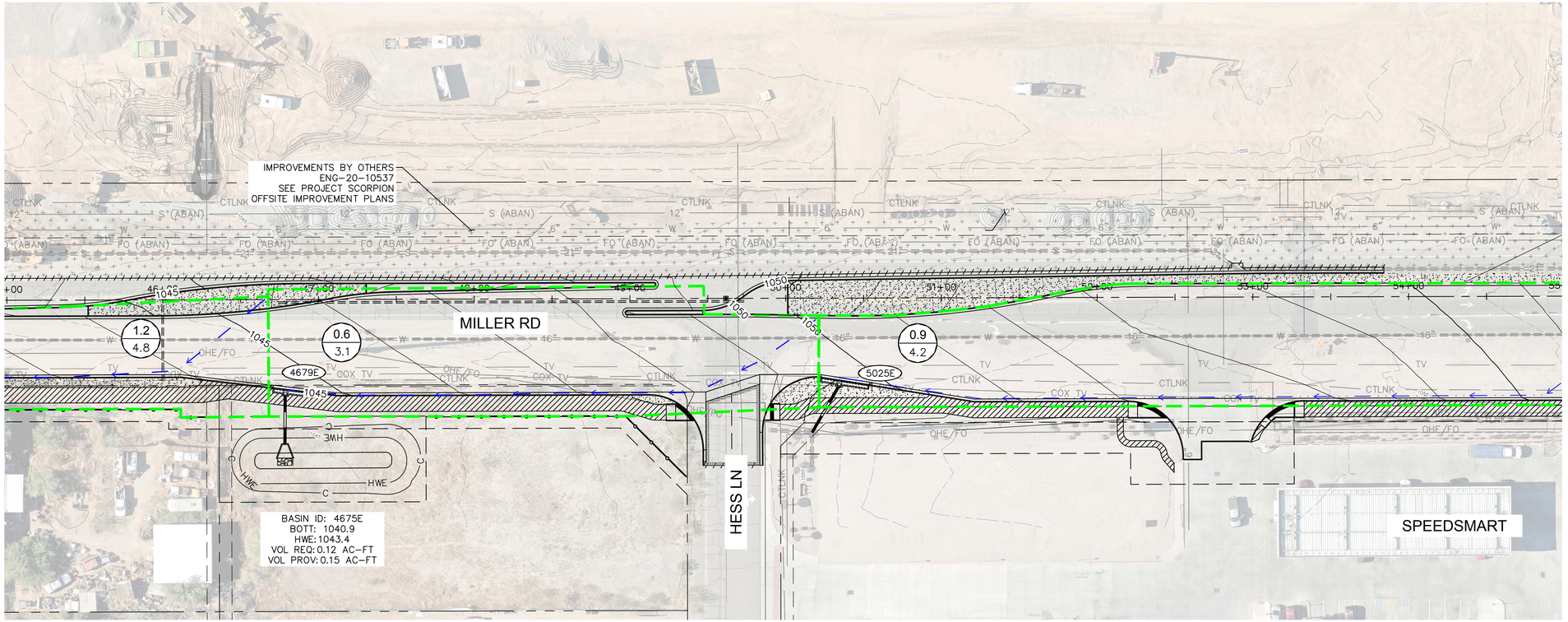
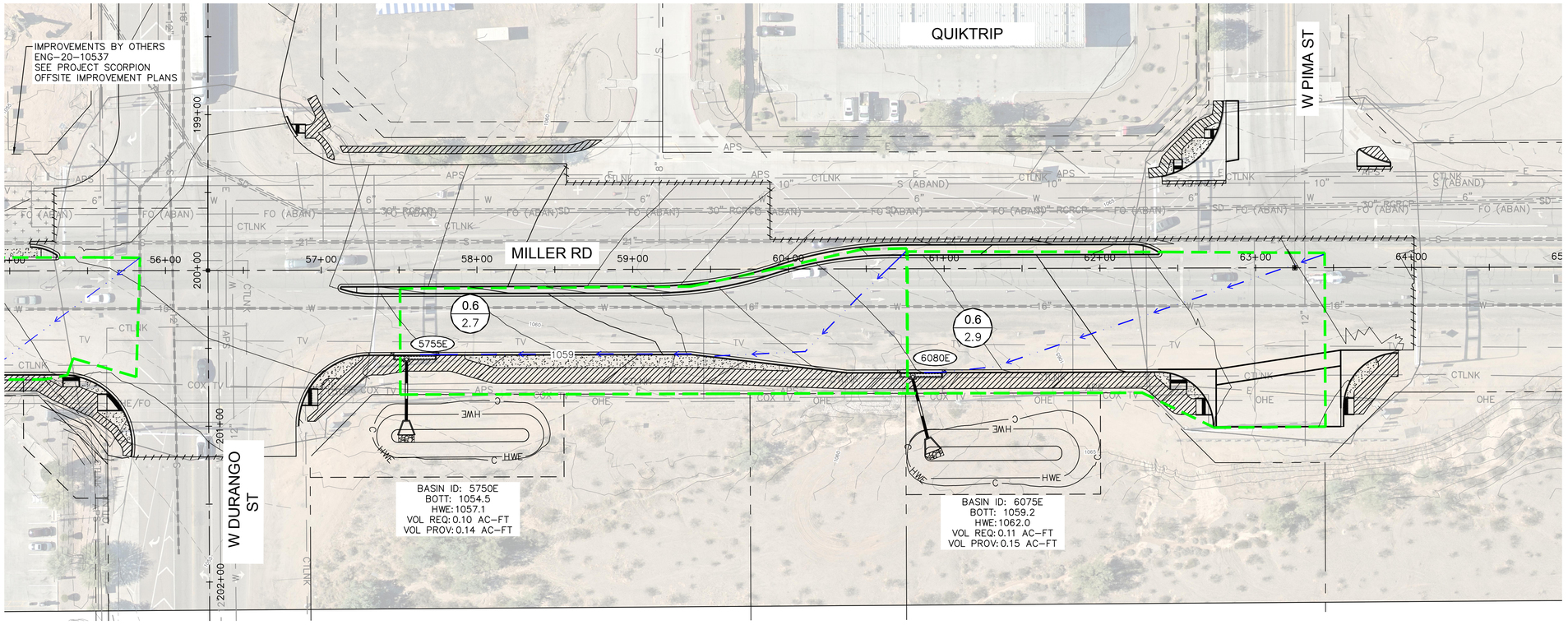
MATCHLINE STA. 45+00 SEE SHEET 1



MATCHLINE STA. 55+00 SEE BELOW LEFT

MATCHLINE STA. 55+00 SEE SHEET ABOVE RIGHT



LEGEND:

- XXX — DRAINAGE BASIN ID
- XXX — CATCH BASIN ID
- X / XX — DRAINAGE BASIN SIZE (AC) 10 YR RUNOFF (CFS)
- DRAINAGE BASIN
- FLOW PATH
- PROPOSED CONTOURS
- EXISTING CONTOURS
- PROPOSED STORM DRAIN PIPE

NORTH

GRAPHIC SCALE IN FEET
0 20 40 80
HORIZONTAL

Contact Arizona 811 at least two full working days before you begin excavation
ARIZONA811
Call 811 or click Arizona811.com

REVISIONS:

1

2

3

PLAN NAME
MILLER ROAD
LOWER BUCKEYE ROAD TO PIMA STREET
ROADWAY IMPROVEMENTS
ONSITE DRAINAGE MAPS

ENGINEER INFORMATION
Kimley»Horn
7740 N 16TH ST, SUITE 300, PHOENIX, AZ 85020 | 602-944-5500

COB PERMITTING APPROVED SEAL	COB ENGINEERING APPROVED SEAL
AS-BUILT SEAL	DESIGN SEAL
ORIGINAL PLAN DATE 1/25/2022	LATEST REVISION DATE
PROJECT NUMBER CIP #105260	SHEET NUMBER 2 OF 2

SUBMITTAL: 100%

COB PLAN TRACKING # N/A

COB PERMIT #

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8.0 REFERENCES

City of Buckeye, *Storm Water Drainage System Design Manual,* 2007.

Coe & Van Loo Consultants Inc., *Homes at Susan's Ranch Preliminary Drainage Report,* 2020

Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Arizona – Hydrology,* revised 2018.

Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Arizona – Hydraulics,* revised 2018.

Flood Control District of Maricopa County, *Drainage Policies and Standards for Maricopa County, Arizona*, revised 2018.

Granite Basin Engineering, Inc., *Final Drainage Report 4th Submittal for Tractor Supply Company Town of Buckeye, AZ, 2010*

Hilgart Wilson, *Final Drainage Report for 10 West Commerce Center,* 2021

Hilgart Wilson, *Final Drainage Report for Village at Sundance-Phase II Parcel 1,* 2020

Hilgart Wilson, *Final Drainage Report for Village at Sundance-Phase 2 Parcel 2,* 2020

Hilgart Wilson, *Final Drainage Report for Village at Sundance-Phase II Parcel 3A,* 2020

Hilgart Wilson, *Final Drainage Report for Village at Sundance Parcel 3B, 4, 5 and Apache Road,* 2019

Kimley Horn, *Papago Freeway (Interstate 10): State Route 85 to Verrado Way,* October 2020.

National Oceanic and Atmospheric Administration, NOAA Atlas 14, Precipitation-Frequency Atlas of the United States, 2011.

Stanley Consultants Inc., *Durango Street (Miller to Yuma Road) DCR Preliminary Drainage Report, 2020*

W.C. Scoutten, Inc., *Drainage Report for Lower Buckeye Road Improvements (East of Miller Road), 2010*

Appendix A – Hydrology and Hydraulics

Kimley»Horn

Rainfall Information

General Project Information			
Project	Miller Road		
Project #	191342026		
Designed by	TWC	Date	01/22

NOAA 14 Rainfall Depth Data [in]										
	Storm Event [yr]									
Duration	1	2	5	10	25	50	100	200	500	1000
5-min:	0.201	0.262	0.358	0.43	0.525	0.597	0.67	0.743	0.839	0.912
10-min:	0.305	0.398	0.545	0.654	0.799	0.908	1.02	1.13	1.28	1.39
15-min:	0.379	0.494	0.676	0.811	0.99	1.13	1.26	1.4	1.58	1.72
30-min:	0.51	0.665	0.91	1.09	1.33	1.52	1.7	1.89	2.13	2.32
60-min:	0.631	0.823	1.13	1.35	1.65	1.88	2.11	2.34	2.64	2.87
2-hr:	0.704	0.912	1.23	1.48	1.81	2.07	2.34	2.61	2.99	3.28
3-hr:	0.746	0.956	1.28	1.53	1.88	2.17	2.47	2.79	3.23	3.6
6-hr:	0.866	1.1	1.43	1.7	2.07	2.36	2.67	3	3.45	3.82
12-hr:	0.946	1.2	1.55	1.83	2.2	2.5	2.81	3.12	3.56	3.9
24-hr:	1.18	1.51	1.96	2.31	2.8	3.19	3.6	4.03	4.61	5.07
2-day:	1.26	1.61	2.12	2.52	3.09	3.54	4.01	4.5	5.2	5.75
3-day:	1.33	1.7	2.23	2.66	3.27	3.76	4.27	4.82	5.58	6.19
4-day:	1.39	1.78	2.35	2.81	3.46	3.98	4.54	5.13	5.96	6.63
7-day:	1.53	1.95	2.58	3.09	3.8	4.37	4.98	5.62	6.53	7.26
10-day:	1.65	2.12	2.79	3.33	4.08	4.69	5.33	6.01	6.95	7.71
20-day:	1.95	2.52	3.32	3.93	4.75	5.37	6.01	6.66	7.54	8.2
30-day:	2.22	2.86	3.77	4.46	5.38	6.09	6.81	7.53	8.52	9.27
45-day:	2.6	3.35	4.42	5.19	6.23	7	7.78	8.56	9.57	10.3
60-day:	2.88	3.72	4.89	5.74	6.85	7.66	8.48	9.28	10.3	11.1

NOAA 14 Rainfall Intensity [in/hr]										
	Storm Event									
Duration	1	2	5	10	25	50	100	200	500	1000
5-min:	2.41	3.14	4.30	5.16	6.30	7.16	8.04	8.92	10.07	10.94
10-min:	1.83	2.39	3.27	3.92	4.79	5.45	6.12	6.78	7.68	8.34
15-min:	1.52	1.98	2.70	3.24	3.96	4.52	5.04	5.60	6.32	6.88
30-min:	1.02	1.33	1.82	2.18	2.66	3.04	3.40	3.78	4.26	4.64
60-min:	0.63	0.82	1.13	1.35	1.65	1.88	2.11	2.34	2.64	2.87
2-hr:	0.35	0.46	0.62	0.74	0.91	1.04	1.17	1.31	1.50	1.64
3-hr:	0.25	0.32	0.43	0.51	0.63	0.72	0.82	0.93	1.08	1.20
6-hr:	0.14	0.18	0.24	0.28	0.35	0.39	0.45	0.50	0.58	0.64
12-hr:	0.079	0.100	0.129	0.153	0.183	0.208	0.234	0.260	0.297	0.325
24-hr:	0.049	0.063	0.082	0.096	0.117	0.133	0.150	0.168	0.192	0.211
2-day:	0.026	0.034	0.044	0.053	0.064	0.074	0.084	0.094	0.108	0.120
3-day:	0.018	0.024	0.031	0.037	0.045	0.052	0.059	0.067	0.078	0.086
4-day:	0.015	0.019	0.025	0.030	0.036	0.042	0.048	0.054	0.063	0.070
7-day:	0.009	0.012	0.015	0.018	0.023	0.026	0.030	0.033	0.039	0.043
10-day:	0.007	0.009	0.012	0.014	0.017	0.020	0.022	0.025	0.029	0.032
20-day:	0.004	0.005	0.007	0.008	0.010	0.011	0.013	0.014	0.016	0.017
30-day:	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.012	0.013
45-day:	0.002	0.003	0.004	0.005	0.006	0.006	0.007	0.008	0.009	0.010
60-day:	0.002	0.003	0.003	0.004	0.005	0.005	0.006	0.006	0.007	0.008

Kimley»Horn

Half Street Volume Calculations

General Project Information				
Project #	191342022			
Designed by	TWC		Date	3/24
Design Storm Event [yr]			100	
Duration [hr]			2	

Starting Station	Ending Station	Basin ID	Length [ft]	Half-Street Roadway Width [ft]	Area [ac]	Rational Coefficient	Volume Required [ac-ft]	Volume Provided [ac-ft]	Basin Bottom Area [ft^2]	Basin High Water Area [ft2]	Basin Depth	Basin Bottom Area [ft^2]	Percolation Rate [in/hr]	De-rating Factor	Discharge per Drywell [cfs]	No. of Dry Wells	Drain Down Time [hrs]
37+00	32+00	3200E	500	80	*0.91*	0.95	*0.17*	0.22	1,246.00	5,192.00	3.00	1,246	4.20	2.00	0.00	0.00	34
46+75	40+00	4000E	675	65	*1.15*	0.95	*0.21*	0.21	1,715.00	4,239.00	3.00	1,715	4.20	2.00	0.00	0.00	31
49+50	46+75	4675E	275	75	*0.63*	0.95	*0.12*	0.15	866.00	3,588.00	3.00	866	4.20	2.00	0.00	0.00	34
60+75	57+50	5750E	325	60	*0.56*	0.95	*0.10*	0.14	712.00	3,390.00	3.00	712	4.20	2.00	0.00	0.00	36
63+45	60+75	6075E	270	80	*0.60*	0.95	*0.11*	0.15	778.00	3,469.00	3.00	778	4.20	2.00	0.00	0.00	36

Kimley»Horn

HEC-22 Inlet Calculations

General Project Information			
Project #	191342026		
Designed by	TWC	Date	03/24
Design Storm Event	10		
Minimum T_c [min]	5		

Inlet Information				Hydrology							
Starting Station	Ending Station	Inlet Name	Roadway Longitudinal Slope, S_l [ft/ft]	Rational Coefficient	Flowpath Length [ft]	Roadway Width [ft]	Area [ac]	I [in/hr]	T_c [min]	Bypass Runoff [cfs]	Q [cfs]
32+00	36+50	3204E	0.007	0.95	*532*	40	*0.9*	*4.7*	*7.3*	*0.0*	*4.03*
36+50	40+00	3718E	0.011	0.95	*305*	40	*0.5*	*5.2*	*5.0*	*0.0*	*2.21*
40+00	46+75	4011E	0.009	0.95	*675*	40	*1.1*	*4.4*	*7.9*	*0.0*	*4.81*
46+75	50+20	4679E	0.011	0.95	*353*	40	*0.6*	*5.2*	*5.2*	*0.0*	*3.09*
50+20	55+83	5025E	0.011	0.95	*574*	40	*0.9*	*4.7*	*6.6*	*0.0*	*4.17*
57+50	61+00	5755E	0.013	0.95	*350*	40	*0.6*	*5.2*	*5.0*	*0.0*	*2.70*
60+75	63+50	6080E	0.014	0.95	*270*	40	*0.6*	*5.2*	*5.0*	*0.0*	*2.94*

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HEC-22 Inlet Calculations

General Project Information			
Project #	191342026		
Designed by	TWC	Date	03/24
Design Storm Event	10		
Minimum T_c [min]	5		

Inlet Information									Hydrology					Inlet Calculations																				
Starting Station	Ending Station	Inlet Name	Roadway Longitudinal Slope, S_l [ft/ft]	Bypass Runoff [cfs]	Q [cfs]	Roadway Cross Slope, S_x [ft/ft]	Gutter Type	Mannings "n"	Governing Depth [ft]	Governing Spread [ft]	Gutter Pan Width, W [ft]	Gutter Depression, a [in]	Gutter Cross Slope, S_w [ft/ft]	Inlet Condition	Inlet Detail	Type	Clogging Factor	Grate Length [ft]	Grate Width [ft]	Effective Curb Opening Length [ft]	Effective Grate Length	Number of Grates	Local Depression [in]	Local Depression Width [ft]	Q_i [cfs]	Downstream Inlet	Q_{bypass} [cfs]	Inlet Efficiency	d_{inlet} [ft]	Spread at Inlet [ft]	Velocity [fps]
32+00	36+50	3204E	0.007	*0.0*	*4.03*	0.02	MAG 220-A	0.016	*0.50*	*23.5*	*1.42*	*0.37*	*0.0417*	At-Grade	COB-510, M-2, L=17' L=10'	*Curb Opening*	80%	---	---	*24*	---	---	2.0	2.0	4.0		0.0	100%	0.29	*12.75*	*2.4*
36+50	40+00	3718E	0.011	*0.0*	*2.21*	0.02	MAG 220-A	0.016	*0.50*	*23.5*	*1.42*	*0.37*	*0.0417*	At-Grade	COB-510, L=17'	*Curb Opening*	80%	---	---	*16*	---	---	2.0	2.0	2.2	3204E	0.0	100%	0.22	*9.31*	*2.5*
40+00	46+75	4011E	0.009	*0.0*	*4.81*	0.02	MAG 220-A	0.016	*0.50*	*23.5*	*1.42*	*0.37*	*0.0417*	At-Grade	COB-510, M-2, L=17' L=10'	*Curb Opening*	80%	---	---	*24*	---	---	2.0	2.0	4.8	3718E	0.0	100%	0.29	*13.17*	*2.7*
46+75	50+20	4679E	0.011	*0.0*	*3.09*	0.02	MAG 220-A	0.016	*0.50*	*23.5*	*1.42*	*0.37*	*0.0417*	At-Grade	COB-510, M-2, L=17' L=6'	*Curb Opening*	80%	---	---	*20.8*	---	---	2.0	2.0	3.1	4011E	0.0	100%	0.25	*10.72*	*2.6*
50+20	55+83	5025E	0.011	*0.0*	*4.17*	0.02	MAG 220-A	0.016	*0.50*	*23.5*	*1.42*	*0.37*	*0.0417*	At-Grade	COB-510, M-2, L=17' L=10'	*Curb Opening*	80%	---	---	*24*	---	---	2.0	2.0	4.2	4679E	0.0	100%	0.27	*11.88*	*2.9*
57+50	61+00	5755E	0.013	*0.0*	*2.70*	0.02	MAG 220-A	0.016	*0.50*	*23.5*	*1.42*	*0.37*	*0.0417*	At-Grade	COB-510, M-2, L=17' L=6'	*Curb Opening*	80%	---	---	*20.8*	---	---	2.0	2.0	2.7		0.0	100%	0.23	*9.84*	*2.7*
60+75	63+50	6080E	0.014	*0.0*	*2.94*	0.02	MAG 220-A	0.016	*0.50*	*23.5*	*1.42*	*0.37*	*0.0417*	At-Grade	COB-510, M-2, L=17' L=6'	*Curb Opening*	80%	---	---	*20.8*	---	---	2.0	2.0	2.9	5755E	0.0	100%	0.23	*9.98*	*2.9*

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HEC-22 Inlet Calculations

General Project Information			
Project #	191342026		
Designed by	TWC	Date	03/24
Design Storm Event	100		
Minimum T_c [min]	5		

Inlet Information				Hydrology							
Starting Station	Ending Station	Inlet Name	Roadway Longitudinal Slope, S_l [ft/ft]	Rational Coefficient	Flowpath Length [ft]	Roadway Width [ft]	Area [ac]	I [in/hr]	T_c [min]	Bypass Runoff [cfs]	Q [cfs]
32+00	36+50	3204E	0.007	0.95	*532*	40	*0.9*	*7.7*	*6.1*	*0.1*	*6.74*
36+50	40+00	3718E	0.011	0.95	*305*	40	*0.5*	*8.0*	*5.0*	*0.2*	*3.62*
40+00	46+75	4011E	0.009	0.95	*675*	40	*1.1*	*7.3*	*6.5*	*0.0*	*7.96*
46+75	50+20	4679E	0.011	0.95	*353*	40	*0.6*	*8.0*	*5.0*	*0.2*	*4.99*
50+20	55+83	5025E	0.011	0.95	*574*	40	*0.9*	*8.0*	*5.4*	*0.0*	*7.18*
57+50	61+00	5755E	0.013	0.95	*350*	40	*0.6*	*8.0*	*5.0*	*0.0*	*4.25*
60+75	63+50	6080E	0.014	0.95	*270*	40	*0.6*	*8.0*	*5.0*	*0.0*	*4.58*

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HEC-22 Inlet Calculations

General Project Information			
Project #	191342026		
Designed by	TWC	Date	03/24
Design Storm Event	100		
Minimum T_c [min]	5		

Inlet Information									Hydrology					Inlet Calculations																			
Starting Station	Ending Station	Inlet Name	Roadway Longitudinal Slope, S_l [ft/ft]	Bypass Runoff [cfs]	Q [cfs]	Roadway Cross Slope, S_x [ft/ft]	Gutter Type	Mannings "n"	Governing Depth [ft]	Governing Spread [ft]	Gutter Pan Width, W [ft]	Gutter Depression, a [in]	Gutter Cross Slope, S_w [ft/ft]	Inlet Condition	Inlet Detail	Type	Clogging Factor	Grate Length [ft]	Grate Width [ft]	Effective Curb Opening Length [ft]	Effective Grate Length	Number of Grates	Local Depression [in]	Local Depression Width [ft]	Q_i [cfs]	Downstream Inlet	Q_{bypass} [cfs]	Inlet Efficiency	d_{inlet} [ft]	Spread at Inlet [ft]	Velocity [fps]
32+00	36+50	3204E	0.007	*0.1*	*6.74*	0.02	MAG 220-A	0.016	*0.50*	*23.5*	*1.42*	*0.37*	*0.0417*	At-Grade	COB-510, M-2, L=17' L=10'	*Curb Opening*	80%	---	---	*24*	---	---	2.0	2.0	6.7		0.0	100%	0.34	*15.51*	*2.8*
36+50	40+00	3718E	0.011	*0.2*	*3.62*	0.02	MAG 220-A	0.016	*0.50*	*23.5*	*1.42*	*0.37*	*0.0417*	At-Grade	COB-510, L=17'	*Curb Opening*	80%	---	---	*16*	---	---	2.0	2.0	3.5	3204E	0.1	97%	0.26	*11.28*	*2.8*
40+00	46+75	4011E	0.009	*0.0*	*7.96*	0.02	MAG 220-A	0.016	*0.50*	*23.5*	*1.42*	*0.37*	*0.0417*	At-Grade	COB-510, M-2, L=17' L=10'	*Curb Opening*	80%	---	---	*24*	---	---	2.0	2.0	7.8	3718E	0.2	98%	0.35	*15.95*	*3.1*
46+75	50+20	4679E	0.011	*0.2*	*4.99*	0.02	MAG 220-A	0.016	*0.50*	*23.5*	*1.42*	*0.37*	*0.0417*	At-Grade	COB-510, M-2, L=17' L=6'	*Curb Opening*	80%	---	---	*20.8*	---	---	2.0	2.0	5.0	4011E	0.0	99%	0.29	*12.89*	*3.0*
50+20	55+83	5025E	0.011	*0.0*	*7.18*	0.02	MAG 220-A	0.016	*0.50*	*23.5*	*1.42*	*0.37*	*0.0417*	At-Grade	COB-510, M-2, L=17' L=10'	*Curb Opening*	80%	---	---	*24*	---	---	2.0	2.0	7.0	4679E	0.2	98%	0.32	*14.63*	*3.3*
57+50	61+00	5755E	0.013	*0.0*	*4.25*	0.02	MAG 220-A	0.016	*0.50*	*23.5*	*1.42*	*0.37*	*0.0417*	At-Grade	COB-510, M-2, L=17' L=6'	*Curb Opening*	80%	---	---	*20.8*	---	---	2.0	2.0	4.2		0.0	100%	0.27	*11.72*	*3.0*
60+75	63+50	6080E	0.014	*0.0*	*4.58*	0.02	MAG 220-A	0.016	*0.50*	*23.5*	*1.42*	*0.37*	*0.0417*	At-Grade	COB-510, M-2, L=17' L=6'	*Curb Opening*	80%	---	---	*20.8*	---	---	2.0	2.0	4.5	5755E	0.0	99%	0.27	*11.85*	*3.2*

10-Year Storm Event

FlexTable: Catch Basin Table

Label	Carryover Additional Flow (cfs)	Flow (Total Out) (cfs)	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Coefficient (Standard)
CB-3204E	4.03	4.03	1,028.71	1,024.50	1,026.20	1,026.13	0.800
CB-3718E	2.21	2.21	1,034.04	1,029.83	1,031.93	1,031.91	0.800
CB-4011E	4.81	4.81	1,037.27	1,033.27	1,034.82	1,034.73	0.800
CB-4679E	3.09	3.09	1,045.02	1,040.81	1,042.47	1,042.43	0.800
CB-5025E	4.17	4.17	1,050.12	1,046.54	1,048.26	1,048.19	0.800
CB-5755E	2.70	2.70	1,058.90	1,054.80	1,056.22	1,056.19	0.800
CB-6080E	2.94	2.94	1,063.23	1,059.35	1,060.79	1,060.75	0.800

10-Year Storm Event

FlexTable: Conduit Table

Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Manning's n
PIPE -05 (MillerRetentionBasin)	CB-6080E	1,059.35	HW-5 (MillerRetentionBasin)	1,059.22	47.5	0.003	18.0	2.94	3.18	5.53	1,060.75	1,060.72	1,063.23	1,061.01	0.013
PIPE -04 (MillerRetentionBasin)	CB-5755E	1,054.80	HW-4 (MillerRetentionBasin)	1,054.66	45.6	0.003	18.0	2.70	3.23	5.82	1,056.19	1,056.16	1,058.90	1,056.74	0.013
PIPE -08 (MillerRetentionBasin)	CB-5025E	1,046.75	ExstSystem2	1,046.64	35.1	0.003	18.0	4.17	3.55	5.75	1,048.19	1,048.14	1,050.12	1,050.20	0.013
PIPE -03 (MillerRetentionBasin)	CB-4679E	1,041.02	HW-3 (MillerRetentionBasin)	1,040.91	38.6	0.003	18.0	3.09	3.32	5.76	1,042.43	1,042.41	1,045.02	1,042.87	0.013
PIPE -02 (MillerRetentionBasin)	CB-4011E	1,033.27	HW-2 (MillerRetentionBasin)	1,033.15	40.0	0.003	18.0	4.81	3.64	5.75	1,034.73	1,034.65	1,037.27	1,034.94	0.013
PIPE -06 (MillerRetentionBasin)	CB-3718E	1,030.14	MH-37+03 (MillerRetentionBasin)	1,029.62	17.3	0.030	18.0	2.21	1.25	18.21	1,031.91	1,031.90	1,034.04	1,033.84	0.013
PIPE -07 (MillerRetentionBasin)	MH-37+03 (MillerRetentionBasin)	1,029.62	ExstSystem	1,029.40	45.9	0.005	30.0	2.21	3.43	28.40	1,031.90	1,031.90	1,033.84	1,031.81	0.013
PIPE -01 (MillerRetentionBasin)	CB-3204E	1,024.71	HW-1 (MillerRetentionBasin)	1,024.56	50.3	0.003	18.0	4.03	3.51	5.73	1,026.13	1,026.06	1,028.71	1,026.54	0.013

10-Year Storm Event

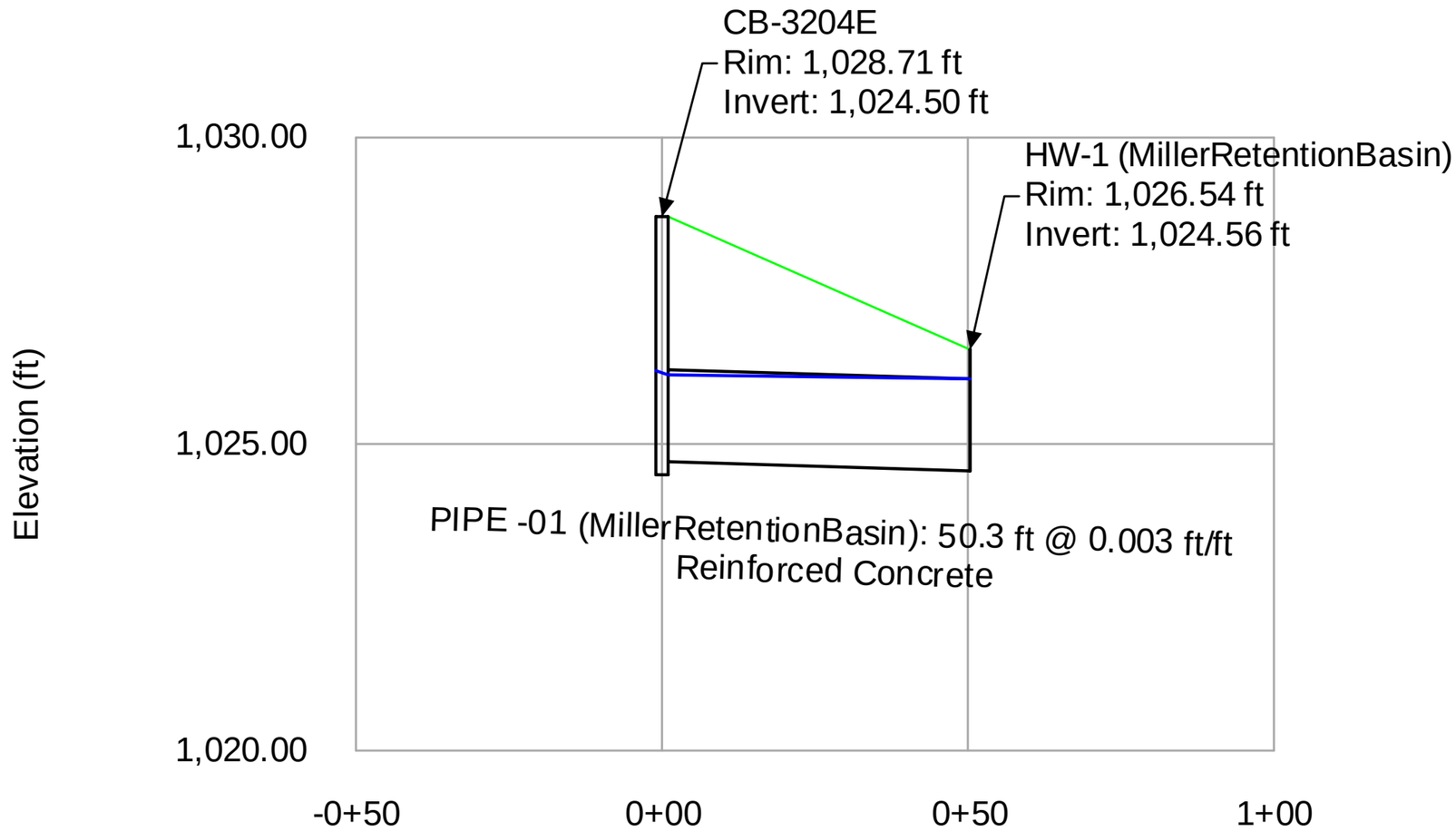
FlexTable: Outfall Table

Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
HW-5 (MillerRetentionBasin)	1,061.01	1,059.22	Crown	1,060.72	2.94
HW-4 (MillerRetentionBasin)	1,056.74	1,054.66	Crown	1,056.16	2.70
HW-3 (MillerRetentionBasin)	1,042.87	1,040.91	Crown	1,042.41	3.09
HW-2 (MillerRetentionBasin)	1,034.94	1,033.15	Crown	1,034.65	4.81
HW-1 (MillerRetentionBasin)	1,026.54	1,024.56	Crown	1,026.06	4.03
ExstSystem	1,031.81	1,029.40	Crown	1,031.90	2.21
ExstSystem2	1,050.20	1,046.64	Crown	1,048.14	4.17

10-Year Storm Event

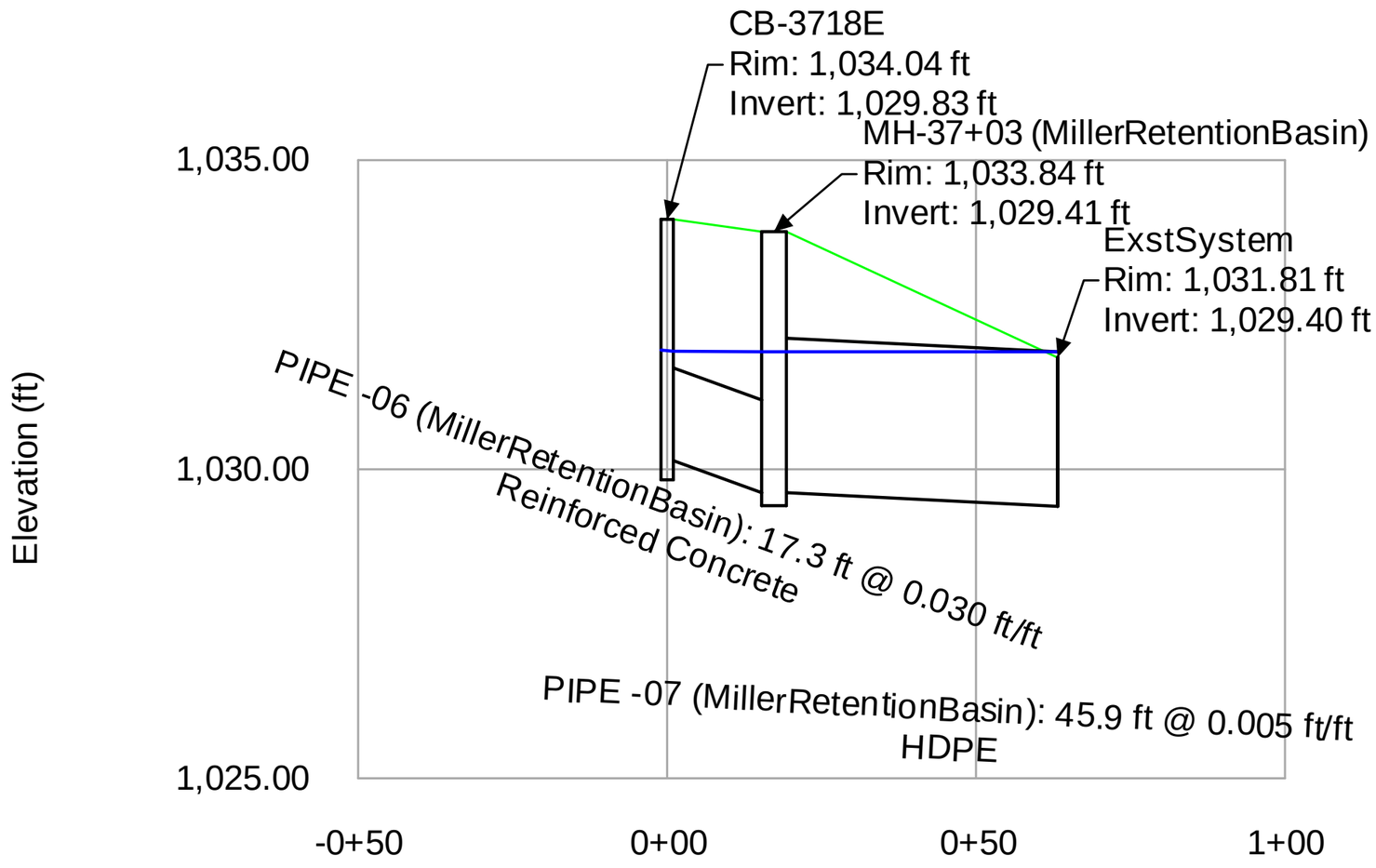
Profile Report

Engineering Profile - CB-3204E (MillerRetentionBasin) to HW-1 (MillerRetentionBasin) (MillerBasins.stsw)



10-Year Storm Event

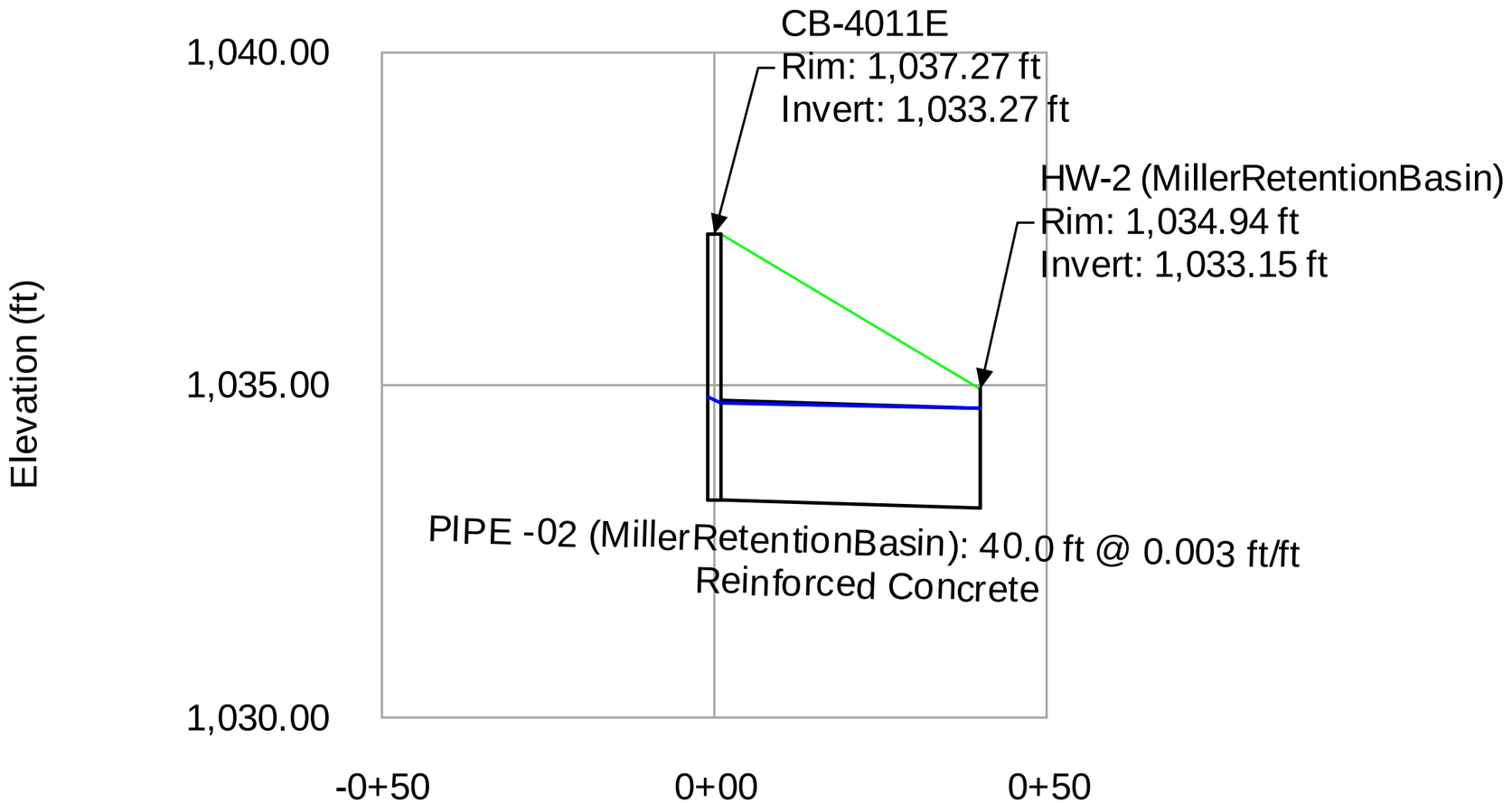
Profile Report
Engineering Profile - CB-3718E (MillerRetentionBasin) to ExstSystem (MillerBasins.stsw)



10-Year Storm Event

Profile Report

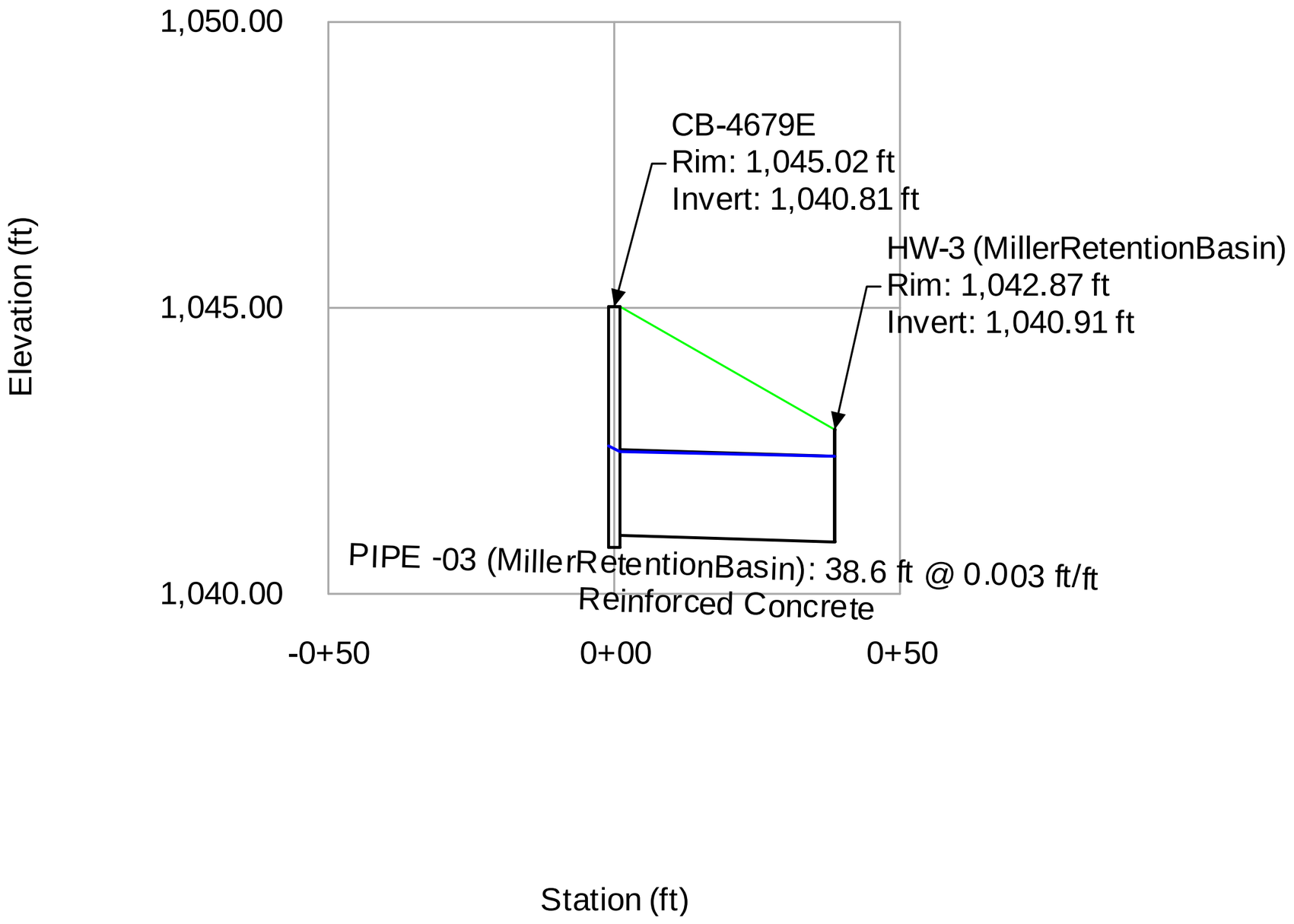
Engineering Profile - CB-4011E (MillerRetentionBasin) to HW-2 (MillerRetentionBasin) (MillerBasins.stsw)



10-Year Storm Event

Profile Report

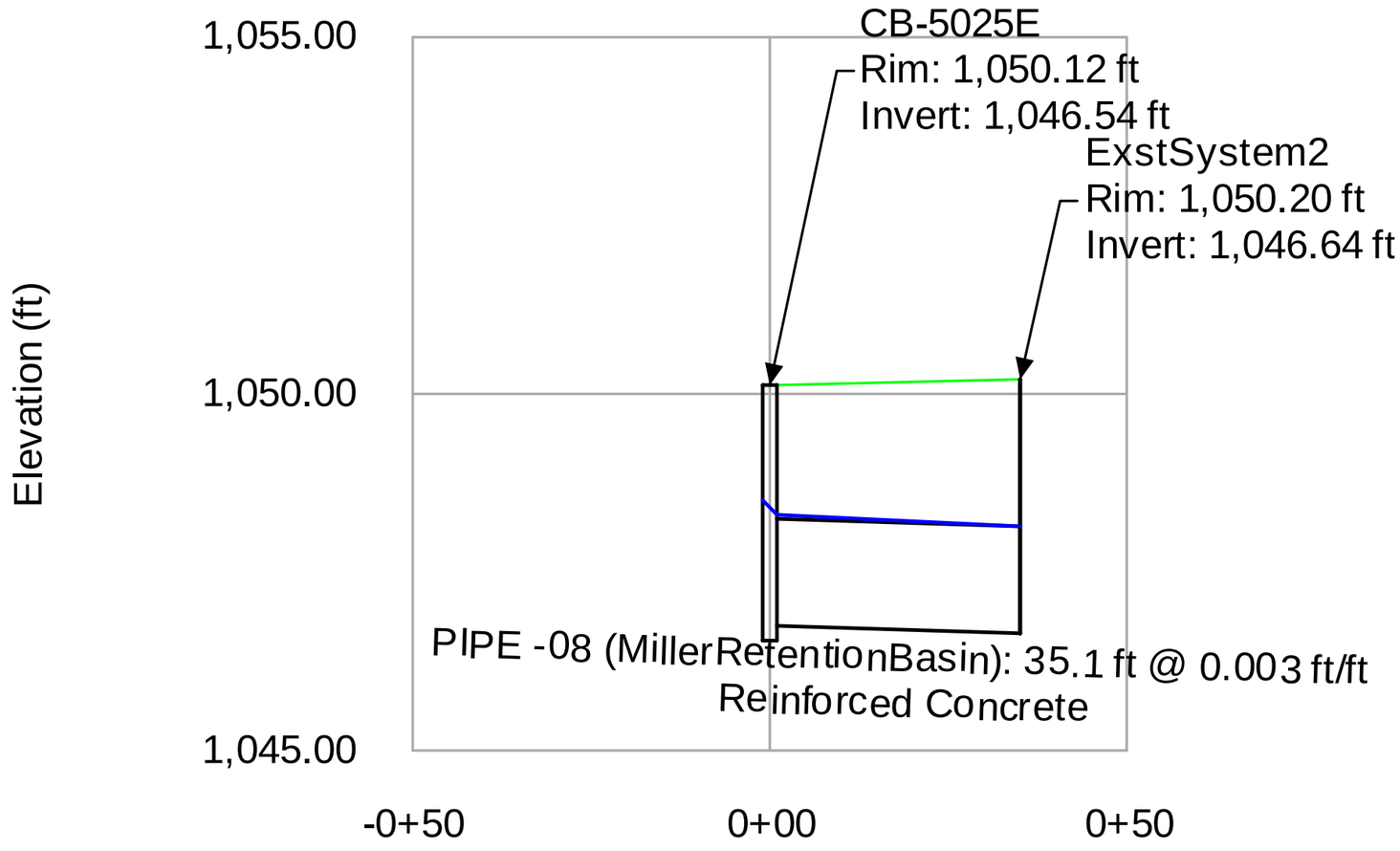
Engineering Profile - CB-4679E (MillerRetentionBasin) to HW-3 (MillerRetentionBasin) (MillerBasins.stsw)



10-Year Storm Event

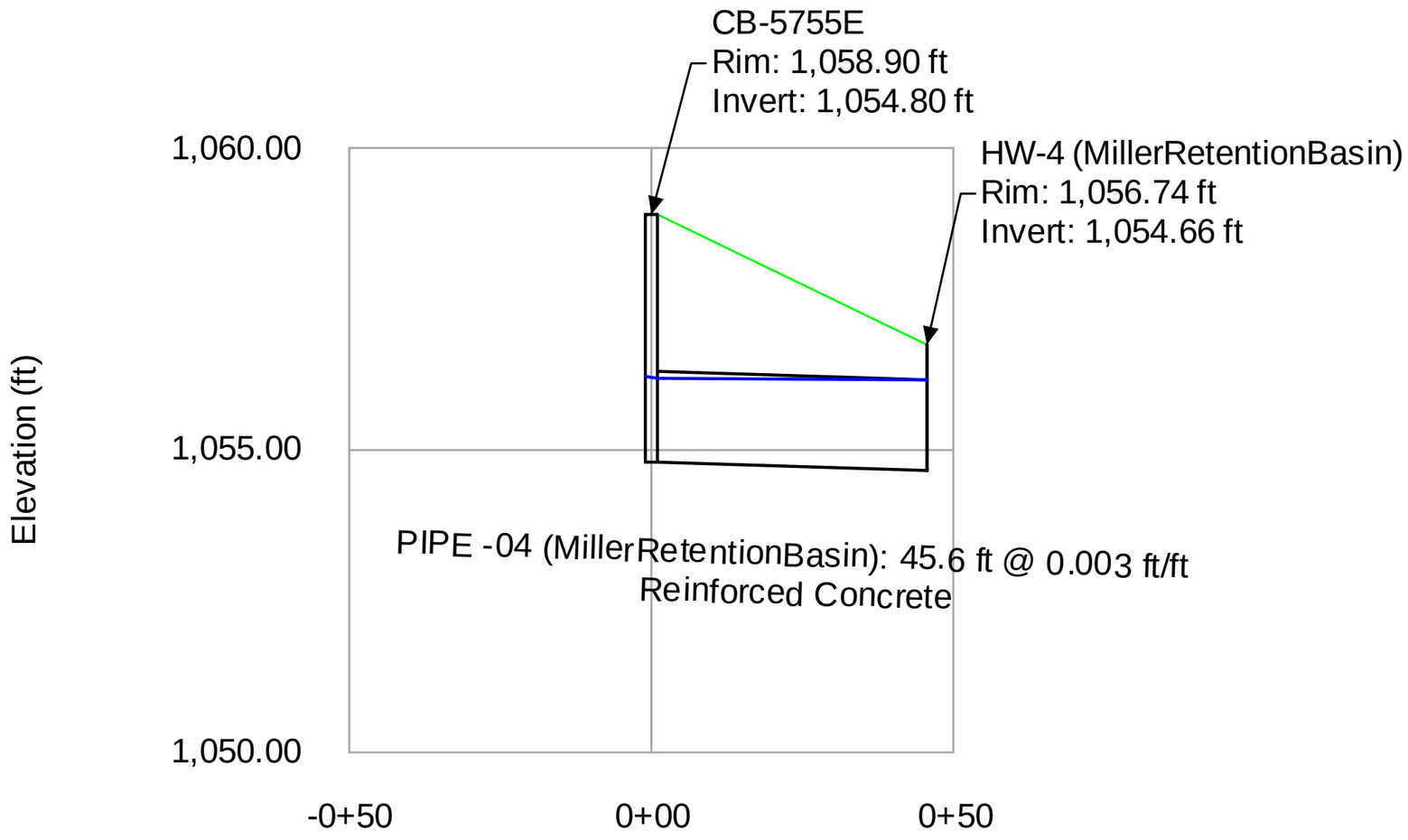
Profile Report

Engineering Profile - CB-5025E (MillerRetentionBasin) to ExstSystem2 (MillerBasins.stsw)



10-Year Storm Event

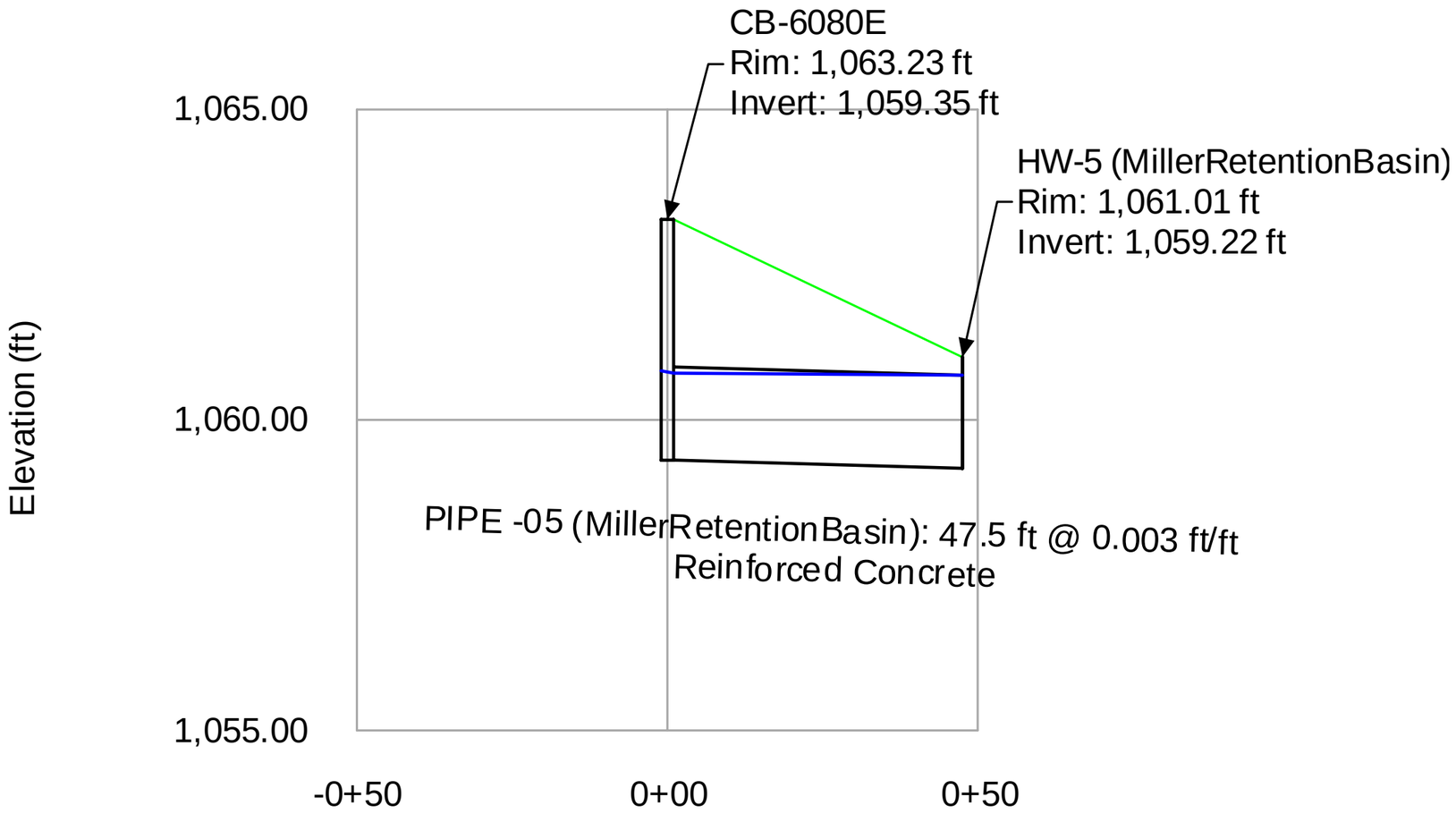
Profile Report
Engineering Profile - CB-5755E (MillerRetentionBasin) to HW-4 (MillerRetentionBasin) (MillerBasins.stsw)



10-Year Storm Event

Profile Report

Engineering Profile - CB-6080E (MillerRetentionBasin) to HW-5 (MillerRetentionBasin) (MillerBasins.stsw)



100-Year Storm Event

FlexTable: Catch Basin Table

Label	Carryover Additional Flow (cfs)	Flow (Total Out) (cfs)	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Coefficient (Standard)
CB-3204E	6.74	6.74	1,028.71	1,024.50	1,026.45	1,026.27	0.800
CB-3718E	3.62	3.62	1,034.04	1,029.83	1,031.98	1,031.92	0.800
CB-4011E	7.96	7.96	1,037.27	1,033.27	1,035.13	1,034.88	0.800
CB-4679E	4.99	4.99	1,045.02	1,040.81	1,042.59	1,042.49	0.800
CB-5025E	7.18	7.18	1,050.12	1,046.54	1,048.51	1,048.31	0.800
CB-5755E	4.25	4.25	1,058.90	1,054.80	1,056.30	1,056.23	0.800
CB-6080E	4.58	4.58	1,063.23	1,059.35	1,060.89	1,060.80	0.800

100-Year Storm Event

FlexTable: Conduit Table

Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Manning's n
PIPE -05 (MillerRetentionBasin)	CB-6080E	1,059.35	HW-5 (MillerRetentionBasin)	1,059.22	47.5	0.003	18.0	4.58	3.50	5.53	1,060.80	1,060.72	1,063.23	1,061.01	0.013
PIPE -04 (MillerRetentionBasin)	CB-5755E	1,054.80	HW-4 (MillerRetentionBasin)	1,054.66	45.6	0.003	18.0	4.25	3.60	5.82	1,056.23	1,056.16	1,058.90	1,056.74	0.013
PIPE -08 (MillerRetentionBasin)	CB-5025E	1,046.75	ExstSystem2	1,046.64	35.1	0.003	18.0	7.18	4.06	5.75	1,048.31	1,048.14	1,050.12	1,050.20	0.013
PIPE -03 (MillerRetentionBasin)	CB-4679E	1,041.02	HW-3 (MillerRetentionBasin)	1,040.91	38.6	0.003	18.0	4.99	3.67	5.76	1,042.49	1,042.41	1,045.02	1,042.87	0.013
PIPE -02 (MillerRetentionBasin)	CB-4011E	1,033.27	HW-2 (MillerRetentionBasin)	1,033.15	40.0	0.003	18.0	7.96	4.50	5.75	1,034.88	1,034.65	1,037.27	1,034.94	0.013
PIPE -06 (MillerRetentionBasin)	CB-3718E	1,030.14	MH-37+03 (MillerRetentionBasin)	1,029.62	17.3	0.030	18.0	3.62	2.05	18.21	1,031.92	1,031.90	1,034.04	1,033.84	0.013
PIPE -07 (MillerRetentionBasin)	MH-37+03 (MillerRetentionBasin)	1,029.62	ExstSystem	1,029.40	45.9	0.005	30.0	3.62	3.97	28.40	1,031.90	1,031.90	1,033.84	1,031.81	0.013
PIPE -01 (MillerRetentionBasin)	CB-3204E	1,024.71	HW-1 (MillerRetentionBasin)	1,024.56	50.3	0.003	18.0	6.74	3.81	5.73	1,026.27	1,026.06	1,028.71	1,026.54	0.013

100-Year Storm Event

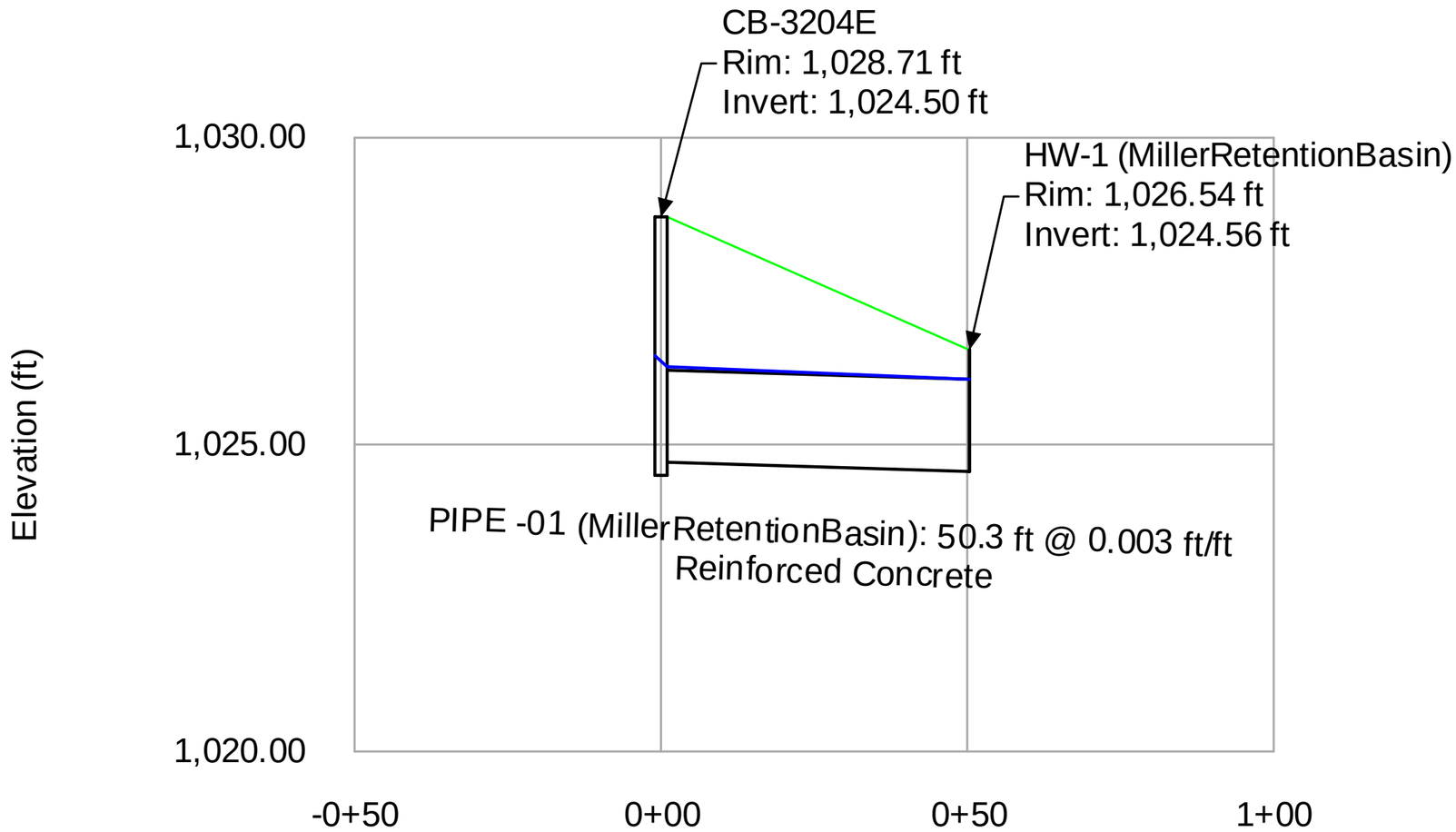
FlexTable: Outfall Table

Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
HW-5 (MillerRetentionBasin)	1,061.01	1,059.22	Crown	1,060.72	4.58
HW-4 (MillerRetentionBasin)	1,056.74	1,054.66	Crown	1,056.16	4.25
HW-3 (MillerRetentionBasin)	1,042.87	1,040.91	Crown	1,042.41	4.99
HW-2 (MillerRetentionBasin)	1,034.94	1,033.15	Crown	1,034.65	7.96
HW-1 (MillerRetentionBasin)	1,026.54	1,024.56	Crown	1,026.06	6.74
ExstSystem	1,031.81	1,029.40	Crown	1,031.90	3.62
ExstSystem2	1,050.20	1,046.64	Crown	1,048.14	7.18

100-Year Storm Event

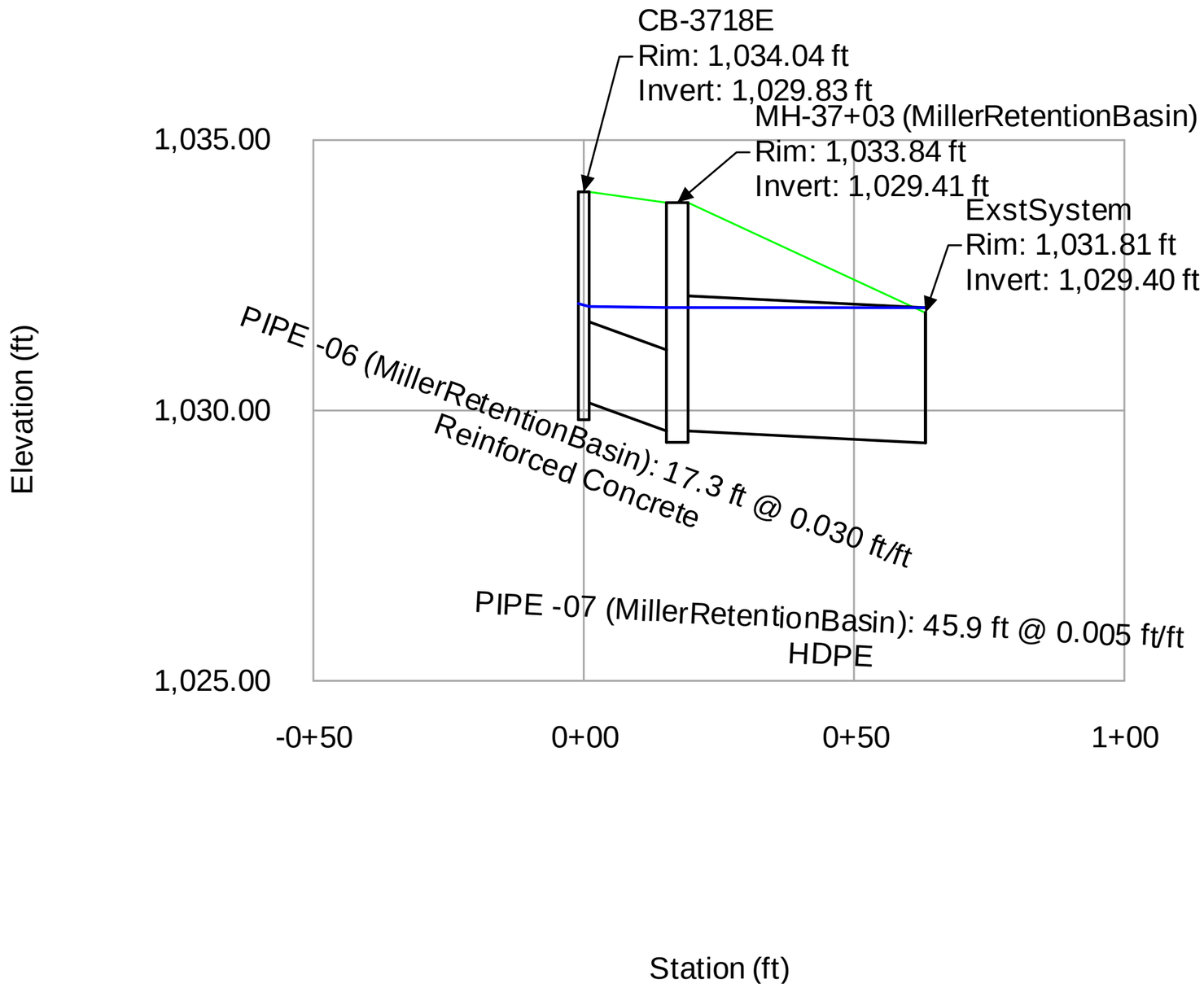
Profile Report

Engineering Profile - CB-3204E (MillerRetentionBasin) to HW-1 (MillerRetentionBasin) (MillerBasins.stsw)



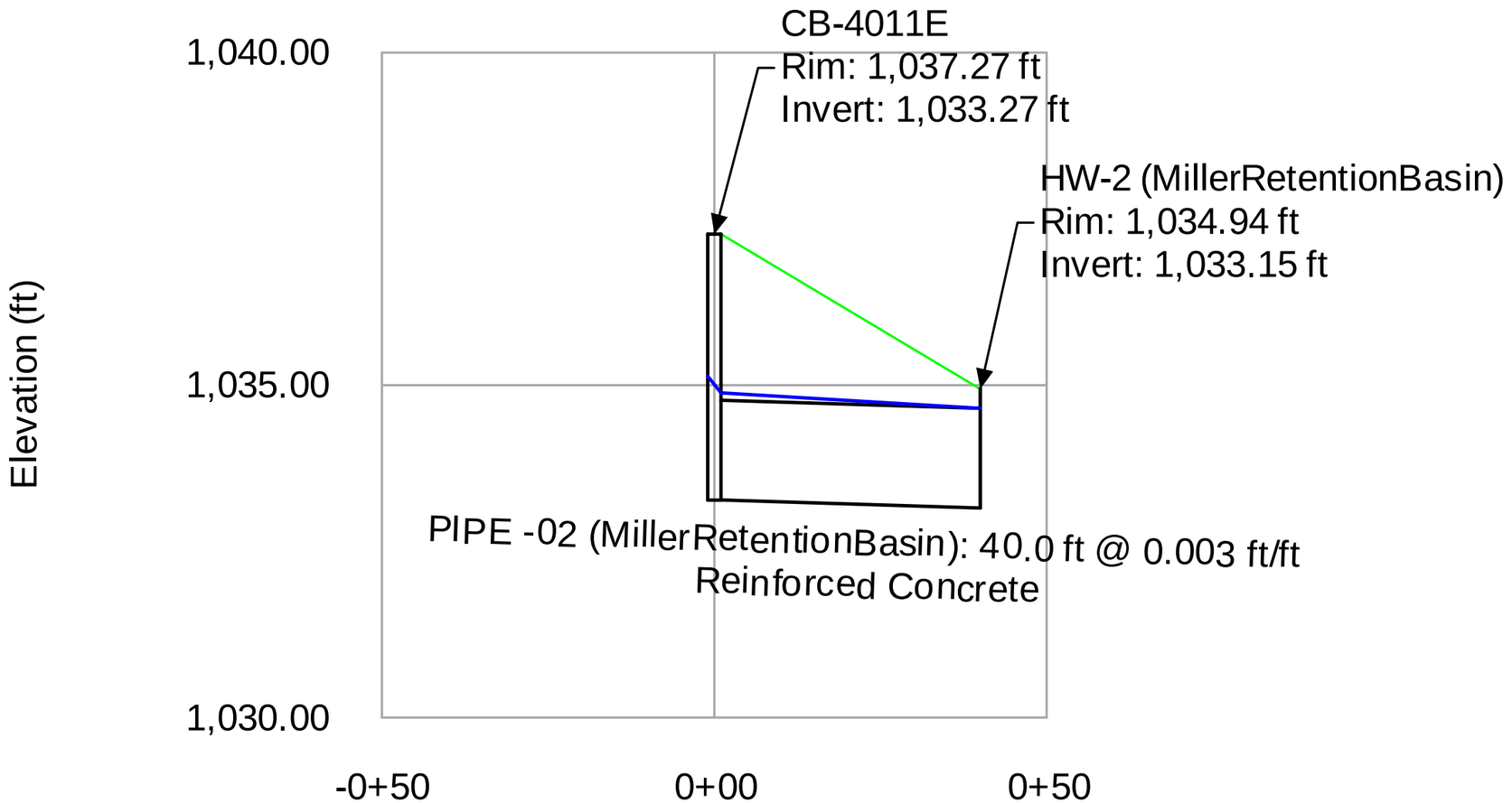
100-Year Storm Event

Profile Report
Engineering Profile - CB-3718E (MillerRetentionBasin) to ExstSystem (MillerBasins.stsw)



100-Year Storm Event

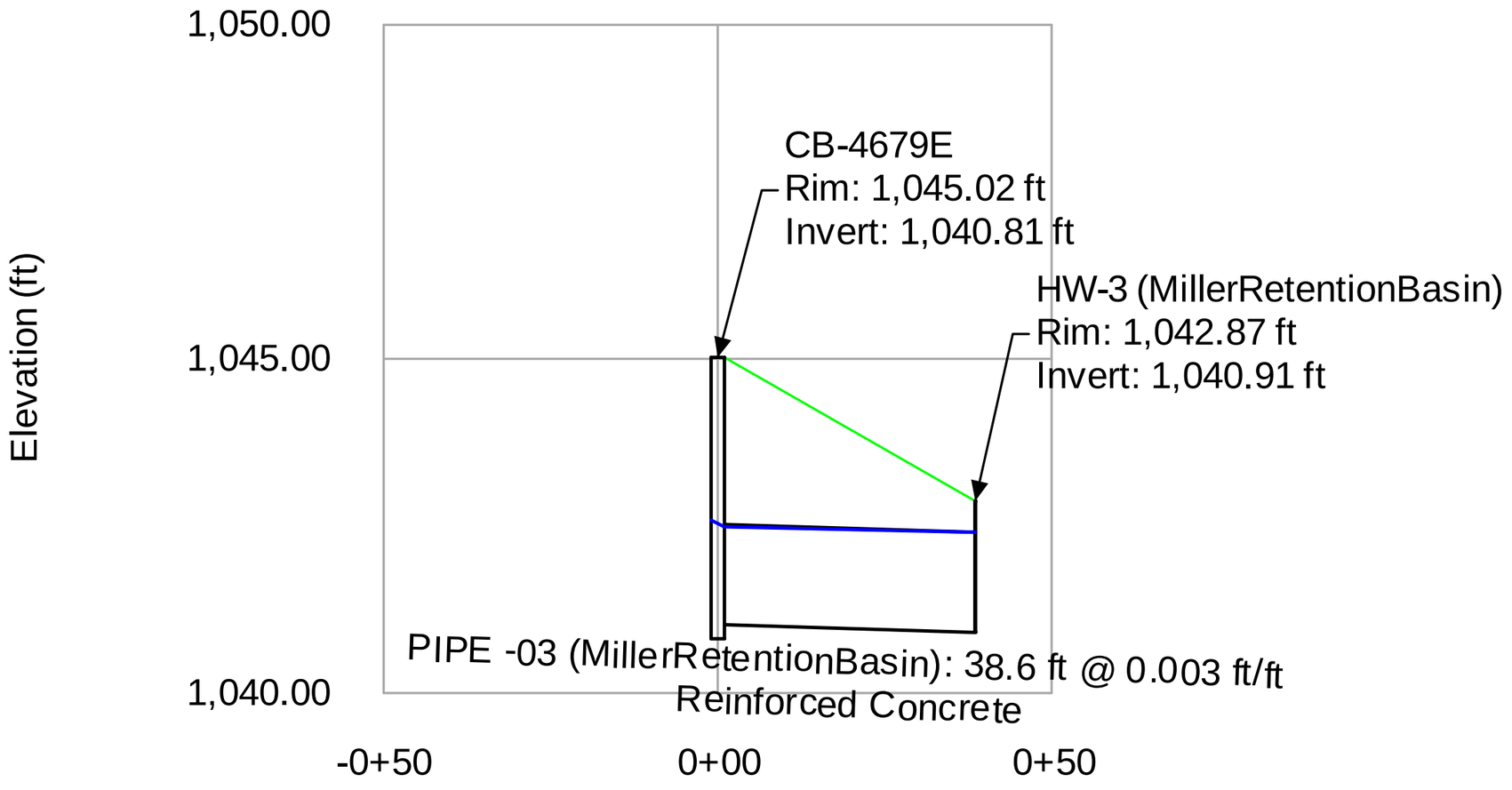
Profile Report
Engineering Profile - CB-4011E (MillerRetentionBasin) to HW-2 (MillerRetentionBasin) (MillerBasins.stsw)



100-Year Storm Event

Profile Report

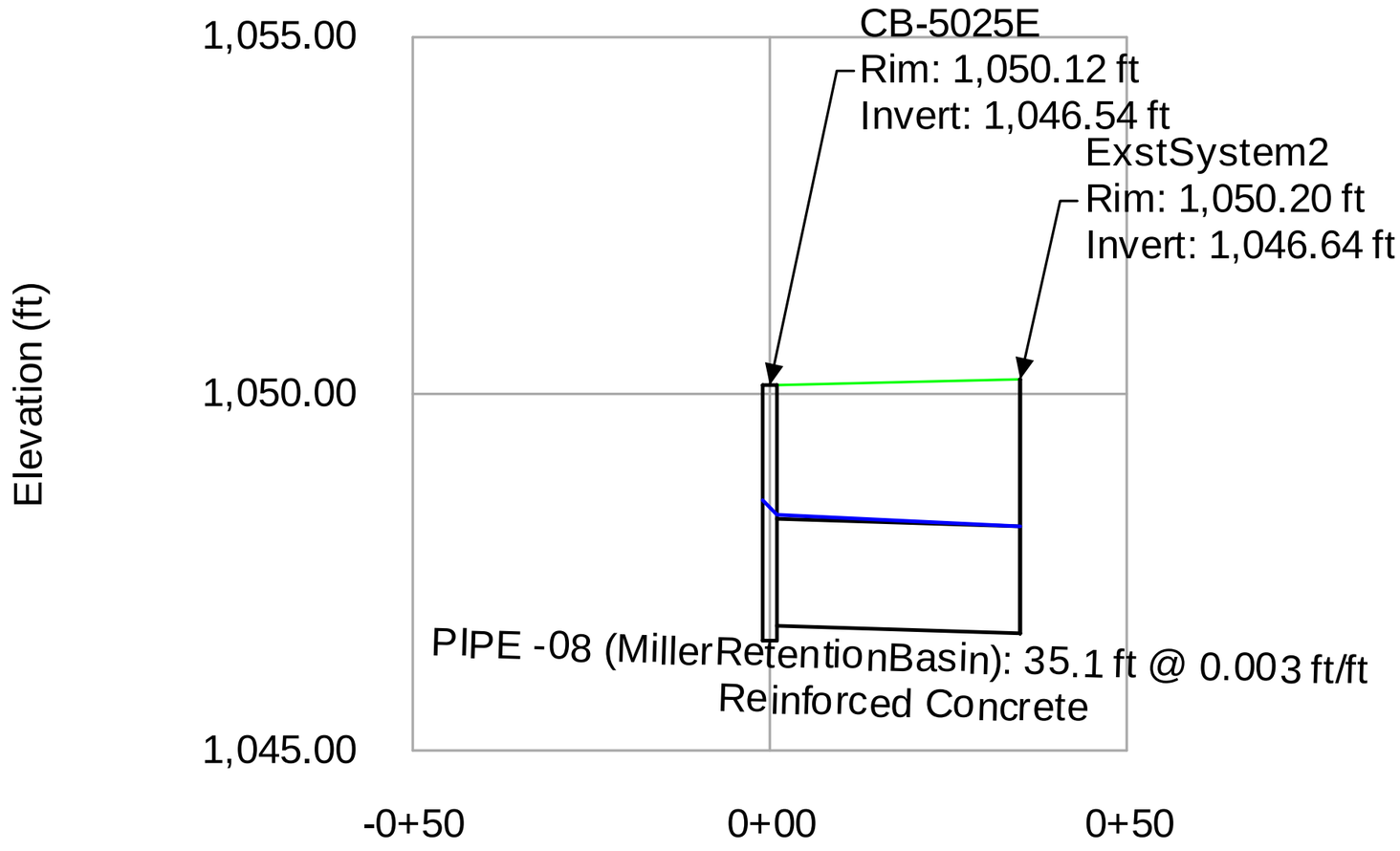
Engineering Profile - CB-4679E (MillerRetentionBasin) to HW-3 (MillerRetentionBasin) (MillerBasins.stsw)



100-Year Storm Event

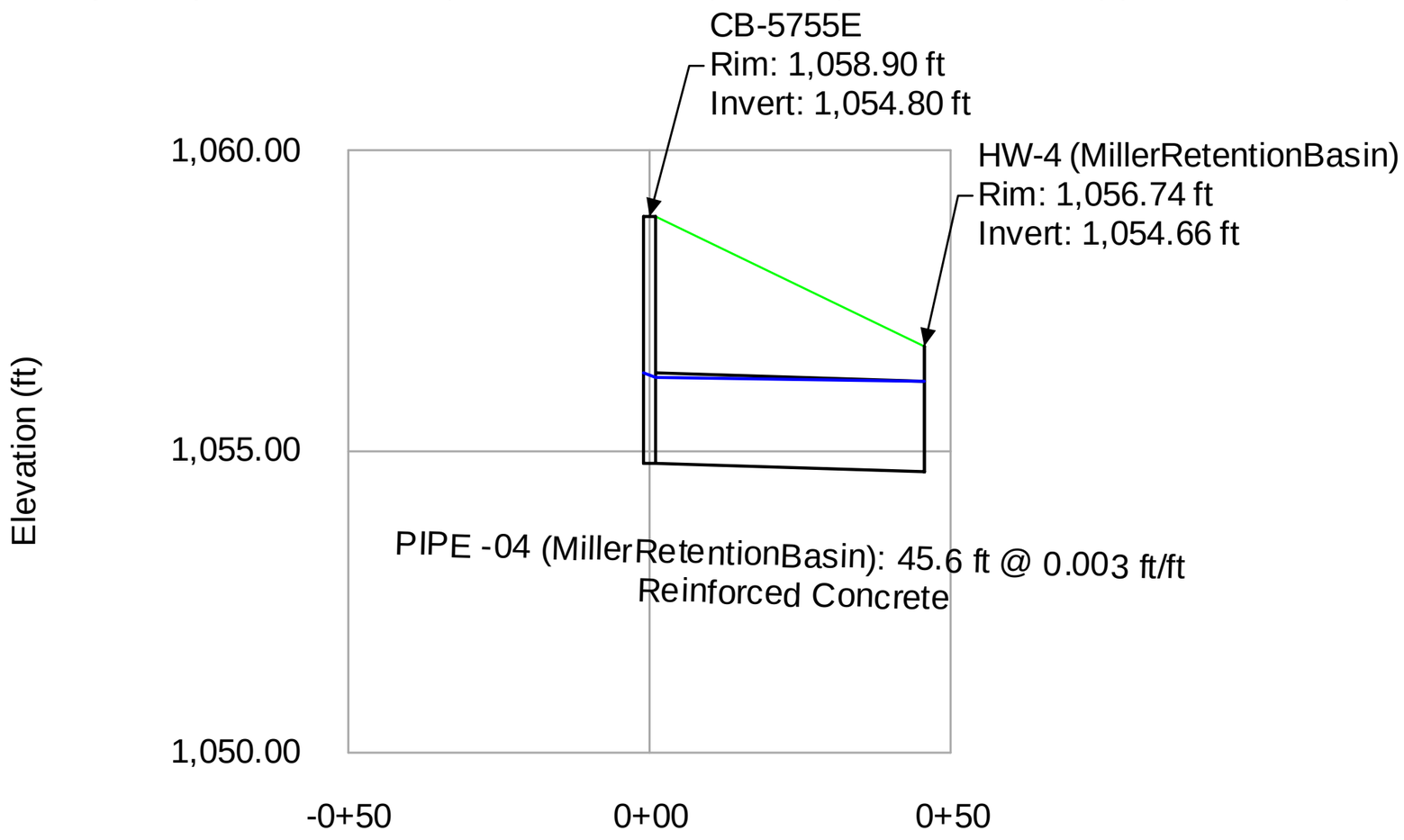
Profile Report

Engineering Profile - CB-5025E (MillerRetentionBasin) to ExstSystem2 (MillerBasins.stsw)



100-Year Storm Event

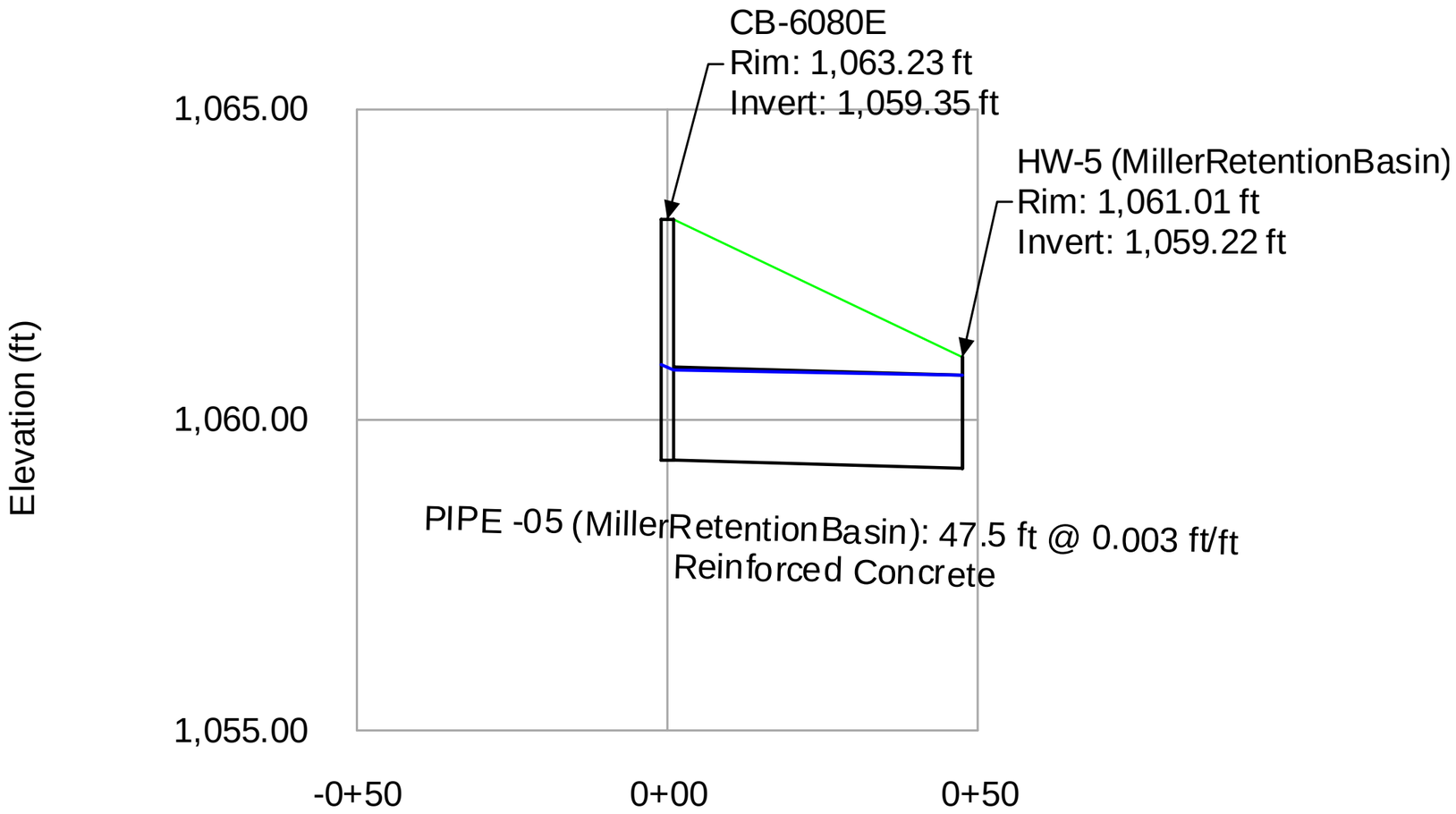
Profile Report
Engineering Profile - CB-5755E (MillerRetentionBasin) to HW-4 (MillerRetentionBasin) (MillerBasins.stsw)



100-Year Storm Event

Profile Report

Engineering Profile - CB-6080E (MillerRetentionBasin) to HW-5 (MillerRetentionBasin) (MillerBasins.stsw)



Appendix B – Drainage Excerpts

FINAL DRAINAGE REPORT

Papago Freeway (Interstate 10): State Route 85 to Verrado Way

Project No. 010 MA 112 F0119 01C
Federal Aid No. 010-A(232)S

Prepared for:

Arizona Department of Transportation
Infrastructure Development and Operations Division

Prepared by:

Kimley-Horn
7740 N. 16th Street
Suite 300
Phoenix, Arizona 85020

291167001
October 2020

FINAL DRAINAGE REPORT

PAPAGO FREEWAY (INTERSTATE 10): STATE ROUTE 85 TO VERRADO WAY

PROJECT NO. 010 MA 112 F0119 01C
FEDERAL AID NO. 010-A(232)S

OCTOBER 2020

Prepared By:

Kimley»Horn

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Figures

Appendices

1 INTRODUCTION

1.1 PROJECT LOCATION

The Interstate 10 (I-10) improvements consist of approximately 8.5 miles of roadway widening from State Route 85 (SR 85) to Verrado Way (I-10 milepost 111.8 to 120.3). Along with the widening of I-10, the Traffic Interchanges (TI) at Miller and Watson Roads will be reconstructed. This project is located in the Arizona Department of Transportation (ADOT) Central District and is within the City of Buckeye (City) in Maricopa County Arizona.

1.2 BACKGROUND

This project is programmed to widen I-10 by providing an additional general purpose lane in both directions through the 8.5-mile project limits. The widening will be within the open median. This section of I-10 can also be widened to the inside for an additional High Occupancy Vehicle (HOV) lane in the future. Improvements at the Miller and Watson Road Tis include widening the arterial streets to the ultimate width.

1.3 PURPOSE

The purpose of this report is to document the existing conditions and proposed drainage improvements within the project limits.

2 CONCEPT PLAN DEVELOPMENT

2.1 LOCAL WATERSHED

The existing topography throughout the project and the surrounding area is generally north to south. Off-site flows are conveyed under I-10 through existing culverts. Most of parcels adjacent to I-10 is undeveloped desert with the exception of two (2) residential developments on the south side of I-10. Sundance is located east of Watson Road and Acacia Crossing is located on the west side of Watson Road.

2.2 FLOODPLAIN LOCATIONS

The project is in Flood Insurance Rate Maps (FIRM) for Maricopa County, Arizona and incorporated areas, Panel Numbers 04013C2105L and 04013C2110L. The FIRM Panels are included as **Figure 3**.

Zone “X” (shaded) is defined by FEMA as follows:

> Areas of 0.2% annual chance flood; areas of 1% annual flood chance with average depths of less than 1 foot or with drainage areas 1 square mile; and areas protected by levees from 1% annual chance flood.

Zone “A” is defined by FEMA as follows:

> Areas subject to inundation by the 1% annual chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown.

There is a portion of the project near Verrado Way that is in an existing Zone A floodplain. The proposed improvements within the floodplain will not be raising or lowering profiles of roadway and are limited to median drainage improvements and culvert extensions to meet clear zone requirements. A floodplain use permit (FPU) is obtained from the Flood Control District of Maricopa County (FCDMC). FCDMC is the floodplain administrator for the City and the Unincorporated Areas of Maricopa County. The hydrologic and hydraulic analysis completed for the floodplain use permit is discussed further in sections 4, 5, and 6.

2.3 PREVIOUS DRAINAGE STUDIES

Several reports were reviewed to develop an understanding of the drainage patterns and infrastructure in the project limits. Below is a list and summary of each study reviewed.

- Initial Drainage Report for I-10 (Papago) Median Widening, SR 85 to Citrus Road, May 2006.
    - The improvements discussed in this report were for inside widening throughout the mainline and did not include any modifications to existing TI's.
- Loop 303 corridor/White Tanks Area Drainage Master Plan (ADMP) Update, February 2005, URS.
    - This ADMP determined the amount of off-site runoff impacting I-10 north and south of the freeway. Off-site hydrology was completed using HEC-1.
- Final Drainage Report for I-10/Watson Road TI, April 2002, RBF Consulting.
    - This report documents the design for the overpass and ramps on I-10 at Watson Road in Buckeye, Arizona.
- Final Drainage Report for Sundance Towne Center, October 2005, Optimus Civil Design Group.
    - This report documents the improvements for the Sundance Towne Center to the southwest of the Watson Road TI.
- I-10/Verrado Way TI Final Drainage Report, March 2002, AZTEC Engineering.
    - Final design drainage report for the overpass and ramps at Verrado Way along I-10.
- Initial Drainage Report North Miller Road Improvement District, August 2008, AZTEC Engineering
    - Conceptual drainage analysis for future Miller Road improvement district. Includes drainage memo to address Miller Road TI runoff

Kimley»Horn Expect More. Experience Better.	**Interstate 10** **SR 85 to Verrado Way**	**Arizona Department of Transportation**
	Figure 2. Vicinity Map	

5.3 PROPOSED ON-SITE RUNOFF

The Rational Method was used to estimate the 10-year and 100-year storm event peak discharges for each drainage sub-basin throughout the project limits. The time of concentration was determined using flow time of the longest flow path. The minimum time of concentration used was ten minutes per the ADOT Drainage Design Manual. A runoff coefficient of 0.95 was used for all impervious areas and a coefficient of 0.70 was used for all median and infield areas. See **Appendix B** for the median runoff calculations and TI pavement spread calculations.

6 HYDRAULICS

6.1 INLET HYDRAULICS

Proposed ditches within the mainline median are designed to be a minimum of one (1) foot below the proposed subgrade. Bentley FlowMaster was used to calculate the ditch hydraulics for each median drainage area. Each ditch is designed to have a maximum flow depth of one-foot so that the 10-year depth within the ditch is beneath the adjacent roadway subgrade per the ADOT Roadway Design Guidelines. Nomographs from the Federal Highway Administration (FHWA) Hydraulic Engineering Circular No. 22 (HEC-22) Chart 9B were used to size proposed median and ditch inlets and verify the depth of ponding in the 10-year event are less than one-foot. See **Appendix B.**

Proposed catch basins will be used to capture pavement runoff at each of the TI's. New inlets are located and sized to meet ADOT and City spread requirements outlined in section 3.2. Curb opening inlets are sized with an 80% reduction factor for clogging and grate inlets are sized with a 50% reduction factor. The inlets used for this project are ADOT standard catch basins within ADOT right-of-way and City standard detail B-510 catch basins within City right-of-way. See **Appendix B** for pavement spread calculations.

6.2 STORM DRAIN HYDRAULICS

The proposed storm drain systems at each TI limits were modeled using Bentley StormCAD software. All storm drain systems were designed to convey the 10-year storm event with the hydraulic grade line (HGL) no greater than 6-inches below the inlet gutter flowline per the ADOT Drainage Design Manual. The tailwater condition was set to the crown of the pipe for both the Miller and Watson Road systems. See **Appendix B** for output from the StormCAD models.

6.3 CULVERT HYDRAULICS

The existing culverts crossing I-10 are conveying offsite runoff from the north to south. Several existing culverts are being extended to meet clear zone requirements and relocated ramps. A pre- and post-project conditions hydraulic analysis for the extended culverts was completed using FHWA's HY-8 culvert software. Refer to **Appendix B** for culvert hydraulics.

6.4 RETENTION

The 100-year, 6-hour depth of 2.73-inches was used to design the proposed retention basin at Miller Road and to verify the capacity of the existing basin at Watson Road. The Miller Road basin is designed for the ultimate condition of the TI. The ponding depth within the basin is greater than three-feet and will be required to have a fence around the basin to restrict access. Surface infiltration will be used to drain the Miller Road basin within 36 hours. Percolation tests were completed at the basin location. The lowest

rate was 4.2 inches/hour. This rate was used for the drain down time calculations with a de-rating factor of 2 for the double ring infiltrometer test. Refer to **Appendix C** for retention basin calculations.

The 100-year, 2-hour depth of 2.11-inches was used to design the proposed retention basin at Yuma Road. The ponding depth is less than one (1) foot. Therefore, no additional drain down calculations were completed.

The existing Watson Road basin has a volume required of 5.00 acre-feet for the 100-year, 6-hour event per the Sundance drainage report and as-builts. However, this was determined using older rainfall data of 3.30-inches. Topographical survey of the existing basin shows the capacity of the basin is 6.63 acre-feet. The contributing weighted area (CA) is 26.9 acres. Therefore, the total 100-year, 6-hour storm event volume required is 6.12 acre-feet. This additional capacity of the basin will be utilized to store the increase in runoff for the ultimate condition of the TI. There are nine (9) existing drywells in the basin bottom to drain the basin. Refer to **Appendix D** for excerpts from the previous studies and obtained topography.

7 REFERENCES

Arizona Department of Transportation, *Highway Drainage Design Manual, Volume 2 - Hydrology* revised 2014

Arizona Department of Transportation, Roadway Engineering Group, *Roadway Design Guidelines,* May 2012

Arizona Department of Transportation, *Post-Construction Best Management Practices Manual for Water Quality,* January 2016

AZTEC, Initial Drainage Report – North Miller Road Improvement District, August 2008.

Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Arizona – Hydrology,* revised 2013.

Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Arizona – Hydraulics,* revised 2013.

Flood Control District of Maricopa County, *Drainage Policies and Standards for Maricopa County, Arizona*, revised 2016.

Federal Highway Administration, *Hydraulic Engineering Circular No. 22, Urban Drainage Design Manual – Third Edition*, September 2009

National Oceanic and Atmospheric Administration, NOAA Atlas 14, Precipitation-Frequency Atlas of the United States, 2011

Appendix C – Retention

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Miller Road Basin Volume Calculations

General Project Information			
Project #	291167001		
Designed by	SRJ	Date	10/22/2020

Drainage Area	Area [ac]	Rational Coefficient	Design Storm	Rainfall Depth [in]	Volume Required [ac-ft]	Basin Bottom Area [ac]	Basin Depth [ft^2]	Volume Provided [ac-ft]	Percolation Rate [in/hr]	De-rating Factor	Discharge per Drywell [cfs]	No. of Dry Wells	Drain Down Time [hrs]
Miller Basin	*30.7*	0.85	100-Yr, 6-Hr	2.73	*5.94*	1.07	5.00	6.50	4.20	2.0		0	32
Yuma Basin	*1.84*	0.85	100-Yr, 2-Hr	2.11	*0.27*	0.12	2.00	0.30	4.20	2.0		0	13