



AMAFCA



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Upper Piedras Marcadas Watershed

Drainage and Water Quality Management Plan

Volume 2 - Existing Conditions



WILSON
& COMPANY



**UPPER PIEDRAS MARCADAS WATERSHED
DRAINAGE AND WATER QUALITY MANAGEMENT PLAN
VOLUME 2 - EXISTING CONDITIONS REPORT
SEPTEMBER 2013
UPDATED APRIL 2017**

I, Donald M. Duneman, do hereby certify that this report was prepared by me or under my direction and that I am a duly registered Professional Engineer under the laws of the State of New Mexico.

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04/07/17
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Executive Summary

The objective of the Upper Piedras Marcadas Watershed Drainage and Water Quality Management Plan (UPMDMP) is to:

- Identify existing and potential watershed discharge point locations and capacities.
- Develop strategies for future reimbursement by watershed properties for constructed infrastructure costs.
- Develop final recommendations for the proposed conveyances.
- Define the water quality infrastructure required to support the development of the watershed.

Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) contracted with Wilson & Company for UPMDMP Phase I and Phase II Services in April of 2013. Phase I Services include: literature review and as-built collection; field reconnaissance; and hydrologic and hydraulic analyses of the existing conditions. Phase II Services consist of: hydrologic and hydraulic analyses of the future conditions; capacity analysis of certain existing facilities for future developed conditions; development of alternatives for proposed drainage infrastructure with recommendations; establishment of drainage management policy for the watershed; and coordination with project stakeholders.

The Upper and Lower Piedras Marcadas Watersheds are the two watersheds that currently constitute the Piedras Marcadas Watershed. The Piedras Marcadas Watershed drains to the Piedras Marcadas Dam which has a gated principal spillway and a storage volume capacity of 280 acre-feet with 1 foot of freeboard. When the spillway gate is opened, the 36" principal spillway has a capacity to discharge 90 cfs to the Corrales Main Canal. The dam essentially acts as a retention facility and therefore has limited capacity for developed runoff from the watershed. This report examines the current capacities of downstream infrastructure and discusses the downstream limitations.

The existing conditions hydrologic analysis herein identifies discharge points from the watershed to the Piedras Marcadas Channel and to the Petroglyph National Monument. The drainage basin areas were delineated utilizing 2010 LIDAR data, a drainage literature review, and field investigations and then input into HEC-HMS to compute the peak flow rates and volumetric runoff. The analysis determined discharge rates and runoff volumes from the watershed. The existing conditions runoff volume for the UPMW is 40 acre-feet and the total inflow volume to the



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Dam, combined with the Lower Piedras Marcadas Watershed, has been calculated to be 239 acre-feet. This shows that the existing inflow to the Dam does not exceed the as-built capacity of 280 acre-feet with 1 foot of freeboard.

The Chamisa/Lyon Storm Drain System Analysis Memorandum, included in Appendix D, concluded that the Chamisa Storm Drain Design in the Cooperative Agreement did not consider the addition of runoff from the Church and Shaffer property located at the southwest corner of Unser Boulevard and Paradise Boulevard or the downstream Lyon Storm Drain Hydraulic Grade Line (HGL). When these factors are considered in the Hydraulic Analyses of the Chamisa Storm Drain System, the 60" Chamisa Storm Drain does not accommodate the design storm from contributing Chamisa basins per the Cooperative Agreement. Therefore, the Chamisa storm drain does not have the capacity to convey runoff diverted from the Upper Piedras Marcadas Watershed.

Finally, the results of the analysis show that the Paseo del Norte storm drain has the capacity to accommodate existing conditions flows of 100 cfs, as well as the developed condition flows of 759 cfs as established in previous reports.

1. Introduction

The Upper and Lower Piedras Marcadas Watersheds are the two watersheds that currently constitute the Piedras Marcadas Watershed. The Upper Piedras Marcadas Watershed (UPMW) is generally bounded by the Petroglyph National Monument to the east, Universe Boulevard and the Trails Unit IV to the west, Chamisa and Paradise Basins to the north, and Paseo del Norte (PdN)/Avenida de Jaimito to the south (Figure 1). The basin is mostly undeveloped with paved roadways. The watershed is approximately 986 acres including the majority of the Volcano Heights area defined by the sector plan, as well as 354 acres of the Petroglyph National Monument. Existing topography slopes to the east at slopes generally ranging from 1% to 5%, with the exception of the monument escarpment which slopes at approximately 50%.

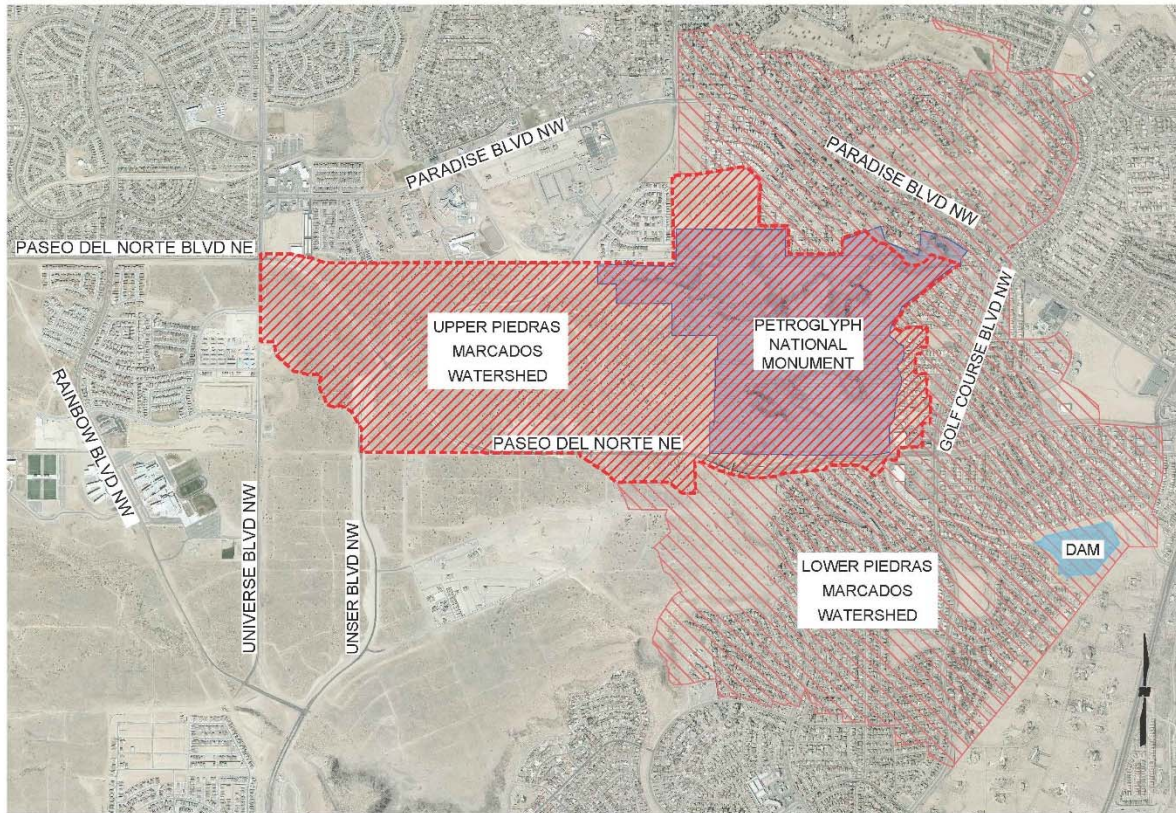


Figure 1: Vicinity Map

The Piedras Marcadas Watershed drains to the Piedras Marcadas Dam. The Dam includes a gated 36" spillway which drains into the Corrales Main Canal. The dam has limited capacity for developed runoff within the watershed. It is necessary to protect the dam by diverting flows from the Piedras Marcadas Watershed to surrounding watersheds, ie: north to the Calabacillas Watershed and south to the Boca Negra Dam or Mariposa Watershed. In the 1993 "Piedras Marcadas DWQMP Revision" by Molzen-Corbin, two diversions were recommended to limit the amount of runoff draining to the Piedras Marcadas Dam. The first diversion, the Las Ventanas Dam, has been built. The second diversion is the Lyon Boulevard Storm Drain, complete from the Chamisa Detention Basin to the Calabacillas Arroyo.

The purpose of the existing conditions analysis is to determine existing drainage conditions and allowable discharge rates; calculate existing conditions peak flows and discharge locations



based on updated hydrologic methodology; and determine the capacity of existing downstream storm drain systems.

2. Literature Review

A literature review of pertinent Drainage Reports, Construction Drawings/As-Built, Agreements and Sector Plans was completed by Wilson & Company to identify existing and potential watershed discharge point locations and capacities of existing conditions. Below is a listing of critical information found in the literature review:

1. Upper Piedras Marcadas

- The allowable discharge to the PdN storm drain at Calle Nortena is 620 cfs.
- The existing 84" PdN storm drain has the capacity to discharge the developed rate of 759 cfs to Piedras Marcadas Arroyo.
- The allowable discharge from the Petroglyph National Monument is 120 cfs.
- The storage capacity of the Piedras Marcadas Dam is 280 ac-ft with one ft of freeboard.
- The 36" principal spillway can discharge 90 cfs to the Corrales Main Canal.

2. Mariposa Diversion

- 64 cfs is allowed to be diverted from UPMW.
- Allowable discharge from UPMW and basins in the Volcano Cliffs area into the Mariposa Arroyo is 106 cfs.

3. Calabacillas Diversion

- The existing 60" Chamisa Storm Drain was designed to convey a flow of 212 cfs. Based on the Existing Conditions Analysis, the capacity is 122 cfs.
- 45 cfs is allowed to be diverted from UPMW.

4. Boca Negra Diversion

- The allowable discharge from the UPMW into the Boca Negra Dam is 171 cfs.



3. Existing Conditions Hydrologic Analysis

3.1 Methodology

Hydrologic modeling for existing conditions was developed using the USACE Hydrologic Engineering Center-Hydrologic Modeling System (HEC-HMS), Version 3.5. HEC-HMS was used to calculate the 100-year peak flow rates and volumetric runoff. Unit hydrographs were computed by the model using the Soil Conservation Service (SCS) Type II a Unit Hydrograph Method. Initial abstraction and infiltration losses are based on soil characteristics, land cover, and land use. A time interval of one minute was used for the computation time step. The basin's physical properties input into the model include sub-basin area, percent of land treatment types, rainfall distribution, and lag time.

A bulking factor was applied to the hydrologic calculations to account for the sediment transport capacity in the existing conditions. The Piedras Marcadas DMP Revision, completed in 1993, addressed sediment transport using a survey of sediment issues in the Piedras Marcadas Watershed conducted by Dr. Richard Hagan with Water Resources Engineering. The survey established a range of bulking factors of 0.1% to 10% for the watershed. The sediment survey accounted for rock outcroppings throughout the watershed, as well as playas which collect some sediment from storm water runoff. For the existing conditions, a bulking factor of 10% was selected throughout the watershed based on the survey by Dr. Hagan and the runoff from recent rainfall events.

3.2 Hydrologic Characteristics

3.2.1. Watershed Delineation

The existing basin boundaries herein vary slightly from those established in the 1993 DMP. This is a result of constructed roadways including PdN and Unser Boulevard, updated LIDAR mapping and the Chamisa storm drain diversion. In addition, the basin names were modified from previous reports. Resources used to define sub-basins included a site visit, previous reports, 2010 LIDAR mapping and 2010 Ortho-photography. Basin areas were divided at major drainage structures, confluences of drainage paths, or by encompassing shallow terrain.



3.2.2. Precipitation

The precipitation depths for the 15-minute, 1-hour, 6-hour, and 24-hour duration, 100-year storm frequency were obtained from the National Oceanic and Atmospheric Administration (NOAA), Atlas 14 as of 04-03-2017. Table 3-1 below lists the precipitation depths. The User Specified Hyetograph based on NMSHTD Drainage Manual was developed to determine the Type II-a Unit distribution. See Appendix A, User Specified Hyetograph.

Table 3-1: NOAA Precipitation Depths	
Storm Duration for 100 Year Frequency (hr)	Precipitation Depth (in)
0.25	1.02
1	1.70
6	2.20
24	2.52

3.2.3. Land Use

The NMDOT Drainage Manual Volume 1, Hydrology, 1995 (NMDOT Drainage manual) was used to determine sub-basin land condition by cover type. A 2013 aerial map and field investigations were used to help determine the cover type for the existing condition. The NRCS website was used to determine the hydrologic soil group for the watershed (See Appendix C for Custom Soils Resource Report). The majority of the Upper Piedras Marcadas Watershed is undeveloped with exception of PdN and Unser Blvd. The impervious area for the existing roadways was delineated using 2010 ortho-photography.



Runoff Curve Numbers were calculated based on TR-55 methodology for Arid and Semiarid Rangelands as presented in Table 3-2, Runoff Curve Numbers, in the NMDOT Drainage Manual. The primary land cover type is “Piñon, Juniper, or both; grass understory” with a fair hydrologic condition. The urban area in the study is limited to the “paved roadways; curbs and storm sewers”. CN values were assigned to each drainage basin based on the land cover, hydrologic soil group, and hydrologic condition. See Table 3-2 for Runoff Curve Numbers based on Hydrologic Soil Groups. For an illustration of the weighted CN values for each sub-basin, refer to Table 3-3: Weighted CNs.

Table 3-2: Runoff Curve Numbers for Hydrologic Soil Groups

Cover Type	Hydrologic Group			
	A	B	C	D
Piñon-Juniper – Fair Condition		58	73	80
Streets and Roads: Paved; curbs and storm sewer	98	98	98	98



Table 3-3: Weighted CNs

Basin ID	Total Area (mi ²)	Area (ac)	Weighted CN
102A	0.1118	72	74
102B	0.054	35	73
102C	0.0306	20	74
102D	0.0438	28	75
103	0.0803	51	73
104	0.0843	54	73
105A	0.0965	62	77
105B	0.0291	19	77
106A	0.1629	104	73
106B	0.1599	102	73
106C	0.0277	18	73
106D	0.042	27	73
107	0.389	249	63
108	0.1749	112	68
109	0.0514	33	81

3.2.4. Time of Concentration

Time of Concentration is defined as the time required for runoff to travel from the hydraulically most distant part of the watershed to the analysis point. At the very top of the watershed, sheet (overland) flow is the predominant flow regime. For this reason and referencing the NMDOT Drainage Manual Volume 1, the Time of Concentration Upland Method for un-gullied areas, which estimates travel times for overland flow and shallow concentrated flow, was applied. As shallow concentrated flow is assumed to occur from the end of overland flow to the bottom of a watershed where there is little or no gullying, the Upland Method was again applied. For sub-basins with gullied flow, which occur primarily downstream of the Petroglyph National Monument escarpment, the Kirpich Formula was used. Figure 3-10, 'Flow Velocities for Overland and Shallow Concentrated Flows', from the NMDOT Drainage Manual, was used to determine the velocity based on the slope. From Figure 3-10, land treatment "nearly bare and untilled flow" was used for overland flow and land treatment "alluvial fans in western mountain regions" was used for shallow concentrated flow to determine velocities. Using the basic equation for time of concentration, the T_c was calculated for both the sheet flow and shallow concentrated flow. The minimum time of concentration used is 10 minutes.



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$$T_c = \left(\frac{L_1}{V_1} + \frac{L_2}{V_2} + \dots \frac{L_n}{V_n} \right) * \frac{1}{60}$$

where,

L = length of reach (ft)

V = average flow velocity (ft/s)

T_c = Time of Concentration (minutes)

$$T_c = t_{\text{sheet}} + t_{\text{shallow}}$$

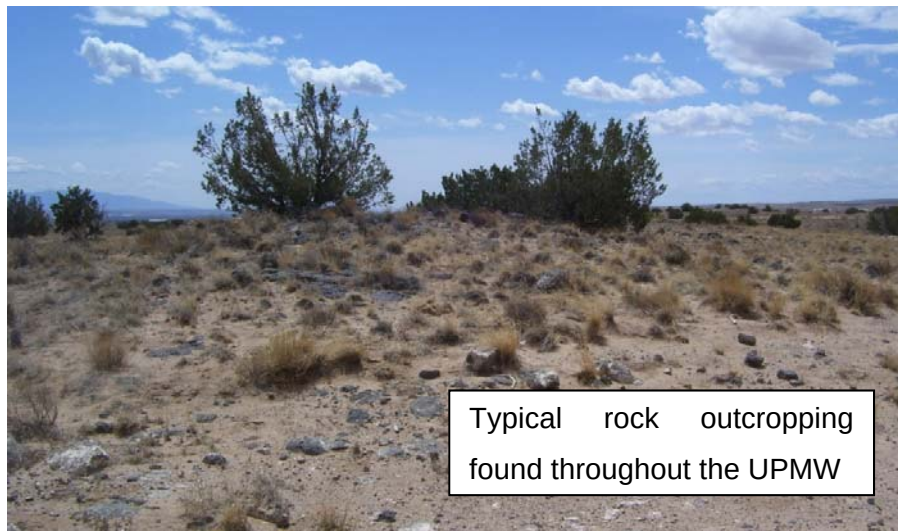
where,

t_{sheet} = the sum of travel in sheet flow segments over the watershed land surface

t_{shallow} = the sum of travel time in shallow flow segments

The lag time was then calculated for each sub-basin. Lag time, the difference between the centroid of the excess rainfall and the peak of the runoff hydrograph, is estimated as 60 percent of the time of concentration.

$$T_L = 0.6 T_c$$





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Table 3-4: Lag Time Calculations

Basin ID	Overland Flow Length (ft)	Velocity (ft/s)	Slope (ft/ft)	Shallow Concentrated Flow Length (ft)	Velocity (ft/s)	Slope (ft/ft)
102A	100	0.8	0.006	2954	0.9	0.009
102B	100	1.9	0.036	2625	1.7	0.023
102C	100	1.4	0.015	2353	1.4	0.015
102D	100	1.1	0.012	1989	1.1	0.011
103	100	0.7	0.005	2582	1.0	0.010
104	100	0.9	0.008	2504	1.5	0.019
105A	100	1.0	0.010	4842	1.4	0.017
105B	100	1.7	0.024	2301	1.9	0.034
106A	100	1.7	0.026	4581	1.5	0.019
106B	100	2.1	0.042	3369	1.5	0.021
106C	100	2.8	0.071	1444	1.7	0.024
106D	100	1.7	0.024	1932	1.7	0.025
107	-	-	0.026	8360	-	0.026
108	-	-	0.048	3865	-	0.048
109	100	2.0	0.039	1421	1.5	0.019

Table 3-5: Lag Time

Basin ID	Time of Concentration (min)	Lag Time (min)
102A	57	34
102B	27	16
102C	29	18
102D	32	19
103	45	27
104	30	18
105A	59	15
105B	21	13
106A	52	31
106B	38	23
106C	15	9
106D	20	12
107	33	20
108	15	9
109	19	10



3.3 Hydrologic Summary

3.3.1. Existing Conditions Basin Summary

The Upper Piedras Marcadas Watershed is approximately 1.54 square miles (986 acres) and is illustrated in Figure 2, Existing Conditions Basin Map. The area generally drains to the east and is conveyed to the Piedras Marcadas Channel. The watershed includes the Petroglyph National Monument, which encompasses 354 acres of the eastern portion of the watershed, and will remain undeveloped.

Within the UPMW, there are opportunity to direct generated runoff to several different watersheds, including the UPMW, as presented below.

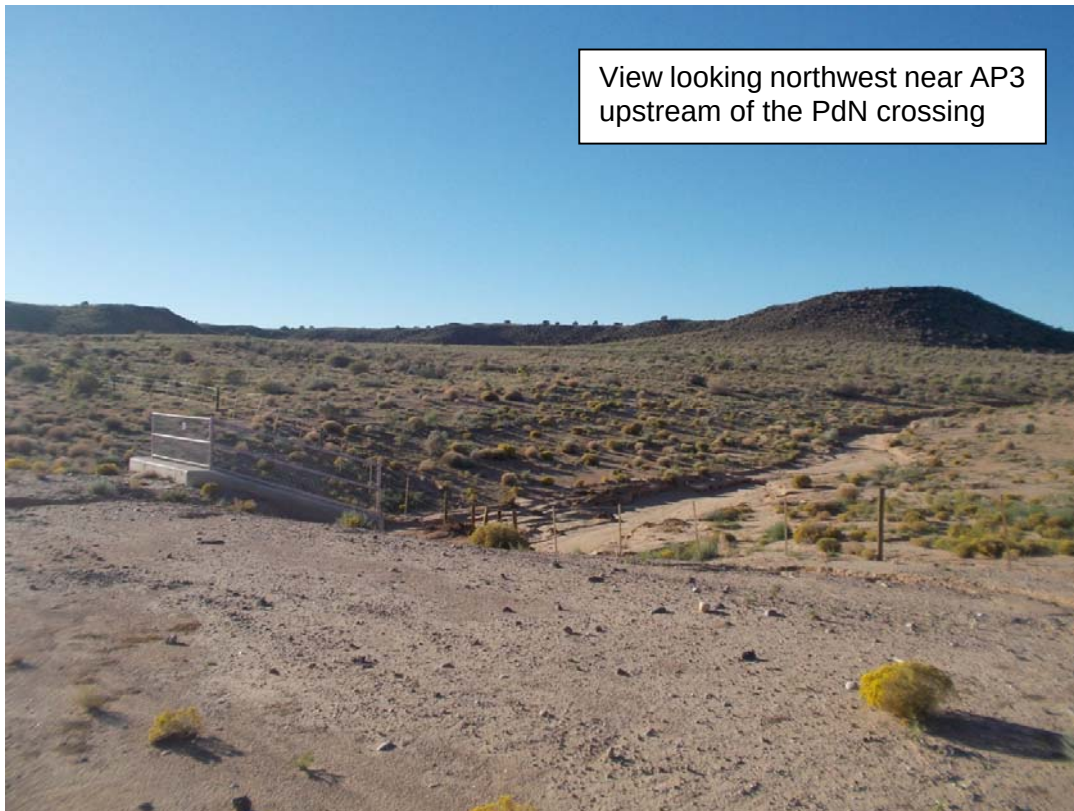
Calabacillas Watershed – Sub-basin 102A drains to the northeast toward the Chamisa Ridge Subdivision and is routed through sub-basin 102B. PdN bisects sub-basin 102A, with 2 –24” culverts conveying runoff under the roadway.

Analysis Point 6 is located at the intersection of Unser Blvd. and Paradise Blvd. The Chamisa drainage basin was not analyzed with this existing condition analysis. The allowable discharge rate was analyzed with the Chamisa/Lyon Storm Drain System Analysis included in Appendix D.

Mariposa Watershed – Sub-basin 103 drains to the southeast to analysis point 5 located just west of Unser Blvd. at the Alameda Grant Boundary and into the Volcano Cliffs area. Sub-basin 104 drains to the southeast toward the intersection of PdN and the Alameda Grant Boundary and into the Volcano Cliffs area to analysis point 15. Both sub-basin areas eventually drain to the Mariposa Basin in the existing conditions. Since they do not contribute runoff to the Piedras Marcadas Channel, these sub-basins have not been added to the remaining sub-basins in the HEC-HMS model.

Upper Piedras Marcadas Watershed – Basin 102B drains to the east toward Unser Blvd. to a point just south of the Boulders Subdivision where runoff is conveyed via a 36” culvert under the roadway and into sub-basin 106A. 102C and 102D drain to the east with analysis points at existing 24” culverts under Unser Blvd. and discharge to basin 106A. Basin 106A drains to the northeast and runoff discharges to the Petroglyph National Monument just south of the Sundance Estates Subdivision. Runoff is then routed through

sub-basin 107 and conveyed to the existing 84" culvert crossing at PdN before discharging into the Piedras Marcadas Channel. Sub-basin 105A drains to the southeast to PdN and runoff is conveyed along the north side of the roadway before being collected in the existing PdN storm drain system. Sub-basin 105B drains to the northeast to the PdN right-of-way and runoff is captured by storm drain inlets within the roadway. These sub-basins are then conveyed to the Piedras Marcadas Channel via an existing 84" storm drain pipe along PdN.



As mentioned previously, flow-rates and volumes have been adjusted within the hydrologic model to account for a 10% sediment bulking factor. Refer to Table 3-6 and Table 3-7 for hydrologic data.



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Table 3-6: Existing Sub-Basin Peak Discharge and Volumes

Basin ID	Area (ac)	Q_{2yr-6hr} (cfs)	V_{2yr-24hr} (ac-ft)	Q_{10yr-6hr} (cfs)	V_{10yr-24hr} (ac-ft)	Q_{100yr-6hr} (cfs)	V_{100yr-24hr} (ac-ft)	Q_{100yr-6hr} (cfs/ac)
102A	72	0.0	0.35	2.1	1.43	13.0	4.04	0.2
102B	35	0.0	0.14	4.1	0.62	22.3	1.83	0.6
102C	20	0.0	0.10	2.4	0.39	12.3	1.11	0.6
102D	28	0.1	0.17	3.8	0.63	18.0	1.70	0.6
103	51	0.0	0.21	2.1	0.93	14.4	2.71	0.3
104	54	0.0	0.22	5.3	0.97	30.5	2.85	0.6
105A	62	1.3	0.52	16.1	1.68	59.3	4.25	1.0
105B	19	0.5	0.16	5.4	0.51	19.0	1.28	1.0
106A	104	0.0	0.42	3.0	1.88	21.2	5.50	0.2
106B	102	0.0	0.42	6.2	1.85	39.6	5.40	0.4
106C	18	0.0	0.07	3.4	0.32	14.8	0.94	0.8
106D	27	0.0	0.11	4.4	0.49	20.5	1.42	0.8
107	249	0.0	0.00	0.1	0.97	28.2	5.69	0.1
108	112	0.0	0.11	7.1	1.08	57.3	4.05	0.5
109	33	3.8	0.49	17.0	1.28	50.1	2.88	1.5

Table 3-7: Existing Analysis Points, Peak Discharge and Volumes

AP ID	Area (ac)	Q_{2yr-6hr} (cfs)	V_{2yr-24hr} (ac-ft)	Q_{10yr-6hr} (cfs)	V_{10yr-24hr} (ac-ft)	Q_{100yr-6hr} (cfs)	V_{100yr-24hr} (ac-ft)
1	80	0.6	0.67	11.6	2.18	52.1	5.53
2	156	0.0	0.29	11.4	1.88	87.7	6.41
3	642	0.0	2.06	0.1	8.99	30.2	28.05
4	879	0.0	3.01	5.4	13.04	89.9	39.95
5	51	0.0	0.21	2.1	0.93	14.4	2.71
7	72	0.0	0.35	2.1	1.43	13.0	4.04
8	106	0.0	0.49	4.1	2.05	23.1	5.86
9	20	0.0	0.10	2.4	0.39	12.3	1.11
10	28	0.1	0.17	3.8	0.63	18.0	1.70
11	258	0.0	1.18	5.1	4.94	37.6	14.15
12	102	0.0	0.42	6.2	1.85	39.6	5.40
13	18	0.0	0.07	3.4	0.32	14.8	0.94
14	27	0.0	0.11	4.4	0.49	20.5	1.42
15	54	0.0	0.22	5.3	0.97	30.5	2.85
16	62	1.3	0.52	16.1	1.68	59.3	4.25
17	33	3.8	0.49	17.0	1.28	50.1	2.88



Existing conditions discharge rates and volumes computed with this analysis were compared to the existing conditions hydrology presented in the 1993 Piedras Marcadas DMP Revision. Given that the basin boundaries differ between the 1993 DMP Revision and this updated analysis, peak runoff per acre values were compared. The 1993 analysis indicates peak runoff per acre from the watershed ranging from 0.60 to 1.4 cfs/acre, while this report's UPMDMP analysis results range from 0.16 to 1.56 cfs/acre. Runoff volumes per acre were also compared between the two analyses. The 1993 report indicates values ranging from 0.03 to 0.05 acre-feet/acre, while the results of this UPMDMP analysis range from 0.02 to 0.09 acre-feet/acre. Differences can be attributed to modified basin boundaries and differing methodologies.

4. Existing Conditions Hydraulic Analysis

4.1 Methodology

The purpose of the hydraulic analysis is to calculate the capacity of the existing storm drain systems in order to determine the allowable discharge from the UPMW. Hydraulic calculations have been performed to obtain the existing storm drain capacities. Hydraflow Storm Sewers (Hydraflow SS) Extension in AutoCAD Civil 3D 2012 software by Intelisolve was used to calculate pipe capacities.

4.2 Hydraflow Storm Sewers Analysis

4.2.1. Closed Conduit Analysis

Hydraulic modeling for closed conduits was performed using Hydraflow SS. Hydraflow uses the Step Method for calculating the hydraulic grade-line. This computer program determines the hydraulic grade-line throughout the alignment of the storm drain system. Input parameters for each pipe segment of the storm drain system include: invert elevations, rim elevations, pipe length, size, roughness, deflection angle, junction type, and its geometry. Peak runoff values were added to each pipe segment along the storm drain system based on design flow-rates. Junction loss coefficients are computed and based on data adapted from Federal Highway Administration (FHWA) Hydraulic Engineering Circular (HEC) No.22. The existing pipe network was modeled to determine the capacity of each system with the hydraulic grade line below ground elevations.



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The input parameters for each pipe segment were obtained from field storm drain system survey information provided by Wilson & Company. The survey was completed in July 2013. See Appendix B for Hydraflow Storm Sewer summary files and as-built survey sheets.

Initially, six separate existing storm drain systems were analyzed for capacity in order to determine the allowable discharge from the UPMW. UPM_1 is the existing 24" storm drain system built with the Chamisa Ridge Subdivision to ultimately convey runoff from the Villa De La Chamisa Subdivision and Chamisa Ridge Subdivision to the Chamisa storm drain within Unser Blvd. UPM_2 is the storm drain located along the east property line of James Monroe Middle School and a segment of the 48" Chamisa storm drain. UPM_3 is the storm drain outfall from the Boulders Phase 2 development to the Chamisa Detention Basin.

UPM_4 is the Chamisa storm drain from the Chamisa Retention Basin to the 90" Lyon storm drain north of Paradise Boulevard. The survey of the existing storm drain systems did not include the 90" Lyon storm drain or the 60" Chamisa storm drain from Sundance Estates Subdivision to Paradise Boulevard. For the purposes of this analysis, construction drawings were utilized for storm drain profile information in order to model the complete system. The downstream hydraulic grade line (HGL) for the model was determined based on the Lyon Boulevard Storm Drain Extension from Paradise Boulevard to Irving Boulevard construction drawings. The drawings show the HGL at approximately 15 feet above the invert of the 90" pipe immediately north of Paradise Boulevard, with a flow-rate of 615 cfs.

UPM_5 is the 48" outfall from the Boulders Phase 1 development to the Chamisa Detention Basin. UPM_6 is the Paseo del Norte storm drain system from Calle Nortena to the Piedras Marcadas Channel. The results of this initial analysis is found in Table 4-1 below.



Table 4-1: Storm Sewer Analysis Results			
ID	Description	Capacity (cfs)	Design Flow-rate (cfs)
UPM_1*	Chamisa Ridge 24" SD	22	20
UPM_2*	James Monroe M.S. outfall/48" Chamisa SD	77	-
UPM_3*	Boulders 42" outfall	141	-
UPM_4*	Chamisa/Lyon SD	212	212
UPM_5*	Boulders 48" outfall	180	-
UPM_6	PdN SD	759	759

*Superseded by Chamisa/Lyon Storm Drain Analysis

The storm drain systems were then further analyzed in 2014 in the Chamisa/Lyon Storm Drain Analysis which is included in Appendix D, the results of which supersede the UPM_1 through UPM_5 analyses. The Chamisa Detention Basin capacity was also analyzed in the Chamisa/Lyon Storm Drain Analysis. The Paseo del Norte storm drain (UPM_6) has the capacity to accommodate existing conditions flows of 100 cfs, as well as the planned discharge rate of 759 cfs as identified in previous reports. The allowable discharge to the system at Calle Nortena is 620 cfs.

4.2.2. Chamisa/Lyon Storm Drain Analysis

In 2014, a detailed hydraulic analysis to determine capacity of Chamisa/Lyon Storm Drain System was completed by Wilson & Company. StormCAD version 8i by Bentley was used for to analyze and assess the performance of the system in the current conditions and the conditions of public and private agreements utilized for funding the Chamisa Storm Drain system (referred to as full build-out conditions). Refer to Appendix D for the Hydraulic Analyses of the Chamisa Storm Drain System Memorandum. The analyses concluded that the Chamisa/Lyon storm drain (UPM_4), with a capacity of 122 cfs, could accommodate the design storm in the existing conditions, but it is near capacity and cannot accommodate the developed conditions flows of 212 cfs as established in previous reports. It should be noted that the downstream HGL in the model was not adjusted for a reduced discharge rate from the UPMW and the Chamisa basin.



5. Conclusion

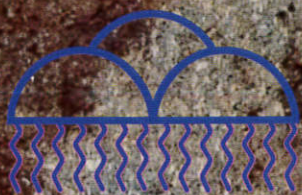
5.1 Upper Piedras Marcadas Watershed

The existing conditions analysis of the Upper Piedras Marcadas Watershed verifies that the Dam is near capacity in the existing conditions. There is approximately 288 cfs and 40 acre-feet (100-year) draining into the Piedras Marcadas Arroyo and to the Piedras Marcadas Dam from the Upper Piedras Marcadas Watershed in the existing conditions. The Lower Piedras Marcadas Watershed contributes 199 acre-feet of runoff volume to the Dam. The existing hydrologic analysis demonstrates that the dam has the capacity to accommodate an additional 40 acre-feet of runoff volume before reaching capacity of 280 acre-ft with 1 foot of freeboard.

Based on the literature review, the capacity of the dam limits the volumetric runoff from the Upper Piedras Marcadas Watershed, in addition to the other sub-basins, to 280 acre-feet and a discharge rate of 965 cfs at AP4. The results of the analysis show that the Paseo del Norte storm drain has the capacity to accommodate existing conditions flows of 100 cfs, as well as the developed condition flows of 759 cfs as established in previous reports. The developed conditions report will evaluate alternatives that consider these constraints.

5.2 Chamisa/Lyon Storm Drain System

The Chamisa/Lyon storm drain diversion does not have the capacity to accommodate the developed conditions flows as established in previous reports. The Lyon storm drain north of Paradise Blvd. has capacity to convey 212 cfs. The Chamisa/Lyon Storm Drain Analysis concluded that the Chamisa Storm Drain Design in the Cooperative Agreement did not consider the addition of runoff from the Church and Shaffer property located at the southwest corner of Unser Boulevard and Paradise Boulevard. In addition, the design did not consider the downstream Lyon Storm Drain Hydraulic Grade Line (HGL). When considering this condition in the Hydraulic Analyses of the Chamisa Storm Drain System upstream of Paradise Blvd., the 60" Chamisa Storm Drain does not accommodate the design storm from contributing Chamisa basins per the Cooperative Agreement. In conclusion, the Chamisa storm drain does not have the capacity to convey the additional runoff planned diversion in previous reports from the Upper Piedras Marcadas Watershed.



AMAFCA





**Upper Piedras Marcadas Watershed Drainage
And Water Quality Management Plan
Existing Conditions Report**

**Appendix A
Hydrology**



UPPER PIEDRAS MARCADAS WATERSHED DRAINAGE
AND WATER QUALITY MANAGEMENT PLAN
EXISTING CONDITIONS REPORT

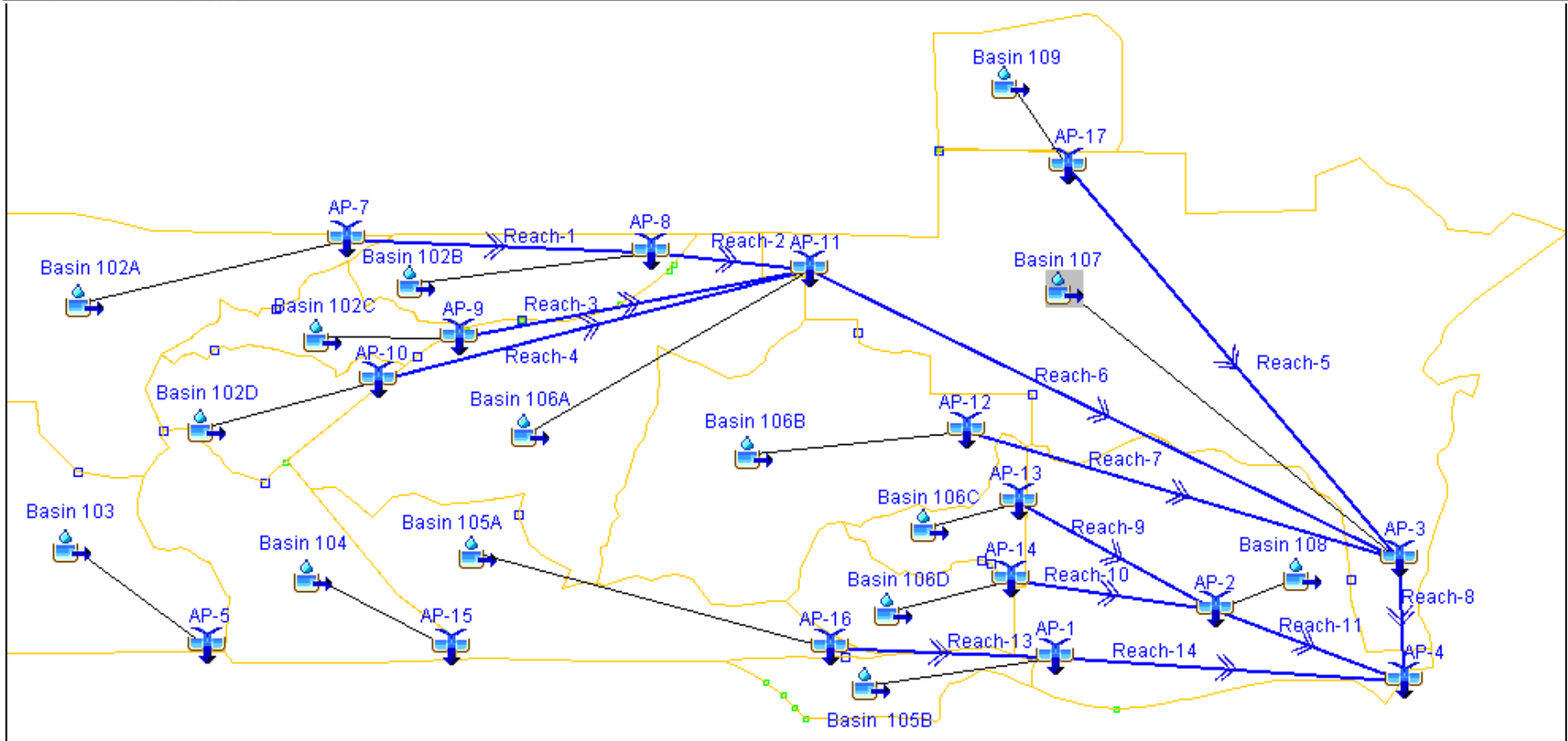


HEC-HMS

Project : Existing Conditions

Basin Model : Existing Basins

Oct 29 14:58:56 GMT 2013





UPPER PIEDRAS MARCADAS WATERSHED DRAINAGE AND WATER QUALITY MANAGEMENT PLAN EXISTING CONDITIONS REPORT

Hydrologic Calculations

(Per NMDOT Drainage Manual, Vol. 1 Hydrology)

TIME OF CONCENTRATION

	Simplified Peak Flow Method												Total Time of Concentration		Lag time
	Overland Flow	MAX	MIN	Slope	Velocity*	Time of	Shallow Conc.	MAX	MIN	Slope	Velocity*	Time of	Total	Minimum	Lag Time
Basin	Length (ft)	EL (FT)	EL (FT)	(ft/ft)	(ft/s)	Conc. (min)	Flow Length (ft)	EL (FT)	EL (FT)	(ft/ft)	(ft/s)	Conc. (min)	(min)	(min)	(min)
102A**	100	5422	5422	0.006	0.8	2.1	2954	5422	5395	0.009	0.9	54.7	56.8	57	34
102B**	100	5404	5400	0.036	1.9	0.9	2625	5400	5340	0.023	1.7	25.7	26.6	27	16
102C**	100	5414	5413	0.015	1.4	1.2	2353	5413	5378	0.015	1.4	28.0	29.2	29	18
102D**	100	5414	5413	0.012	1.1	1.5	1989	5413	5391	0.011	1.1	30.1	31.7	32	19
103**	100	5424	5423	0.005	0.7	2.4	2582	5423	5398	0.010	1.0	43.0	45.4	45	27
104**	100	5423	5422	0.008	0.9	1.9	2504	5422	5376	0.019	1.5	27.8	29.7	30	18
105A**	100	5404	5403	0.010	1.0	1.7	4842	5403	5319	0.017	1.4	57.6	59.3	59	15
105B**	100	5350	5348	0.024	1.7	1.0	2301	5348	5270	0.034	1.9	20.2	21.2	21	13
106A**	100	5405	5402	0.026	1.7	1.0	4581	5402	5313	0.019	1.5	50.9	51.9	52	31
106B**	100	5376	5372	0.042	2.1	0.8	3369	5372	5300	0.021	1.5	37.4	38.2	38	23
106C**	100	5336	5329	0.071	2.8	0.6	1444	5329	5295	0.024	1.7	14.2	14.8	15	9
106D**	100	5341	5339	0.024	1.7	1.0	1932	5339	5290	0.025	1.7	18.9	19.9	20	12
107***							8360	5333	5118	0.026	-	33.4	33.4	33	20
108***							3865	5303	5118	0.048	-	14.5	14.5	15	9
109**	100	5333	5329	0.039	2.0	0.9	1421	5329	5302	0.019	1.5	15.8	16.6	17	10

* Figure 3-10 Flow Velocities for Overland and Shallow Concentrated Flows was used from the NMDOT Drainage Manual, Volume 1. Hydrology. The Flow Velocity plot for the Nearly Bare and Untilled (Overland Flow) & Alluvial Fans in Western Mountain Regions (Shallow Concentrated Flow) was used.

** Un-gullied watershed condition uses the Upland Method.

*** Gullied watershed condition uses the Kirpich Formula.



UPPER PIEDRAS MARCADAS WATERSHED DRAINAGE AND WATER QUALITY MANAGEMENT PLAN EXISTING CONDITIONS REPORT

Hydrologic Calculations (Per NMDOT Drainage Manual, Vol. 1 Hydrology)

TIME OF CONCENTRATION

From	To	Reach	Upland Method												Total Time of Concentration		Lag time
			Overland Flow Length (ft)	MAX EL (FT)	MIN EL (FT)	Slope (ft/ft)	Velocity* (ft/s)	Time of Conc. (min)	Shallow Conc. Flow Length (ft)	MAX EL (FT)	MIN EL (FT)	Slope (ft/ft)	Velocity* (ft/s)	Time of Conc. (min)	Total (min)	Minimum (min)	Lag Time (min)
AP7	AP8	Reach 1	100	5400	5399	0.010	1.0	1.7	2466	5399	5344	0.022	1.6	25.7	27.3	27	16
AP8	AP11	Reach 2	100	5344	5343	0.010	1.0	1.7	899	5343	5321	0.024	1.7	8.8	10.5	10	6
AP9	AP11	Reach 3	100	5382	5380	0.020	1.5	1.1	2801	5380	5321	0.021	1.5	31.1	32.2	32	19
AP10	AP11	Reach 4	100	5394	5391	0.030	1.8	0.9	3303	5391	5321	0.021	1.5	36.7	37.6	38	23
AP17	AP3	Reach 5	100	5303	5302	0.010	1.0	1.7	4594	5302	5131	0.037	1.8	42.5	44.2	44	27
AP11	AP3	Reach 6	100	5321	5319	0.020	1.5	1.1	5552	5319	5131	0.034	1.7	54.4	55.5	56	33
AP12	AP3	Reach 7	100	5303	5302	0.010	1.0	1.7	3575	5302	5131	0.048	2.2	27.1	28.8	29	17
AP3	AP4	Reach 8	100	5131	5130	0.010	1.5	1.1	179	5130	5123	0.039	2.0	1.5	2.6	10	6
AP13	AP2	Reach 9	100	5297	5294	0.030	1.8	0.9	2147	5294	5160	0.062	2.7	13.3	14.2	14	9
AP14	AP2	Reach 10	100	5293	5292	0.010	1.0	1.7	2020	5292	5160	0.065	2.8	12.0	13.7	14	8
AP2	AP4	Reach 11	100	5160	5156	0.040	2.0	0.8	1070	5156	5123	0.031	1.8	9.9	10.7	11	6
AP15	AP16	Reach 12	100	5374	5372	0.020	1.5	1.1	3043	5372	5328	0.014	1.3	39.0	40.1	40	24
AP16	AP1	Reach 13	100	5328	5325	0.030	1.8	0.9	1558	5325	5286	0.025	1.6	16.2	17.2	17	10
AP1	AP4	Reach 14	100	5286	5280	0.060	2.6	0.6	2865	5280	5123	0.055	2.4	19.9	20.5	21	12
AP5	AP4	Reach 15	100	5397	5395	0.020	1.5	1.1	9226	5395	5123	0.029	1.8	85.4	86.5	87	52

* Figure 3-10 Flow Velocities for Overland and Shallow Concentrated Flows was used from the NMDOT Drainage Manual, Volume 1. Hydrology. The Flow Velocity plot for the Nearly Bare and Untilled (Overland Flow) & Alluvial Fans in Western Mountain Regions (Shallow Concentrated Flow) was used.



UPPER PIEDRAS MARCADAS WATERSHED DRAINAGE AND WATER QUALITY MANAGEMENT PLAN EXISTING CONDITIONS REPORT

Weighted CN Calculations

Basin ID	Basin Area (ac)	Basin Area (sm)	Cover Type and Hydrologic Condition	HSG "A"		HSG "B"		HSG "C"		HSG "D"		Basin Total Area (ac)	Normal Weighted CN
				Area (ac)	CN	Area (ac)	CN	Area (ac)	CN	Area (ac)	CN		
102A	71.57	0.112	Pinon-Juniper: Fair					68.66	73				
102A			Streets and Roads: Paved					2.91	98			72	74
102B	34.59	0.054	Pinon-Juniper: Fair					34.59	73			35	73
102C	19.57	0.031	Pinon-Juniper: Fair					19.15	73				
102C			Streets and Roads: Paved					0.42	98			20	74
102D	28.06	0.044	Pinon-Juniper: Fair					25.96	73				
102D			Streets and Roads: Paved					2.09	98			28	75
103	51.41	0.080	Pinon-Juniper: Fair					51.41	73			51	73
104	53.98	0.084	Pinon-Juniper: Fair					53.98	73			54	73
105A	61.77	0.097	Pinon-Juniper: Fair					52.55	73				
105A			Streets and Roads: Paved					9.21	98			62	77
105B	18.62	0.029	Pinon-Juniper: Fair					15.31	73				
105B			Streets and Roads: Paved					3.32	98			19	77
106A	104.25	0.163	Pinon-Juniper: Fair					104.25	73				
106A			Streets and Roads: Paved					0.53	98			104	73
106B	102.35	0.160	Pinon-Juniper: Fair					102.35	73			102	73
106C	17.70	0.028	Pinon-Juniper: Fair					17.70	73			18	73
106D	26.86	0.042	Pinon-Juniper: Fair					26.86	73			27	73
107	248.99	0.389	Desert Shrub: Fair	167.73	55			81.26	81			249	63
108	111.91	0.175	Desert Shrub: Fair	64.12	55			37.25	81				
108			Streets and Roads: Paved	7.27	98			3.27	98			112	68
109	32.90	0.051	Desert Shrub: Fair	0.07	55			32.78	81			33	81



UPPER PIEDRAS MARCADAS WATERSHED DRAINAGE
AND WATER QUALITY MANAGEMENT PLAN
EXISTING CONDITIONS REPORT

WEIGHTED CURVE NUMBERS			
ID	AREA		Weighted CN
	(MI ²)	(ac)	
102A	0.1118	72	74
102B	0.054	35	73
102C	0.0306	20	74
102D	0.0438	28	75
103	0.0803	51	73
104	0.0843	54	73
105A	0.0965	62	77
105B	0.0291	19	77
106A	0.1629	104	73
106B	0.1599	102	73
106C	0.0277	18	73
106D	0.042	27	73
107	0.389	249	63
108	0.17449	112	68
109	0.0514	33	81



NOAA Atlas 14, Volume 1, Version 5
Location name: Albuquerque, New Mexico,
USA*
Latitude: 35.184°, Longitude: -106.7032°
Elevation: 5303.62 ft**
 * source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aeriels](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.160 (0.137–0.188)	0.208 (0.177–0.243)	0.280 (0.238–0.328)	0.337 (0.286–0.393)	0.415 (0.350–0.484)	0.476 (0.400–0.555)	0.541 (0.451–0.629)	0.610 (0.505–0.710)	0.704 (0.577–0.820)	0.779 (0.633–0.907)
10-min	0.244 (0.209–0.286)	0.316 (0.270–0.370)	0.426 (0.362–0.500)	0.513 (0.435–0.599)	0.631 (0.532–0.737)	0.724 (0.609–0.844)	0.823 (0.687–0.958)	0.929 (0.769–1.08)	1.07 (0.878–1.25)	1.19 (0.964–1.38)
15-min	0.302 (0.259–0.354)	0.392 (0.334–0.459)	0.527 (0.449–0.620)	0.635 (0.539–0.742)	0.782 (0.660–0.913)	0.898 (0.755–1.05)	1.02 (0.851–1.19)	1.15 (0.953–1.34)	1.33 (1.09–1.55)	1.47 (1.20–1.71)
30-min	0.408 (0.349–0.477)	0.528 (0.450–0.618)	0.710 (0.604–0.835)	0.856 (0.726–0.999)	1.05 (0.889–1.23)	1.21 (1.02–1.41)	1.37 (1.15–1.60)	1.55 (1.28–1.80)	1.79 (1.47–2.09)	1.98 (1.61–2.30)
60-min	0.504 (0.431–0.590)	0.653 (0.557–0.765)	0.879 (0.747–1.03)	1.06 (0.899–1.24)	1.30 (1.10–1.52)	1.50 (1.26–1.74)	1.70 (1.42–1.98)	1.92 (1.59–2.23)	2.21 (1.82–2.58)	2.45 (1.99–2.85)
2-hr	0.592 (0.506–0.698)	0.757 (0.645–0.894)	1.00 (0.854–1.19)	1.20 (1.02–1.41)	1.48 (1.25–1.73)	1.71 (1.43–1.99)	1.95 (1.62–2.27)	2.20 (1.81–2.56)	2.56 (2.08–2.97)	2.85 (2.29–3.31)
3-hr	0.638 (0.554–0.751)	0.812 (0.702–0.956)	1.07 (0.923–1.25)	1.27 (1.10–1.49)	1.55 (1.33–1.81)	1.78 (1.52–2.08)	2.03 (1.71–2.36)	2.29 (1.91–2.66)	2.65 (2.19–3.08)	2.95 (2.41–3.44)
6-hr	0.737 (0.642–0.857)	0.932 (0.816–1.09)	1.21 (1.05–1.40)	1.42 (1.24–1.65)	1.72 (1.49–1.98)	1.95 (1.68–2.25)	2.20 (1.88–2.53)	2.45 (2.08–2.82)	2.81 (2.36–3.24)	3.10 (2.58–3.58)
12-hr	0.822 (0.723–0.937)	1.04 (0.914–1.18)	1.32 (1.16–1.50)	1.54 (1.35–1.76)	1.84 (1.60–2.09)	2.07 (1.80–2.35)	2.32 (2.00–2.62)	2.57 (2.19–2.91)	2.91 (2.46–3.30)	3.18 (2.68–3.62)
24-hr	0.932 (0.822–1.06)	1.17 (1.03–1.33)	1.47 (1.29–1.67)	1.70 (1.50–1.93)	2.02 (1.77–2.29)	2.26 (1.98–2.56)	2.52 (2.20–2.85)	2.78 (2.41–3.13)	3.13 (2.69–3.53)	3.40 (2.91–3.84)
2-day	0.983 (0.874–1.11)	1.23 (1.10–1.39)	1.54 (1.37–1.74)	1.79 (1.59–2.01)	2.11 (1.87–2.37)	2.37 (2.08–2.65)	2.62 (2.31–2.94)	2.89 (2.52–3.24)	3.24 (2.82–3.64)	3.51 (3.04–3.95)
3-day	1.13 (1.02–1.25)	1.41 (1.27–1.56)	1.74 (1.57–1.93)	2.00 (1.81–2.21)	2.36 (2.12–2.60)	2.62 (2.35–2.90)	2.90 (2.59–3.20)	3.17 (2.83–3.50)	3.54 (3.14–3.91)	3.81 (3.37–4.23)
4-day	1.27 (1.17–1.39)	1.58 (1.45–1.73)	1.94 (1.77–2.12)	2.22 (2.03–2.42)	2.60 (2.37–2.83)	2.88 (2.62–3.14)	3.17 (2.88–3.45)	3.46 (3.13–3.77)	3.83 (3.46–4.18)	4.12 (3.70–4.50)
7-day	1.46 (1.34–1.59)	1.81 (1.66–1.97)	2.20 (2.02–2.39)	2.50 (2.30–2.71)	2.90 (2.66–3.14)	3.20 (2.93–3.46)	3.49 (3.19–3.78)	3.77 (3.44–4.09)	4.14 (3.77–4.49)	4.40 (4.00–4.78)
10-day	1.61 (1.48–1.75)	2.00 (1.83–2.17)	2.44 (2.25–2.64)	2.79 (2.56–3.02)	3.25 (2.98–3.51)	3.59 (3.29–3.87)	3.94 (3.59–4.24)	4.27 (3.89–4.61)	4.71 (4.27–5.08)	5.03 (4.55–5.43)
20-day	2.01 (1.84–2.19)	2.49 (2.29–2.72)	3.03 (2.78–3.29)	3.42 (3.15–3.71)	3.93 (3.61–4.26)	4.30 (3.94–4.65)	4.65 (4.26–5.03)	4.98 (4.55–5.39)	5.39 (4.92–5.84)	5.68 (5.18–6.15)
30-day	2.40 (2.21–2.60)	2.98 (2.74–3.22)	3.58 (3.29–3.86)	4.02 (3.70–4.33)	4.57 (4.20–4.92)	4.96 (4.56–5.34)	5.33 (4.89–5.73)	5.67 (5.20–6.10)	6.08 (5.56–6.54)	6.36 (5.81–6.84)
45-day	2.93 (2.71–3.17)	3.63 (3.35–3.92)	4.32 (3.99–4.65)	4.81 (4.44–5.17)	5.40 (4.99–5.80)	5.79 (5.36–6.23)	6.15 (5.69–6.60)	6.46 (5.97–6.93)	6.80 (6.30–7.29)	7.00 (6.50–7.50)
60-day	3.37 (3.11–3.64)	4.16 (3.85–4.50)	4.95 (4.59–5.35)	5.52 (5.11–5.95)	6.19 (5.74–6.67)	6.65 (6.16–7.16)	7.07 (6.55–7.61)	7.43 (6.89–8.00)	7.84 (7.28–8.44)	8.08 (7.52–8.70)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).
 Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.
 Please refer to NOAA Atlas 14 document for more information.

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UPPER PIEDRAS MARCADAS WATERSHED DRAINAGE AND WATER QUALITY MANAGEMENT PLAN EXISTING CONDITIONS REPORT

User Specified Hyetograph						
Rainfall Depths in Inches						
Duration	Average Recurrence Interval (years)					
	2	5	10	25	50	100
6-hour	0.932	1.210	1.420	1.720	1.950	2.200
24-hour	1.170	1.470	1.700	2.020	2.260	2.520

t (min)	dd(in)
0	0
15	0.0058
30	0.0060
45	0.0062
60	0.0064
75	0.0066
90	0.0068
105	0.0070
120	0.0072
135	0.0074
150	0.0076
165	0.0078
180	0.0082
195	0.0086
210	0.0090
225	0.0094
240	0.0098
255	0.0103
270	0.0140
285	0.0168
300	0.0210
315	0.0246
330	0.2497
345	1.1081
360	0.4277
375	0.1586
390	0.0228
405	0.0192
420	0.0154
435	0.0126
450	0.0101
465	0.0096
480	0.0092
495	0.0088

t (min)	dd(in)
510	0.0084
525	0.0080
540	0.0077
555	0.0075
570	0.0073
585	0.0071
600	0.0069
615	0.0067
630	0.0065
645	0.0063
660	0.0061
675	0.0059
690	0.0057
705	0.0056
720	0.0055
735	0.0050
750	0.0049
765	0.0048
780	0.0048
795	0.0047
810	0.0046
825	0.0045
840	0.0045
855	0.0044
870	0.0043
885	0.0043
900	0.0042
915	0.0041
930	0.0041
945	0.0040
960	0.0039
975	0.0039
990	0.0038
1005	0.0037

t (min)	dd(in)
1020	0.0036
1035	0.0036
1050	0.0035
1065	0.0034
1080	0.0034
1095	0.0033
1110	0.0032
1125	0.0032
1140	0.0031
1155	0.0030
1170	0.0030
1185	0.0029
1200	0.0028
1215	0.0027
1230	0.0027
1245	0.0026
1260	0.0025
1275	0.0025
1290	0.0024
1305	0.0023
1320	0.0023
1335	0.0022
1350	0.0021
1365	0.0020
1380	0.0020
1395	0.0019
1410	0.0018
1425	0.0018
1440	0.0017



UPPER PIEDRAS MARCADAS WATERSHED DRAINAGE AND WATER QUALITY MANAGEMENT PLAN EXISTING CONDITIONS REPORT

Project: Existing Conditions

Simulation Run: 100 Year - 24hour Type II-a

Start of Run: 01 Jan 2013, 00:00

Basin Model: Existing Basins

End of Run: 02 Jan 2013, 00:00

Meteorologic Model: 100 yr storm

Compute Time: 06Mar2015, 10:51:04

Control Specifications: Control 1 - 24 hr

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
AP-1	0.1256	75.2	01Jan2013, 06:10	5.529
AP-2	0.24419	92.9	01Jan2013, 06:04	6.407
AP-3	1.0034	174.6	01Jan2013, 06:33	28.052
AP-4	1.37319	287.9	01Jan2013, 06:25	39.954
AP-5	0.0803	28.3	01Jan2013, 06:19	2.712
AP-7	0.1118	36.9	01Jan2013, 06:26	4.040
AP-8	0.1658	42.3	01Jan2013, 06:36	5.859
AP-9	0.0306	14.2	01Jan2013, 06:08	1.108
AP-10	0.0438	21.5	01Jan2013, 06:09	1.696
AP-11	0.4031	123.9	01Jan2013, 06:29	14.151
AP-12	0.1599	61.4	01Jan2013, 06:14	5.404
AP-13	0.0277	14.8	01Jan2013, 05:54	0.938
AP-14	0.042	20.5	01Jan2013, 06:00	1.422
AP-15	0.0843	36.2	01Jan2013, 06:08	2.851
AP-16	0.0965	60.0	01Jan2013, 06:02	4.251
AP-17	0.0514	50.1	01Jan2013, 05:53	2.879
Basin 102A	0.1118	36.9	01Jan2013, 06:26	4.040
Basin 102B	0.054	24.3	01Jan2013, 06:06	1.827
Basin 102C	0.0306	14.2	01Jan2013, 06:08	1.108
Basin 102D	0.0438	21.5	01Jan2013, 06:09	1.696
Basin 103	0.0803	28.3	01Jan2013, 06:19	2.712
Basin 104	0.0843	36.2	01Jan2013, 06:08	2.851
Basin 105A	0.0965	60.0	01Jan2013, 06:02	4.251
Basin 105B	0.0291	19.0	01Jan2013, 05:59	1.282
Basin 106A	0.1629	52.8	01Jan2013, 06:23	5.498
Basin 106B	0.1599	61.4	01Jan2013, 06:14	5.404
Basin 106C	0.0277	14.8	01Jan2013, 05:54	0.938
Basin 106D	0.042	20.5	01Jan2013, 06:00	1.422
Basin 107	0.389	59.3	01Jan2013, 06:16	5.692
Basin 108	0.17449	58.7	01Jan2013, 06:03	4.050
Basin 109	0.0514	50.1	01Jan2013, 05:53	2.879
Reach-1	0.1118	36.9	01Jan2013, 06:42	4.033
Reach-2	0.1658	42.3	01Jan2013, 06:42	5.855
Reach-3	0.0306	14.2	01Jan2013, 06:27	1.106
Reach-4	0.0438	21.5	01Jan2013, 06:32	1.692
Reach-5	0.0514	50.1	01Jan2013, 06:20	2.872
Reach-6	0.4031	123.9	01Jan2013, 07:02	14.095
Reach-7	0.1599	61.4	01Jan2013, 06:31	5.393
Reach-8	1.0034	174.6	01Jan2013, 06:39	28.030
Reach-9	0.0277	14.8	01Jan2013, 06:03	0.937
Reach-10	0.042	20.5	01Jan2013, 06:08	1.420
Reach-11	0.24419	92.9	01Jan2013, 06:10	6.402
Reach-13	0.0965	60.0	01Jan2013, 06:12	4.246
Reach-14	0.1256	75.2	01Jan2013, 06:22	5.522



UPPER PIEDRAS MARCADAS WATERSHED DRAINAGE AND WATER QUALITY MANAGEMENT PLAN EXISTING CONDITIONS REPORT

Project: Existing Conditions

Simulation Run: 100 Year - 6hour Type II-a

Start of Run: 01 Jan 2013, 00:00

Basin Model: Existing Basins

End of Run: 02 Jan 2013, 00:00

Meteorologic Model: 100 yr storm

Compute Time: 06Mar2015, 10:51:49

Control Specifications: Control 2 - 6 hr

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
AP-1	0.1256	52.14	01Jan2013, 06:00	0.540
AP-2	0.24419	87.68	01Jan2013, 06:00	1.198
AP-3	1.0034	30.22	01Jan2013, 06:00	0.229
AP-4	1.37319	89.9	01Jan2013, 06:00	0.672
AP-5	0.0803	14.4	01Jan2013, 06:00	0.139
AP-7	0.1118	12.96	01Jan2013, 06:00	0.122
AP-8	0.1658	23.1	01Jan2013, 06:00	0.288
AP-9	0.0306	12.25	01Jan2013, 06:00	0.148
AP-10	0.0438	18.04	01Jan2013, 06:00	0.216
AP-11	0.4031	37.58	01Jan2013, 06:00	0.323
AP-12	0.1599	39.63	01Jan2013, 06:00	0.407
AP-13	0.0277	14.76	01Jan2013, 05:54	0.288
AP-14	0.042	20.46	01Jan2013, 06:00	0.334
AP-15	0.0843	30.53	01Jan2013, 06:00	0.360
AP-16	0.0965	59.28	01Jan2013, 06:00	0.896
AP-17	0.0514	50.1	01Jan2013, 05:53	1.077
Basin 102A	0.1118	12.96	01Jan2013, 06:00	0.122
Basin 102B	0.054	22.28	01Jan2013, 06:00	0.285
Basin 102C	0.0306	12.25	01Jan2013, 06:00	0.148
Basin 102D	0.0438	18.04	01Jan2013, 06:00	0.216
Basin 103	0.0803	14.4	01Jan2013, 06:00	0.139
Basin 104	0.0843	30.53	01Jan2013, 06:00	0.360
Basin 105A	0.0965	59.28	01Jan2013, 06:00	0.896
Basin 105B	0.0291	18.99	01Jan2013, 05:59	0.327
Basin 106A	0.1629	21.15	01Jan2013, 06:00	0.198
Basin 106B	0.1599	39.63	01Jan2013, 06:00	0.407
Basin 106C	0.0277	14.76	01Jan2013, 05:54	0.288
Basin 106D	0.042	20.46	01Jan2013, 06:00	0.334
Basin 107	0.389	28.21	01Jan2013, 06:00	0.223
Basin 108	0.17449	57.31	01Jan2013, 06:00	0.967
Basin 109	0.0514	50.1	01Jan2013, 05:53	1.077
Reach-1	0.1118	0.83	01Jan2013, 06:00	0.003
Reach-2	0.1658	15.98	01Jan2013, 06:00	0.124
Reach-3	0.0306	0.38	01Jan2013, 06:00	0.001
Reach-4	0.0438	0.07	01Jan2013, 06:00	0.000
Reach-5	0.0514	0.17	01Jan2013, 06:00	0.000
Reach-6	0.4031	0	01Jan2013, 00:00	0.000
Reach-7	0.1599	1.84	01Jan2013, 06:00	0.006
Reach-8	1.0034	11.87	01Jan2013, 06:00	0.061
Reach-9	0.0277	14.02	01Jan2013, 06:00	0.110
Reach-10	0.042	16.36	01Jan2013, 06:00	0.121
Reach-11	0.24419	67	01Jan2013, 06:00	0.552
Reach-13	0.0965	33.18	01Jan2013, 06:00	0.214
Reach-14	0.1256	11.04	01Jan2013, 06:00	0.059



UPPER PIEDRAS MARCADAS WATERSHED DRAINAGE AND WATER QUALITY MANAGEMENT PLAN EXISTING CONDITIONS REPORT

Project: Existing Conditions

Simulation Run: 10 Year - 24hour Type II-a

Start of Run: 01 Jan 2013, 00:00

Basin Model: Existing Basins

End of Run: 02 Jan 2013, 00:00

Meteorologic Model: 10 yr storm

Compute Time: 06Mar2015, 10:52:24

Control Specifications: Control 1 - 24 hr

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
AP-1	0.1256	22.6	01Jan2013, 06:15	2.181
AP-2	0.24419	17.56	01Jan2013, 06:09	1.881
AP-3	1.0034	41.82	01Jan2013, 07:00	8.992
AP-4	1.37319	65.85	01Jan2013, 06:28	13.035
AP-5	0.0803	6.87	01Jan2013, 06:24	0.926
AP-7	0.1118	9.58	01Jan2013, 06:31	1.434
AP-8	0.1658	11.03	01Jan2013, 06:43	2.054
AP-9	0.0306	3.67	01Jan2013, 06:12	0.394
AP-10	0.0438	5.87	01Jan2013, 06:12	0.625
AP-11	0.4031	31.52	01Jan2013, 06:34	4.943
AP-12	0.1599	14.89	01Jan2013, 06:19	1.845
AP-13	0.0277	3.67	01Jan2013, 06:04	0.321
AP-14	0.042	5.12	01Jan2013, 06:07	0.486
AP-15	0.0843	8.77	01Jan2013, 06:13	0.974
AP-16	0.0965	18.16	01Jan2013, 06:07	1.677
AP-17	0.0514	16.99	01Jan2013, 05:55	1.275
Basin 102A	0.1118	9.58	01Jan2013, 06:31	1.434
Basin 102B	0.054	5.9	01Jan2013, 06:11	0.624
Basin 102C	0.0306	3.67	01Jan2013, 06:12	0.394
Basin 102D	0.0438	5.87	01Jan2013, 06:12	0.625
Basin 103	0.0803	6.87	01Jan2013, 06:24	0.926
Basin 104	0.0843	8.77	01Jan2013, 06:13	0.974
Basin 105A	0.0965	18.16	01Jan2013, 06:07	1.677
Basin 105B	0.0291	5.71	01Jan2013, 06:05	0.506
Basin 106A	0.1629	12.85	01Jan2013, 06:28	1.876
Basin 106B	0.1599	14.89	01Jan2013, 06:19	1.845
Basin 106C	0.0277	3.67	01Jan2013, 06:04	0.321
Basin 106D	0.042	5.12	01Jan2013, 06:07	0.486
Basin 107	0.389	3.49	01Jan2013, 06:29	0.974
Basin 108	0.17449	10.04	01Jan2013, 06:06	1.075
Basin 109	0.0514	16.99	01Jan2013, 05:55	1.275
Reach-1	0.1118	9.58	01Jan2013, 06:47	1.429
Reach-2	0.1658	11.03	01Jan2013, 06:49	2.051
Reach-3	0.0306	3.67	01Jan2013, 06:31	0.393
Reach-4	0.0438	5.87	01Jan2013, 06:35	0.623
Reach-5	0.0514	16.99	01Jan2013, 06:22	1.270
Reach-6	0.4031	31.52	01Jan2013, 07:07	4.909
Reach-7	0.1599	14.89	01Jan2013, 06:36	1.839
Reach-8	1.0034	41.82	01Jan2013, 07:06	8.980
Reach-9	0.0277	3.67	01Jan2013, 06:13	0.320
Reach-10	0.042	5.12	01Jan2013, 06:15	0.485
Reach-11	0.24419	17.56	01Jan2013, 06:15	1.878
Reach-13	0.0965	18.16	01Jan2013, 06:17	1.675
Reach-14	0.1256	22.6	01Jan2013, 06:27	2.176



UPPER PIEDRAS MARCADAS WATERSHED DRAINAGE AND WATER QUALITY MANAGEMENT PLAN EXISTING CONDITIONS REPORT

Project: Existing Conditions

Simulation Run: 10 Year - 6hour Type II-a

Start of Run: 01 Jan 2013, 00:00

Basin Model: Existing Basins

End of Run: 02 Jan 2013, 00:00

Meteorologic Model: 10 yr storm

Compute Time: 06Mar2015, 10:52:24

Control Specifications: Control 2 - 6 hr

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
AP-1	0.1256	11.62	01Jan2013, 06:00	0.102
AP-2	0.24419	11.43	01Jan2013, 06:00	0.075
AP-3	1.0034	0.1	01Jan2013, 06:00	0.000
AP-4	1.37319	5.43	01Jan2013, 06:00	0.021
AP-5	0.0803	2.12	01Jan2013, 06:00	0.016
AP-7	0.1118	2.05	01Jan2013, 06:00	0.016
AP-8	0.1658	4.11	01Jan2013, 06:00	0.038
AP-9	0.0306	2.37	01Jan2013, 06:00	0.022
AP-10	0.0438	3.79	01Jan2013, 06:00	0.036
AP-11	0.4031	5.13	01Jan2013, 06:00	0.035
AP-12	0.1599	6.16	01Jan2013, 06:00	0.049
AP-13	0.0277	3.38	01Jan2013, 06:00	0.046
AP-14	0.042	4.38	01Jan2013, 06:00	0.048
AP-15	0.0843	5.26	01Jan2013, 06:00	0.046
AP-16	0.0965	16.11	01Jan2013, 06:00	0.191
AP-17	0.0514	16.99	01Jan2013, 05:55	0.328
Basin 102A	0.1118	2.05	01Jan2013, 06:00	0.016
Basin 102B	0.054	4.06	01Jan2013, 06:00	0.038
Basin 102C	0.0306	2.37	01Jan2013, 06:00	0.022
Basin 102D	0.0438	3.79	01Jan2013, 06:00	0.036
Basin 103	0.0803	2.12	01Jan2013, 06:00	0.016
Basin 104	0.0843	5.26	01Jan2013, 06:00	0.046
Basin 105A	0.0965	16.11	01Jan2013, 06:00	0.191
Basin 105B	0.0291	5.43	01Jan2013, 06:00	0.072
Basin 106A	0.1629	3	01Jan2013, 06:00	0.023
Basin 106B	0.1599	6.16	01Jan2013, 06:00	0.049
Basin 106C	0.0277	3.38	01Jan2013, 06:00	0.046
Basin 106D	0.042	4.38	01Jan2013, 06:00	0.048
Basin 107	0.389	0.05	01Jan2013, 06:00	0.000
Basin 108	0.17449	7.13	01Jan2013, 06:00	0.054
Basin 109	0.0514	16.99	01Jan2013, 05:55	0.328
Reach-1	0.1118	0.05	01Jan2013, 06:00	0.000
Reach-2	0.1658	2.13	01Jan2013, 06:00	0.012
Reach-3	0.0306	0.01	01Jan2013, 06:00	0.000
Reach-4	0.0438	0	01Jan2013, 00:00	0.000
Reach-5	0.0514	0	01Jan2013, 06:00	0.000
Reach-6	0.4031	0	01Jan2013, 00:00	0.000
Reach-7	0.1599	0.05	01Jan2013, 06:00	0.000
Reach-8	1.0034	0	01Jan2013, 00:00	0.000
Reach-9	0.0277	2.08	01Jan2013, 06:00	0.010
Reach-10	0.042	2.21	01Jan2013, 06:00	0.011
Reach-11	0.24419	3.69	01Jan2013, 06:00	0.014
Reach-13	0.0965	6.19	01Jan2013, 06:00	0.030
Reach-14	0.1256	1.74	01Jan2013, 06:00	0.007



UPPER PIEDRAS MARCADAS WATERSHED DRAINAGE AND WATER QUALITY MANAGEMENT PLAN EXISTING CONDITIONS REPORT

Project: Existing Conditions

Simulation Run: 10 Year - 2hour Type II-a

Start of Run: 01 Jan 2013, 00:00

Basin Model: Existing Basins

End of Run: 02 Jan 2013, 00:00

Meteorologic Model: 2 yr storm

Compute Time: 06Mar2015, 10:53:22

Control Specifications: Control 1 - 24 hr

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
AP-1	0.1256	3.57	01Jan2013, 06:22	0.673
AP-2	0.24419	0.57	01Jan2013, 06:29	0.289
AP-3	1.0034	4.53	01Jan2013, 06:33	2.055
AP-4	1.37319	8.53	01Jan2013, 06:38	3.009
AP-5	0.0803	0.45	01Jan2013, 06:40	0.208
AP-7	0.1118	0.87	01Jan2013, 06:46	0.354
AP-8	0.1658	1.1	01Jan2013, 07:00	0.492
AP-9	0.0306	0.33	01Jan2013, 06:25	0.098
AP-10	0.0438	0.66	01Jan2013, 06:24	0.168
AP-11	0.4031	2.72	01Jan2013, 06:51	1.176
AP-12	0.1599	0.97	01Jan2013, 06:34	0.415
AP-13	0.0277	0.24	01Jan2013, 06:19	0.072
AP-14	0.042	0.33	01Jan2013, 06:22	0.110
AP-15	0.0843	0.57	01Jan2013, 06:27	0.220
AP-16	0.0965	2.83	01Jan2013, 06:14	0.518
AP-17	0.0514	4.08	01Jan2013, 06:05	0.485
Basin 102A	0.1118	0.87	01Jan2013, 06:46	0.354
Basin 102B	0.054	0.38	01Jan2013, 06:25	0.141
Basin 102C	0.0306	0.33	01Jan2013, 06:25	0.098
Basin 102D	0.0438	0.66	01Jan2013, 06:24	0.168
Basin 103	0.0803	0.45	01Jan2013, 06:40	0.208
Basin 104	0.0843	0.57	01Jan2013, 06:27	0.220
Basin 105A	0.0965	2.83	01Jan2013, 06:14	0.518
Basin 105B	0.0291	0.9	01Jan2013, 06:11	0.156
Basin 106A	0.1629	0.87	01Jan2013, 06:46	0.421
Basin 106B	0.1599	0.97	01Jan2013, 06:34	0.415
Basin 106C	0.0277	0.24	01Jan2013, 06:19	0.072
Basin 106D	0.042	0.33	01Jan2013, 06:22	0.110
Basin 107	0.389	0	01Jan2013, 00:00	0.000
Basin 108	0.17449	0.09	01Jan2013, 16:19	0.107
Basin 109	0.0514	4.08	01Jan2013, 06:05	0.485
Reach-1	0.1118	0.87	01Jan2013, 07:02	0.352
Reach-2	0.1658	1.1	01Jan2013, 07:06	0.491
Reach-3	0.0306	0.33	01Jan2013, 06:44	0.097
Reach-4	0.0438	0.66	01Jan2013, 06:47	0.167
Reach-5	0.0514	4.08	01Jan2013, 06:32	0.482
Reach-6	0.4031	2.72	01Jan2013, 07:24	1.161
Reach-7	0.1599	0.97	01Jan2013, 06:51	0.413
Reach-8	1.0034	4.53	01Jan2013, 06:39	2.050
Reach-9	0.0277	0.24	01Jan2013, 06:28	0.072
Reach-10	0.042	0.33	01Jan2013, 06:30	0.109
Reach-11	0.24419	0.57	01Jan2013, 06:35	0.288
Reach-13	0.0965	2.83	01Jan2013, 06:24	0.517
Reach-14	0.1256	3.57	01Jan2013, 06:34	0.671



UPPER PIEDRAS MARCADAS WATERSHED DRAINAGE AND WATER QUALITY MANAGEMENT PLAN EXISTING CONDITIONS REPORT

Project: Existing Conditions

Simulation Run: 2 Year - 6hour Type II-a

Start of Run: 01 Jan 2013, 00:00

Basin Model: Existing Basins

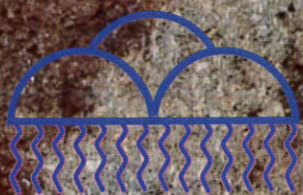
End of Run: 02 Jan 2013, 00:00

Meteorologic Model: 2 yr storm

Compute Time: 06Mar2015, 10:53:52

Control Specifications: Control 2 - 6 hr

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
AP-1	0.1256	0.64	01Jan2013, 06:00	0.004
AP-2	0.24419	0	01Jan2013, 00:00	0.000
AP-3	1.0034	0	01Jan2013, 00:00	0.000
AP-4	1.37319	0.03	01Jan2013, 06:00	0.000
AP-5	0.0803	0.01	01Jan2013, 06:00	0.000
AP-7	0.1118	0.02	01Jan2013, 06:00	0.000
AP-8	0.1658	0.01	01Jan2013, 06:00	0.000
AP-9	0.0306	0.02	01Jan2013, 06:00	0.000
AP-10	0.0438	0.09	01Jan2013, 06:00	0.000
AP-11	0.4031	0.01	01Jan2013, 06:00	0.000
AP-12	0.1599	0.02	01Jan2013, 06:00	0.000
AP-13	0.0277	0.03	01Jan2013, 06:00	0.000
AP-14	0.042	0.02	01Jan2013, 06:00	0.000
AP-15	0.0843	0.02	01Jan2013, 06:00	0.000
AP-16	0.0965	1.31	01Jan2013, 06:00	0.009
AP-17	0.0514	3.83	01Jan2013, 06:00	0.054
Basin 102A	0.1118	0.02	01Jan2013, 06:00	0.000
Basin 102B	0.054	0.01	01Jan2013, 06:00	0.000
Basin 102C	0.0306	0.02	01Jan2013, 06:00	0.000
Basin 102D	0.0438	0.09	01Jan2013, 06:00	0.000
Basin 103	0.0803	0.01	01Jan2013, 06:00	0.000
Basin 104	0.0843	0.02	01Jan2013, 06:00	0.000
Basin 105A	0.0965	1.31	01Jan2013, 06:00	0.009
Basin 105B	0.0291	0.5	01Jan2013, 06:00	0.004
Basin 106A	0.1629	0.01	01Jan2013, 06:00	0.000
Basin 106B	0.1599	0.02	01Jan2013, 06:00	0.000
Basin 106C	0.0277	0.03	01Jan2013, 06:00	0.000
Basin 106D	0.042	0.02	01Jan2013, 06:00	0.000
Basin 107	0.389	0	01Jan2013, 00:00	0.000
Basin 108	0.17449	0	01Jan2013, 00:00	0.000
Basin 109	0.0514	3.83	01Jan2013, 06:00	0.054
Reach-1	0.1118	0	01Jan2013, 00:00	0.000
Reach-2	0.1658	0	01Jan2013, 06:00	0.000
Reach-3	0.0306	0	01Jan2013, 00:00	0.000
Reach-4	0.0438	0	01Jan2013, 00:00	0.000
Reach-5	0.0514	0	01Jan2013, 00:00	0.000
Reach-6	0.4031	0	01Jan2013, 00:00	0.000
Reach-7	0.1599	0	01Jan2013, 00:00	0.000
Reach-8	1.0034	0	01Jan2013, 00:00	0.000
Reach-9	0.0277	0	01Jan2013, 00:00	0.000
Reach-10	0.042	0	01Jan2013, 00:00	0.000
Reach-11	0.24419	0	01Jan2013, 00:00	0.000
Reach-13	0.0965	0.14	01Jan2013, 06:00	0.000
Reach-14	0.1256	0.03	01Jan2013, 06:00	0.000



AMAFCA

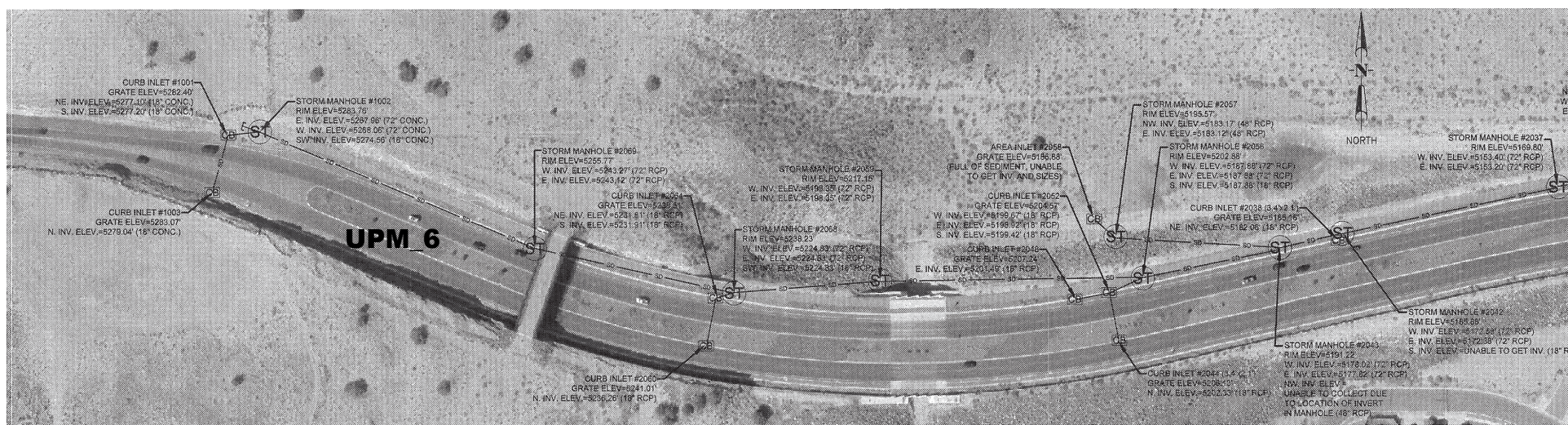




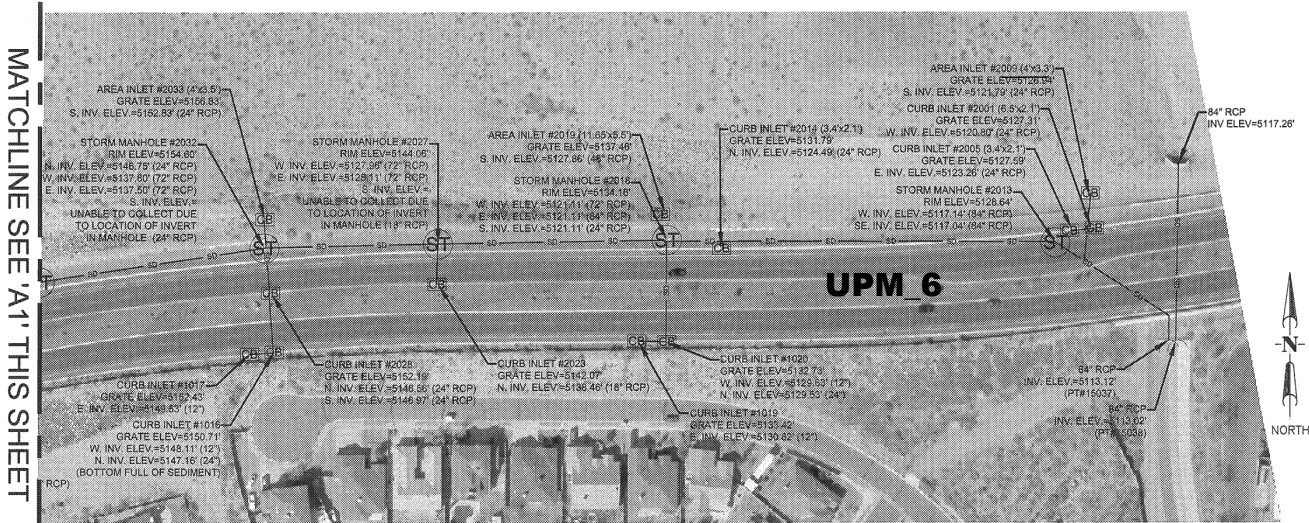
**Upper Piedras Marcadas Watershed Drainage
And Water Quality Management Plan
Existing Conditions Report**

**Appendix B
Hydraulics
Existing Capacity**

\\ms0301\00-000-0448-10\00-0448-10\00-0448-10\Upper Piedras Marcadas As-Built Survey.dwg



A1 AS-BUILT SURVEY
1" = 100'



A2 AS-BUILT SURVEY
1" = 100'

MATCHLINE SEE 'A2' THIS SHEET

GENERAL SURVEY NOTES:

1. FIELD SURVEY PERFORMED IN JULY 2013
2. US SURVEY FEET
COMBINED GRID-TO-GROUND FACTOR=1.0003278455
NEW MEXICO STATE PLANE CENTRAL ZONE
(SCALED TO GROUND AROUND 0,0)
3. HORIZONTAL DATUM:
NAD 83
4. VERTICAL DATUM:
NAVD 88
GEOID 03

CONTROL POINTS:

CONTROL POINT "ACS 7_C10":
N: 1522337.277
E: 1499891.742
ELEV: 5425.352
DESCRIPTION: 3-1/4" ALUMINUM CAP

CONTROL POINT "ACS 8_C10":
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E: 1502599.082
ELEV: 5393.212
DESCRIPTION: 3-1/4" ALUMINUM CAP

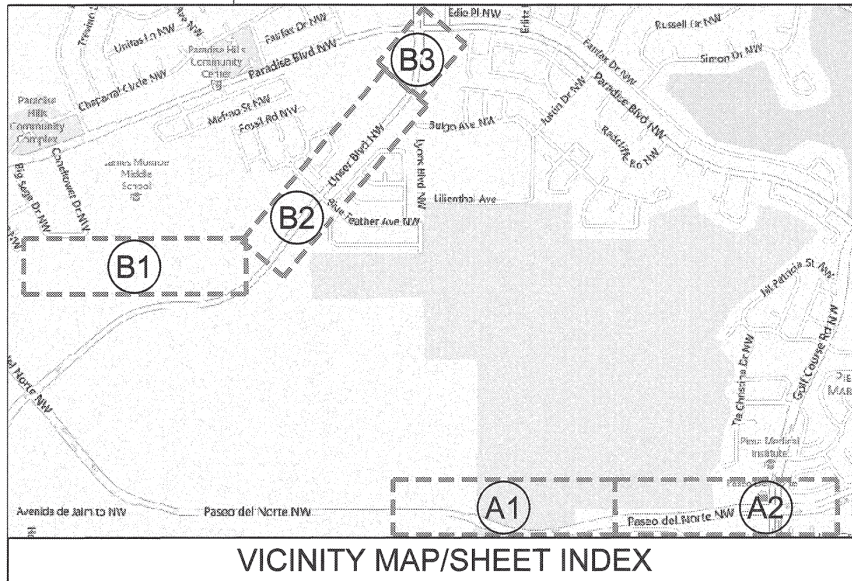
LEGEND:

- ST STORM DRAIN MANHOLE
CB STORM DRAIN INLET/CURB INLET
- SD STORM DRAIN OUTLET/INLET
SD STORM DRAIN LINE

SURVEYOR'S CERTIFICATE:

I, BENJAMIN M. ARAGON, NEW MEXICO PROFESSIONAL SURVEYOR NO. 15268, DO HEREBY CERTIFY THAT THIS AS-BUILT SURVEY WAS PERFORMED BY ME OR UNDER MY DIRECT SUPERVISION; THAT I AM RESPONSIBLE FOR THIS SURVEY; THAT THIS SURVEY MEETS THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO; AND IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

Benjamin M. Aragon
BENJAMIN M. ARAGON NMPS 15268
NEW MEXICO PROFESSIONAL SURVEYOR
15268
7-24-13
DATE



VICINITY MAP/SHEET INDEX

WILSON & COMPANY

4800 Lang Avenue, N.E.
Albuquerque, NM 87109
PH: (505) 348-4000
FAX: (505) 348-4055
www.wilsonco.com

CONSULTANTS

SEAL



PROJECT NAME
Upper Piedras Marcadas
As-Built Survey

ALBUQUERQUE, NEW MEXICO

DATE

DESCRIPTION

MARK

PROJECT NO: 10-300-048-10

DESIGNED BY:

DRAWN BY: AMT

CHECKED BY: BMA

DATE: JULY 2013

SHEET TITLE

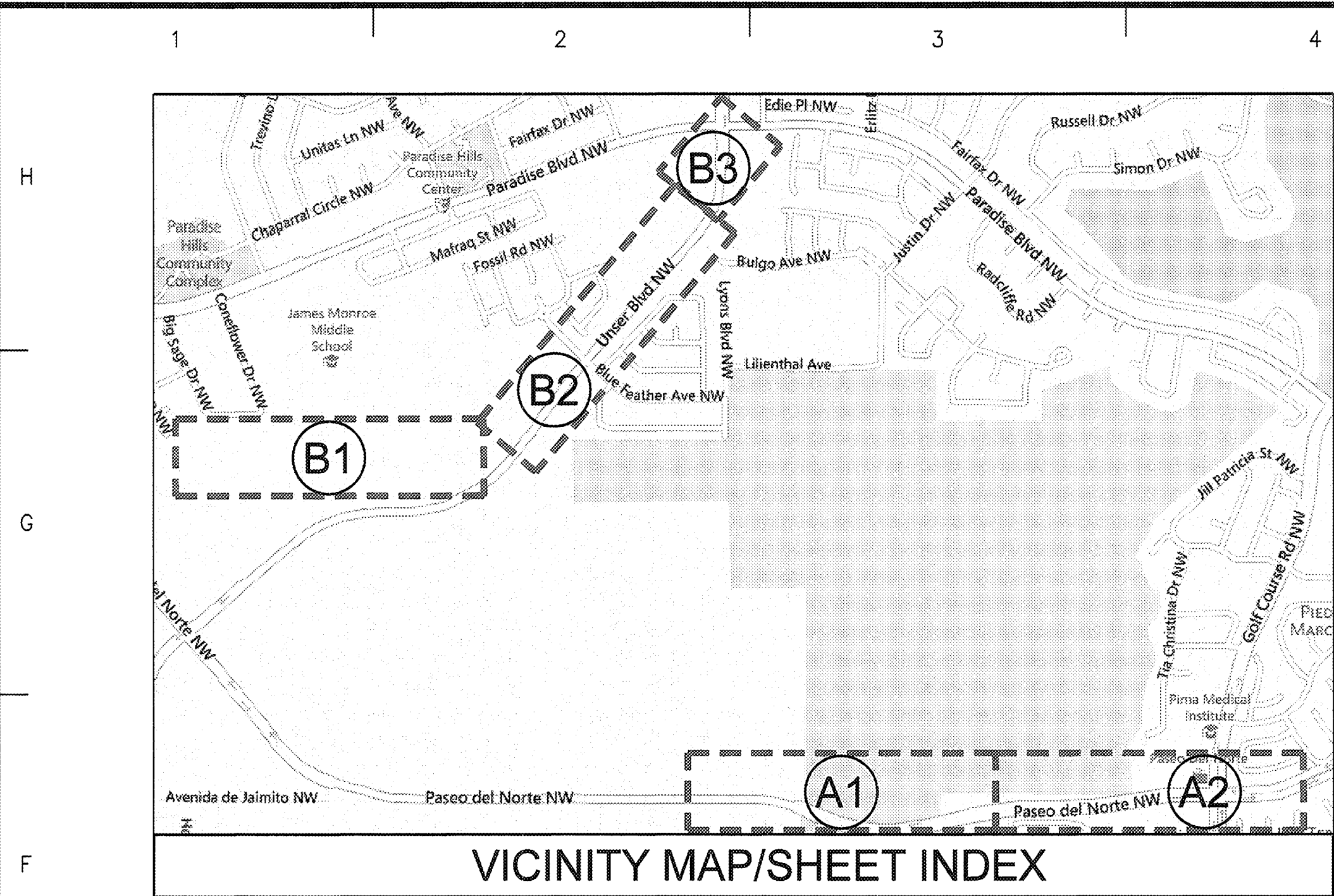
AS-BUILT
SURVEY

SHEET NO:

V-101

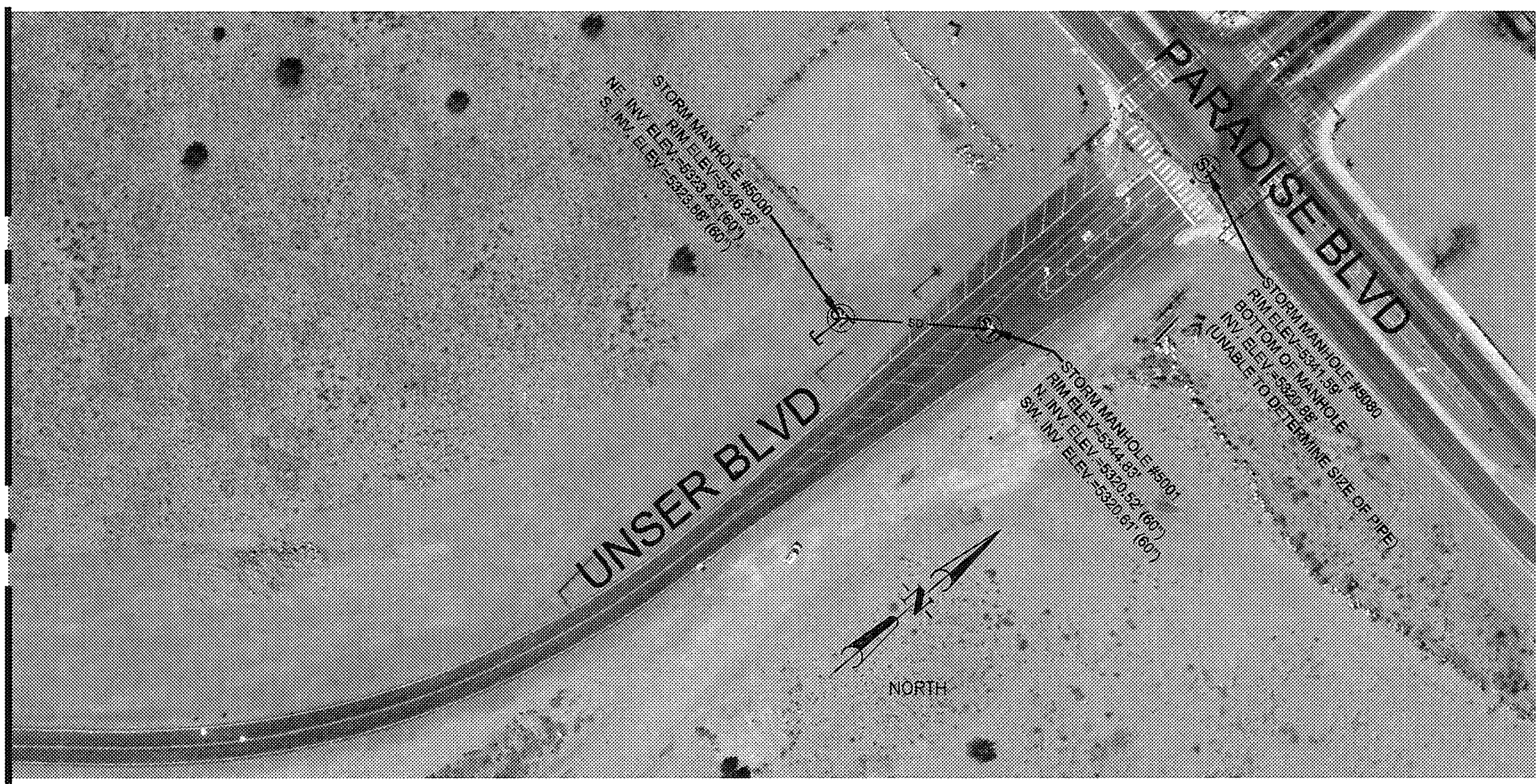
1 of 2

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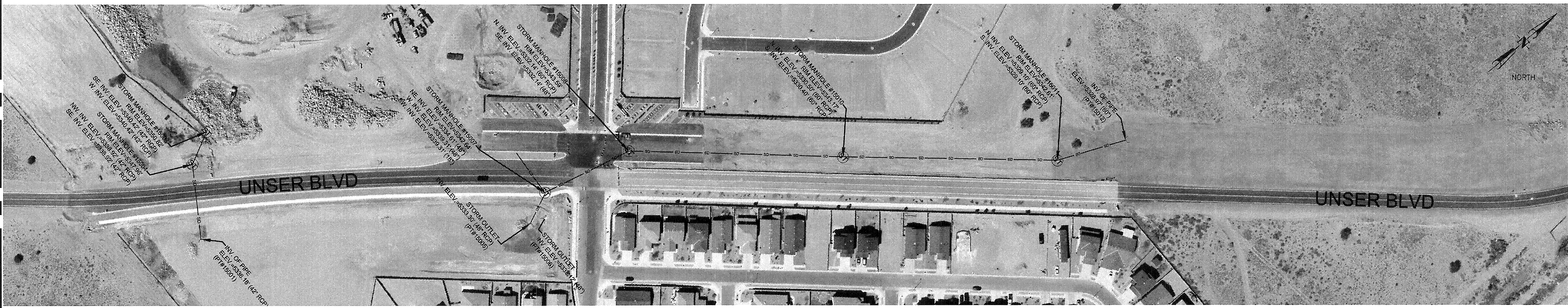
- LEGEND:**
- ST STORM DRAIN MANHOLE
 - CB STORM DRAIN INLET/CURB INLET
 - SD — STORM DRAIN OUTLET/INLET
 - SD — STORM DRAIN LINE

MATCHLINE SEE 'B2' THIS SHEET



B3 AS-BUILT SURVEY
1" = 100'

MATCHLINE SEE 'B1' THIS SHEET



B2 AS-BUILT SURVEY
1" = 100'

MATCHLINE SEE 'B3' THIS SHEET



B1 AS-BUILT SURVEY
1" = 100'

MATCHLINE SEE 'B2' THIS SHEET

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CONSULTANTS

SEAL

REGISTERED PROFESSIONAL SURVEYOR
NEW MEXICO
15268
BENJAMIN ARACON

PROJECT NAME
Upper Piedras Marcadas
As-Built Survey

DATE

DESCRIPTION

MARK

PROJECT NO: 10-300-048-10
DESIGNED BY:
DRAWN BY: AMT
CHECKED BY: BMA
DATE: JULY 2013

SHEET TITLE
AS-BUILT SURVEY

SHEET NO:
V-102
2 of 2

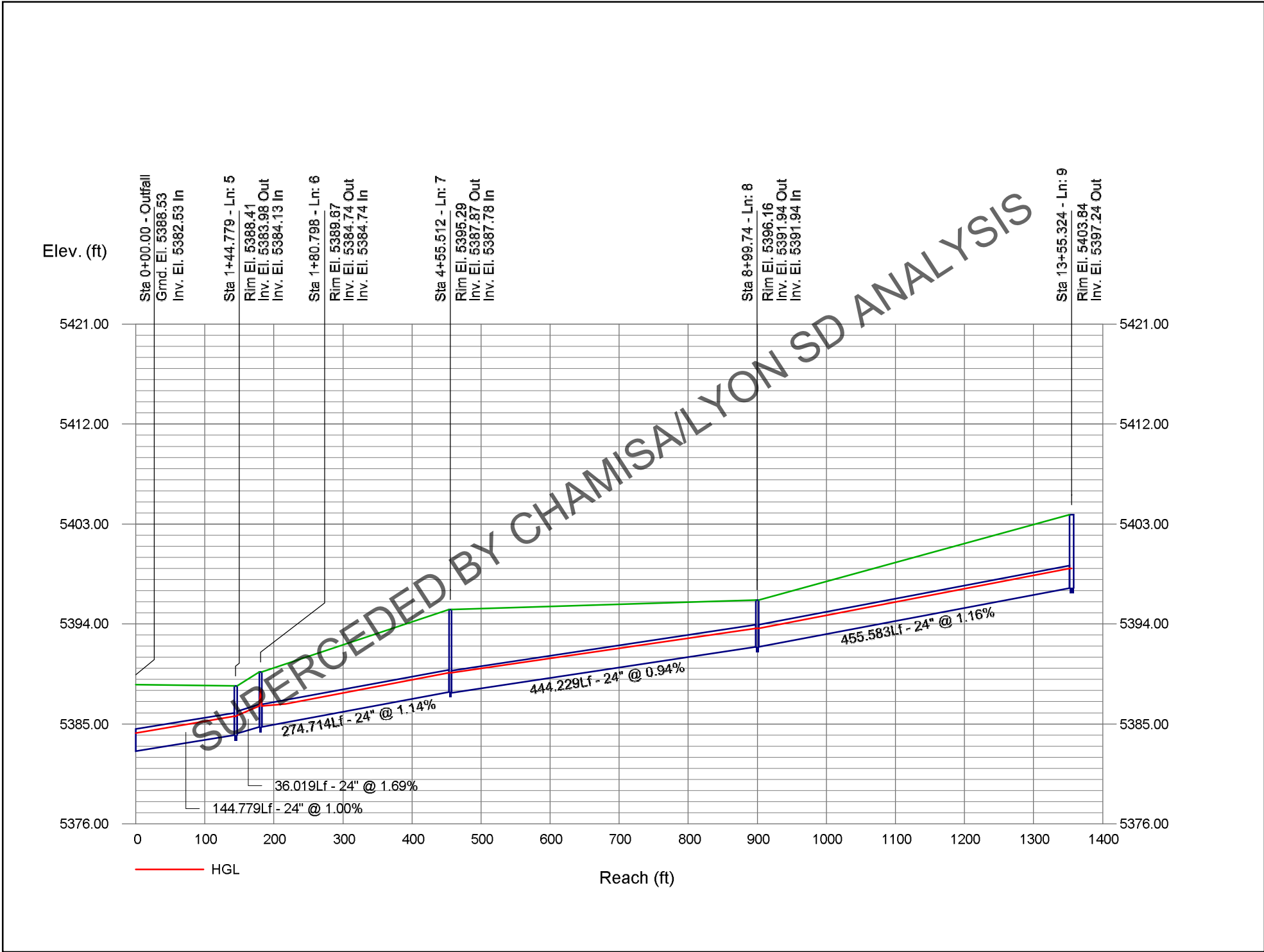
Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2012 Plan



Storm Sewer Summary Report

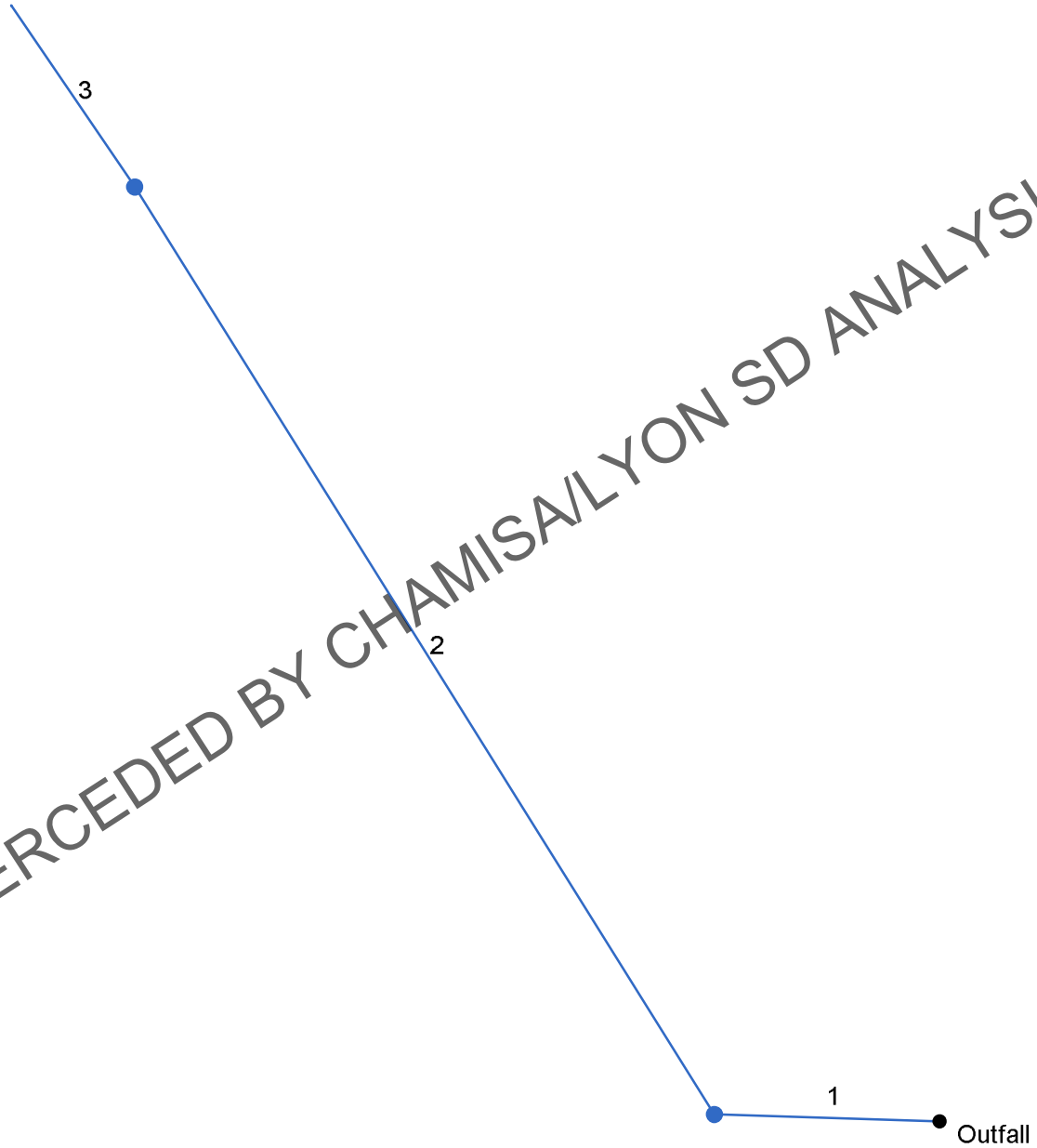
Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	Pipe - (11)	14.97	18	Cir	103.380	5392.80	5394.90	2.031	5394.03	5396.30	n/a	5396.30	End	Manhole
2	Pipe - (12)	23.98	18	Cir	22.810	5394.90	5396.09	5.217	5396.30	5397.57	n/a	5397.57	1	Manhole
3	Pipe - (13)	25.25	18	Cir	25.950	5396.09	5397.59	5.780	5397.57	5399.08	n/a	5399.08	2	Manhole
4	Pipe - (14)	23.26	24	Cir	71.859	5397.24	5398.00	1.057	5398.88	5399.71	n/a	5399.71	End	Manhole
5	Pipe - (18) (1)	22.64	24	Cir	144.779	5382.53	5383.98	1.002	5384.17	5385.67	n/a	5385.67	End	Manhole
6	Pipe - (18)	29.44	24	Cir	36.019	5384.13	5384.74	1.695	5385.77	5386.59	1.46	5388.05	5	Manhole
7	Pipe - (17)	24.14	24	Cir	274.714	5384.74	5387.87	1.139	5386.59	5389.61	n/a	5389.61 j	6	Manhole
8	Pipe - (16)	21.89	24	Cir	444.229	5387.78	5391.94	0.936	5389.61	5393.61	0.14	5393.61	7	Manhole
9	Pipe - (15)	24.40	24	Cir	455.583	5391.94	5397.24	1.163	5393.61	5398.99	n/a	5398.99	8	Manhole
10	Pipe - (20)	7.08	24	Cir	143.043	5384.28	5384.42	0.098	5385.22	5385.89	0.13	5386.02	End	Manhole
11	Pipe - (19)	45.50	24	Cir	11.861	5383.77	5384.25	4.047	5388.05*	5388.54*	3.26	5391.80	6	Manhole
Project File: UPM_1.stm									Number of lines: 11			Run Date: 9/16/2013		
NOTES: Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.														

Storm Sewer Profile



Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2012 Plan

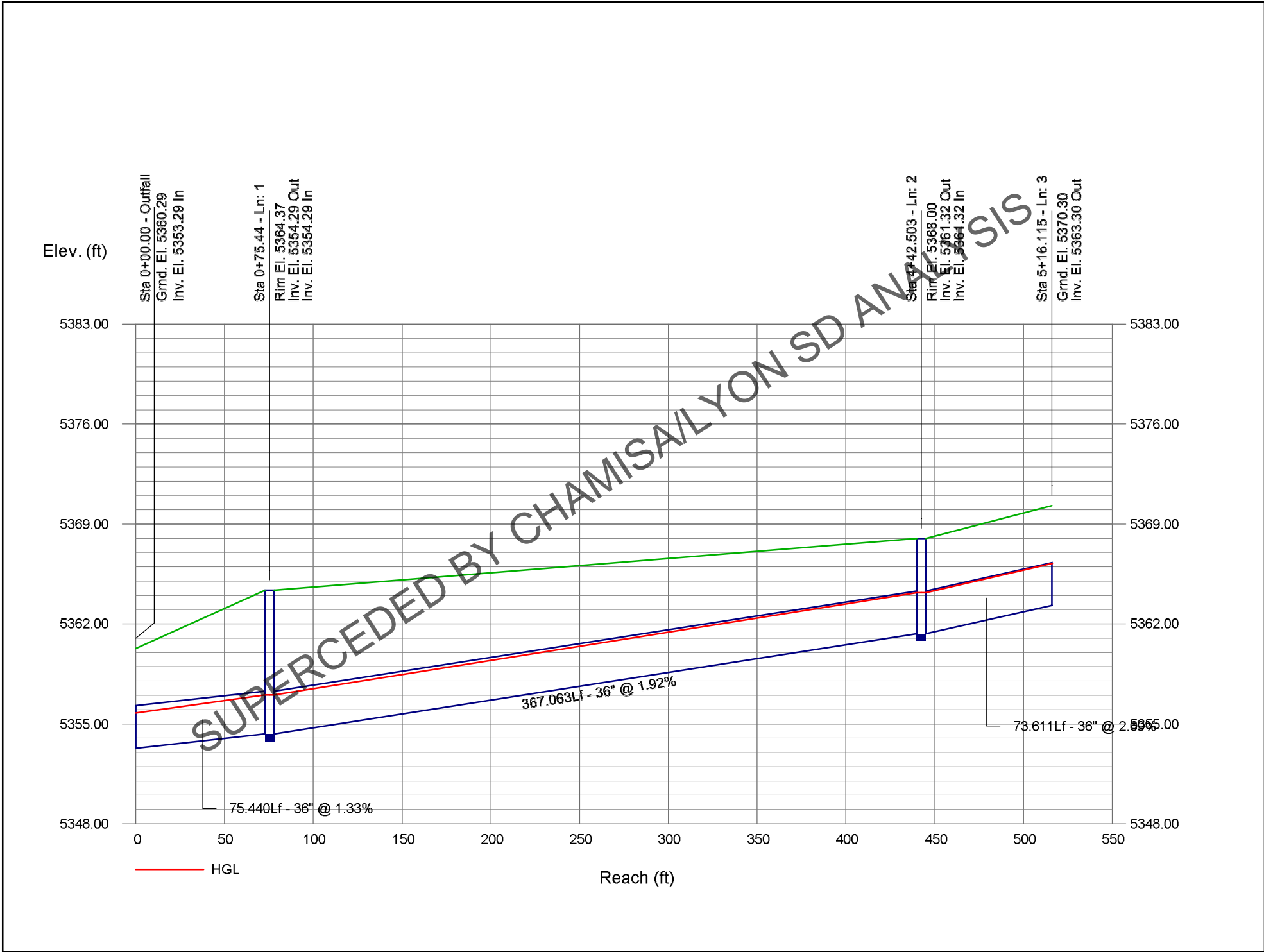
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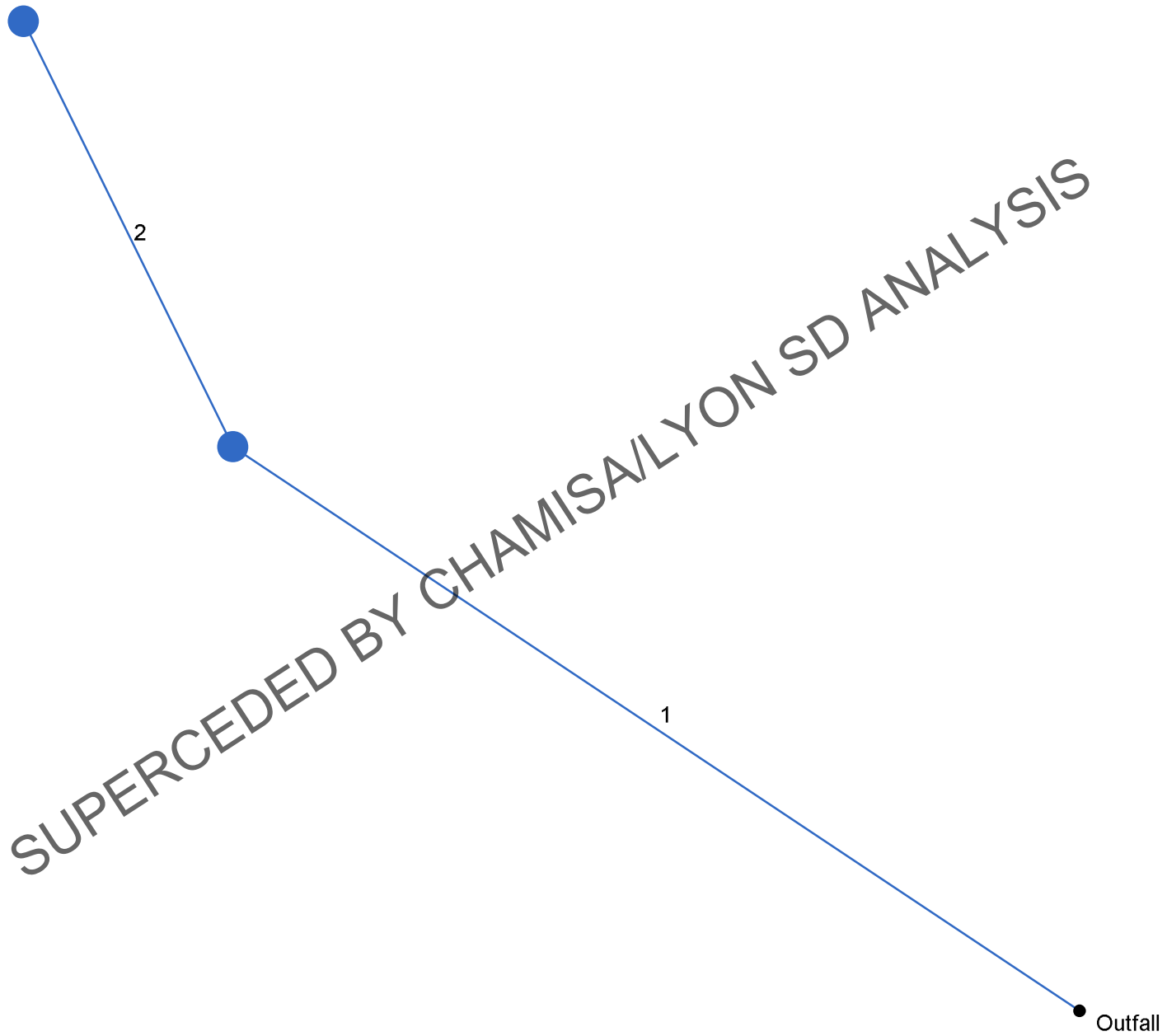
Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	Pipe - (26)	76.79	36	Cir	75.440	5353.29	5354.29	1.326	5355.75	5357.03	n/a	5357.03	End	Manhole
2	Pipe - (25)(0)	92.30	36	Cir	367.063	5354.29	5361.32	1.915	5357.03	5364.18	n/a	5364.18	1	Manhole
3	Pipe - (24)	109.4	36	Cir	73.611	5361.32	5363.30	2.690	5364.18	5366.23	n/a	5366.23	2	None
SUPERCEDED BY CHAMISA/LYON SD ANALYSIS														
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NOTES: Return period = 100 Yrs.														

Storm Sewer Profile



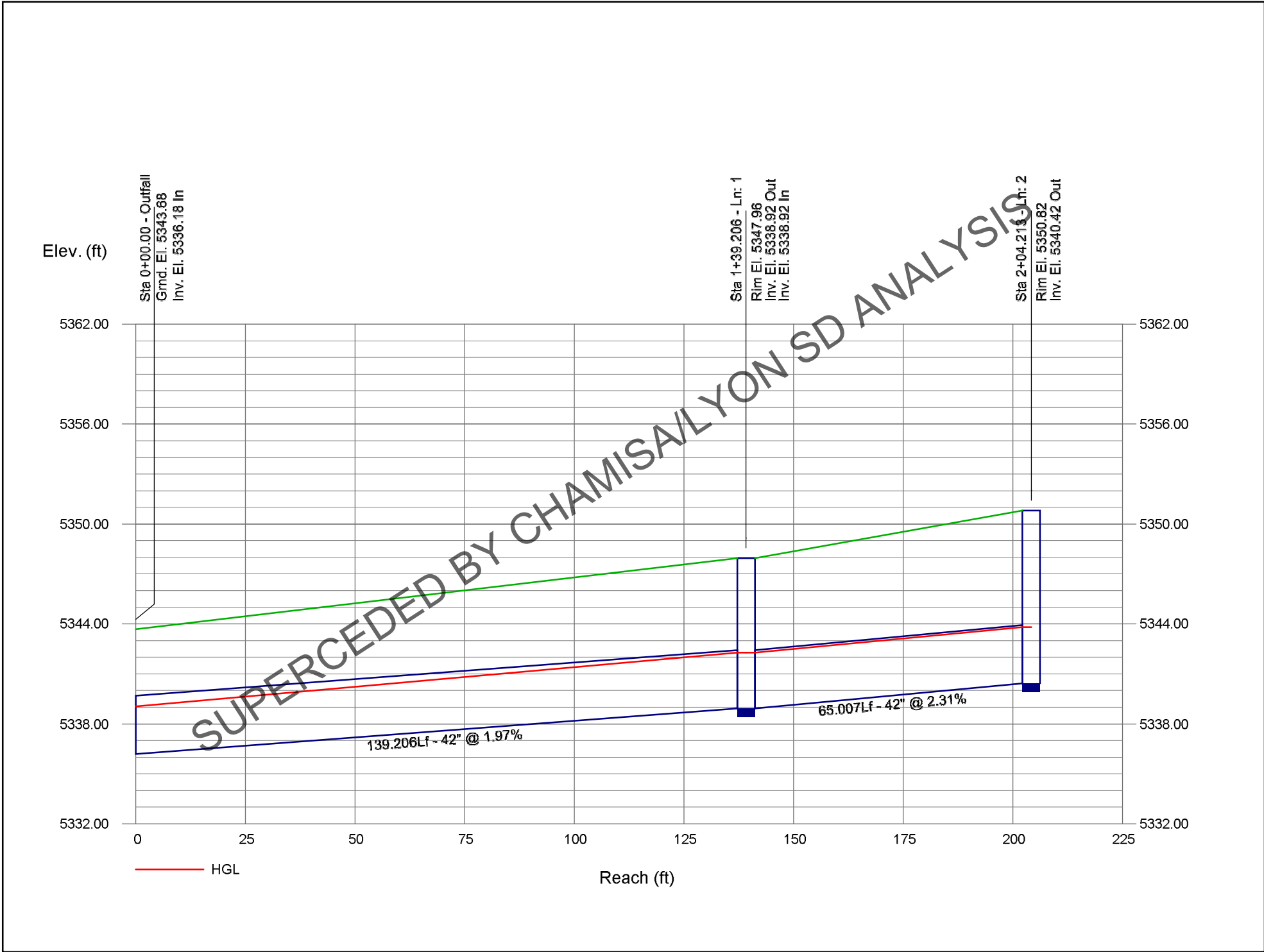
Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2012 Plan



Storm Sewer Summary Report

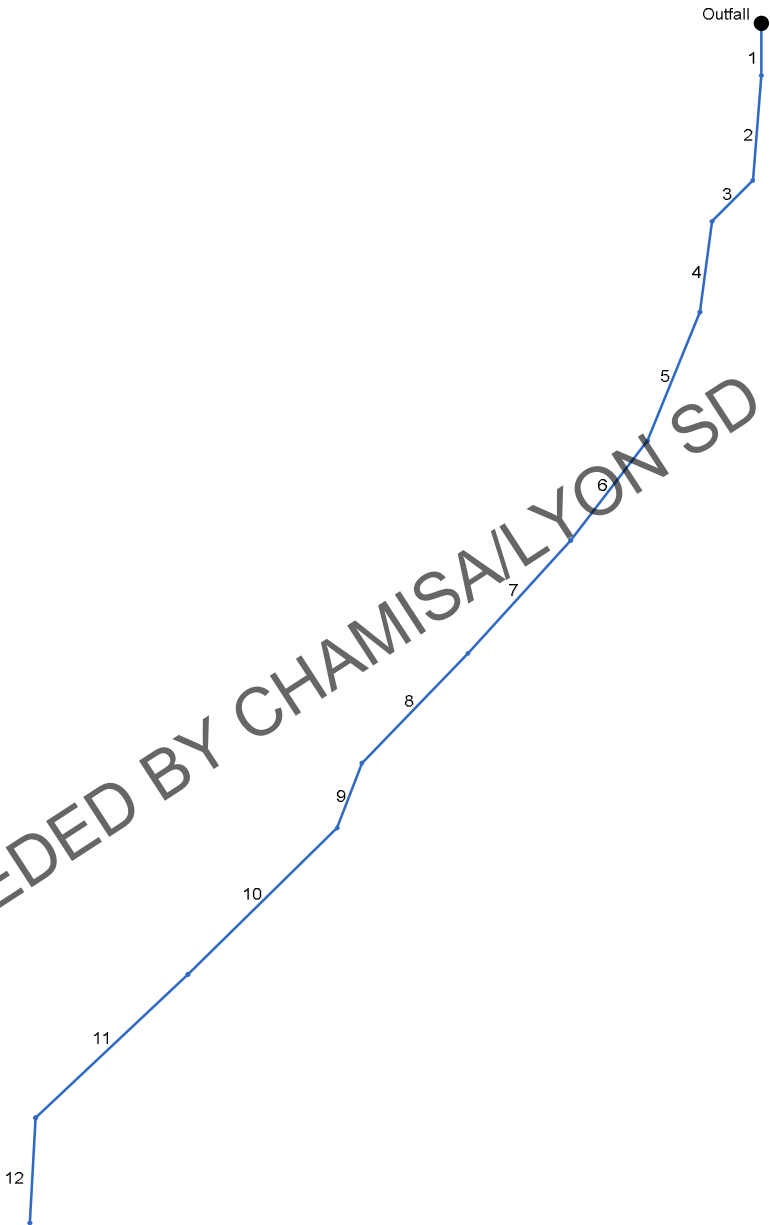
Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	Pipe - (10)	141.1	42	Cir	139.206	5336.18	5338.92	1.968	5339.05	5342.28	1.93	5342.28	End	Manhole
2	Pipe - (09)	152.8	42	Cir	65.007	5338.92	5340.42	2.307	5342.28	5343.81	n/a	5343.81	1	Manhole
SUPERCEDED BY CHAMISA/LYON SD ANALYSIS														
Project File: UPM_3.stm									Number of lines: 2			Run Date: 9/16/2013		
NOTES: Return period = 100 Yrs.														

Storm Sewer Profile



Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2012 Plan

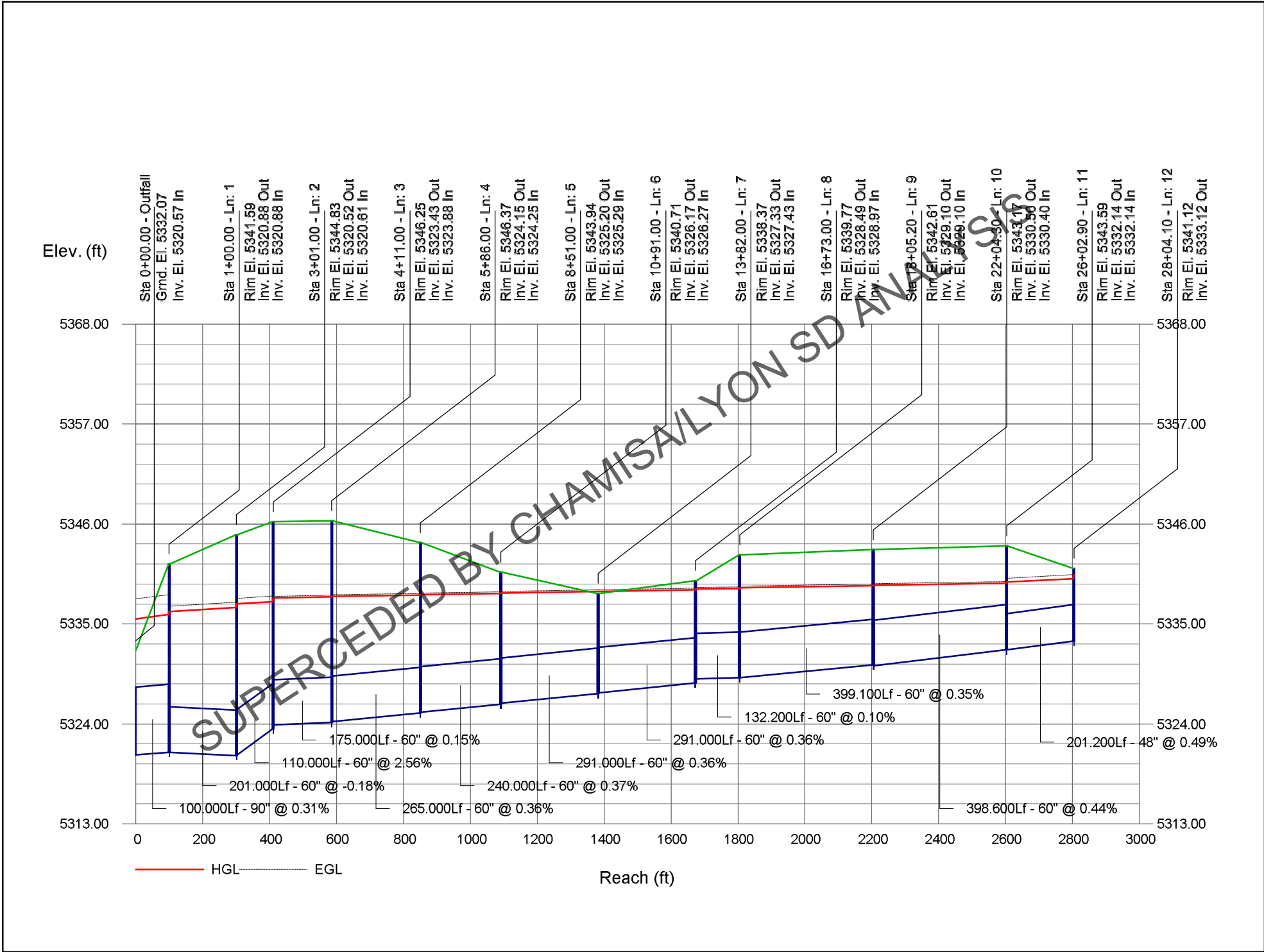
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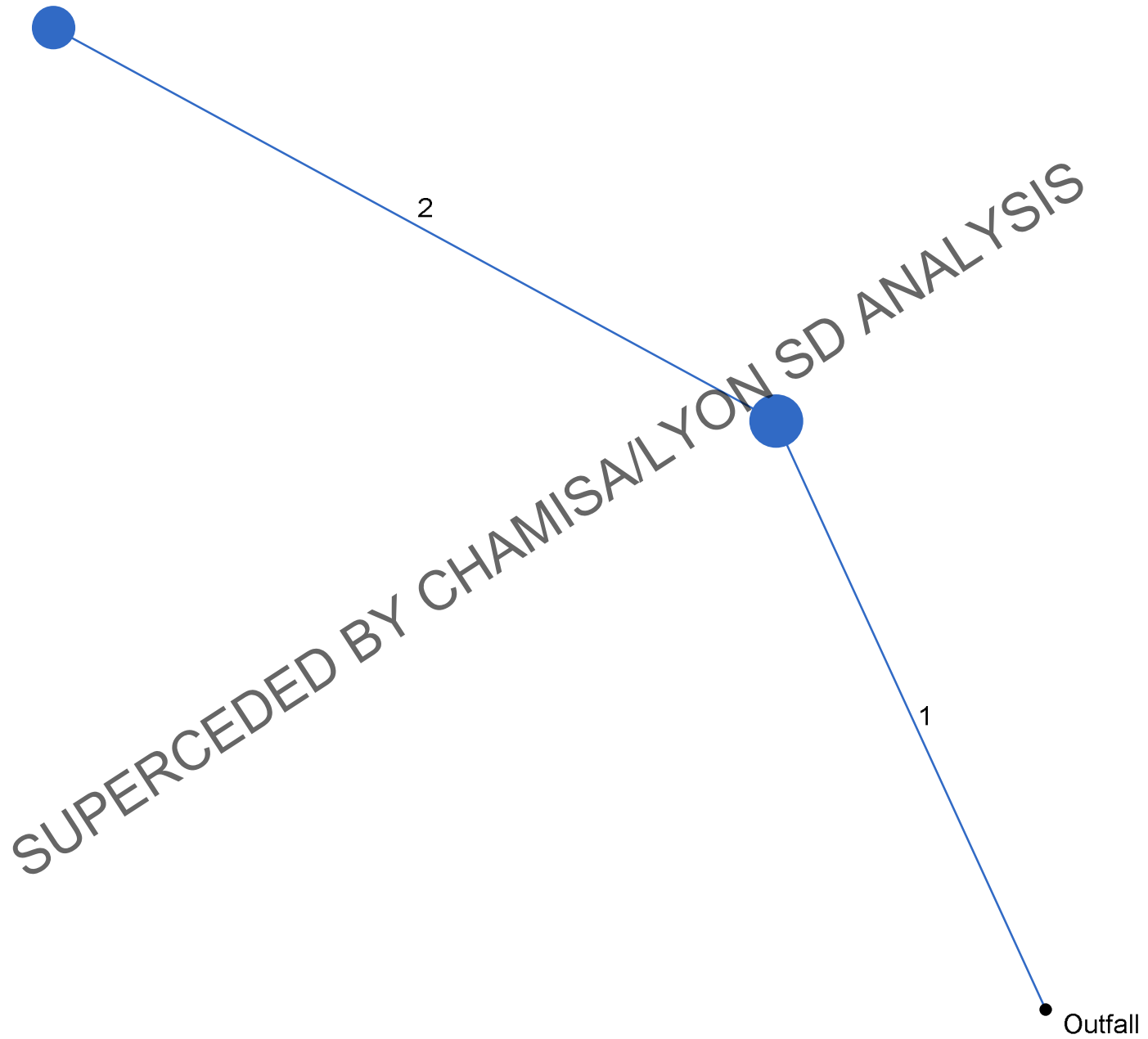
Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1		525.0	90	Cir	100.000	5320.57	5320.88	0.310	5335.57*	5336.04*	0.33	5336.37	End	Manhole
2		122.0	60	Cir	201.000	5320.88	5320.52	-0.179	5336.37*	5336.81*	0.41	5337.22	1	Manhole
3		122.0	60	Cir	110.000	5320.61	5323.43	2.564	5337.22*	5337.46*	0.39	5337.85	2	Manhole
4		67.00	60	Cir	175.000	5323.88	5324.15	0.154	5337.85*	5337.97*	0.05	5338.02	3	Manhole
5		67.00	60	Cir	265.000	5324.25	5325.20	0.359	5338.02*	5338.17*	0.06	5338.23	4	Manhole
6		67.00	60	Cir	240.000	5325.29	5326.17	0.367	5338.23*	5338.37*	0.03	5338.39	5	Manhole
7		67.00	60	Cir	291.000	5326.27	5327.33	0.364	5338.39*	5338.56*	0.03	5338.58	6	Manhole
8		67.00	60	Cir	291.000	5327.43	5328.49	0.364	5338.58*	5338.75*	0.08	5338.83	7	Manhole
9		67.00	60	Cir	132.200	5328.97	5329.10	0.098	5338.83*	5338.90*	0.09	5338.99	8	Manhole
10		67.00	60	Cir	399.100	5329.10	5330.50	0.351	5338.99*	5339.22*	0.03	5339.24	9	Manhole
11		67.00	60	Cir	398.600	5330.40	5332.14	0.437	5339.24*	5339.47*	0.13	5339.60	10	Manhole
12		67.00	48	Cir	201.200	5332.14	5333.12	0.487	5339.60*	5339.97*	0.44	5340.42	11	Manhole
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NOTES: Return period = 100 Yrs. ; *Surcharged (HGL above crown).														

Storm Sewer Profile



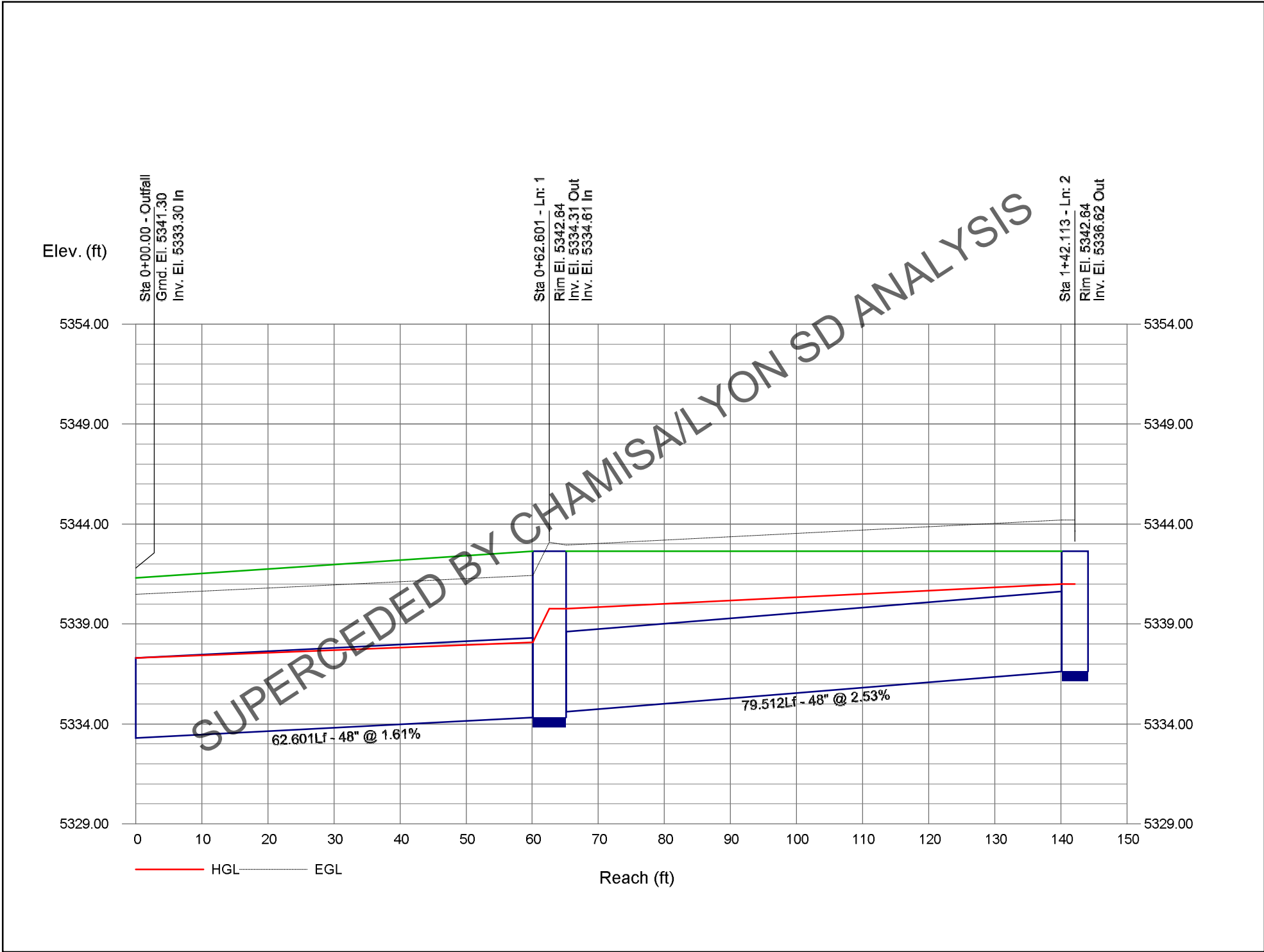
Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2012 Plan



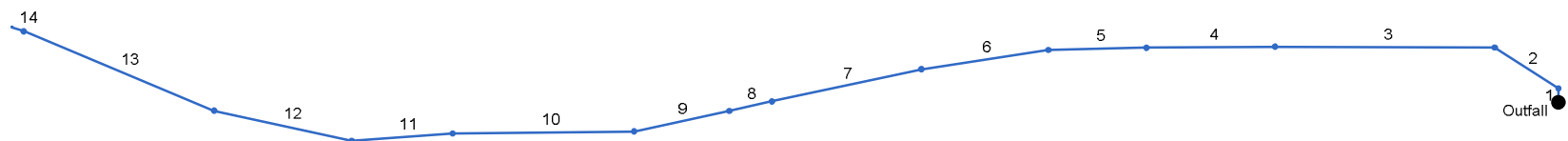
Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	Pipe - (07)	180.0	48	Cir	62.601	5333.30	5334.31	1.614	5337.30	5338.09	1.67	5339.76	End	Manhole
2		180.0	48	Cir	79.512	5334.61	5336.62	2.528	5339.76*	5341.01*	0.00	5341.01	1	Manhole
SUPERCEDED BY CHAMISA/LYON SD ANALYSIS														
Project File: UPM_5.stm									Number of lines: 2			Run Date: 11/12/2013		
NOTES: Return period = 100 Yrs. ; *Surcharged (HGL above crown).														

Storm Sewer Profile



Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2012 Plan



Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	Pipe - (14)	759.0	84	Cir	28.000	5113.12	5113.73	2.178	5118.86	5120.39	3.14	5120.39	End	Manhole
2	Pipe - (13)	759.0	84	Cir	153.861	5113.73	5117.04	2.151	5120.39	5123.70	3.14	5126.83	1	Manhole
3	Pipe - (12)	759.0	84	Cir	445.218	5117.14	5121.11	0.892	5126.83*	5133.12*	0.91	5134.03	2	Manhole
4	Pipe - (11)	677.0	72	Cir	260.548	5121.11	5128.11	2.687	5134.03*	5140.69*	1.34	5142.02	3	Manhole
5	Pipe - (10)	675.0	72	Cir	198.749	5127.96	5137.50	4.800	5142.02*	5147.08*	1.42	5148.49	4	Manhole
6	Pipe - (09)	668.0	72	Cir	260.362	5137.80	5153.20	5.915	5148.49	5159.09	1.31	5159.09	5	Manhole
7	Pipe - (08)	668.0	72	Cir	309.637	5153.40	5172.38	6.130	5159.09	5178.27	1.31	5178.27	6	Manhole
8	Pipe - (07)	666.0	72	Cir	88.814	5172.58	5177.82	5.900	5178.27	5183.71	n/a	5183.71	7	Manhole
9	Pipe - (06)	647.0	72	Cir	197.314	5178.02	5187.88	4.997	5183.71	5193.75	n/a	5193.75	8	Manhole
10	Pipe - (05)	640.0	72	Cir	367.556	5187.88	5198.35	2.849	5193.75	5204.22	1.21	5204.22	9	Manhole
11	Pipe - (04)	635.0	72	Cir	205.185	5198.35	5224.83	12.905	5204.22	5230.70	n/a	5230.70	10	Manhole
12	Pipe - (03)	630.0	72	Cir	285.440	5224.83	5243.12	6.408	5230.70	5248.98	n/a	5248.98	11	Manhole
13	Pipe - (02)	620.0	72	Cir	418.259	5243.27	5267.96	5.903	5248.98	5273.81	n/a	5273.81	12	Manhole
14	Pipe - (01)	620.0	72	Cir	25.782	5268.06	5269.36	5.042	5273.81	5275.21	n/a	5275.21	13	Manhole

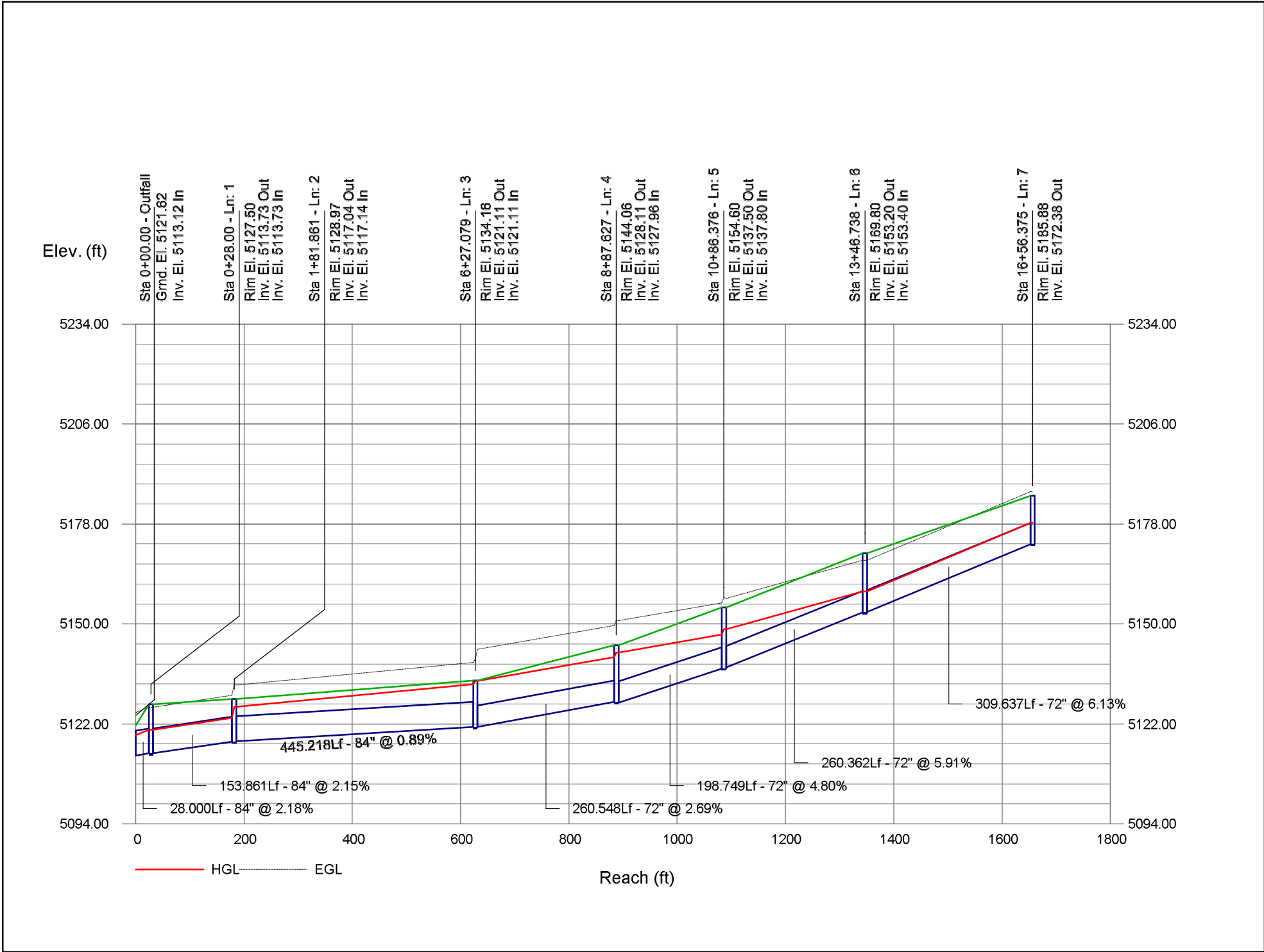
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Number of lines: 14

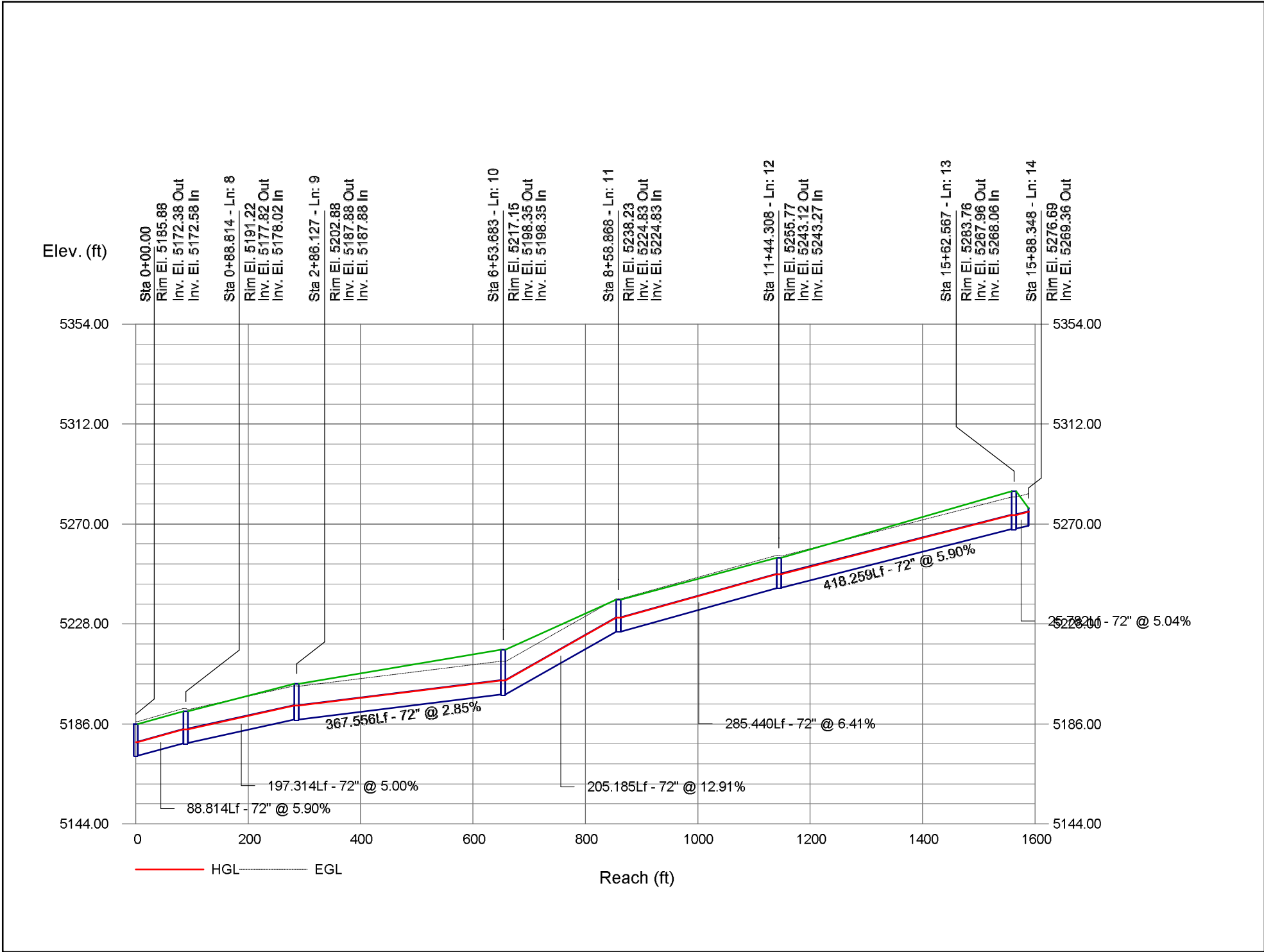
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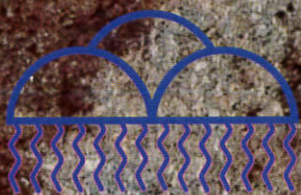
NOTES: Known Qs only ; *Surcharged (HGL above crown).

Storm Sewer Profile



Storm Sewer Profile





AMAFCA





**Upper Piedras Marcadas Watershed Drainage
And Water Quality Management Plan
Existing Conditions Report**

**Appendix C
NRCS Custom Soils Resource Report**



United States
Department of
Agriculture

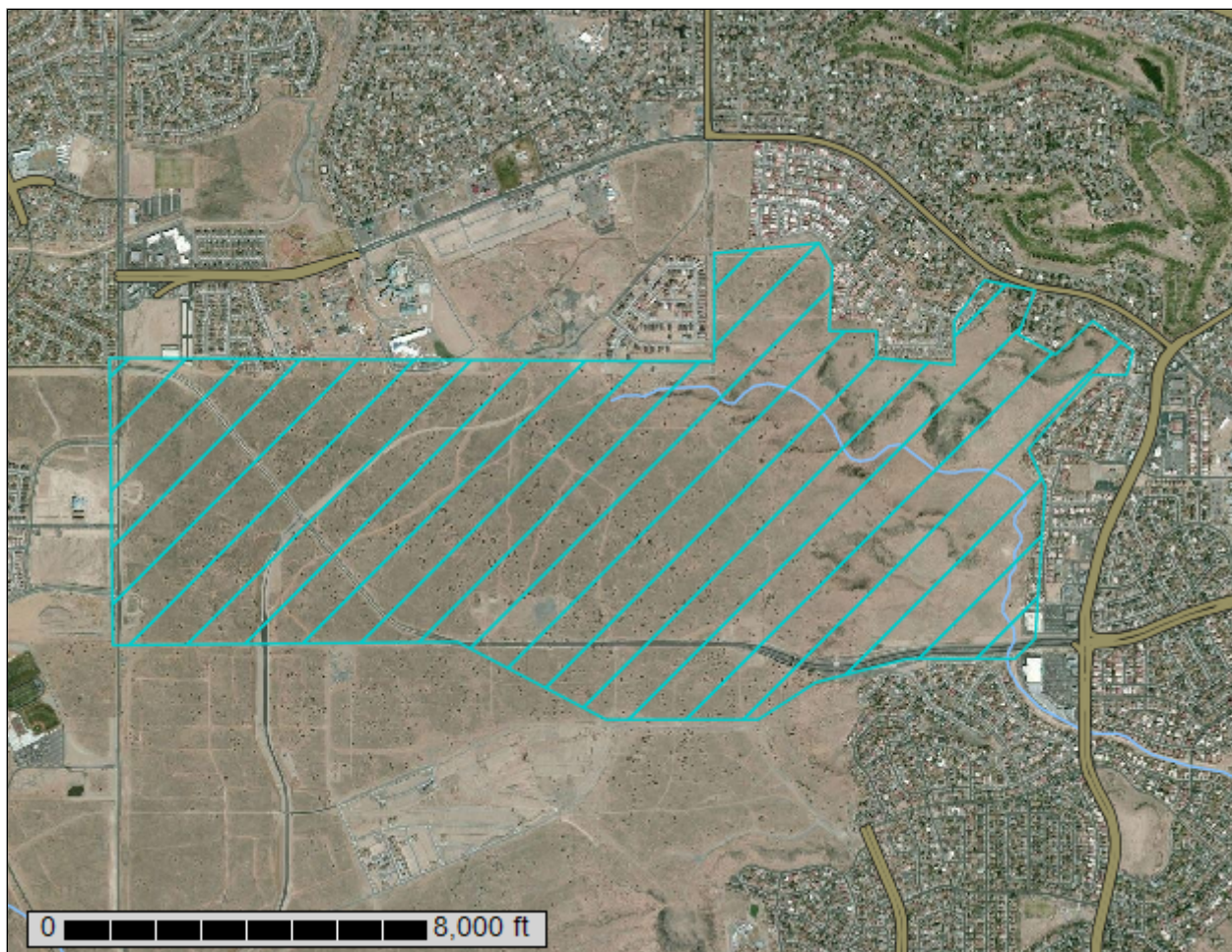


NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Bernalillo County and Parts of Sandoval and Valencia Counties, New Mexico



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://soils.usda.gov/sqi/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<http://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

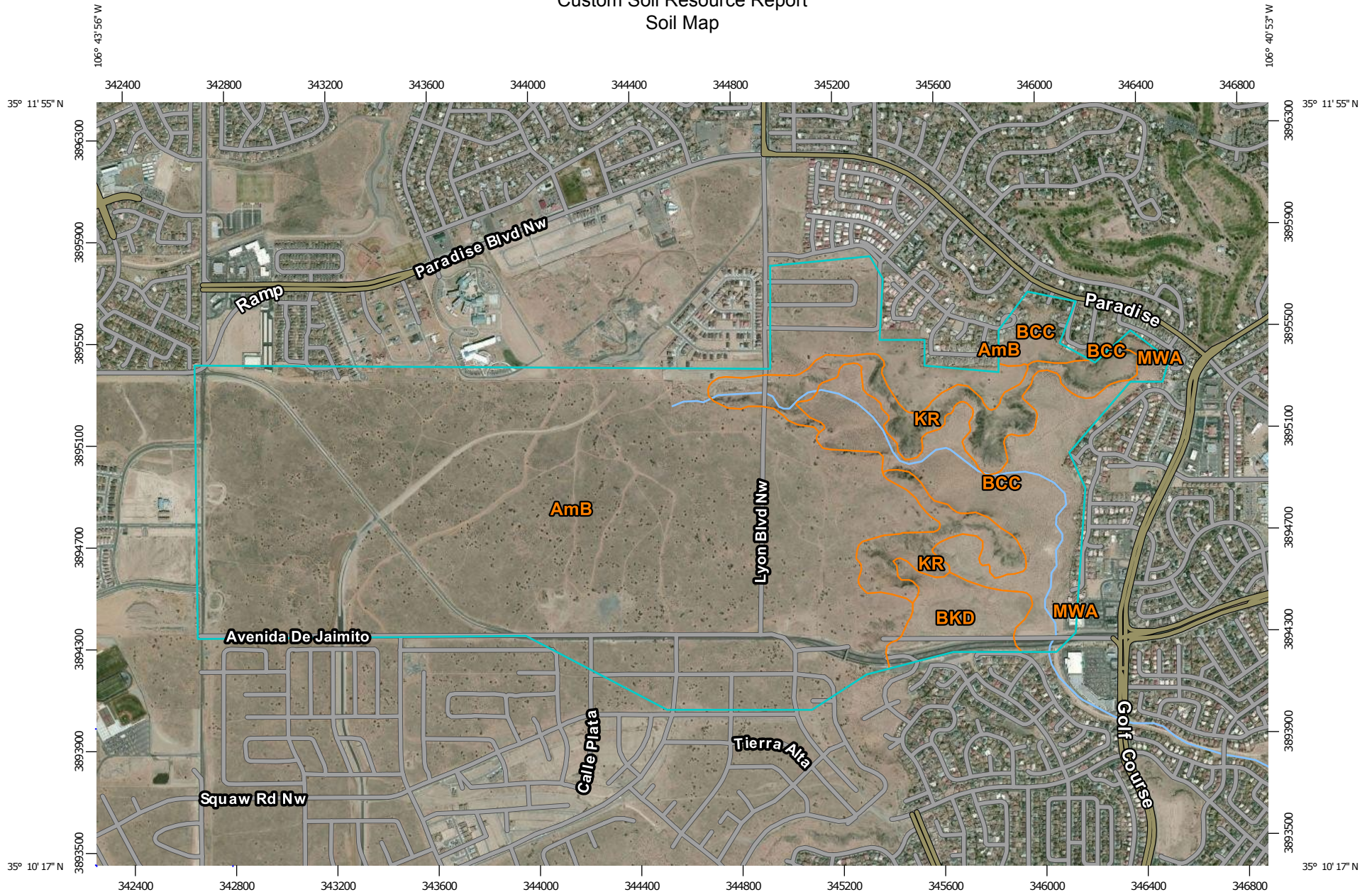
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

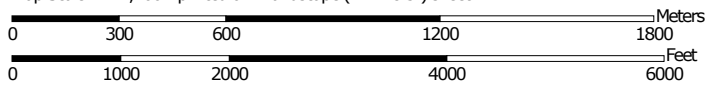
Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



Map Scale: 1:21,200 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit

 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot

 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals

Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Bernalillo County and Parts of Sandoval and Valencia Counties, New Mexico
Survey Area Data: Version 9, Dec 9, 2008

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 23, 2011—May 4, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Bernalillo County and Parts of Sandoval and Valencia Counties, New Mexico (NM600)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AmB	Alemeda sandy loam, 0 to 5 percent slopes	821.7	75.4%
BCC	Bluepoint loamy fine sand, 1 to 9 percent slopes	143.4	13.2%
BKD	Bluepoint-Kokan association, hilly	34.6	3.2%
KR	Kokan-Rock outcrop association	89.3	8.2%
MWA	Madurez-Wink associatin, gently sloping	0.2	0.0%
Totals for Area of Interest		1,089.1	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Bernalillo County and Parts of Sandoval and Valencia Counties, New Mexico

AmB—Alemeda sandy loam, 0 to 5 percent slopes

Map Unit Setting

Elevation: 4,850 to 6,000 feet

Mean annual precipitation: 7 to 10 inches

Mean annual air temperature: 58 to 60 degrees F

Frost-free period: 170 to 195 days

Map Unit Composition

Alemeda and similar soils: 70 percent

Description of Alemeda

Setting

Landform: Lava flows, hillslopes

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Center third of mountainflank, lower third of mountainflank, side slope

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Eolian deposits derived from igneous and sedimentary rock

Properties and qualities

Slope: 0 to 5 percent

Depth to restrictive feature: 20 to 40 inches to lithic bedrock

Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 50 percent

Maximum salinity: Nonsaline to very slightly saline (2.0 to 4.0 mmhos/cm)

Sodium adsorption ratio, maximum: 6.0

Available water capacity: Very low (about 2.6 inches)

Interpretive groups

Farmland classification: Not prime farmland

Land capability (nonirrigated): 7e

Hydrologic Soil Group: C

Ecological site: Malpais (R042XA056NM)

Typical profile

0 to 4 inches: Sandy loam

4 to 13 inches: Gravelly sandy loam

13 to 26 inches: Very cobbly loam

26 to 30 inches: Bedrock

BCC—Bluepoint loamy fine sand, 1 to 9 percent slopes

Map Unit Setting

Elevation: 4,850 to 6,000 feet

Mean annual precipitation: 7 to 10 inches

Mean annual air temperature: 58 to 60 degrees F

Frost-free period: 170 to 195 days

Map Unit Composition

Bluepoint and similar soils: 85 percent

Description of Bluepoint

Setting

Landform: Flood plains, alluvial flats

Landform position (three-dimensional): Talf, rise

Down-slope shape: Concave

Across-slope shape: Linear

Parent material: Sandy alluvium and/or eolian sands

Properties and qualities

Slope: 1 to 9 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 3 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)

Sodium adsorption ratio, maximum: 2.0

Available water capacity: Low (about 4.3 inches)

Interpretive groups

Farmland classification: Not prime farmland

Land capability classification (irrigated): 3s

Land capability (nonirrigated): 7s

Hydrologic Soil Group: A

Ecological site: Deep Sand (R042XA054NM)

Typical profile

0 to 8 inches: Loamy fine sand

8 to 20 inches: Stratified fine sand to gravelly loamy fine sand

20 to 60 inches: Loamy sand

BKD—Bluepoint-Kokan association, hilly

Map Unit Setting

Elevation: 4,850 to 6,000 feet
Mean annual precipitation: 7 to 10 inches
Mean annual air temperature: 58 to 60 degrees F
Frost-free period: 170 to 195 days

Map Unit Composition

Bluepoint and similar soils: 50 percent
Kokan and similar soils: 40 percent

Description of Bluepoint

Setting

Landform: Alluvial flats, flood plains
Landform position (three-dimensional): Rise, talf
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Sandy alluvium and/or eolian sands

Properties and qualities

Slope: 5 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 3 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water capacity: Low (about 4.3 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): 4s
Land capability (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: Deep Sand (R042XA054NM)

Typical profile

0 to 8 inches: Loamy fine sand
8 to 60 inches: Stratified fine sand to gravelly loamy fine sand

Description of Kokan

Setting

Landform: Fan piedmonts, hillslopes
Landform position (two-dimensional): Shoulder, footslope, backslope
Landform position (three-dimensional): Side slope, rise

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Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium derived from igneous and sedimentary rock

Properties and qualities

Slope: 15 to 40 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Capacity of the most limiting layer to transmit water (Ksat): Very high (20.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 2 percent

Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)

Sodium adsorption ratio, maximum: 2.0

Available water capacity: Very low (about 2.4 inches)

Interpretive groups

Farmland classification: Not prime farmland

Land capability (nonirrigated): 7e

Hydrologic Soil Group: A

Ecological site: Gravelly Sand (R042XA053NM)

Typical profile

0 to 4 inches: Gravelly sand

4 to 60 inches: Stratified very gravelly sand to extremely gravelly loamy coarse sand

KR—Kokan-Rock outcrop association

Map Unit Setting

Elevation: 4,850 to 6,000 feet

Mean annual precipitation: 7 to 10 inches

Mean annual air temperature: 58 to 60 degrees F

Frost-free period: 170 to 195 days

Map Unit Composition

Kokan and similar soils: 75 percent

Rock outcrop: 10 percent

Description of Kokan

Setting

Landform: Hillslopes, fan piedmonts

Landform position (two-dimensional): Shoulder, footslope, backslope

Landform position (three-dimensional): Side slope, rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium derived from igneous and sedimentary rock

Properties and qualities

Slope: 25 to 45 percent

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Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Very high (20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 4 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water capacity: Very low (about 2.4 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: Gravelly Sand (R042XA053NM)

Typical profile

0 to 4 inches: Gravelly sand
4 to 60 inches: Stratified very gravelly sand to extremely gravelly loamy coarse sand

Description of Rock Outcrop

Setting

Landform: Escarpments
Down-slope shape: Convex
Across-slope shape: Convex

Properties and qualities

Slope: 25 to 90 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 8s
Hydrologic Soil Group: D

Typical profile

0 to 60 inches: Bedrock

MWA—Madurez-Wink associatin, gently sloping

Map Unit Setting

Elevation: 4,850 to 6,000 feet
Mean annual precipitation: 7 to 10 inches
Mean annual air temperature: 58 to 60 degrees F
Frost-free period: 170 to 195 days

Map Unit Composition

Madurez and similar soils: 55 percent

Custom Soil Resource Report

Wink and similar soils: 25 percent

Description of Madurez

Setting

Landform: Fan piedmonts, alluvial fans

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium derived from igneous and sedimentary rock

Properties and qualities

Slope: 1 to 5 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.60 to 2.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 7 percent

Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)

Sodium adsorption ratio, maximum: 2.0

Available water capacity: Moderate (about 8.9 inches)

Interpretive groups

Farmland classification: Not prime farmland

Land capability (nonirrigated): 7e

Hydrologic Soil Group: B

Ecological site: Loamy (R042XA052NM)

Typical profile

0 to 4 inches: Fine sandy loam

4 to 21 inches: Fine sandy loam

21 to 60 inches: Sandy loam

Description of Wink

Setting

Landform: Fan piedmonts, alluvial fans

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium derived from igneous and sedimentary rock

Properties and qualities

Slope: 1 to 7 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 10 percent

Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)

Sodium adsorption ratio, maximum: 2.0

Available water capacity: Moderate (about 7.7 inches)

Interpretive groups

Farmland classification: Not prime farmland

Land capability (nonirrigated): 7e

Hydrologic Soil Group: B

Ecological site: Loamy (R042XA052NM)

Typical profile

0 to 4 inches: Fine sandy loam

4 to 60 inches: Sandy loam

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

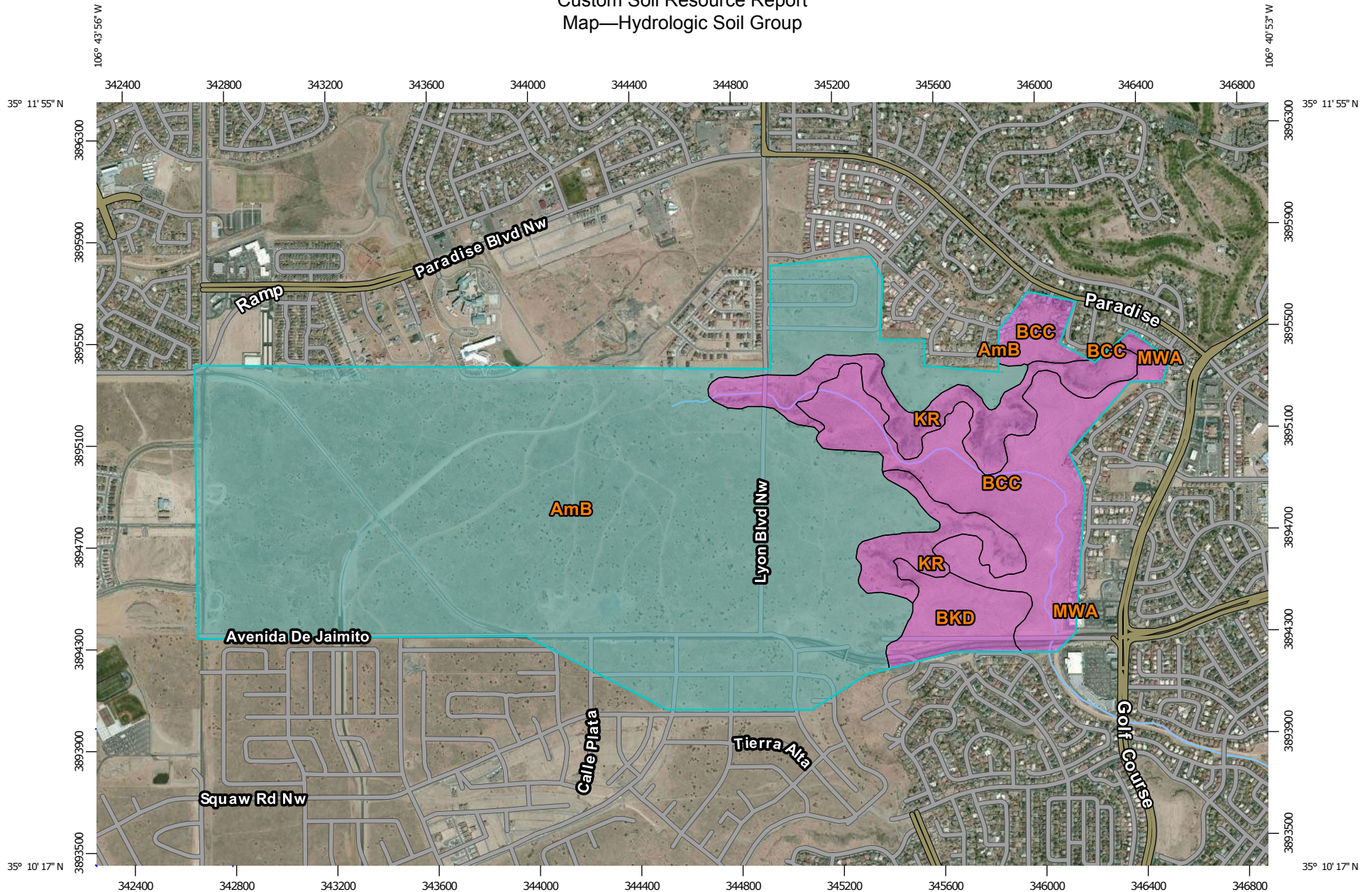
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Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

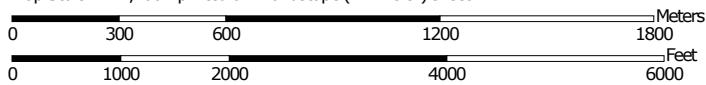
Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Custom Soil Resource Report Map—Hydrologic Soil Group



Map Scale: 1:21,200 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Lines

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

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 Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
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Soil Survey Area: Bernalillo County and Parts of Sandoval and Valencia Counties, New Mexico
 Survey Area Data: Version 9, Dec 9, 2008

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 23, 2011—May 4, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Bernalillo County and Parts of Sandoval and Valencia Counties, New Mexico (NM600)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AmB	Alemeda sandy loam, 0 to 5 percent slopes	C	821.7	75.4%
BCC	Bluepoint loamy fine sand, 1 to 9 percent slopes	A	143.4	13.2%
BKD	Bluepoint-Kokan association, hilly	A	34.6	3.2%
KR	Kokan-Rock outcrop association	A	89.3	8.2%
MWA	Madurez-Wink associatin, gently sloping	B	0.2	0.0%
Totals for Area of Interest			1,089.1	100.0%

Rating Options—Hydrologic Soil Group*Aggregation Method:* Dominant Condition*Component Percent Cutoff:* None Specified*Tie-break Rule:* Higher

References

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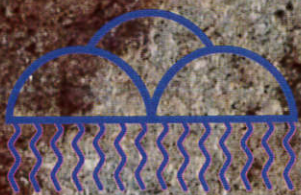
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AMAFCA





**Upper Piedras Marcadas Watershed Drainage
And Water Quality Management Plan
Existing Conditions Report**

Appendix D
Chamisa/Lyon Storm Drain System Analysis

Executive Summary Memorandum

To: Karen Stearns, P.E.

From: Donnie Duneman, P.E. *DmD*
Mario Juarez-Infante, P.E. *[Signature]*
Daniel Aguirre, P.E. *[Signature]*



CC: File

Date: June 3, 2014

File Number: 13-600-407-00

Re: Amendment 2, Hydraulic Analysis for the Chamisa/Lyon Storm Drain System

Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) has requested that Wilson & Company, Inc. (WCI) complete a detailed hydraulic analysis of the Chamisa Storm Drain system under contract for the Upper Piedras Marcadas Watershed Drainage & Storm Water Quality Management Plan (UPMDMP). After completing a Draft Existing Conditions Report for the UPMDMP, it was determined that there may be a capacity issue in the Chamisa Storm Drain that would limit or prevent storm water diversion from the Upper Piedras Marcadas Watershed. AMAFCA determined that additional literature review and hydraulic analysis was necessary in order to properly analyze the Chamisa/Lyon Storm Drain system. Additional documents pertaining to the Chamisa system were reviewed, including the "Cooperative Funding, Construction and Maintenance Agreement for the Lyon Boulevard Storm Drain Extension Project" (Cooperative Agreement) dated February 8, 2005, and the "Chamisa/Lyon Storm Drain Literature Review Report" was submitted to AMAFCA in March 2014. A field survey of the current storm drain system, including all ponds, was also completed and utilized for this hydraulic analysis. The primary purpose of the hydraulic analysis is to model the entire system, from the upstream end at the Vittoria Pond to the Calabacillas Arroyo, to determine the extent of the Chamisa Storm Drain system capacity issue.

The objectives of the Chamisa Storm Drain System Analysis are to:

- Assess the performance of the existing storm drain system in the current conditions.
- Assess the performance of Chamisa Pond as it functions in the current conditions.
- Assess the performance of the storm drain system under the conditions of public and private agreements utilized for funding the Chamisa Storm Drain. These conditions are referred to as the full build-out conditions.
- Assess the performance of Chamisa Pond as it would function in the full build-out conditions.

A summary of the analysis is presented below.

1. Methodology:

HEC-HMS Analysis:

HEC-HMS version 3.4 was utilized for the hydrologic analysis in order to evaluate the functionality of the storm drain system ponds. The SCS Type II-a unit hydrograph distribution with a peak intensity at six hours was used to calculate runoff for the 100-year, 24-hour design storm for pond routing. SCS curve numbers (CN) were utilized in the calculation of runoff for

each basin. Basin areas for the analysis were determined based on approved drainage reports, grading and drainage plans, aerial photography and field visits. Curve numbers were calculated based on Table 6.13 – Curve Numbers for various urban land uses from Water Resources Engineering, David A. Chin, 2000 Edition. Impervious areas were determined based on a development unit (DU) per acres basis for residential areas, while the James Monroe Middle School land treatment evaluation is based on aerial photography. Commercial areas were assumed to be 85% impervious. Time of concentration and lag time calculations were based on NMDOT Drainage Manual, Volume 1, Hydrology. The Upland method was used, with lag time equal to 60% of the time of concentration. Lag times were input into the HEC-HMS model, with a minimum of six minutes. The meteorological model was developed based on the 100-year, 24-hour storm event. Rainfall depths were extracted from the NOAA Atlas website. See table below for rainfall depths.

Table 1 - Rainfall Depths in Inches						
Duration	Average Recurrence Interval (years)					
	2	5	10	25	50	100
6-hour	0.932	1.210	1.420	1.720	1.950	2.200
24-hour	1.170	1.470	1.700	2.020	2.260	2.520

CulvertMaster was utilized to calculate the pond discharge rating curves with downstream tail water conditions based on the hydraulic analysis. Pond elevations and volumes were determined based on the as-built survey.

StormCAD Analysis:

StormCAD version 8i by Bentley was used for the hydraulic analysis. Junction losses for the 90" Lyon Boulevard were extracted from the Design Analysis Report for the Lyon Storm Drain by Wilson & Company, and the City of Albuquerque DPM junction loss calculation procedures were used for the upstream portion of the storm drain. The equations used to calculate loss factors are as follows:

Transition Loss	For increasing velocities	$h_t = 0.1 [(V_1^2/2g) - (V_2^2/2g)]$
	For decreasing velocities	$h_t = 0.2 [(V_1^2/2g) - (V_2^2/2g)]$
Junction Loss		$h_j = (V_1^2/2g) - (V_2^2/2g) - (2A_3/A_2) * (V_3^2/2g) * \cos \Delta$
Manhole Loss		$h_{mh} = 0.05[V^2/2g]$
Bend Loss		$h_b = K_b[V^2/2g]$
	where $K_b = 0.20(\text{SQRT}(\Delta/90))$ Δ = Central Angle	

2. Current Conditions:

The existing system consists of storm drain ranging in size from 24" at the upstream end to 90" north of Paradise Boulevard. There are also five ponds along the alignment: 1) Vittoria Subdivision Pond; 2) Villa De La Chamisa Pond; 3) Chamisa Ridge Pond; 4) James Monroe M.S. Surge Pond; and 5) Chamisa Pond. The existing storm drain begins at the upstream end with a 24" RCP south of the Villa De La Chamisa Pond and continues east along the southern property boundary of the developments, terminating just east of the Chamisa Ridge Pond. These developments do not currently drain to the Chamisa Pond, which outlets to the Lyon Storm Drain system. There is a 42" RCP and 48" RCP storm drain discharging to the Chamisa Pond from the Boulders Phase 2, crossing Unser Boulevard near the south side of the pond. These storm drain systems draining from the Boulders Subdivision were not modeled in the current conditions. A 48" RCP storm drain provides an outlet for the Chamisa Pond and transitions to a 60" RCP at the northeasterly corner of

the Boulders development. The 60" RCP extends north to Paradise Boulevard, where the 90" Lyon Storm Drain begins. The storm drain reduces to 72" north of Irving Boulevard before discharging to the Calabacillas Arroyo.

In comparing as-built/design drawings to the as-built survey completed by WCI, the following significant discrepancies were found:

1. The Chamisa Pond volume was found to have less volume in the current conditions than in original construction plans. The design capacity with one foot of freeboard was 9.24 ac-ft, while the as-built survey volume with one foot of freeboard is 6.09 ac-ft.
2. The 48" storm drain outlet pipe invert was built approximately 0.35 ft higher than designed. The as-built survey elevation is 5333.12 ft, while the construction plans for this invert show an elevation of 5332.77 ft.
3. The invert out of Area Inlet #15029 was found to be higher than the invert in by 0.15 ft, while construction plans show a drop of 0.10 ft from the invert in to invert out.

HEC-HMS Analysis:

HEC-HMS was used for hydrologic modeling in order to be consistent with the UPMDMP analysis, using a SCS Unit Hydrograph with a type II-a distribution. This SCS methodology yields significantly lower flows than previous drainage reports and does not comply with current City of Albuquerque DPM design procedures. Modeling flows based on previous drainage reports and in compliance with the COA DPM would yield different results.

The sole purpose of this analysis is to determine the functionality of the storm drain ponds by routing flows using HEC-HMS, while considering downstream tail water conditions. Basins currently draining to the Chamisa Pond consist of Paradise View Subdivision and the Boulders Phase 1, 2 and 3. Basins not contributing to the Chamisa Pond were not modeled in the current conditions analysis. All the basins except the Boulders resulted in a minimum lag time of six minutes. The Boulders and Paradise View basin areas were delineated based on approved grading and drainage plans for the areas and input into the model for routing to the pond. The HEC-HMS model shows a storage volume of 5.30 acre-feet (ac-ft) with a maximum water surface elevation (MWSEL) of 5337.50-ft, which results in a little over one foot of freeboard. Discharge from the pond is 67.30 cubic feet per second (cfs) in the current conditions. Curve number calculations, lag time calculations, pond rating curve summary and results of the HEC-HMS analysis are attached.

Although the Chamisa Pond has the capacity to accommodate the current conditions, the results of the analysis show that the as-built pond has less capacity than the original design and may not have the capacity to accommodate the ultimate conditions. With no freeboard, the capacity of the pond is approximately 9.40 ac-ft with a MWSEL of 5338.93 (bottom of spillway notch). The top of the perimeter flood wall is at elevation 5340.93 with a volumetric capacity of 15.28 ac-ft. The Boulders Phase 3 drainage report determined that the required storage volume is 8.24 ac-ft with a MWSEL of 5337.50 and a pond capacity of 9.25 ac-ft at an elevation of 5337.93. It appears that the upstream end of the pond is graded approximately 6" higher than the designed elevation, and the pond outlet is 0.35 feet above the designed elevation.

HEC-HMS SCS Unit Hydrograph with a type II-a distribution was used to be consistent with UPMDMP analysis. This SCS methodology yields significantly lower flows than previous drainage reports. Modeling flows based on previous drainage reports could possibly cause overtopping in current conditions.

Assumptions:

1. The pond discharge rating curve was determined based on tail water conditions in the Lyon Storm Drain at Paradise Boulevard.
2. The Boulders Phase 2 is completely developed in the current conditions.

3. The Boulders Phase 3 is treated as a graded dirt road to determine the CN.
4. Weighted CNs for the Boulders Phase 2 and 3 are identical, therefore modeled as one basin.
5. Paradise View and Boulders sub-basins were modeled independently without routing Paradise View flows through the Boulders Subdivision. Routing would have negligible impact to the functionality of the pond.
6. Sediment bulking factors were not applied.

Adjustments/Corrections:

1. Basin areas differ between the Cooperative Agreement and actual current conditions. Basin areas were adjusted in the current conditions HEC-HMS analysis based on aerial photography, approved grading and drainage plans and site visits.

StormCAD Analysis:

The purpose of this analysis was to determine the functionality of the storm drain system given contributing flows in the current conditions. The existing Lyon/Unser Boulevard storm drain system was modeled in StormCAD based on the as-built survey of the system. Discharge from the Chamisa Pond to the Lyon Storm Drain was determined to be 67.30 cfs based on the HEC-HMS analysis and applied to the hydraulic model. No flow was added to the system between the Pond and Paradise Boulevard, based on current conditions. Flow rates downstream of Paradise Boulevard were based on the Design Report for the Lyon Storm Drain completed by Wilson & Company and as-built drawings for Unser Boulevard near the Calabacillas Arroyo. Flows downstream of Paradise Boulevard were decreased to reflect current conditions discharge from the Chamisa Pond. The Chamisa Storm Drain upstream of the Boulders was not modeled for current conditions because there is no existing outfall from the system to the Chamisa Pond. Results indicate that the existing system accommodates the 100-year design flow in the current conditions.

Assumptions:

1. Flows input into the StormCAD model are based on the Cooperative Agreement, the Lyon Storm Drain Design Analysis Report and Unser Boulevard as-built drawings near the Calabacillas Arroyo.

Adjustments/Corrections:

1. A flow of 12.5 cfs was added to the system at Manhole #6997 for a resulting peak flow at the downstream end of 813.80 cfs. Timing of this inflow was not considered compared to the timing of the peak in the storm drain trunk line.

3. Full Build-Out Conditions:

The proposed conditions system was modeled based on the as-built survey, information provided in the Cooperative Agreement and the Boulders Phase 3 design. The storm drain system ranges in size from 18" RCP from the Vittoria Pond to 48" RCP discharging to the Chamisa Pond, based on the Cooperative Agreement. The alignment of the system and sizes were adjusted based on the Boulders Phase 3 design. The remaining storm drain downstream of the Chamisa Pond is the same as discussed above for the current conditions. The Vittoria Pond and the APS Pond were included in the full build-out conditions, while the Villa De La Chamisa and Chamisa Ridge Ponds were excluded because they are temporary. These developments are allowed free discharge per the Cooperative Agreement in the full build-out condition.

HEC-HMS Analysis:

The full build-out HEC-HMS model was not completed due to downstream tail water conditions, which would cause the Chamisa Pond to fail.

StormCAD Analysis:

The purpose of this analysis was to assess the performance of the storm drain system in the full build-out condition based on flows outlined in the Cooperative Agreement, as well as subsequent reports that modified the design. The Boulders development re-aligned the Chamisa Storm Drain through the subdivision, adding flows that were not a part of the original agreement. Pipe sizes were increased from the agreement to accommodate increased flows. This analysis includes discharge rates as outlined in the Boulders Phase 3 Drainage Report. Flows draining to the system along Unser Boulevard between Paradise Boulevard and Calabacillas Arroyo were based on the Design Report and as-built drawings for the Lyon Boulevard Storm Drain. Refer to the attached StormCAD profiles for the Hydraulic Grade Line (HGL) of the storm drain system.

The Chamisa Storm Drain project by Tierra West extended to the system from an existing 60" cap approximately 300-ft south of the Paradise Boulevard intersection to the Chamisa Pond. The plans do not show additional flows from the Shaffer and Church properties to produce the ultimate flow of 212 cfs to the system. Also, the HGL is shown inside the pipe at the connection point to the existing cap at an elevation of approximately 5327.00-ft, which is significantly lower than the HGL shown in the Lyon Storm Drain plans. In this analysis, runoff from the Shaffer property and St. Jude Church was added south of the Paradise intersection for a resulting flow of 212 cfs, which results in an HGL at an elevation of approximately 5336.64-ft at the same location. This elevation is comparable to the HGL elevation shown in the Lyon Boulevard Storm Drain as-built plans.

Assumptions:

1. Flows input into the StormCAD model are based on the Cooperative Agreement, the Lyon Storm Drain Design Analysis Report and as-built drawings for Unser Boulevard near the Calabacillas Arroyo.
2. Although the Cooperative Agreement shows an 18" storm drain from the Vittoria Pond to the Villa De La Chamisa Pond, a 24" storm drain was used in the analysis based on the current minimum pipe size allowed in the City of Albuquerque.
3. The proposed storm drain connections were based on slopes and sizes shown in the Cooperative Agreement and The Boulders Phase 3 Preliminary Construction Plans, with the exception of the run identified above.
4. Flows from the Shaffer properties, Church property and a portion of Unser Boulevard were added at the first manhole upstream of Paradise Boulevard along Unser Boulevard between the Chamisa Pond and Paradise Boulevard (Manhole #7277).

Adjustments/Corrections:

1. A flow of 12.5 cfs was added to the system at Manhole #6997 for a resulting peak flow at the downstream end of 958.50 cfs. Timing of this inflow was not considered compared to the timing of the peak in the storm drain trunk line.
2. The Cooperative Agreement does not include a storm drain conveyance from the Boulders subdivision to the Chamisa Pond. The agreement indicates 20 cfs discharging to the pond via a 24" storm drain, which is the outflow from the APS surge pond. The Boulders Phase 2 construction plans proposed re-aligning the Chamisa Storm Drain through the development and adding onsite flows to the system. The plans indicate a total of 137 cfs (including 20 cfs from the APS surge pond) conveyed through the existing 42" pipe crossing under Unser Boulevard to the Chamisa Pond, while the Phase 3 drainage report notes 158.9 cfs. The more recent analysis from the Boulders Phase 3 with a flow of 158.9 cfs was used in our calculations.

4. Conclusion:

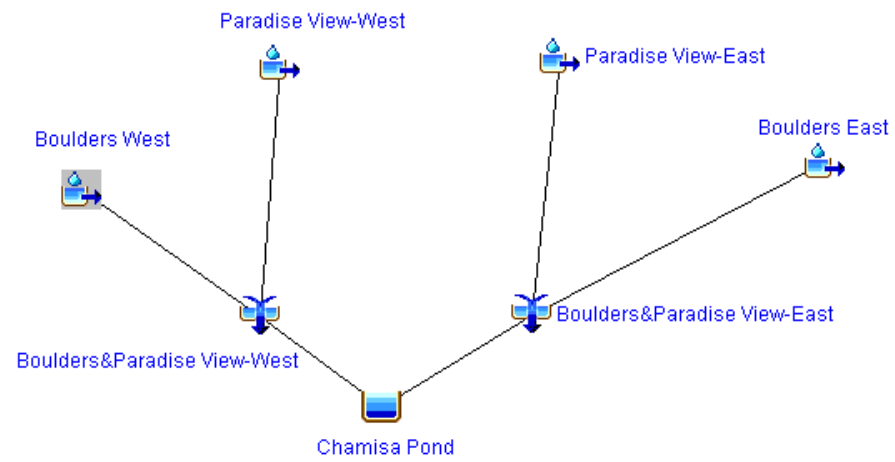
The Chamisa Pond accommodates the 100-year design storm in the current conditions with an outflow of 67.30 cfs and a storage volume of 5.30 ac-ft with a little over one foot of freeboard. In addition, the existing storm drain system from the pond to the Calabacillas Arroyo will accommodate the 100-year design storm in the current conditions. The results of the analysis indicate that the Chamisa Pond does not have the storage volume capacity as designed in previous drainage reports but it does not fail.

The proposed conditions hydraulic analysis indicates that the Chamisa Storm Drain and the Lyon Storm Drain operate under pressure with the proposed 100-year design flows. The 100-year design storm HGL is above the manhole rim in various locations along the Chamisa Storm Drain alignment. The most critical locations are within the Boulders Phase 3 subdivision, at Manhole #6001 between the Chamisa Pond and Paradise Boulevard, and at the Chamisa Pond outfall. Results of the hydraulic analysis indicate that the storm drain outfall from the Chamisa Pond would cause the pond to fail. The tail water in the storm drain outfall from the Chamisa Pond is at an elevation of 5345.42 ft, while the top of the pond flood wall is at an elevation of 5340.93 ft. Tail water conditions do not allow for a discharge rate of 69 cfs from the Chamisa Pond to the Chamisa Storm Drain system.

The results of the literature review and analysis conclude that the Chamisa Storm Drain Design in the Cooperative Agreement did not consider the addition of runoff from the Church and Shaffer property located at the southwest corner of Unser Boulevard and Paradise Boulevard. In addition, the design did not consider the downstream Lyon Storm Drain HGL. When considering this condition, the 60" Chamisa Storm Drain does not accommodate the design storm from contributing basins per the Cooperative Agreement. In conclusion, the Chamisa storm drain does not have the capacity to convey runoff diverted from the Upper Piedras Marcadas Watershed.

Attachments:

- Current Conditions Hydrologic Analysis summary files
- Current Conditions StormCAD model summary files
- Plan and Profile Exhibit of the StormCAD model results in the Current Conditions
- Full Build-Out Conditions StormCAD model summary files
- Plan and Profile Exhibit of the StormCAD model results in the Full Build-Out Conditions.
- Quality Control, Quality Assurance Certificate of Compliance
- Chamisa/Lyon Storm Drain Literature Review Exhibit
- WCI As-built Survey



HEC-HMS CURRENT CONDITIONS PLAN

HMS Results - Current Conditions				
Hydrologic Element	Area	Peak Discharge	Time to Peak	Volume
	sq mi	cfs	hr	ac-ft
Boulders East	0.07242	95.8	01Jan2013, 05:51	5.1
Paradise View-East	0.0199	33.9	01Jan2013, 05:48	1.6
Boulders&Paradise View-East	0.09232	125.5	01Jan2013, 05:51	6.7
Boulders West	0.05257	63.9	01Jan2013, 05:54	3.7
Paradise View-West	0.0149	25.4	01Jan2013, 05:48	1.2
Boulders&Paradise View-West	0.06747	85.2	01Jan2013, 05:51	4.9
Chamisa Pond	0.15979	67.3	01Jan2013, 06:18	11.6

Chamisa Pond Data							
Pond	Inflow (cfs)	Outflow (cfs)	Volume (ac-ft)		Pond Elev (ft)		
			Prv'd	Req'd	Bottom	Top	WSEL
Chamisa Pond	210.7	67.3	6.086*	5.300	5333.00	5340.90	5337.50
* Includes one foot of freeboard at the elvation 5337.93							

Basin Parameters - Current Conditions			
Basin	Area	Curve Number	Lag Time (min)
Boulders East	46.35	87	9
Paradise View Subd-East	12.74	89	6
Boulders West	33.60	87	11
Paradise View Subd-West	9.54	89	6

Chamisa Pond Rating Curve					
Elevation	Storage	Pipe Discharge	Weir Overflow	Bank Breach Overflow	Total Outflow
ft	ac-ft	cfs	cfs	cfs	cfs
5333.0	0.000	0.00			0.00
5334.0	0.140	6.24			6.24
5335.0	0.649	17.58			17.58
5336.0	1.891	37.73			37.73
5337.0	4.062	62.08			62.08
5338.0	6.743	72.92			72.92
5338.9	9.396	77.31			77.31
5339.9	12.337	82.15	61.59	2.5	146.24
5340.9	15.279	87.10	174.19	14.14	275.43
* Peak flow calculated using Culvert Master, Tailwater elevation extracted from StormCAD for varying flow, headwater represents pond WSEL					

StormCAD		Culvert master
Q	TW	HW
cfs	ft	ft
0	5333.12	5333.12
10	5334.04	5334.53
20	5334.44	5335.15
30	5334.74	5335.66
40	5335.01	5336.1
50	5335.24	5336.51
60	5335.45	5336.9
70	5336.15	5337.38
80	5337.93	5339.5
86.2	5338.91	5340.74
90	5339.55	5341.54
100	5341.27	5343.73

Culvert master	
Stage	Q
ft	cfs
5333	0
5334	6.24
5335	17.58
5336	37.73
5337	62.08
5338	72.92
5338.93	77.31
5339.93	82.15
5340.93	87.10

Weighted CN Calculations									
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[illegible]

Hydrologic Calculations

(Per NMDOT Drainage Manual, Vol. 1 Hydrology)

TIME OF CONCENTRATION

Basin ID	Upland Method												Total Time of Concentration		Lag time
	Overland Flow Length (ft)	MAX EL (FT)	MIN EL (FT)	Slope (ft/ft)	Velocity* (ft/s)	Time of Conc. (min)	Shallow Conc. Flow Length (ft)	MAX EL (FT)	MIN EL (FT)	Slope (ft/ft)	Velocity* (ft/s)	Time of Conc. (min)	Total (min)	Minimum (min)	Lag Time (min)
The Boulders - West	100	5379.3	5378.7	0.006	1.70	1.0	2700	5378.7	5338.0	0.015	2.50	18.0	19.0	19.0	11
The Boulders - East	100	5362.5	5361.5	0.010	2.00	0.8	1800	5361.5	5340.1	0.012	2.25	13.3	14.2	14	9
Paradise View Subd - West	100	5373.5	5373.2	0.003	1.20	1.4	757	5373.2	5368.4	0.006	1.70	7.4	8.8	10	6
Paradise View Subd - East	100	5372.7	5372.1	0.005	1.50	1.1	1000	5372.1	5357.6	0.015	2.50	6.7	7.8	10	6

* Figure 3-10 Flow Velocities for Overland and Shallow Concentrated Flows was used from the NMDOT Drainage Manual, Volume 1. Hydrology. The Flow Velocity plot for Paved Areas (Sheet Flow), Small Upland Gullies (Shallow Concentrated Flow) was used.

User Specified Hyetograph

Rainfall Depths in Inches						
Duration	Average Recurrence Interval (years)					
	2	5	10	25	50	100
6-hour	0.932	1.210	1.420	1.720	1.950	2.200
24-hour	1.170	1.470	1.700	2.020	2.260	2.520

t (min)	dd(in)
0	0
15	0.0058
30	0.0060
45	0.0062
60	0.0064
75	0.0066
90	0.0068
105	0.0070
120	0.0072
135	0.0074
150	0.0076
165	0.0078
180	0.0082
195	0.0086
210	0.0090
225	0.0094
240	0.0098
255	0.0103
270	0.0140
285	0.0168
300	0.0210
315	0.0246
330	0.2497
345	1.1081
360	0.4277
375	0.1586
390	0.0228
405	0.0192
420	0.0154
435	0.0126
450	0.0101
465	0.0096
480	0.0092
495	0.0088

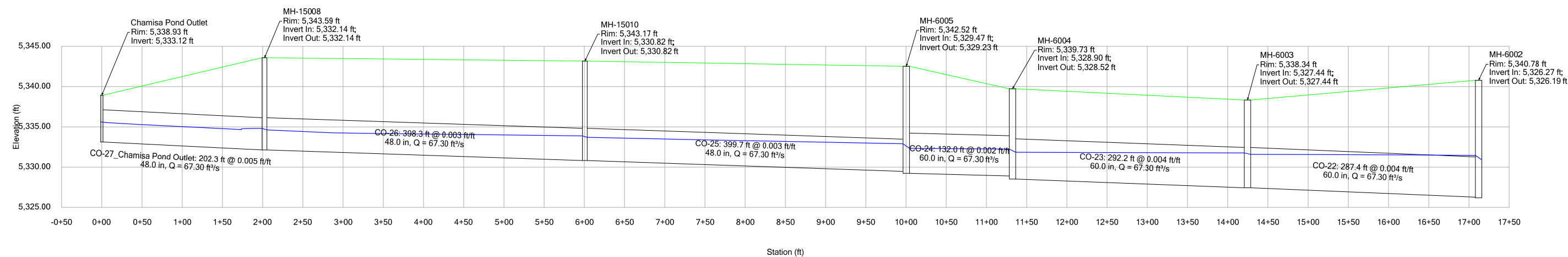
t (min)	dd(in)
510	0.0084
525	0.0080
540	0.0077
555	0.0075
570	0.0073
585	0.0071
600	0.0069
615	0.0067
630	0.0065
645	0.0063
660	0.0061
675	0.0059
690	0.0057
705	0.0056
720	0.0055
735	0.0050
750	0.0049
765	0.0048
780	0.0048
795	0.0047
810	0.0046
825	0.0045
840	0.0045
855	0.0044
870	0.0043
885	0.0043
900	0.0042
915	0.0041
930	0.0041
945	0.0040
960	0.0039
975	0.0039
990	0.0038
1005	0.0037

t (min)	dd(in)
1020	0.0036
1035	0.0036
1050	0.0035
1065	0.0034
1080	0.0034
1095	0.0033
1110	0.0032
1125	0.0032
1140	0.0031
1155	0.0030
1170	0.0030
1185	0.0029
1200	0.0028
1215	0.0027
1230	0.0027
1245	0.0026
1260	0.0025
1275	0.0025
1290	0.0024
1305	0.0023
1320	0.0023
1335	0.0022
1350	0.0021
1365	0.0020
1380	0.0020
1395	0.0019
1410	0.0018
1425	0.0018
1440	0.0017

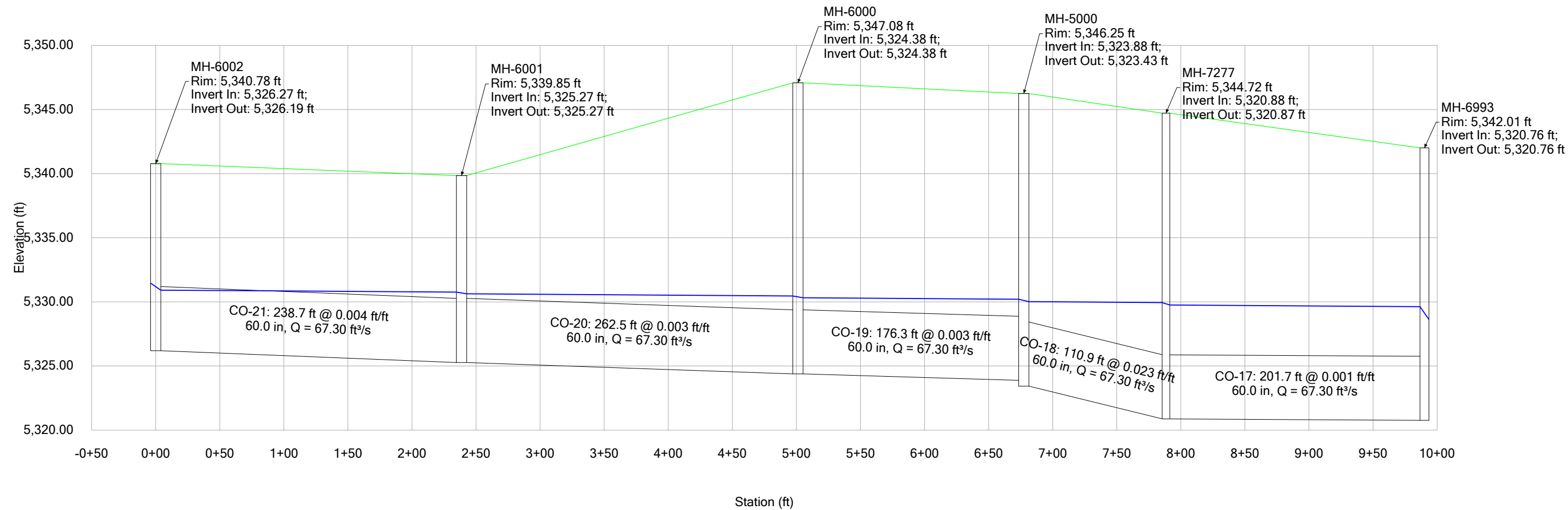
StormCAD Results - Current Conditions

Label	Start Node	Stop Node	Flow (ft³/s)	Diameter (in)	Length (User Defined) (ft)	Slope (Calculate d) (ft/ft)	Invert (Downstre am) (ft)	Invert (Upstream) (ft)	Elevation Ground (Stop) (ft)	Elevation Ground (Start) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Upstream Structure Headloss (ft)	Cover (Start) (ft)	Cover (Stop) (ft)	Velocity (Average) (ft/s)
CO-1	MH-6997	OF-1	813.8	72	116.9	0.081	5,256.33	5,265.84	5,271.00	5,275.29	5,271.79	5,262.33	0.26	3.45	8.67	45.85
CO-3	MH-6995	MH-6996	801.3	72	93.3	0.031	5,294.23	5,297.15	5,303.83	5,312.95	5,304.02	5,300.68	0.20	9.8	3.6	28.34
CO-9	MH-6992	MH-6994	535.3	90	20.2	0.041	5,300.67	5,301.50	5,318.02	5,318.40	5,308.24	5,308.41	0.20	9.4	9.85	31.98
CO-10	MH-6018	MH-6992	535.3	90	378.1	0.025	5,301.55	5,311.10	5,318.40	5,324.85	5,317.08	5,308.44	0.10	6.25	9.35	26.72
CO-11	MH-6017	MH-6018	503.3	90	499.6	0.01	5,311.15	5,316.01	5,324.85	5,340.61	5,321.81	5,317.18	0.20	17.1	6.2	18.34
CO-12	MH-6016	MH-6017	503.3	90	306.5	0.003	5,316.01	5,317.04	5,340.61	5,345.98	5,323.70	5,322.01	0.25	21.44	17.1	11.39
CO-13	MH-6015	MH-6016	503.3	90	297.3	0.003	5,317.04	5,317.95	5,345.98	5,344.45	5,325.16	5,323.95	0.20	19	21.44	11.39
CO-14	MH-6013	MH-6015	470.3	90	395.2	0.002	5,317.95	5,318.75	5,344.45	5,342.05	5,326.84	5,325.36	0.12	15.8	19	10.65
CO-15	MH-20013	MH-6013	470.3	90	291.9	0.004	5,318.75	5,319.98	5,342.05	5,342.33	5,328.06	5,326.96	0.12	14.85	15.8	10.65
CO-16	MH-6993	MH-20013	470.3	90	119.5	0.006	5,320.00	5,320.76	5,342.33	5,342.01	5,328.62	5,328.18	1.00	13.75	14.83	10.65
CO-17	MH-7277	MH-6993	67.3	60	201.7	0.001	5,320.76	5,320.87	5,342.01	5,344.72	5,329.76	5,329.62	0.18	18.85	16.25	3.43
CO-18	MH-5000	MH-7277	67.3	60	110.9	0.023	5,320.88	5,323.43	5,344.72	5,346.25	5,330.02	5,329.94	0.19	17.82	18.84	3.43
CO-19	MH-6000	MH-5000	67.3	60	176.3	0.003	5,323.88	5,324.38	5,346.25	5,347.08	5,330.32	5,330.20	0.14	17.7	17.37	3.43
CO-20	MH-6001	MH-6000	67.3	60	262.5	0.003	5,324.38	5,325.27	5,347.08	5,339.85	5,330.63	5,330.46	0.13	9.58	17.7	3.43
CO-21	MH-6002	MH-6001	67.3	60	238.7	0.004	5,325.27	5,326.19	5,339.85	5,340.78	5,330.91	5,330.76	0.55	9.59	9.58	7.86
CO-22	MH-6003	MH-6002	67.3	60	287.4	0.004	5,326.27	5,327.44	5,340.78	5,338.34	5,331.59	5,331.46	0.17	5.9	9.51	8.02
CO-23	MH-6004	MH-6003	67.3	60	292.2	0.004	5,327.44	5,328.52	5,338.34	5,339.73	5,331.85	5,331.76	0.40	6.21	5.9	7.74
CO-24	MH-6005	MH-6004	67.3	60	132	0.002	5,328.90	5,329.23	5,339.73	5,342.52	5,332.34	5,332.25	0.57	8.29	5.83	6.69
CO-25	MH-15010	MH-6005	67.3	48	399.7	0.003	5,329.47	5,330.82	5,342.52	5,343.17	5,333.66	5,332.91	0.18	8.35	9.05	7.39
CO-26	MH-15008	MH-15010	67.3	48	398.3	0.003	5,330.82	5,332.14	5,343.17	5,343.59	5,334.89	5,333.84	0.18	7.45	8.35	7.33
CO-27_Chamisa Pond Outlet	Chamisa Pond Outlet	MH-15008	67.3	48	202.3	0.005	5,332.14	5,333.12	5,343.59	5,338.93	5,335.60	5,335.08	0.00	1.81	7.45	8.53
CO-29	CB-6	MH-6997	12.5	24	87.9	0.233	5,268.84	5,289.28	5,275.29	5,295.38	5,290.55	5,272.05	0.08	4.1	4.45	23.11
CO-30	CB-7	CB-6	6.8	24	53	0.03	5,290.08	5,291.68	5,295.38	5,296.63	5,292.60	5,290.66	0.00	2.95	3.3	9.38
CO-33_Alder Dr	CB-82	MH-6018	32	48	81	0.027	5,313.60	5,315.81	5,324.85	5,324.04	5,317.49	5,317.18	0.50	4.23	7.25	13.17
CO-51_Essex Dr	CB-81	MH-6015	33	36	87	0.017	5,334.05	5,335.52	5,344.45	5,344.36	5,337.38	5,335.39	0.50	5.84	7.4	11.43
CO-66	MH-6994	CB-Cattle Guard Inlet at Irving Blvd	535.3	90	110	0.005	5,300.15	5,300.67	5,315.17	5,318.02	5,308.31	5,307.78	0.10	9.85	7.52	12.12
CO-70	MH-6996	MH-6997	801.3	72	461.5	0.062	5,265.84	5,294.23	5,275.29	5,303.83	5,300.18	5,272.05	0.50	3.6	3.45	40.91
CO-72	CB-Cattle Guard	T-90" x 72"	801.3	90	209.7	0.013	5,297.44	5,300.15	5,313.16	5,315.17	5,307.58	5,305.32	0.20	7.52	8.22	22.41
CO-73	T-90" x 72"	MH-6995	801.3	72	22.4	0.013	5,297.15	5,297.44	5,312.95	5,313.16	5,305.02	5,304.22	0.30	9.72	9.8	28.34
CO-134_Paradise	CB-80	MH-6993	403	72	229.7	0.051	5,320.76	5,332.57	5,342.01	5,344.02	5,337.92	5,329.62	0.50	5.45	15.25	32.48

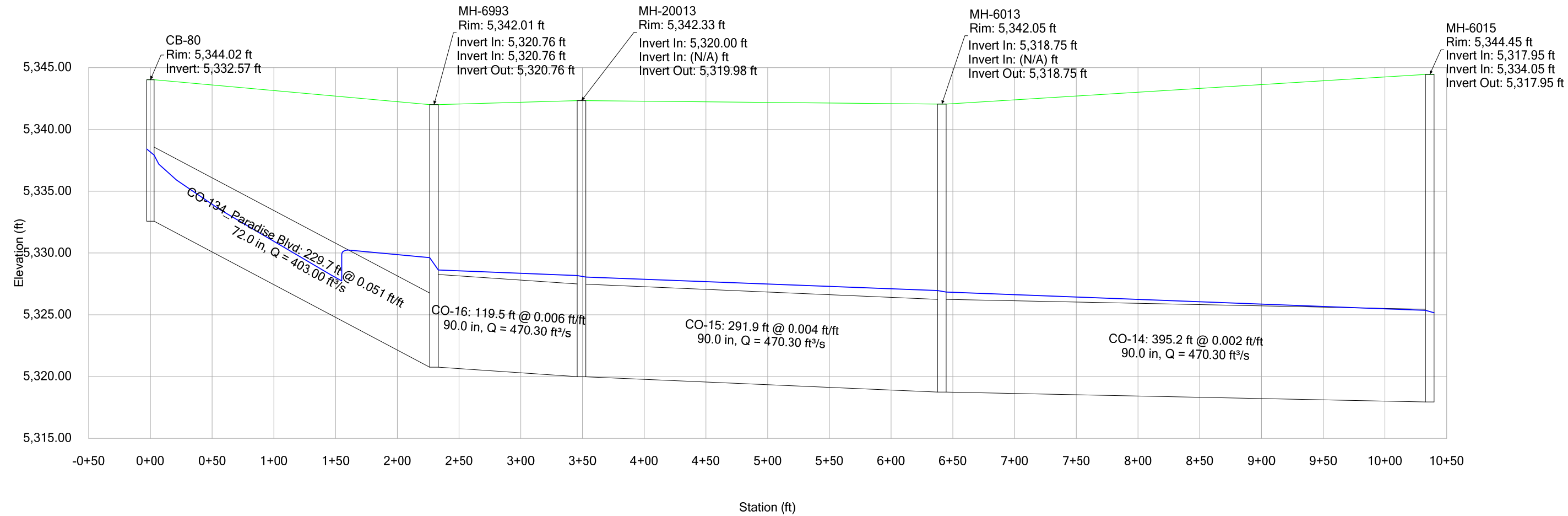
Profile Report
Engineering Profile - 4_2 Chamisa Pond to Paradise (Chamisa SD_Current.stc)



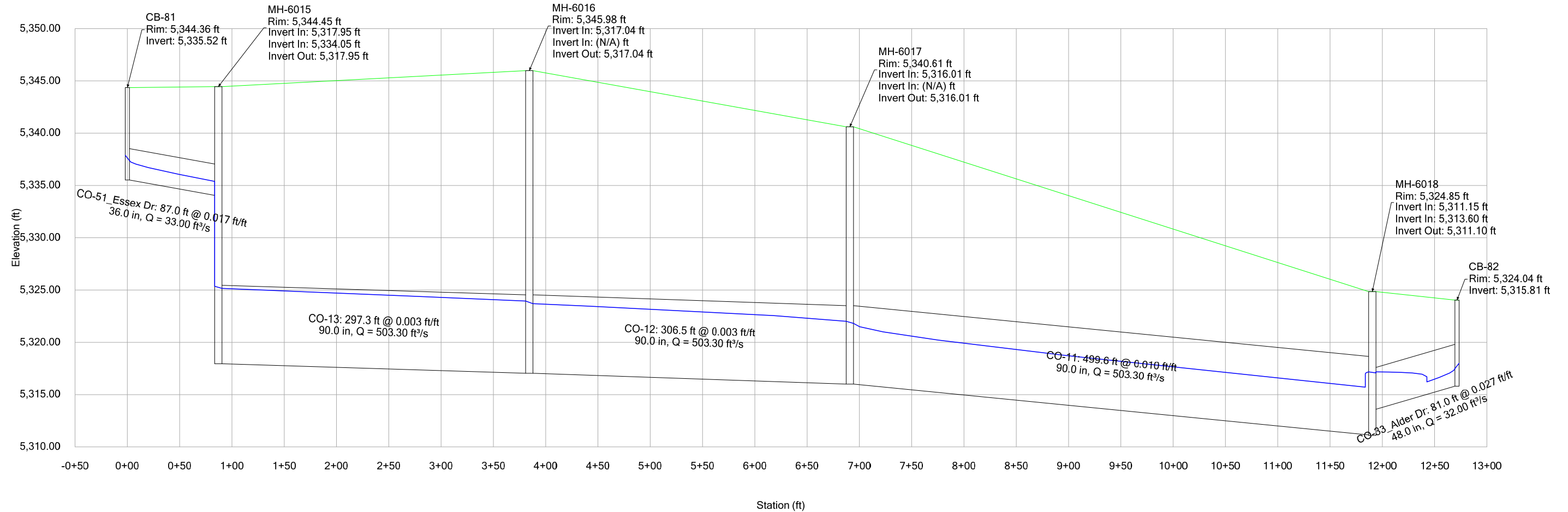
Profile Report
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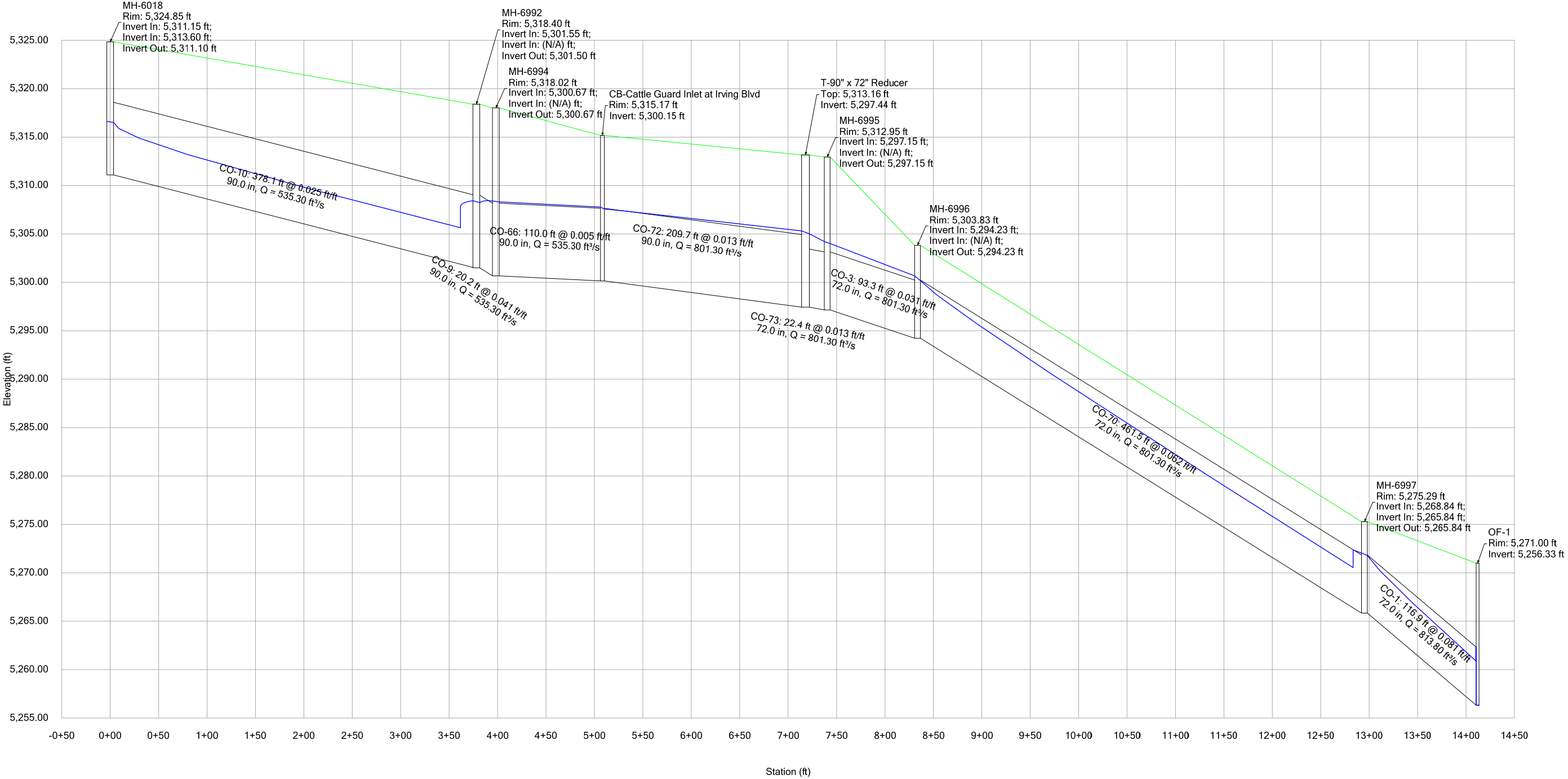
Profile Report
Engineering Profile - 3 - Paradise to Essex (Chamisa SD_Current.stc)

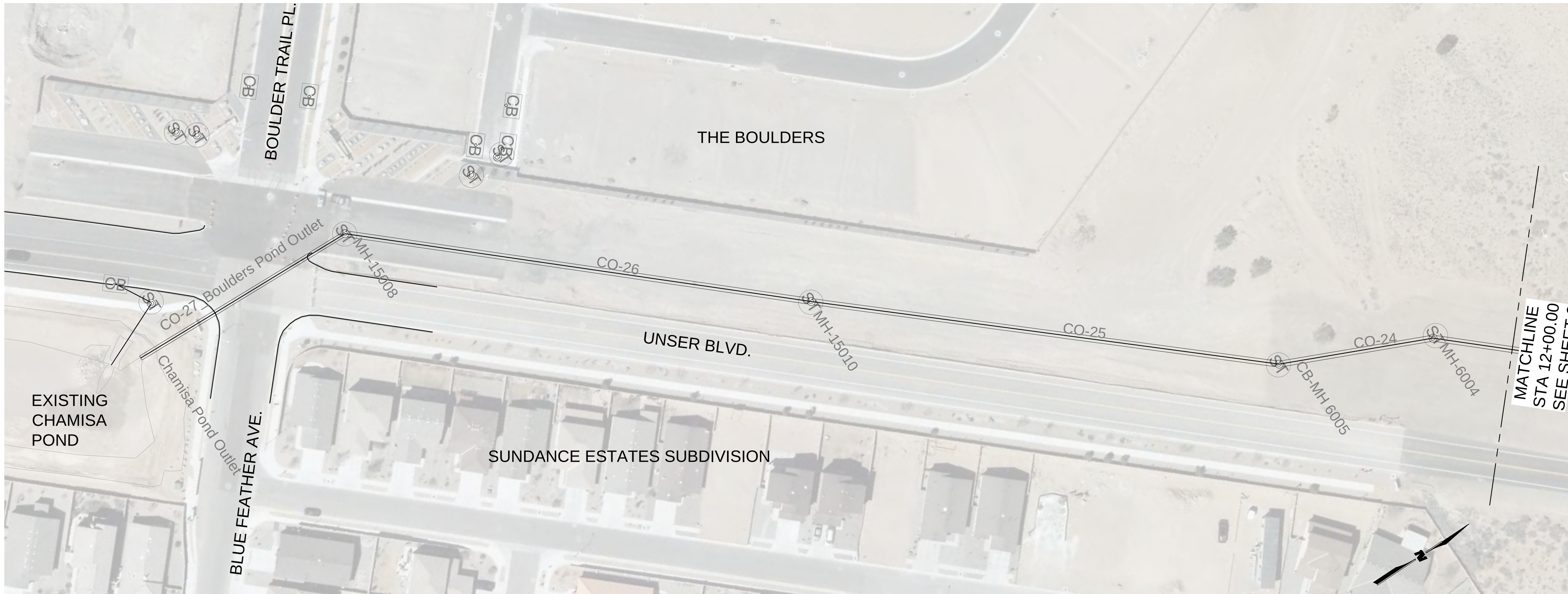


Profile Report
Engineering Profile - 2 - Essex to Alder (Chamisa SD_Current.stc)

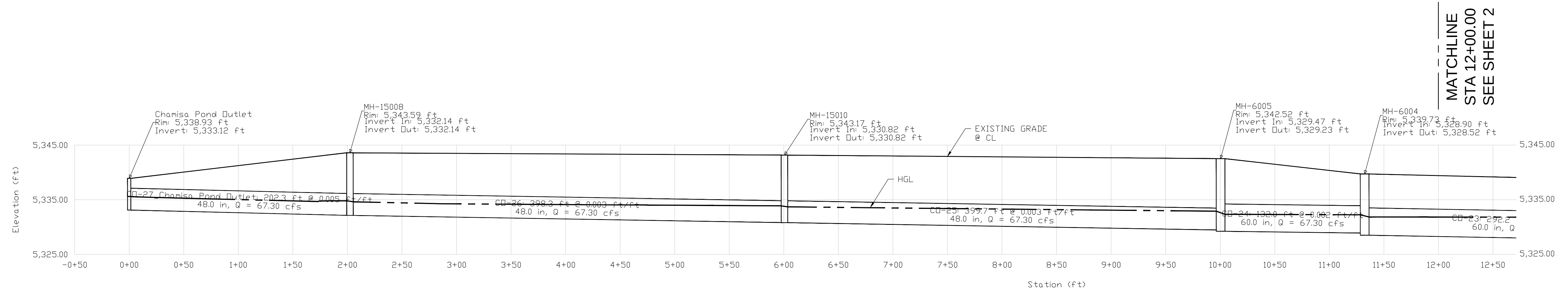


Profile Report
Engineering Profile - 1 - Alder Rd to Outfall (Chamisa SD_Current.stc)





E1 PLAN

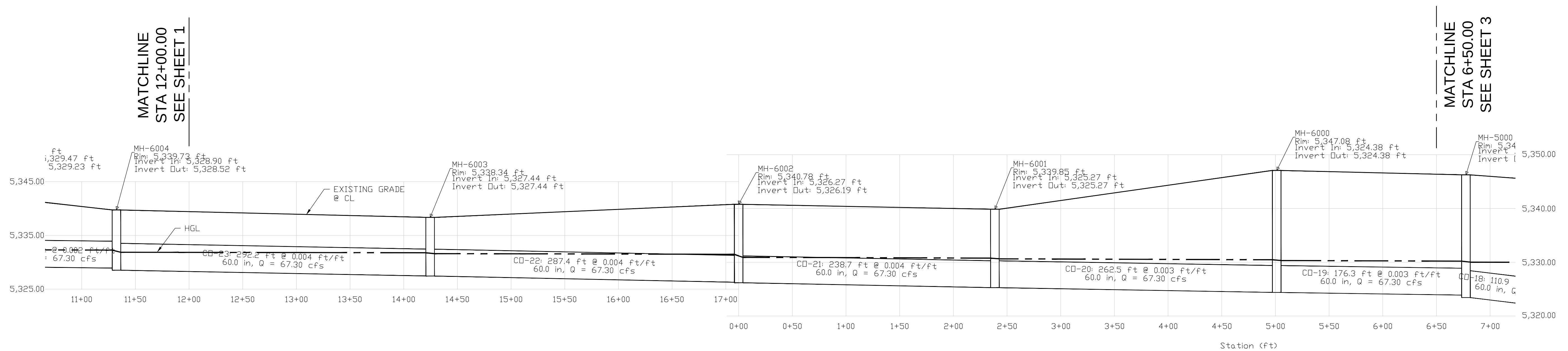


A1 PROFILE

CHAMISA/LYON STORM DRAIN HYDRAULIC ANALYSIS
CURRENT CONDITIONS

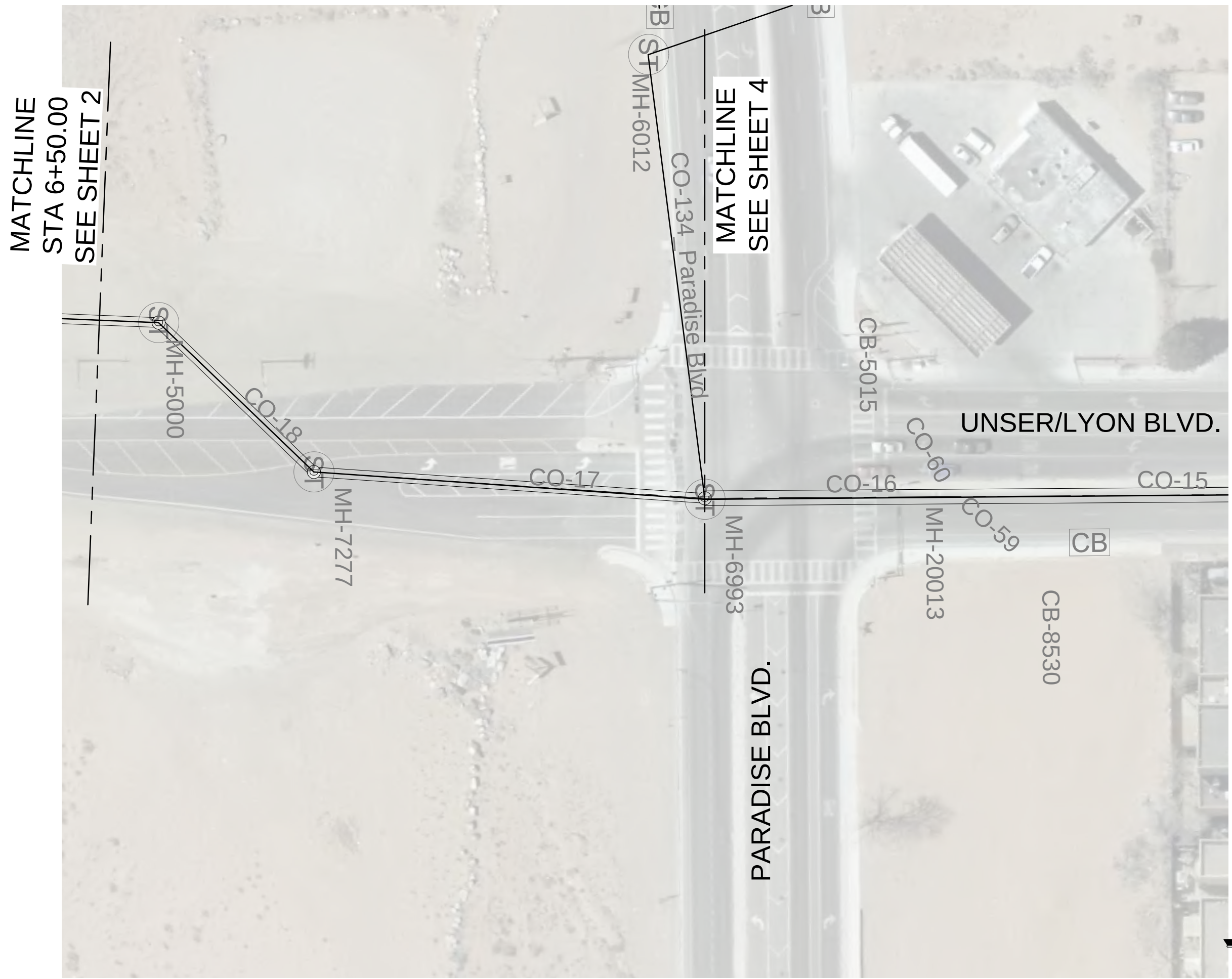


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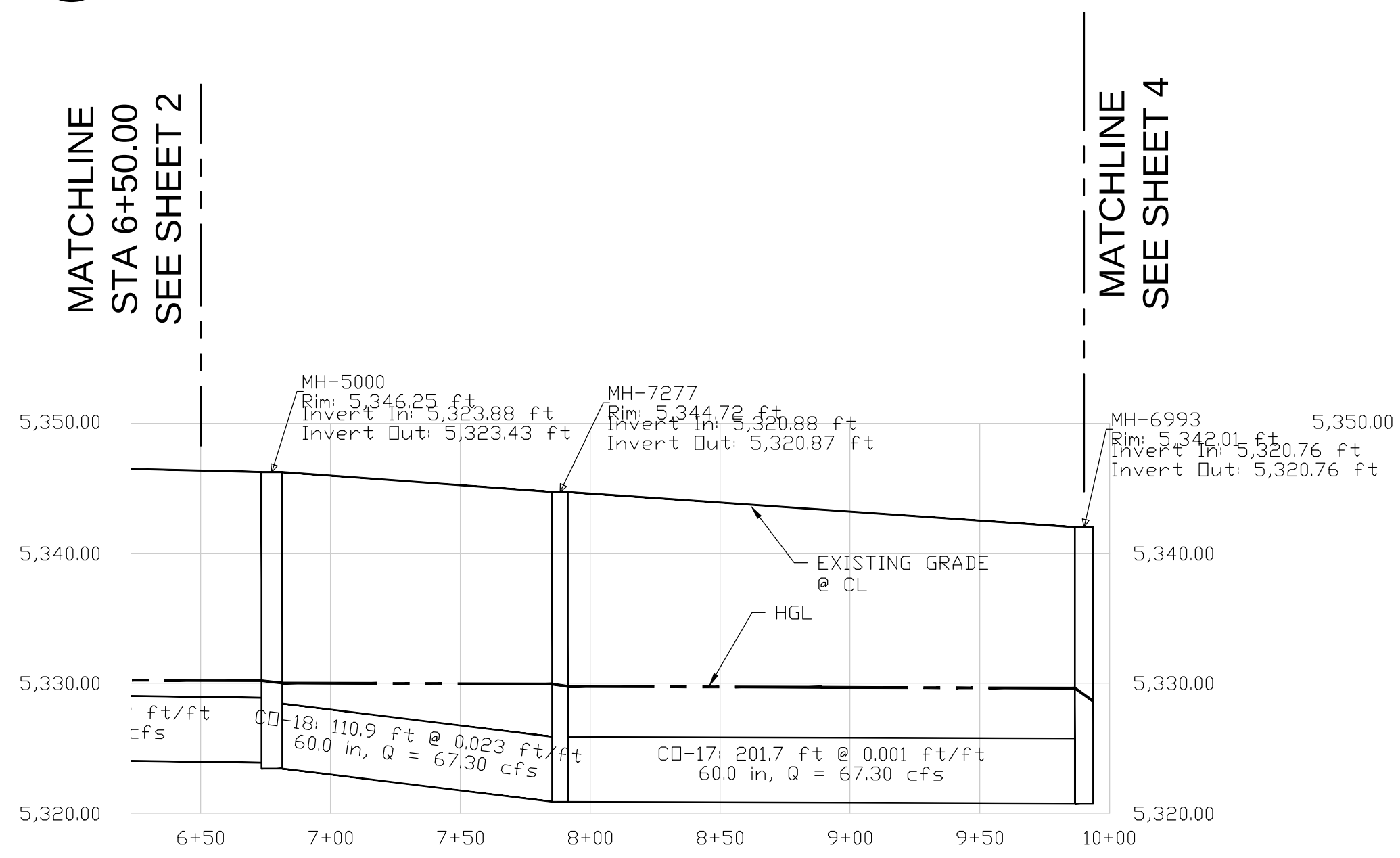


A1 PROFILE
H: 1" = 50' V: 1" = 10'

CHAMISA/LYON STORM DRAIN HYDRAULIC ANALYSIS CURRENT CONDITIONS

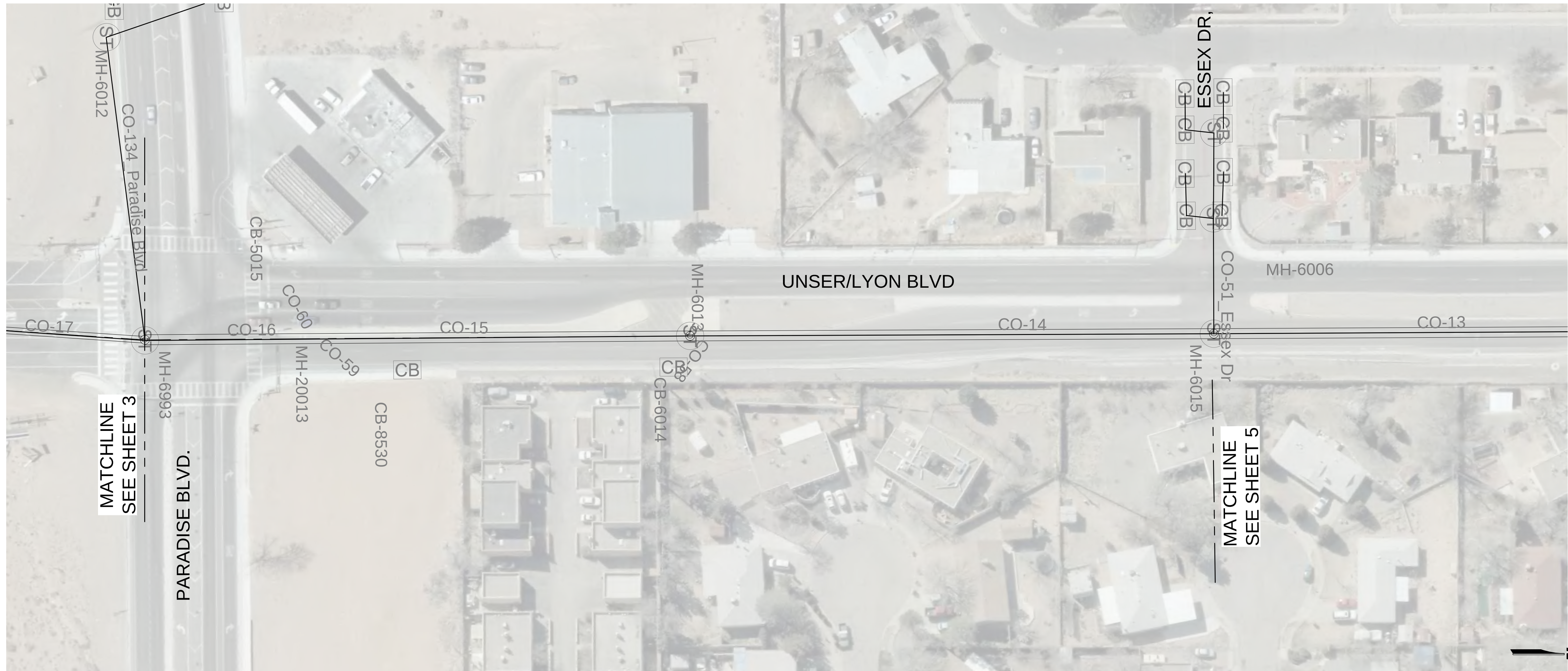


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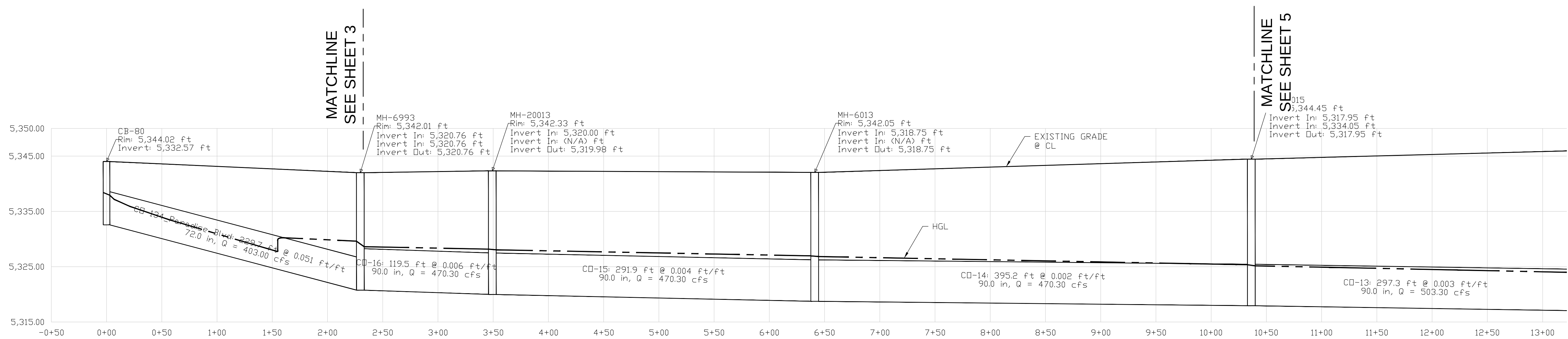


A1 PROFILE
H: 1" = 50' V: 1" = 10'

CHAMISA/LYON STORM DRAIN HYDRAULIC ANALYSIS
CURRENT CONDITIONS



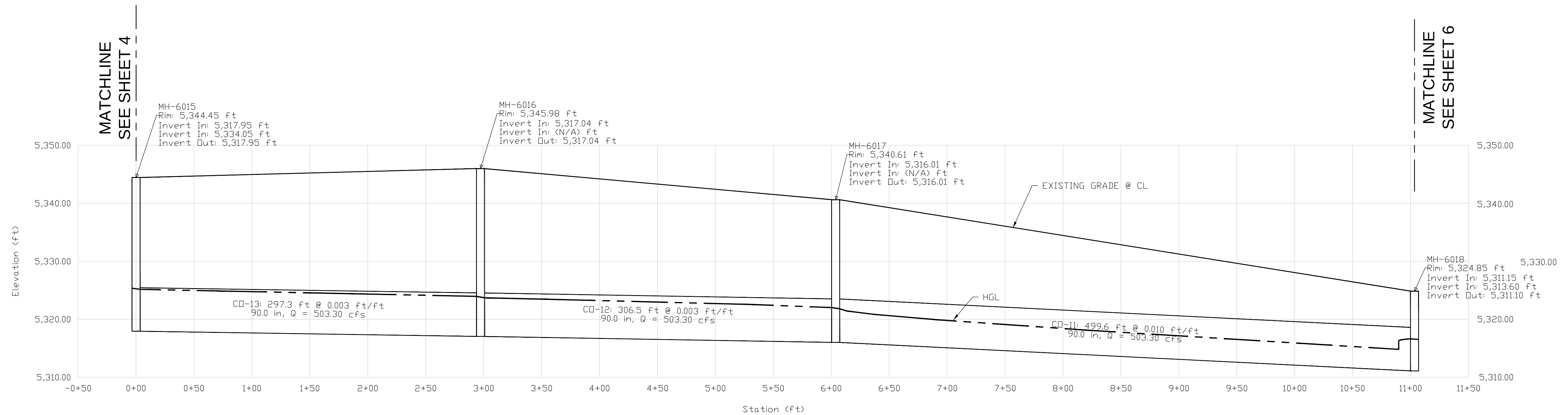
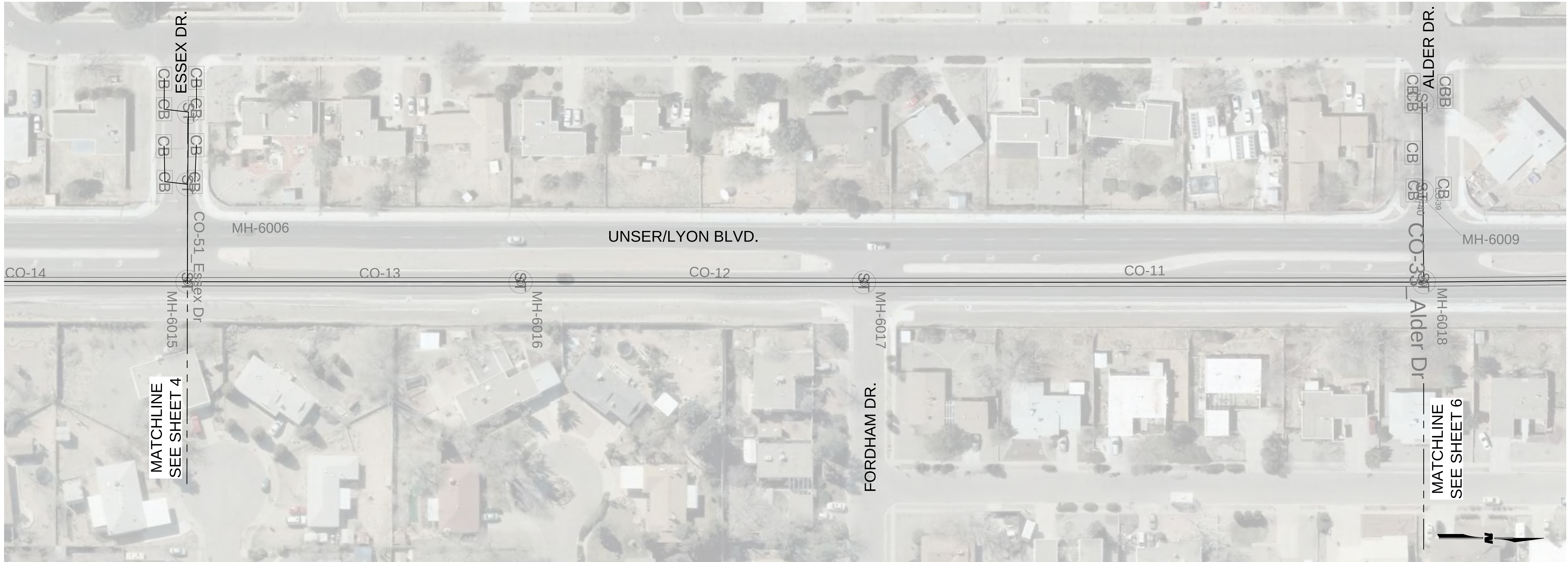
E2 PLAN
1" = 50'



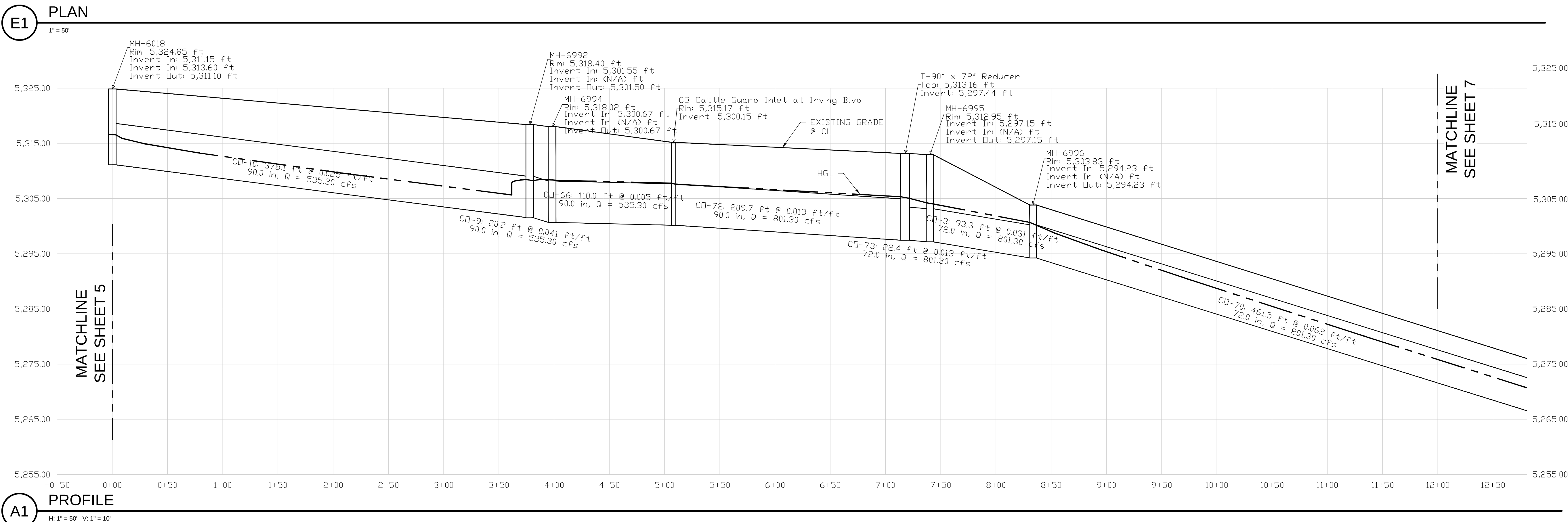
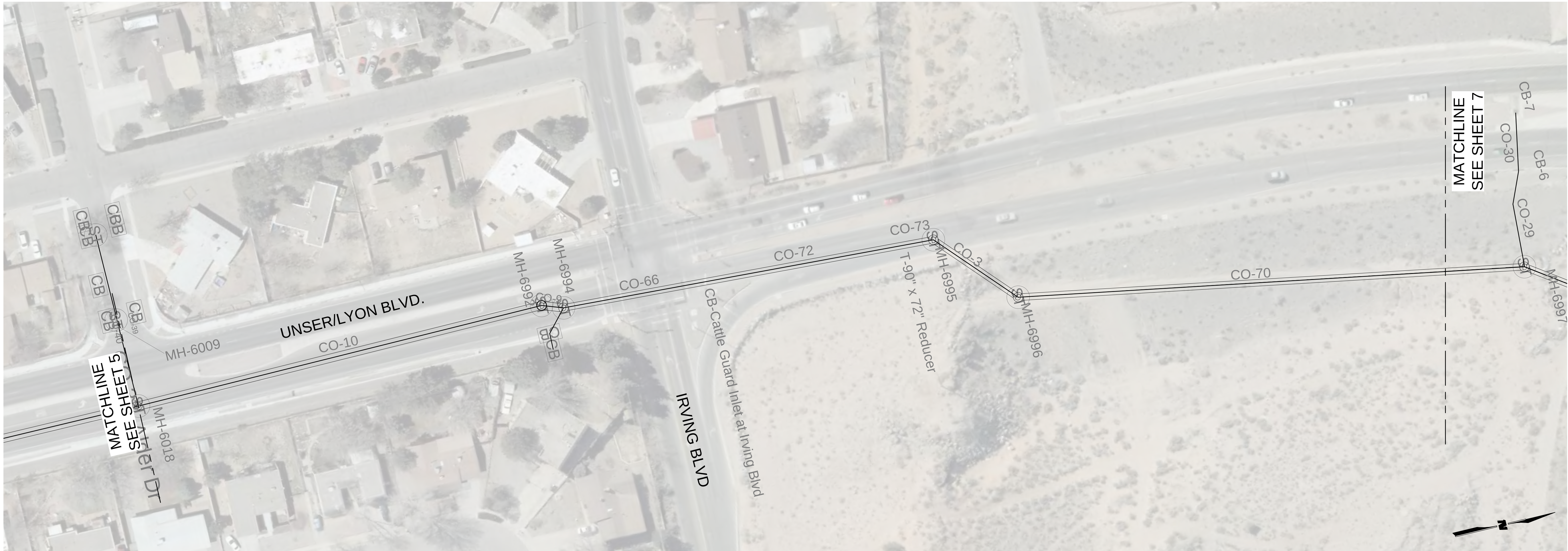
A1 PROFILE
H: 1" = 50' V: 1" = 10'

CHAMISA/LYON STORM DRAIN HYDRAULIC ANALYSIS CURRENT CONDITIONS

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CHAMISA/LYON STORM DRAIN HYDRAULIC ANALYSIS
CURRENT CONDITIONS

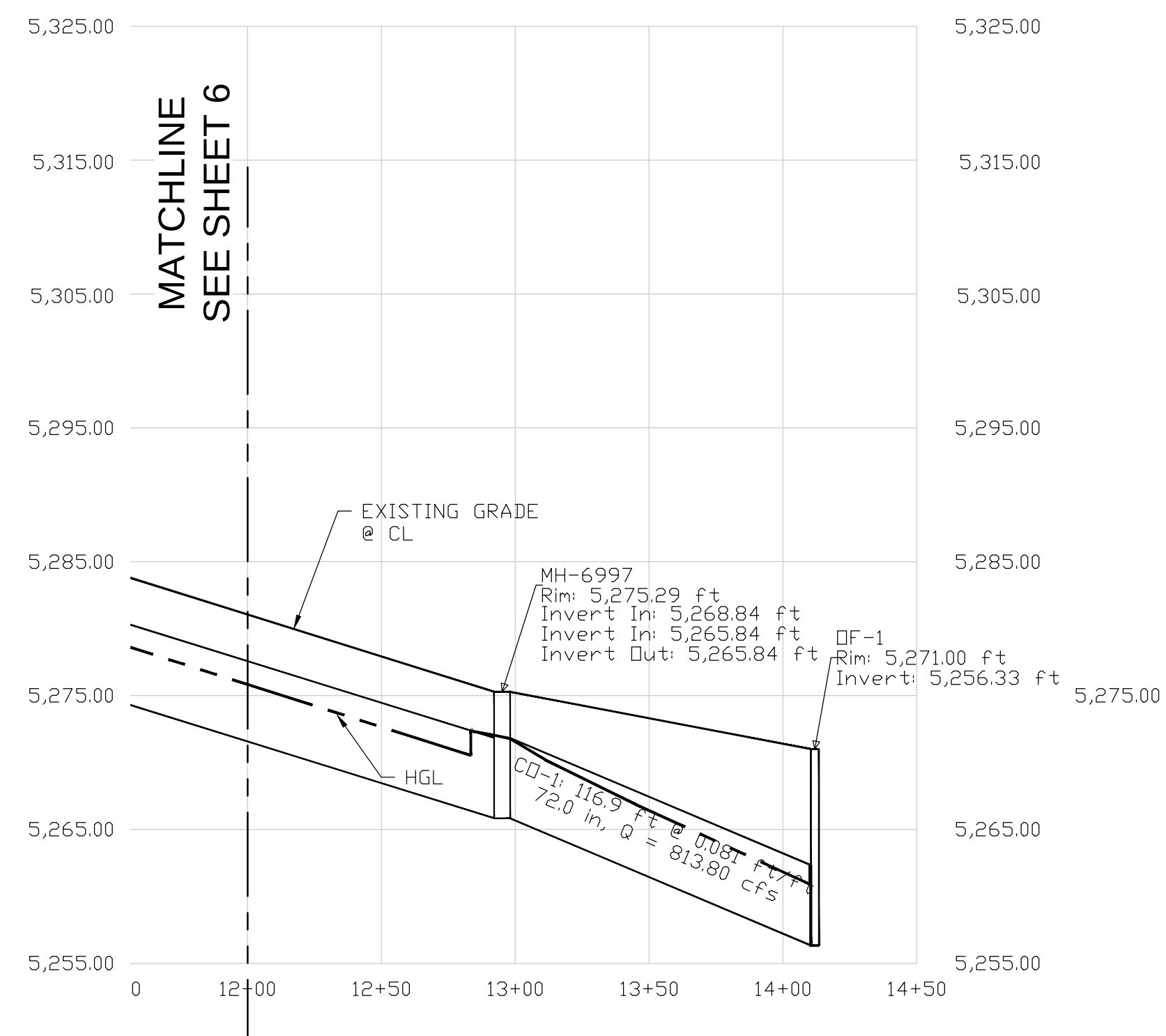


CHAMISA/LYON STORM DRAIN HYDRAULIC ANALYSIS
CURRENT CONDITIONS

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E1 PLAN
1" = 50'



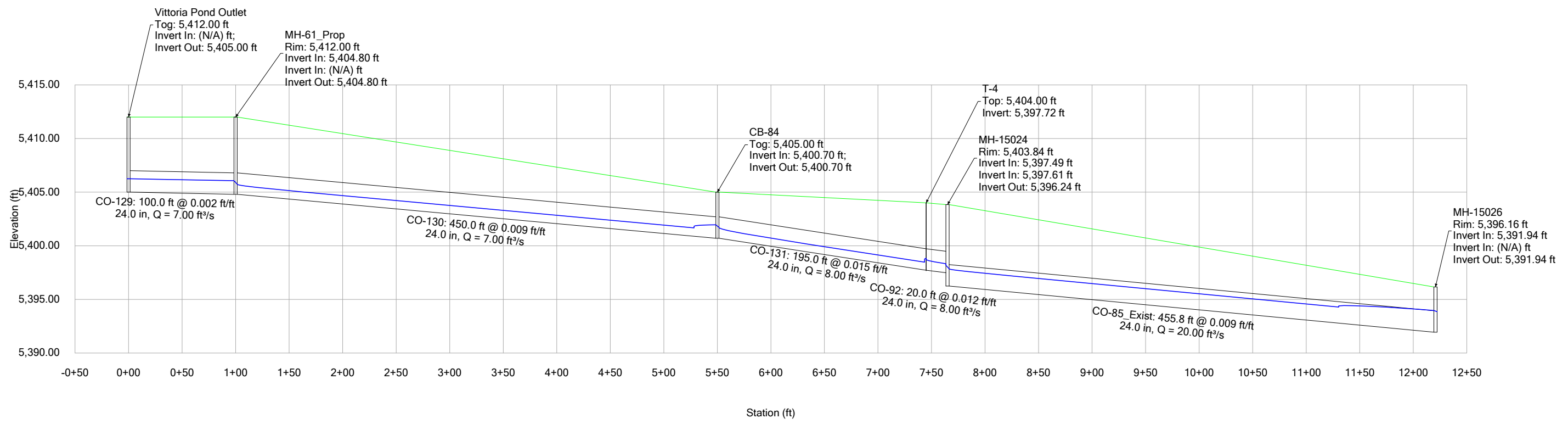
A1 PROFILE
H: 1" = 50' V: 1" = 10'

CHAMISA/LYON STORM DRAIN HYDRAULIC ANALYSIS
CURRENT CONDITIONS

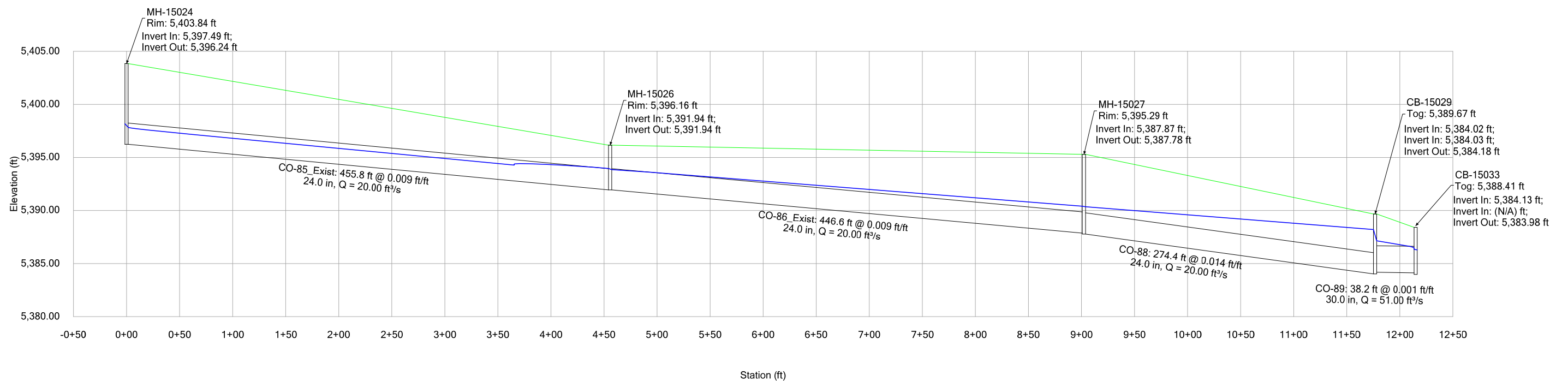
StormCAD Results - Full Build-out Conditions																
Label	Start Node	Stop Node	Flow (ft³/s)	Diameter (in)	Length (User Defined) (ft)	Slope (Calculate d) (ft/ft)	Invert (Downstream) (ft)	Invert (Upstream) (ft)	Elevation Ground (Stop) (ft)	Elevation Ground (Start) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Upstream Structure Headloss (ft)	Cover (Start) (ft)	Cover (Stop) (ft)	Velocity (Average) (ft/s)
CO-1	MH-6997	OF-1	958.5	72	116.9	0.081	5,256.33	5,265.84	5,271.00	5,275.29	5,271.81	5,262.33	0.26	3.45	8.67	47.4
CO-3	MH-6995	MH-6996	946	72	93.3	0.031	5,294.23	5,297.15	5,303.83	5,312.95	5,305.36	5,300.70	0.2	9.8	3.6	33.46
CO-9	MH-6992	MH-6994	785	90	20.2	0.041	5,300.67	5,301.50	5,318.02	5,318.40	5,311.82	5,311.61	0.2	9.4	9.85	17.77
CO-10	MH-6018	MH-6992	785	90	378.1	0.025	5,301.55	5,311.10	5,318.40	5,324.85	5,318.01	5,312.02	0.1	6.25	9.35	29.34
CO-11	MH-6017	MH-6018	648	90	499.6	0.01	5,311.15	5,316.01	5,324.85	5,340.61	5,322.50	5,318.11	0.2	17.1	6.2	19.26
CO-12	MH-6016	MH-6017	648	90	306.5	0.003	5,316.01	5,317.04	5,340.61	5,345.98	5,325.21	5,322.70	0.25	21.44	17.1	14.67
CO-13	MH-6015	MH-6016	648	90	297.3	0.003	5,317.04	5,317.95	5,345.98	5,344.45	5,327.58	5,325.46	0.2	19	21.44	14.67
CO-14	MH-6013	MH-6015	615	90	395.2	0.002	5,317.95	5,318.75	5,344.45	5,342.05	5,330.32	5,327.78	0.12	15.8	19	13.92
CO-15	MH-20013	MH-6013	615	90	291.9	0.004	5,318.75	5,319.98	5,342.05	5,342.33	5,332.31	5,330.44	0.12	14.85	15.8	13.92
CO-16	MH-6993	MH-20013	615	90	119.5	0.006	5,320.00	5,320.76	5,342.33	5,342.01	5,333.20	5,332.43	1	13.75	14.83	13.92
CO-17	MH-7277	MH-6993	212	60	201.7	0.001	5,320.76	5,320.87	5,342.01	5,344.72	5,335.53	5,334.20	0.89	18.85	16.25	10.8
CO-18	MH-5000	MH-7277	137	60	110.9	0.023	5,320.88	5,323.43	5,344.72	5,346.25	5,336.73	5,336.42	0.19	17.82	18.84	6.98
CO-19	MH-6000	MH-5000	137	60	176.3	0.003	5,323.88	5,324.38	5,346.25	5,347.08	5,337.40	5,336.92	0.14	17.7	17.37	6.98
CO-20	MH-6001	MH-6000	137	60	262.5	0.003	5,324.38	5,325.27	5,347.08	5,339.85	5,338.27	5,337.54	0.13	9.58	17.7	6.98
CO-21	MH-6002	MH-6001	137	60	238.7	0.004	5,325.27	5,326.19	5,339.85	5,340.78	5,339.06	5,338.40	0.11	9.59	9.58	6.98
CO-22	MH-6003	MH-6002	137	60	287.4	0.004	5,326.27	5,327.44	5,340.78	5,338.34	5,339.96	5,339.16	0.1	5.9	9.51	6.98
CO-23	MH-6004	MH-6003	137	60	292.2	0.004	5,327.44	5,328.52	5,338.34	5,339.73	5,340.87	5,340.06	0.14	6.21	5.9	6.98
CO-24	MH-6005	MH-6004	137	60	132	0.002	5,328.90	5,329.23	5,339.73	5,342.52	5,341.37	5,341.01	0.43	8.29	5.83	6.98
CO-25	MH-15010	MH-6005	69	48	399.7	0.003	5,329.47	5,330.82	5,342.52	5,343.17	5,342.73	5,341.80	0.1	8.35	9.05	5.49
CO-26	MH-15008	MH-15010	69	48	398.3	0.003	5,330.82	5,332.14	5,343.17	5,343.59	5,343.75	5,342.83	0.18	7.45	8.35	5.49
CO-27_Chamisa Pond Outlet	Chamisa Pond Outlet	MH-15008	69	48	202.3	0.005	5,332.14	5,333.12	5,343.59	5,338.93	5,344.40	5,343.93	0	1.81	7.45	5.49
CO-29	CB-6	MH-6997	12.5	24	87.9	0.233	5,268.84	5,289.28	5,275.29	5,295.38	5,290.55	5,272.07	0.08	4.1	4.45	23.11
CO-30	CB-7	CB-6	6.8	24	53	0.03	5,290.08	5,291.68	5,295.38	5,296.63	5,292.60	5,290.66	0	2.95	3.3	9.38
CO-33_Alder Dr	MH-6009	MH-6018	137	48	81	0.027	5,313.60	5,315.81	5,324.85	5,324.04	5,319.29	5,318.11	0.5	4.23	7.25	19.56
CO-51_Essex Dr	MH-6006	MH-6015	33	36	87	0.017	5,334.05	5,335.52	5,344.45	5,344.36	5,337.38	5,335.39	0.5	5.84	7.4	11.43
CO-66	MH-6994	CB-Cattle Guard Inlet	785	90	110	0.005	5,300.15	5,300.67	5,315.17	5,318.02	5,311.51	5,310.36	0.1	9.85	7.52	17.77
CO-70	MH-6996	MH-6997	946	72	461.5	0.062	5,265.84	5,294.23	5,275.29	5,303.83	5,300.20	5,272.07	0.5	3.6	3.45	42.04
CO-72	CB-Cattle Guard	T-90" x 72" Reducer	946	90	209.7	0.013	5,297.44	5,300.15	5,313.16	5,315.17	5,310.16	5,306.98	0.2	7.52	8.22	21.41
CO-73	T-90" x 72" Reducer	MH-6995	946	72	22.4	0.013	5,297.15	5,297.44	5,312.95	5,313.16	5,306.68	5,305.56	0.3	9.72	9.8	33.46
CO-84_Exist	CB- 1 Villa de	MH-15024	12	18	42.2	0.058	5,397.61	5,400.05	5,403.84	5,403.15	5,401.36	5,398.40	0.23	1.6	4.73	14.12
CO-85_Exist	MH-15024	MH-15026	20	24	455.8	0.009	5,391.94	5,396.24	5,396.16	5,403.84	5,397.85	5,393.96	0.33	5.6	2.22	7.93
CO-86_Exist	MH-15026	MH-15027	20	24	446.6	0.009	5,387.87	5,391.94	5,395.29	5,396.16	5,393.85	5,390.40	0.11	2.22	5.42	7.8
CO-87_Exist	CB-2_VDC	CB- 1 Villa de Chamisa	0.5	18	17.7	0.011	5,400.10	5,400.29	5,403.15	5,403.04	5,401.59	5,401.59	0	1.25	1.55	3.13
CO-88	MH-15027	CB-15029	20	24	274.4	0.014	5,384.03	5,387.78	5,389.67	5,395.29	5,390.35	5,388.21	0.05	5.51	3.64	6.37
CO-89	CB-15029	CB-15033	51	30	38.2	0.001	5,384.13	5,384.18	5,388.41	5,389.67	5,387.15	5,386.44	1.06	2.99	1.78	10.39
CO-90	CB-Chamisa Ridge	MH-15028	31	24	362.6	0.007	5,384.28	5,386.64	5,390.55	5,391.84	5,395.48	5,388.67	0	3.2	4.27	9.87
CO-91	MH-15028	CB-15029	31	24	14	0.016	5,384.02	5,384.25	5,389.67	5,390.55	5,388.47	5,388.21	0.2	4.3	3.65	9.87
CO-92	T-4	MH-15024	8	24	20	0.012	5,397.49	5,397.72	5,403.84	5,404.00	5,398.73	5,398.33	0.1	4.28	4.35	6.93
CO-93	CB-15033	T-5	51	30	7.8	0.029	5,383.75	5,383.98	5,388.50	5,388.41	5,386.29	5,385.80	0.05	1.93	2.25	15.63
CO-94	MH-15013	MH-43	20	24	99.7	0.006	5,353.73	5,354.29	5,361.81	5,364.37	5,360.30	5,359.52	0.31	8.08	6.08	6.37

StormCAD Results - Full Build-out Conditions																
Label	Start Node	Stop Node	Flow (ft³/s)	Diameter (in)	Length (User Defined) (ft)	Slope (Calculate d) (ft/ft)	Invert (Downstream) (ft)	Invert (Upstream) (ft)	Elevation Ground (Stop) (ft)	Elevation Ground (Start) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Upstream Structure Headloss (ft)	Cover (Start) (ft)	Cover (Stop) (ft)	Velocity (Average) (ft/s)
CO-95	MH-43	MH-Sta 22+22	20	24	87.3	0.008	5,352.94	5,353.63	5,359.79	5,361.81	5,359.34	5,358.66	0.18	6.18	4.85	6.37
CO-96	MH-Sta 22+22	MH-Sta 22+77	31.3	30	59.5	0.006	5,352.48	5,352.84	5,358.72	5,359.79	5,358.31	5,357.96	0.35	4.45	3.74	6.38
CO-97	MH-Sta 22+77	MH-Sta 24+73	31.3	30	190.8	0.011	5,350.30	5,352.38	5,355.82	5,358.72	5,357.79	5,356.68	0.17	3.84	3.02	6.38
CO-98	MH-Sta 24+73	MH-Sta 26+70.9	60.8	36	191.4	0.009	5,348.52	5,350.20	5,354.14	5,355.82	5,356.18	5,354.59	0.5	2.62	2.62	8.6
CO-99	MH-Sta 26+70.9	MH-Sta 27+57.3	71.8	36	81.9	0.011	5,347.50	5,348.42	5,353.67	5,354.14	5,354.14	5,353.19	0.45	2.72	3.17	10.16
CO-100	MH-Sta 27+57.3	MH-Sta 27+86.6	71.8	36	25.3	0.018	5,347.05	5,347.50	5,353.22	5,353.67	5,353.00	5,352.71	0.19	3.17	3.17	10.16
CO-101	MH-Sta 27+86.6	MH-Sta 28+28.7	71.8	36	37.6	0.052	5,344.98	5,346.95	5,352.02	5,353.22	5,352.56	5,352.12	0.15	3.27	4.04	10.16
CO-102	MH-Sta 28+28.7	MH-8561	78.4	36	126.8	0.01	5,343.67	5,344.88	5,351.20	5,352.02	5,351.72	5,349.97	0.4	4.14	4.53	11.09
CO-103	MH-8561	MH-8562	138.8	42	33.9	0.018	5,342.86	5,343.46	5,350.93	5,351.20	5,349.43	5,348.78	0.54	4.24	4.57	14.43
CO-104	MH-8562	MH-15003	158.9	42	135.8	0.017	5,340.42	5,342.75	5,350.82	5,350.93	5,348.45	5,345.06	0.33	4.68	6.9	16.52
CO-105	MH-15003	MH-15004	158.9	42	65.6	0.023	5,338.92	5,340.42	5,347.96	5,350.82	5,344.90	5,343.27	0.16	6.9	5.54	16.52
CO-106	MH-15004	OF-Chamisa Pond S Xing	158.9	42	138.8	0.02	5,336.18	5,338.92	5,348.00	5,347.96	5,343.10	5,339.59	0.17	5.54	8.32	16.52
CO-107	CB-Sta 22+11	MH-Sta 22+22	5.65	18	10	0.01	5,352.28	5,352.38	5,359.79	5,359.58	5,358.69	5,358.66	0	5.7	6.01	3.2
CO-108	CB-Sta 21+97.05	MH-Sta 22+22	5.65	18	33.5	0.073	5,354.51	5,356.97	5,359.79	5,359.88	5,358.75	5,358.66	0	1.41	3.78	3.2
CO-109	CB-Sta 20+12.5	MH-Sta 24+73	19	18	84	0.012	5,350.30	5,351.31	5,355.82	5,355.64	5,359.43	5,356.68	0	2.83	4.02	10.75
CO-110	CB-Sta 24+69.08	MH-Sta 24+73	5.25	18	7	0.027	5,350.20	5,350.39	5,355.82	5,354.98	5,356.70	5,356.68	0	3.09	4.12	2.97
CO-111	CB-sta 24+46.3	MH-Sta 24+73	5.25	18	29	0.011	5,350.30	5,350.62	5,355.82	5,355.34	5,356.75	5,356.68	0	3.22	4.02	2.97
CO-112	CB-Sta 26+67.4	MH-Sta 26+70.9	5.5	18	28	0.014	5,348.42	5,348.80	5,354.14	5,353.01	5,354.67	5,354.59	0	2.71	4.22	3.11
CO-113	CB-26+69	MH-Sta 26+70.9	5.5	18	8	0.023	5,348.42	5,348.60	5,354.14	5,353.00	5,354.61	5,354.59	0	2.9	4.22	3.11
CO-114	CB-Sta 28+28.7 LT	MH-Sta 28+28.7	3.3	18	16.7	0.01	5,346.56	5,346.73	5,352.02	5,351.58	5,352.14	5,352.12	0	3.35	3.96	1.87
CO-115	CB-Sta 28+27.7 RT	MH-Sta 28+28.7	3.3	18	7	0.01	5,346.56	5,346.63	5,352.02	5,351.58	5,352.13	5,352.12	0	3.45	3.96	1.87
CO-122	MH-8563	MH-8561	60.4	36	77.2	0.012	5,343.56	5,344.45	5,351.20	5,352.67	5,350.60	5,349.97	0.52	5.22	4.64	8.54
CO-123	CB-8560	MH-8562	20.1	18	21.3	0.015	5,342.88	5,343.20	5,350.93	5,350.53	5,349.56	5,348.78	0	5.83	6.55	11.37
CO-124	T-5	MH-57-Prop	51	30	450	0.03	5,370.43	5,383.75	5,378.00	5,388.50	5,386.06	5,372.84	0	2.25	5.07	15.66
CO-125	MH-57-Prop	MH-58_Prop	51	30	450	0.02	5,361.38	5,370.43	5,366.10	5,378.00	5,372.74	5,365.42	0.1	5.07	2.22	13.36
CO-127	APS Pond Outlet	MH-15013	20	48	42.3	0.092	5,354.29	5,358.16	5,364.37	5,365.20	5,360.55	5,360.61	0	3.04	6.08	17.58
CO-129	Vittoria Pond	MH-61_Prop	7	24	100	0.002	5,404.80	5,405.00	5,412.00	5,412.00	5,406.25	5,406.07	0	5	5.2	3.48
CO-130	MH-61_Prop	CB-84	7	24	450	0.009	5,400.70	5,404.80	5,405.00	5,412.00	5,405.74	5,401.96	0.33	5.2	2.3	6.14
CO-131	CB-84	T-4	8	24	195	0.015	5,397.72	5,400.70	5,404.00	5,405.00	5,401.71	5,398.83	0.25	2.3	4.28	7.68
CO-132	MH-58_Prop	OF-4	51	30	347	0.02	5,354.29	5,361.38	5,364.37	5,366.10	5,365.37	5,360.00	0.05	2.22	7.58	10.39
CO-134_Paradise Blvd	MH-6012	MH-6993	403	72	229.7	0.051	5,320.76	5,332.57	5,342.01	5,344.02	5,337.92	5,334.20	0.5	5.45	15.25	32.48
CO-137	CB-86	MH-6005	68	48	50	0.01	5,329.23	5,329.73	5,342.52	5,342.52	5,341.92	5,341.80	0	8.79	9.29	5.41
CO-138	CB-87	MH-7277	75	48	50	0.01	5,320.87	5,321.37	5,344.72	5,344.80	5,336.56	5,336.42	0	19.43	19.85	5.97

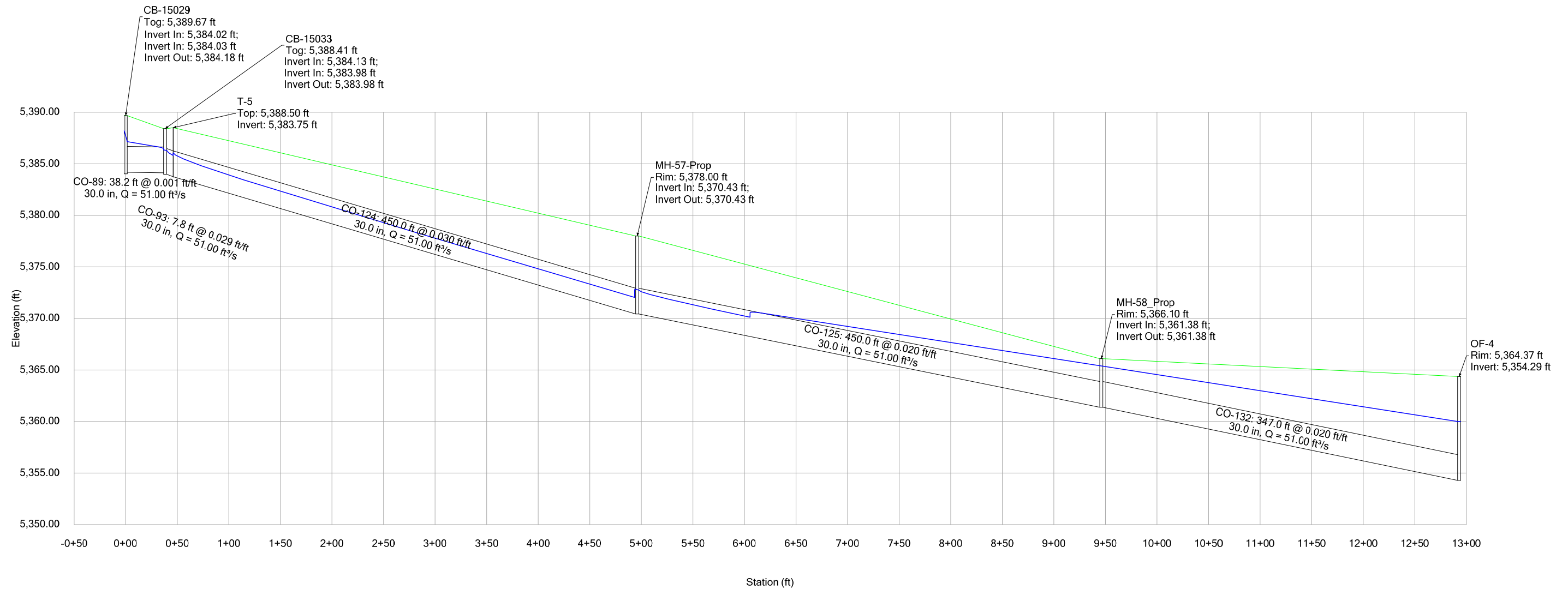
Profile Report
Engineering Profile - 7_2 - Vittoria Pond to Chamisa Ridge (Chamisa SD_Full Build-out.stc)



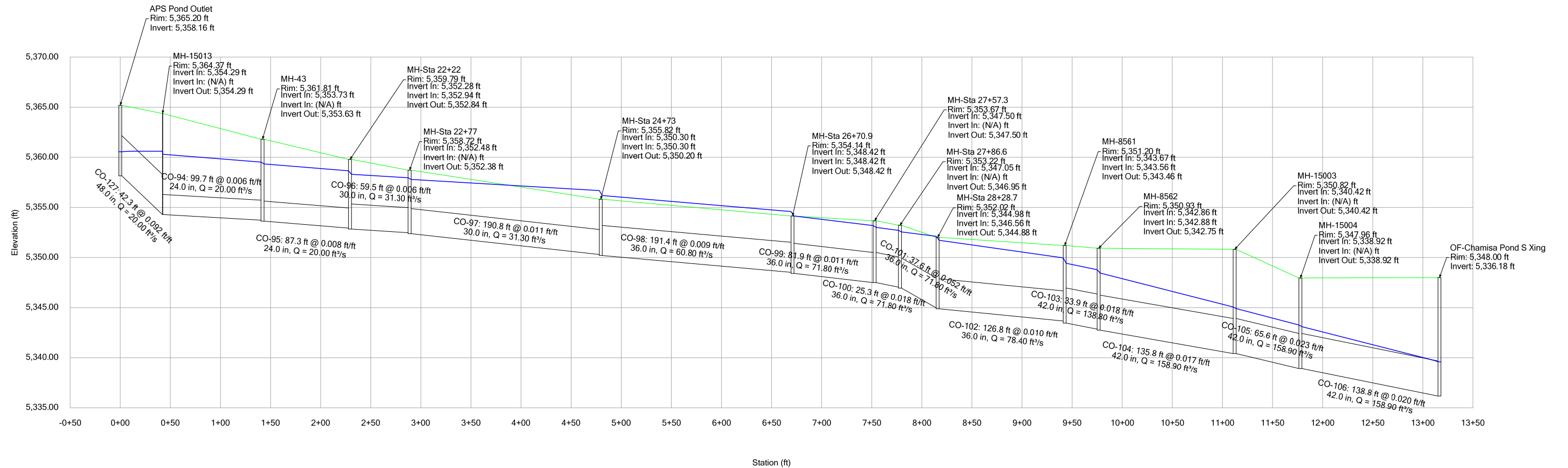
Profile Report
Engineering Profile - 7_1 - Vittoria to Chamisa Ridge (Chamisa SD_Full Build-out.stc)



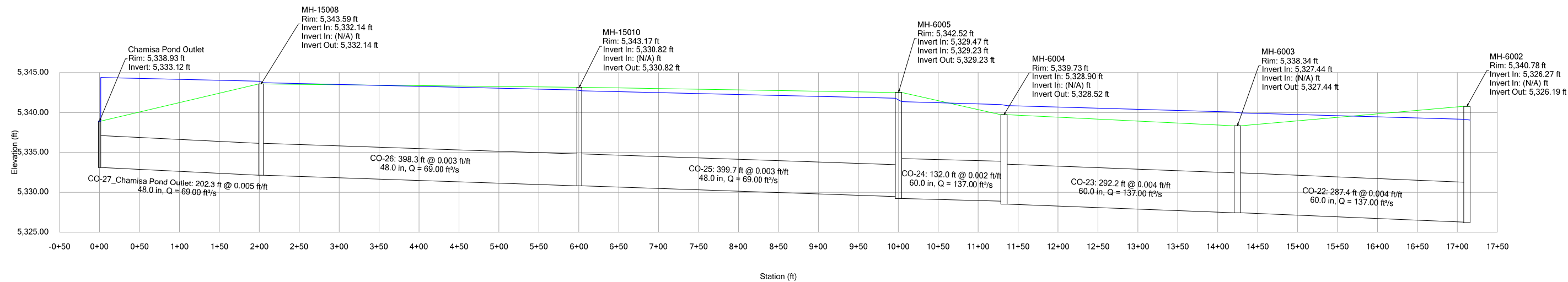
Profile Report
Engineering Profile - 6 - Chamisa Ridge to APS Pond (Chamisa SD_Full Build-out.stc)



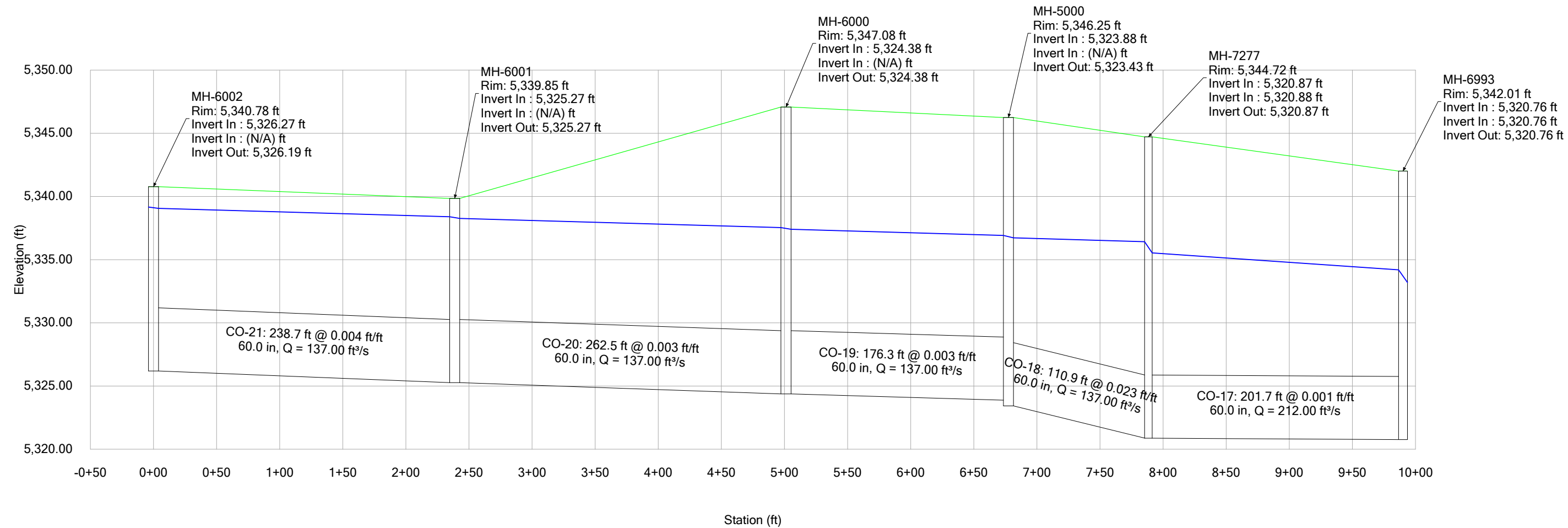
Profile Report
Engineering Profile - 5 - APS Pond to Chamisa Pond (Chamisa SD_Full Build-out.stc)



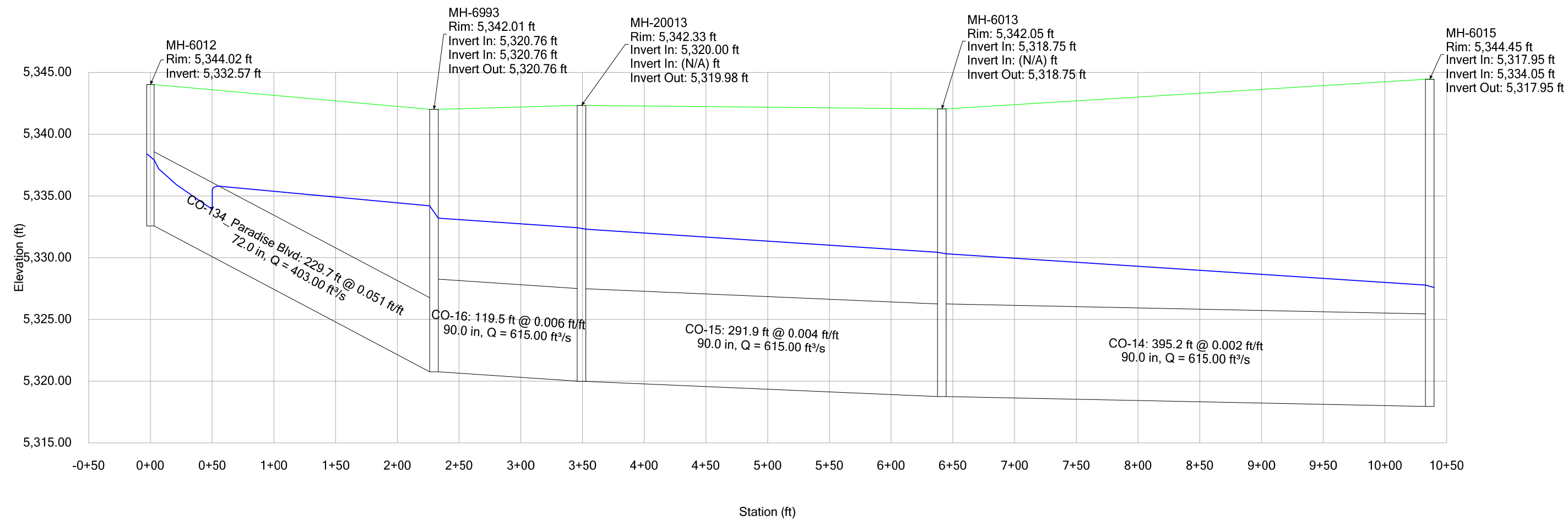
Profile Report
Engineering Profile - 4_2 Chamisa Pond to Paradise (Chamisa SD_Full Build-out.stc)



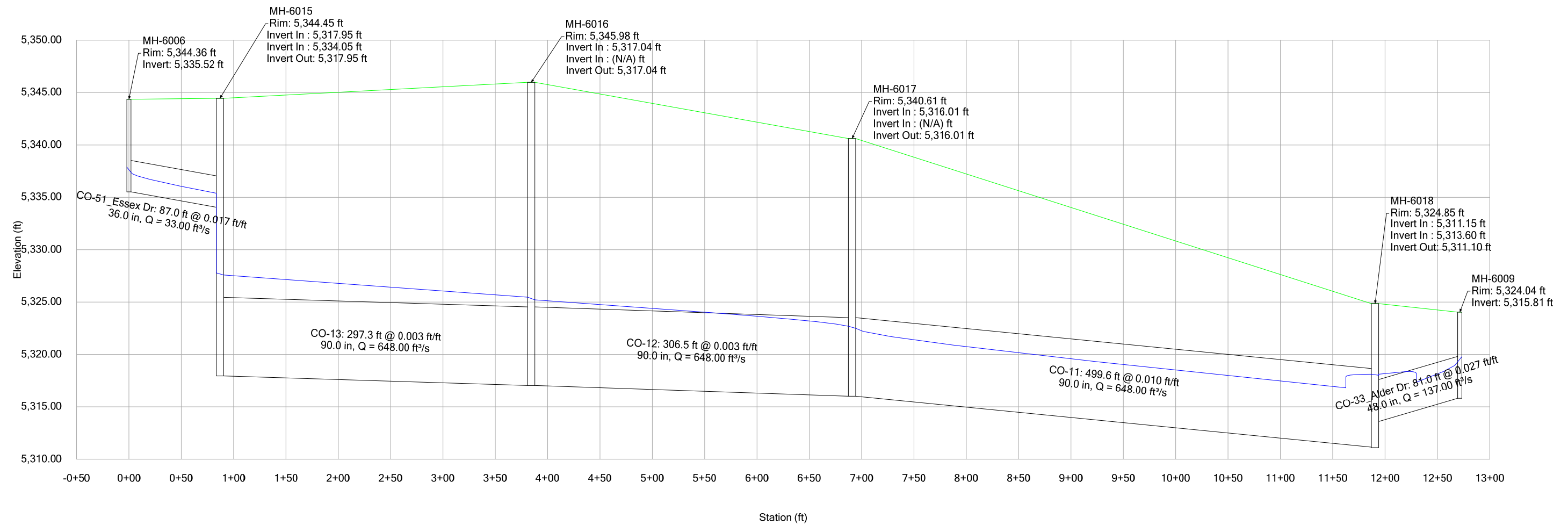
Profile Report
Engineering Profile - 4_1 Chamisa Pond to Paradise (Chamisa SD_Full Build-out.stc)



Profile Report
Engineering Profile - 3 - Paradise to Essex (Chamisa SD_Full Build-out.stc)

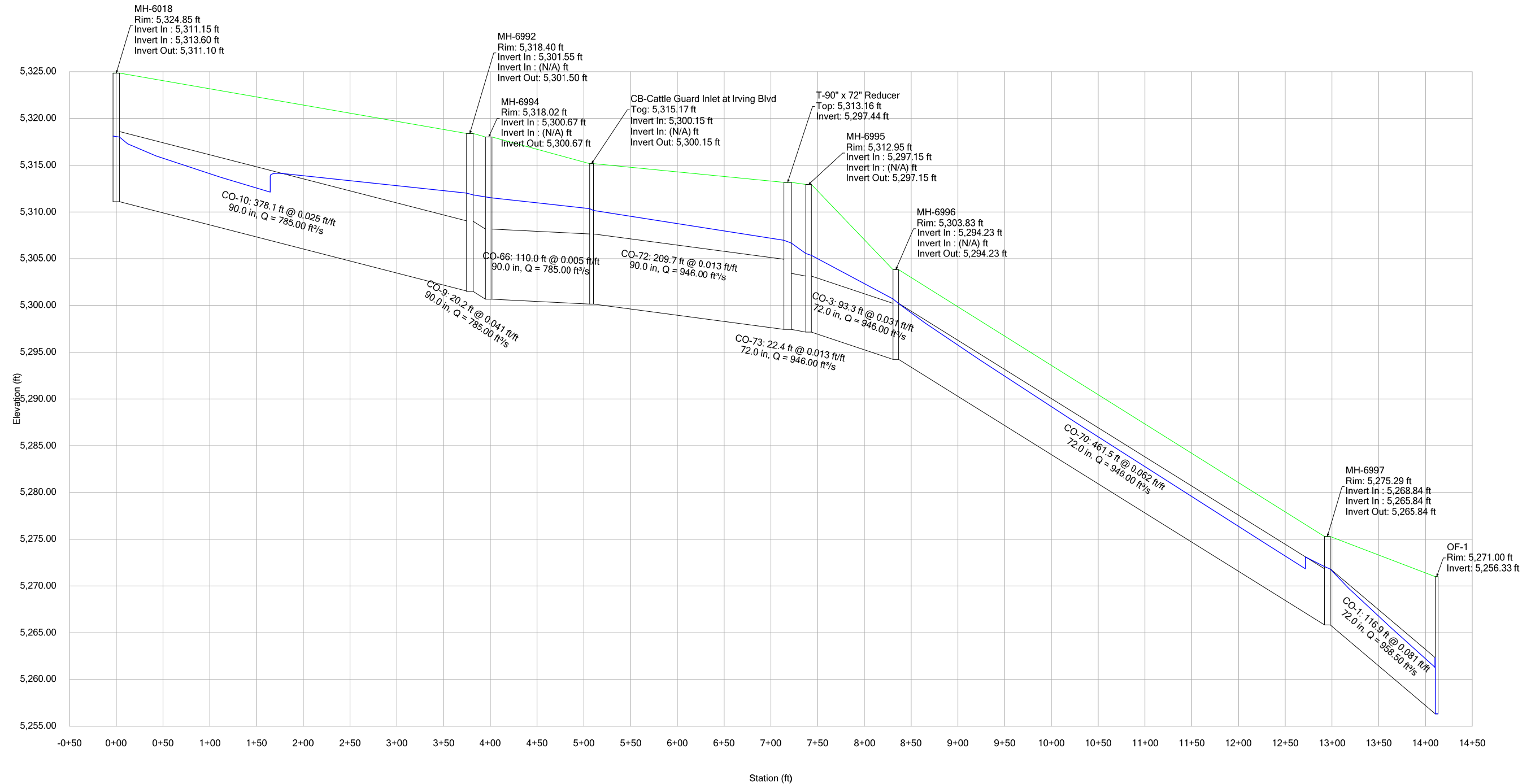


Profile Report
Engineering Profile - 2 - Essex to Alder (Chamisa SD_Full Build-out.stc)



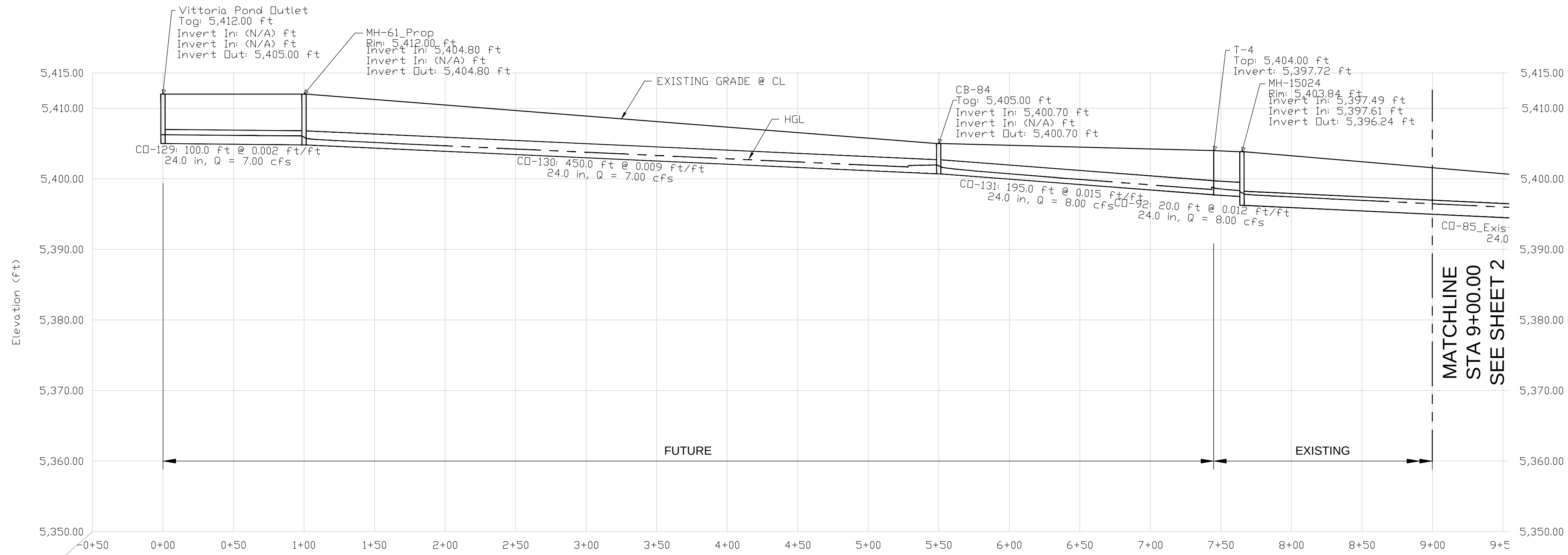
Profile Report

Engineering Profile - 1 - Alder Rd to Outfall (Chamisa SD_Full Build-out.stc)



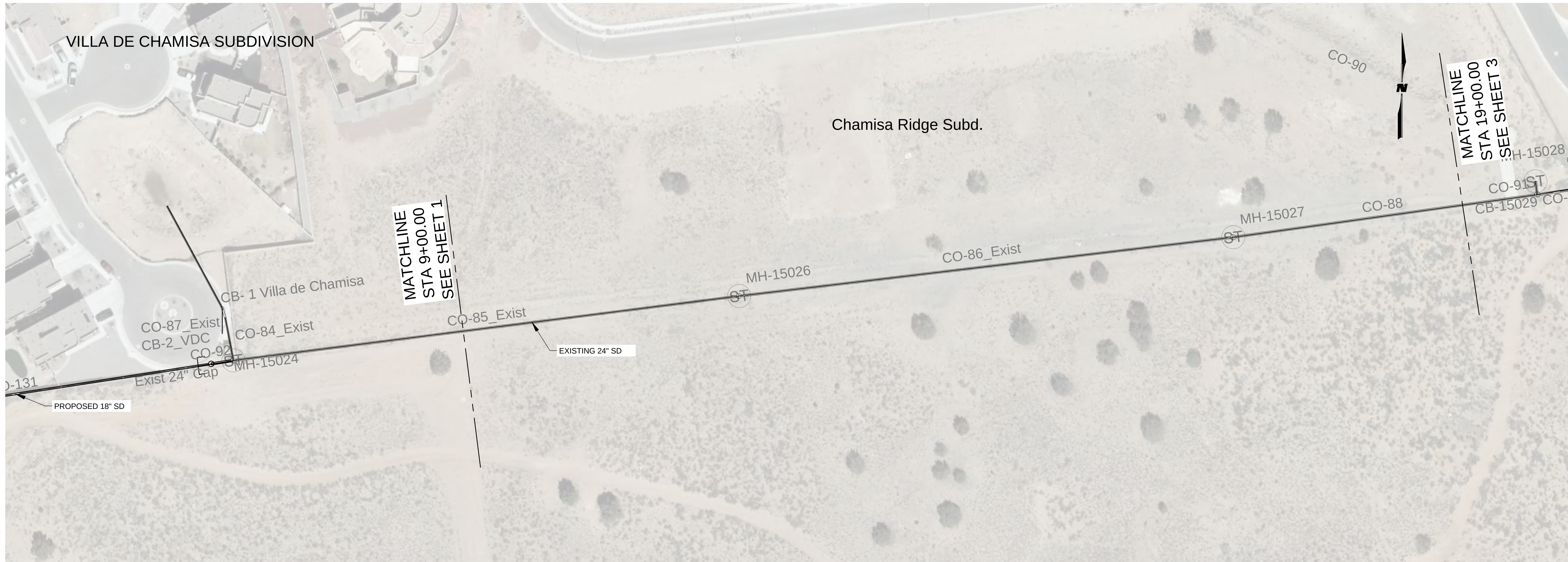


E1 PLAN
1" = 50'

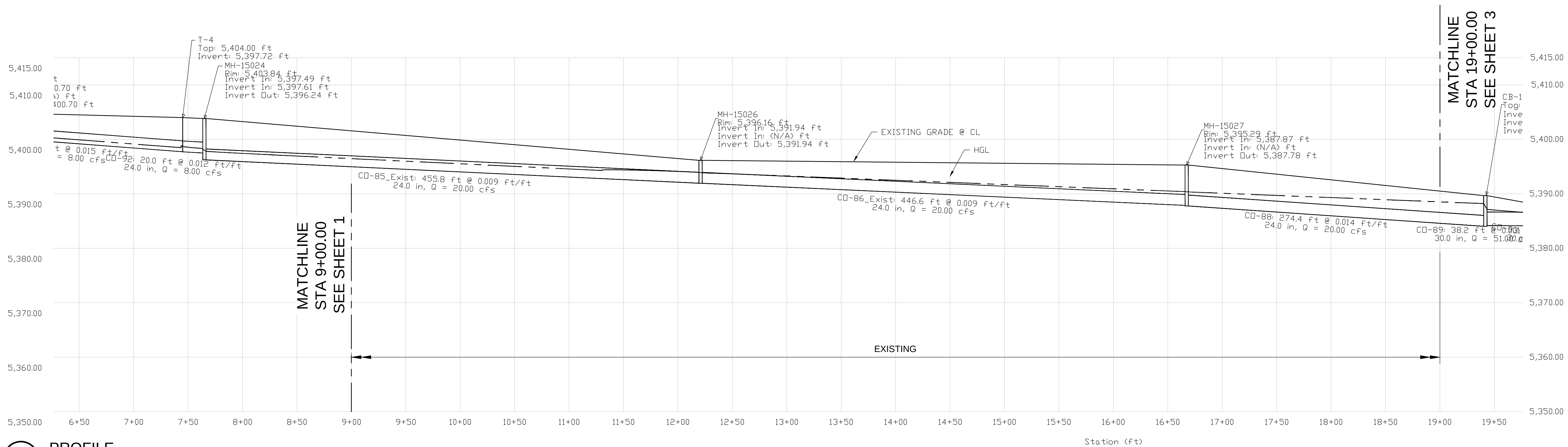


A1 PROFILE
H: 1" = 50' V: 1" = 10'

CHAMISA/LYON STORM DRAIN HYDRAULIC ANALYSIS
FULL BUILD-OUT CONDITIONS



E1 PLAN
1" = 50'

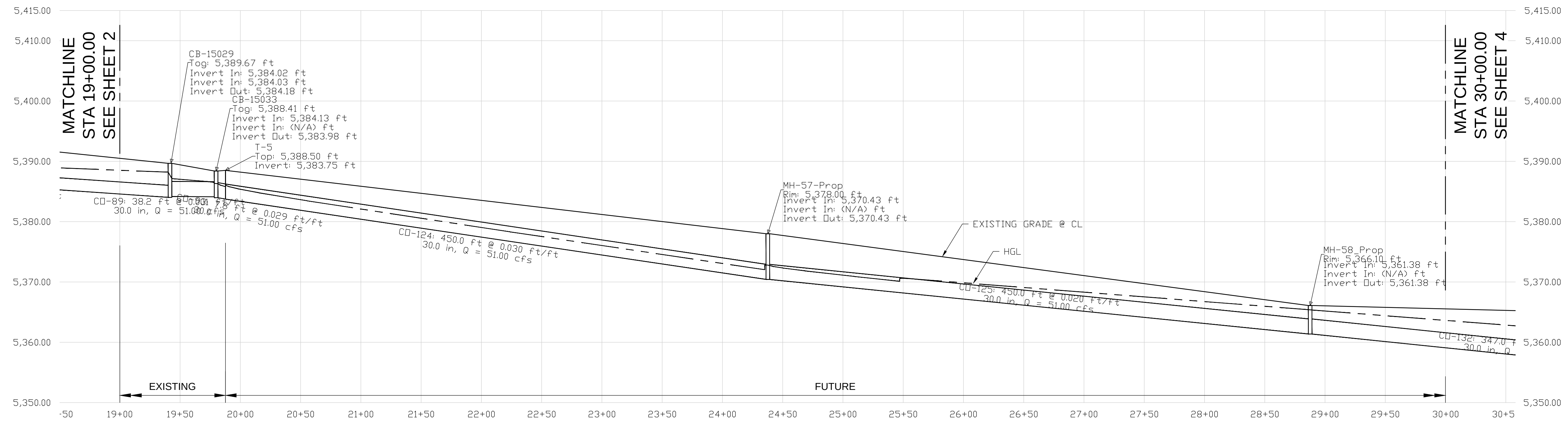


A1 PROFILE
H: 1" = 50' V: 1" = 10'

CHAMISA/LYON STORM DRAIN HYDRAULIC ANALYSIS
FULL BUILD-OUT CONDITIONS

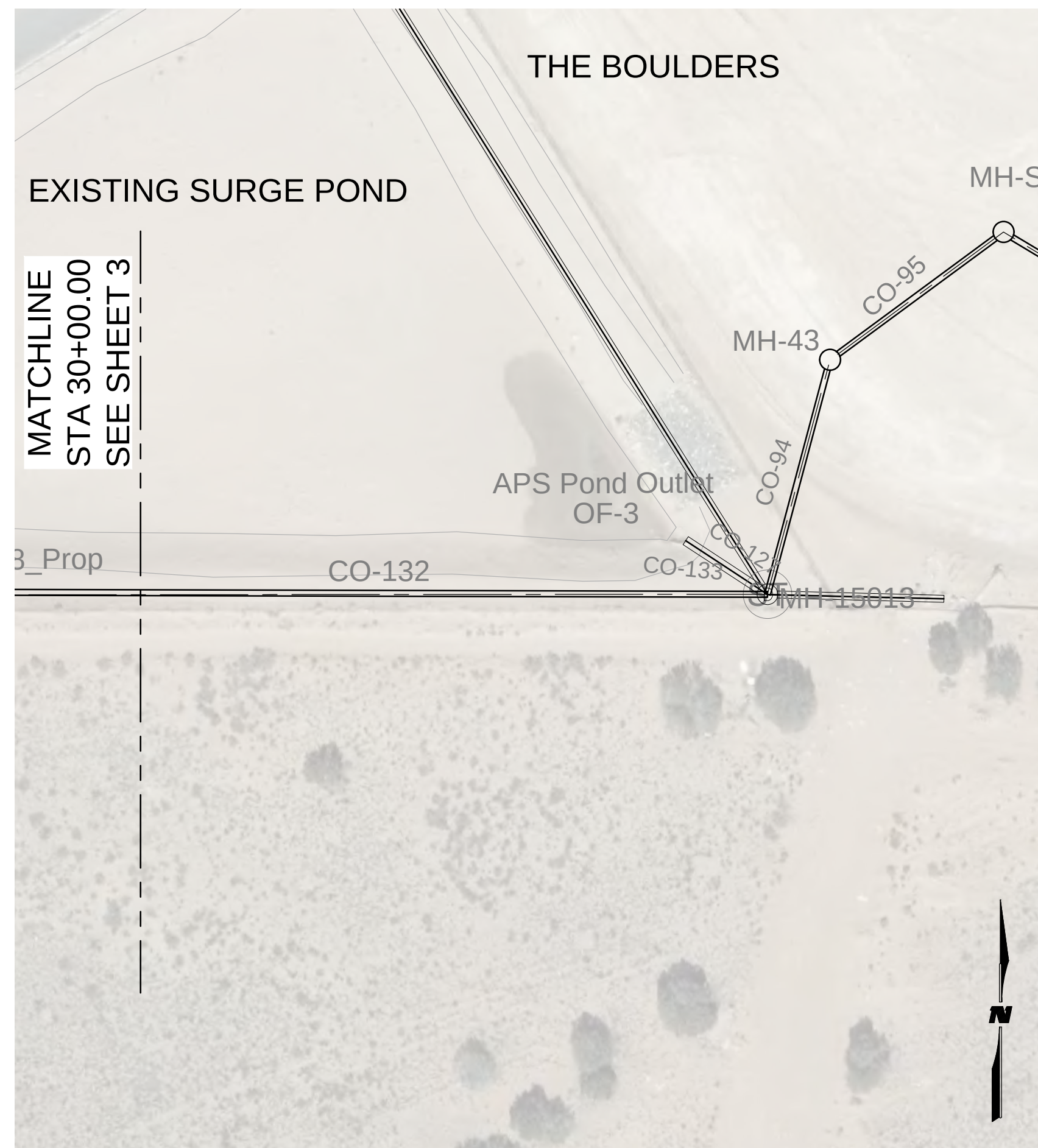


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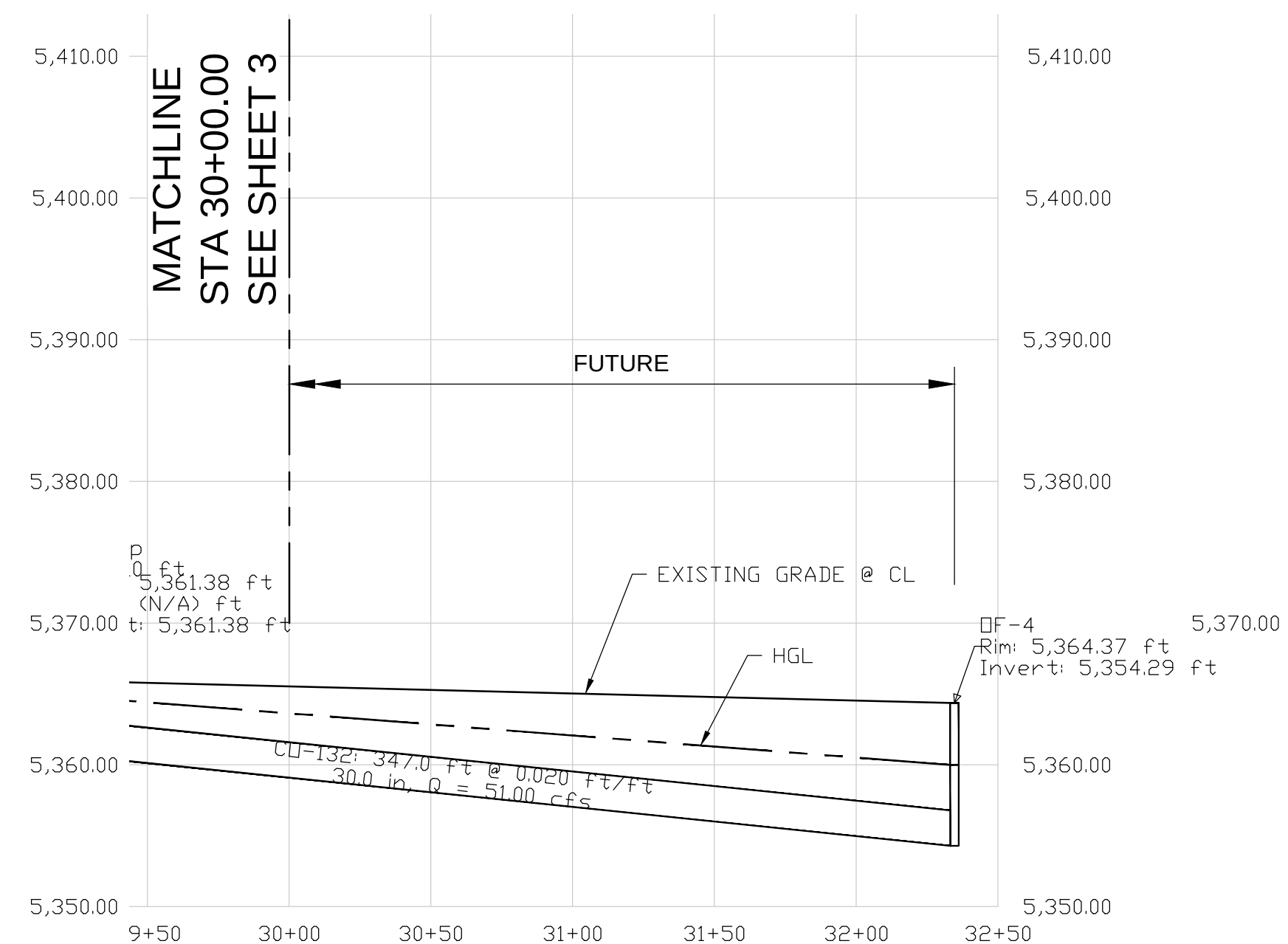


A1 PROFILE

CHAMISA/LYON STORM DRAIN HYDRAULIC ANALYSIS
FULL BUILD-OUT CONDITIONS



E1 PLAN
1" = 50'

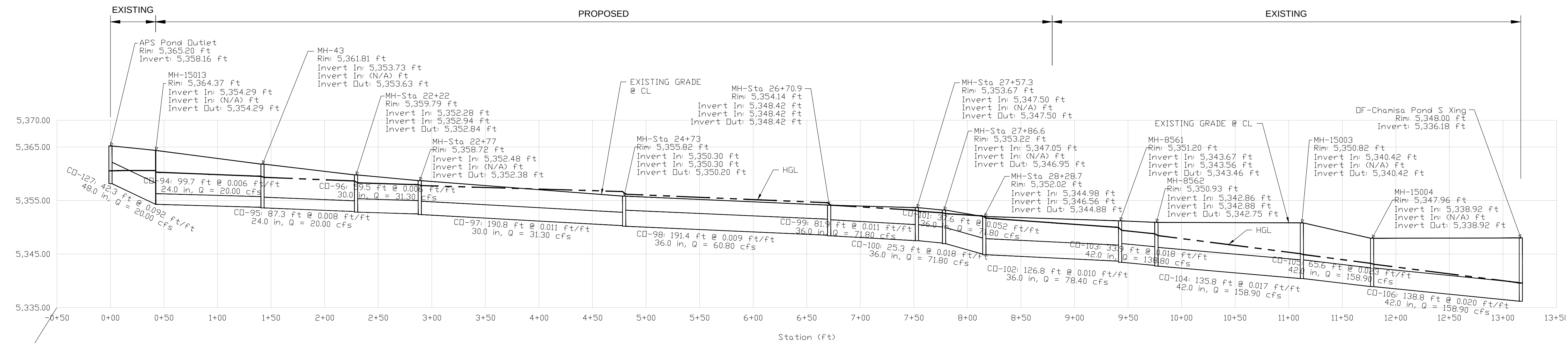


A1 PROFILE
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CHAMISA/LYON STORM DRAIN HYDRAULIC ANALYSIS
FULL BUILD-OUT CONDITIONS

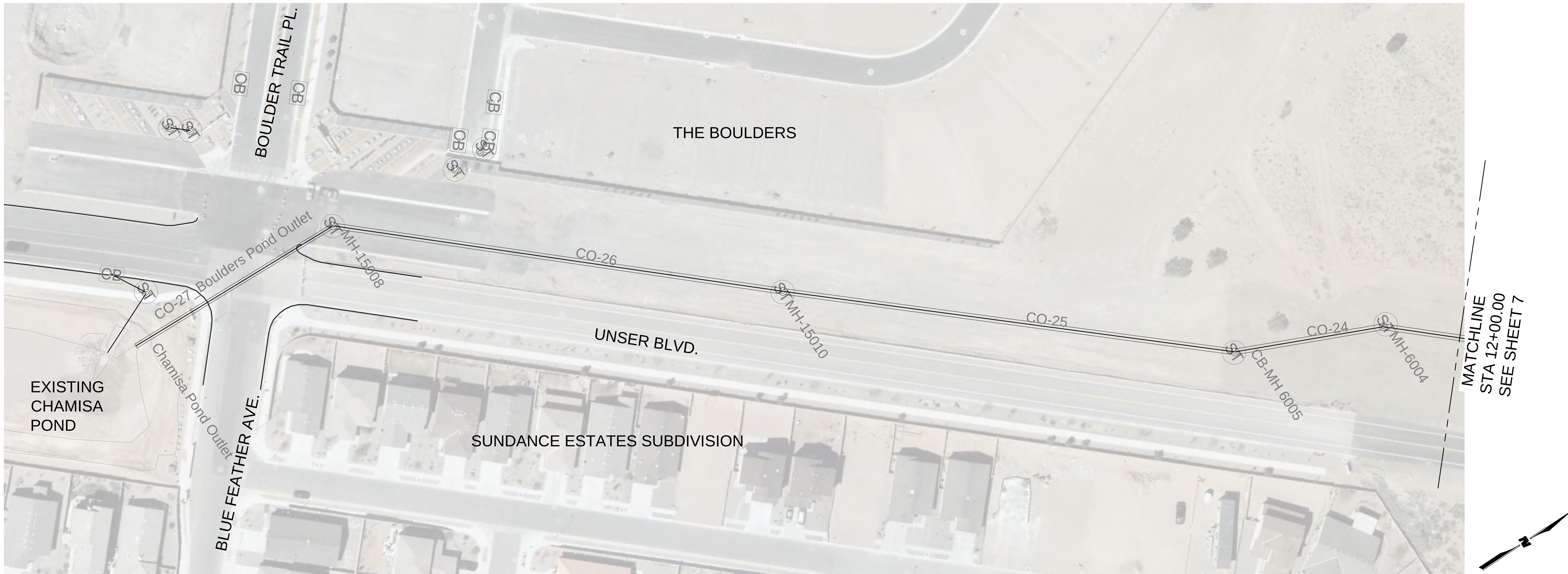


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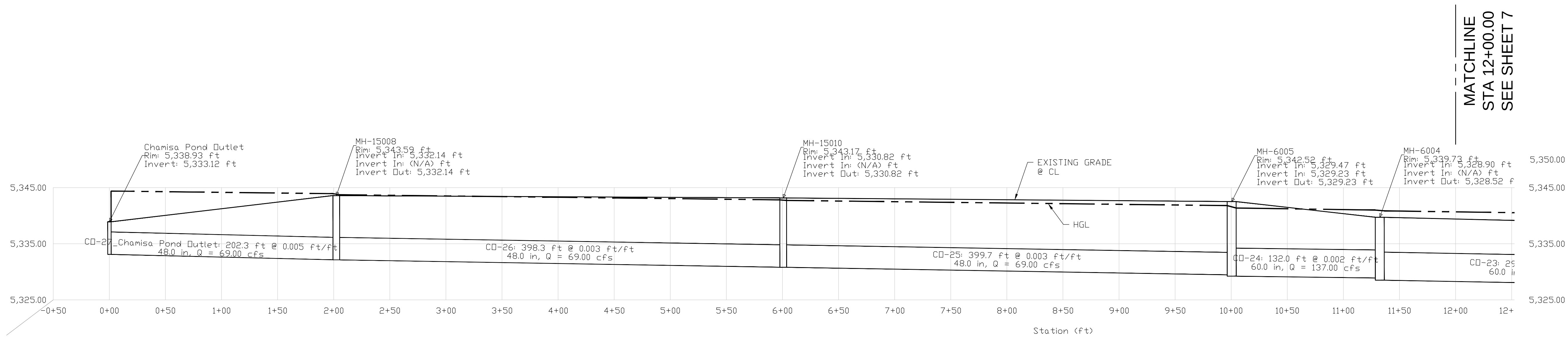


A1 PROFILE
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CHAMISA/LYON STORM DRAIN HYDRAULIC ANALYSIS
FULL BUILD-OUT CONDITIONS



E1 PLAN
1" = 50'

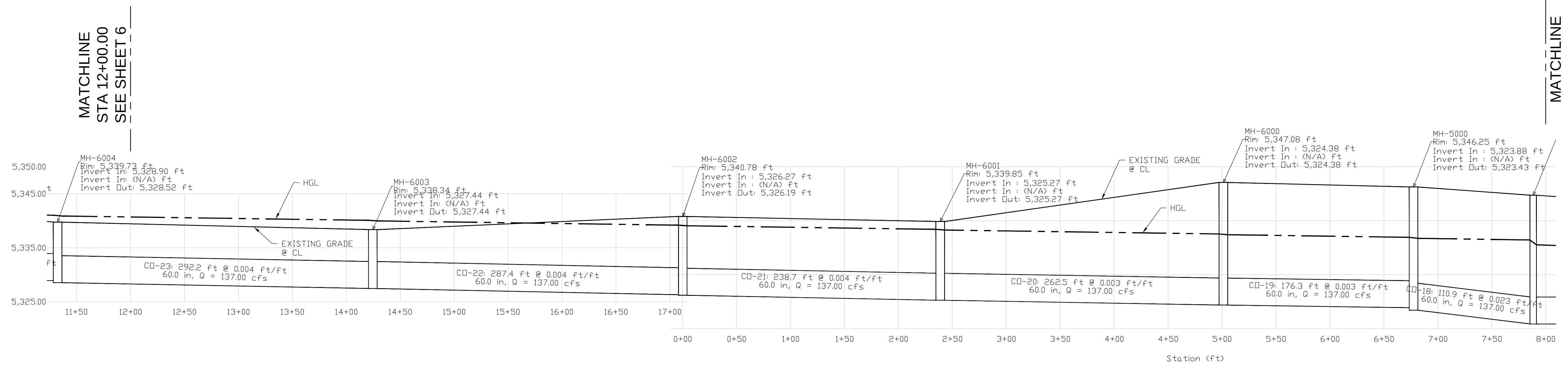


A1 PROFILE
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CHAMISA/LYON STORM DRAIN HYDRAULIC ANALYSIS
FULL BUILD-OUT CONDITIONS



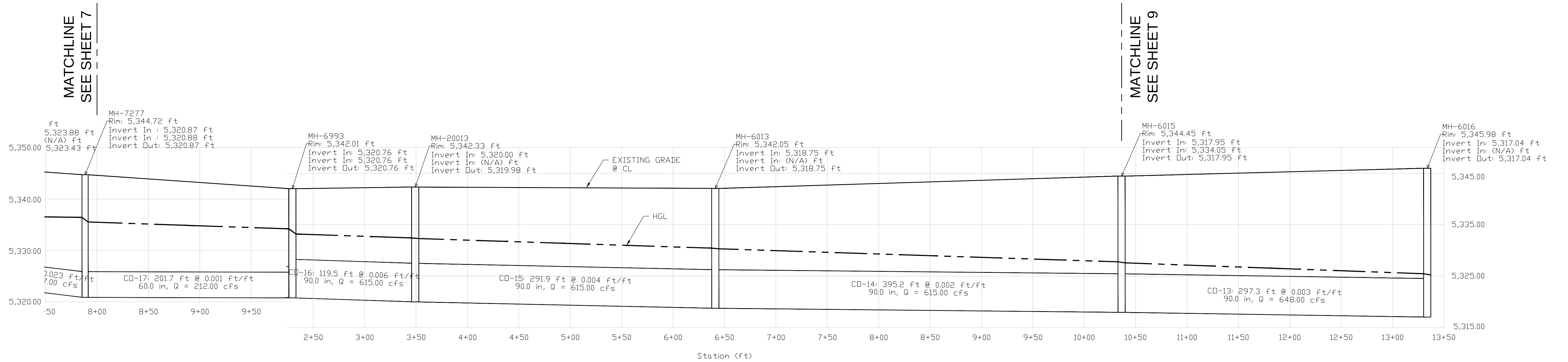
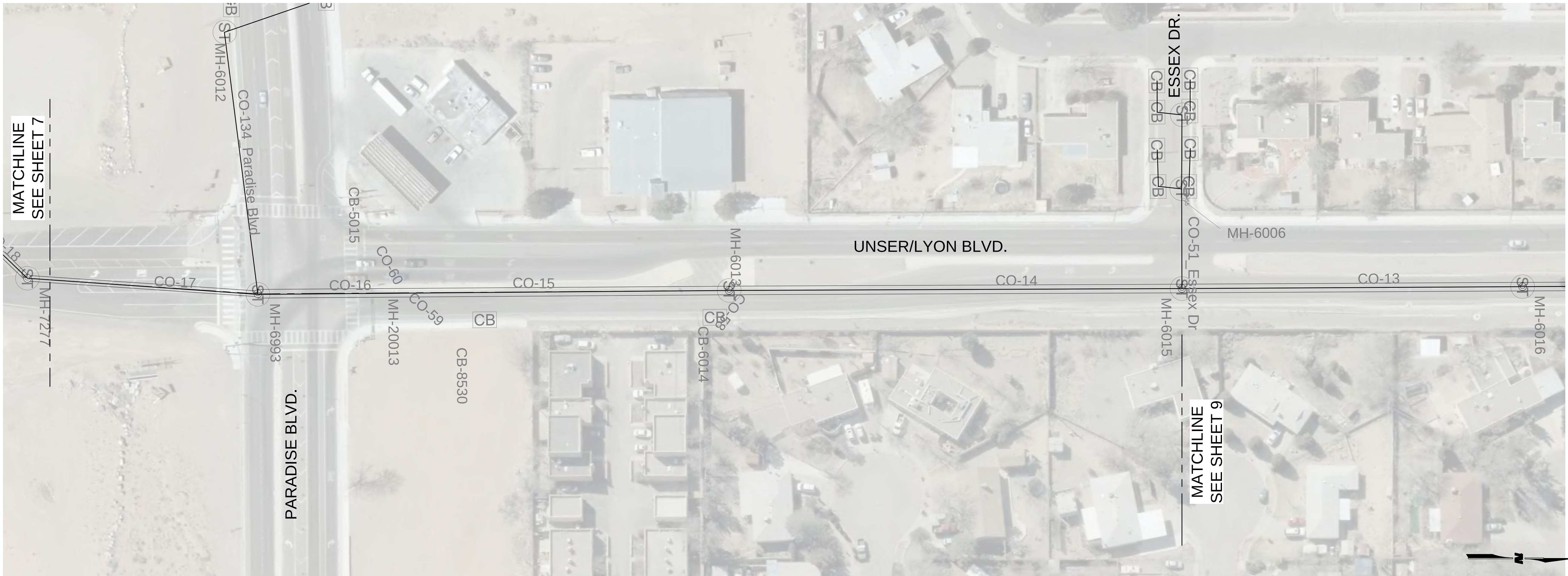
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1" = 50'

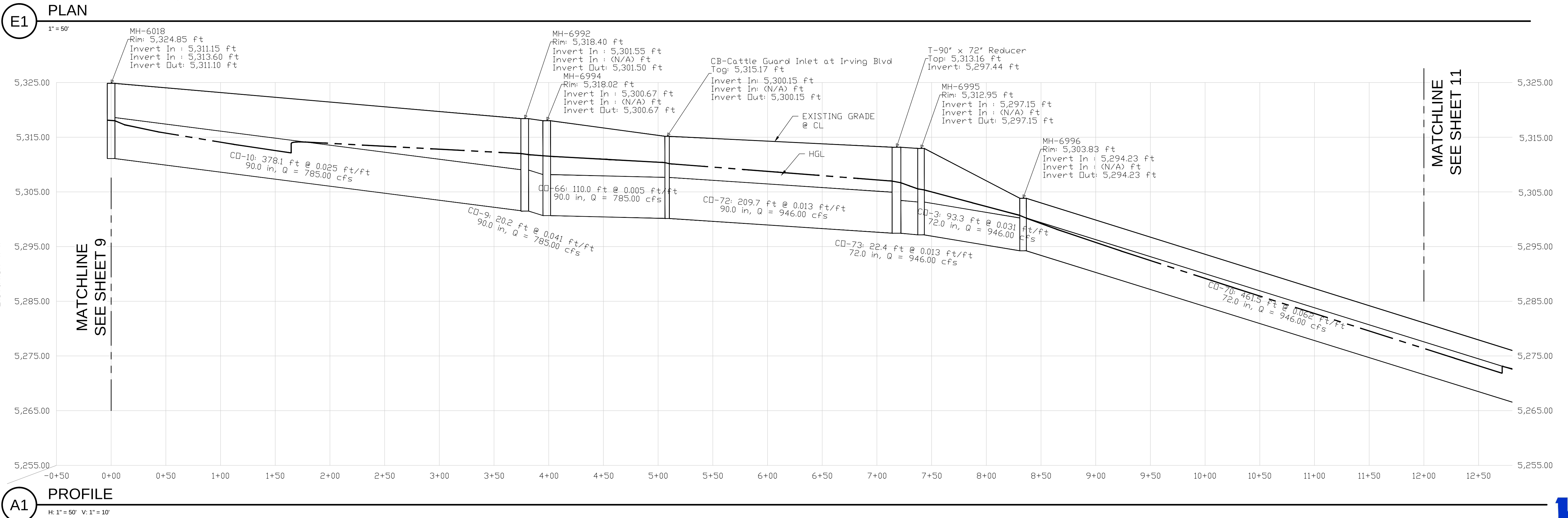
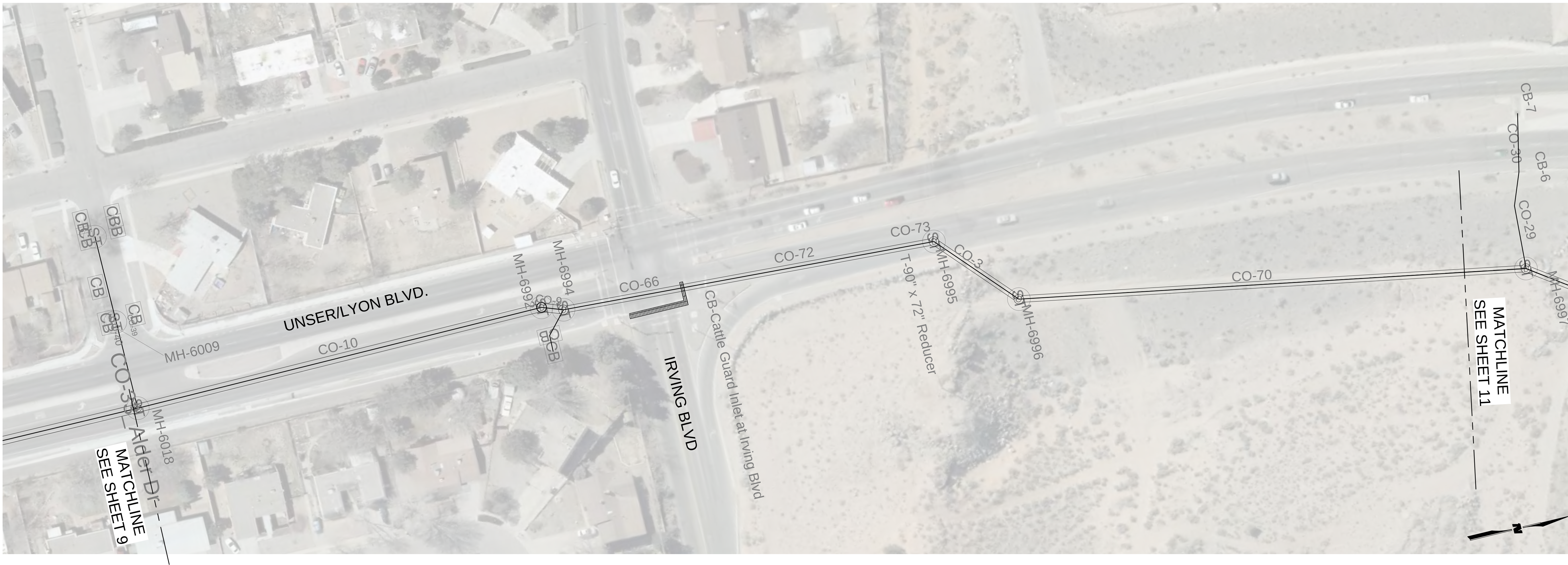


A1 PROFILE
H: 1" = 50' V: 1" = 10'

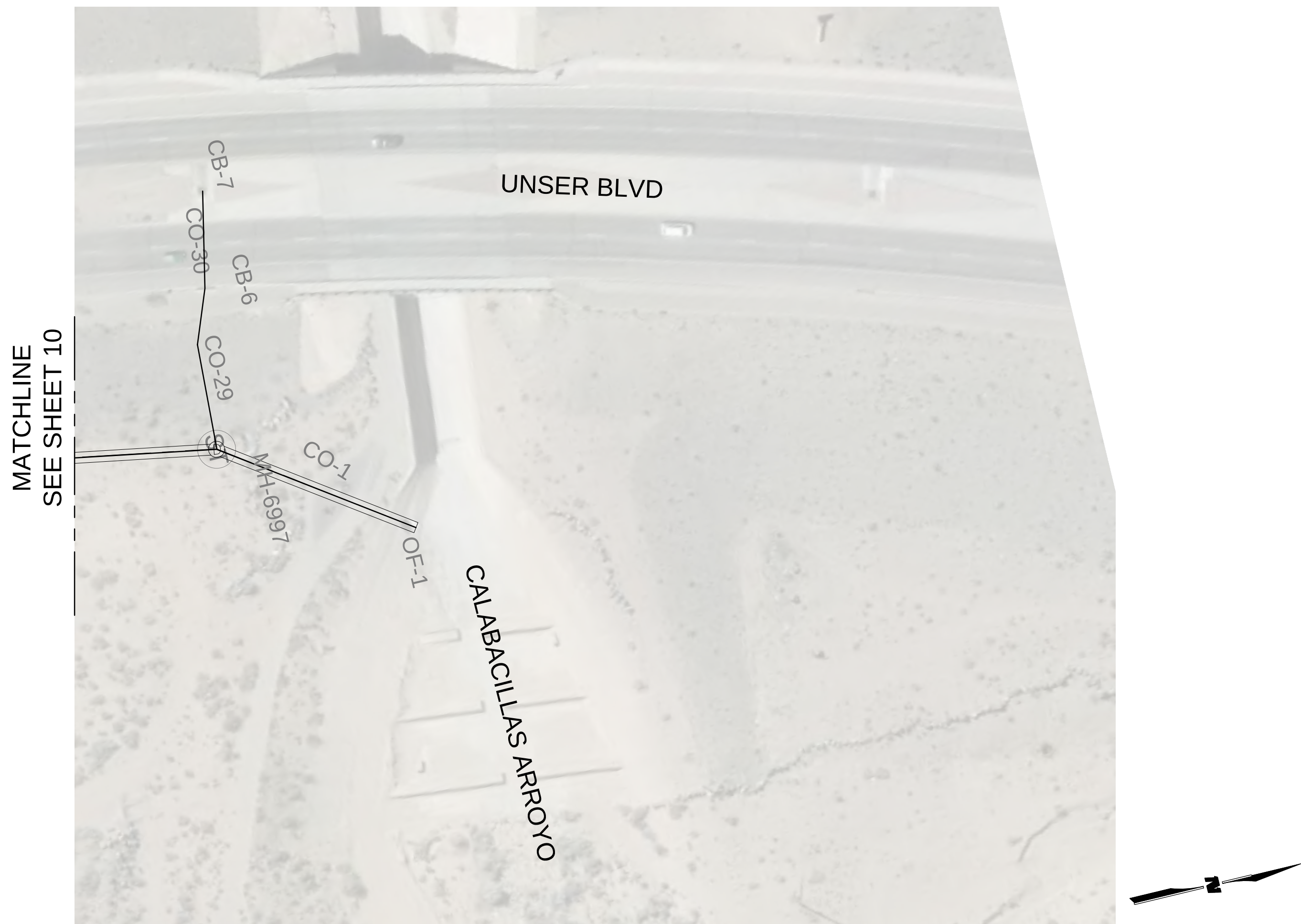
CHAMISA/LYON STORM DRAIN HYDRAULIC ANALYSIS
FULL BUILD-OUT CONDITIONS

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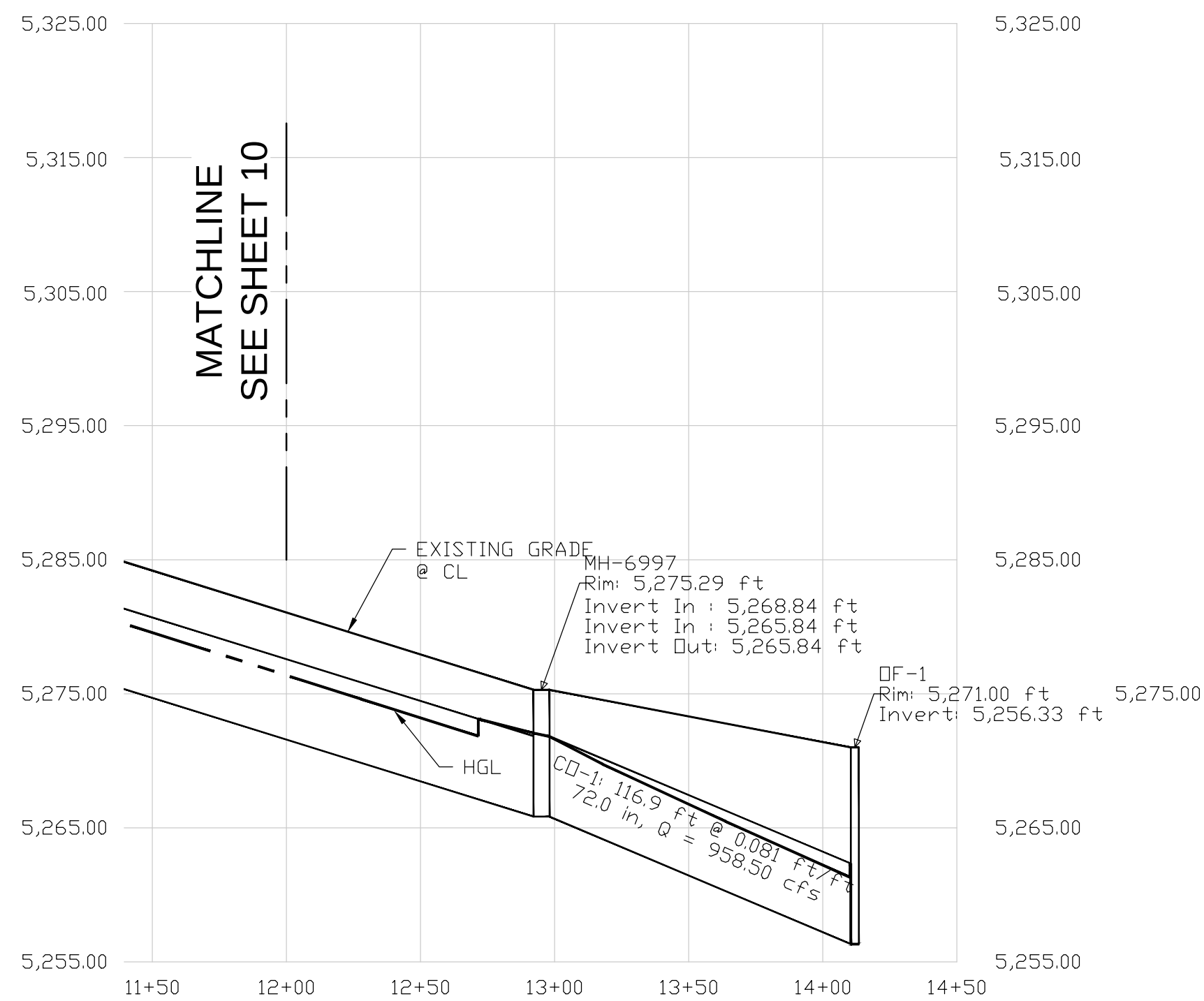




CHAMISA/LYON STORM DRAIN HYDRAULIC ANALYSIS
FULL BUILD-OUT CONDITIONS



E1 PLAN
1" = 50'



A1 PROFILE
H: 1" = 50' V: 1" = 10'

CHAMISA/LYON STORM DRAIN HYDRAULIC ANALYSIS
FULL BUILD-OUT CONDITIONS

**Upper Piedras Marcadas
Drainage and Water Quality Management Plan**

**DESIGN
QUALITY CONTROL, QUALITY ASSURANCE
CERTIFICATE OF COMPLIANCE**

Audit No. QA AUD – 002

Project Status: 100%

Package Name: Chamisa/Lyons Storm Drain Analysis

Upon examination of the documents of this submittal, I find that: The design quality control and quality assurance processes have been completed in compliance with the Design Quality Plan.

Mario Juarez-Infante, PE
Associate Vice President

5/30/14

Date

QUALITY ASSURANCE AUDIT SCOPE

DQP

- | | | |
|-------------------------------------|------------|---|
| ☒ | DQP-PR-001 | Checking Calculations – Line-by-Line Check of Manual Calculations |
| ☒ | DQP-PR-002 | Checking Calculations – Independent Calculations Procedure |
| ☒ | DQP-PR-003 | Checking of Computer Calculation Input |
| ☒ | DQP-PR-004 | Checking As-built/Survey Exhibits |
| ☒ | DQP-PR-005 | Review of Executive Summary Memorandum |
| ☐ | DQP-PR-006 | |
| ☒ | DQP-PR-007 | Final Package Review (FPR) of Documents |

Remarks (variances):

Wilson & Company Comments:

Scope of Services Comments:

Delivarables:



1. HEC-HMS model including all basins contributing to the Chamisa Pond in the current conditions.
 1. Preliminary analysis has been completed and a summary has been included in the memo.
 2. StormCAD hydraulic analysis of the current conditions of the watershed.
 1. Preliminary analysis has been completed and a summary has been included in the memo.
 3. HEC-HMS model including all contributing basins to the Chamisa Pond in the current conditions as well as flows allowed based on public and private agreements.
 1. Preliminary analysis has been completed, but AMAFCA decided not to include the analysis in the memo because the system downstream of the Chamisa Pond causes the system to fail and thus makes the HEC-HMS model not applicable.
 4. StormCAD hydraulic analysis including all flows based on conditions of the public and private agreements.
 5. Executive Summary presenting findings of the analysis and potential impacts to the Upper Piedras Marcadas DMP.
 1. Preliminary Executive Summary has been completed.
 6. Plan & Profile Exhibit showing the hydraulic grade line in the current and full build-out conditions.
 1. Preliminary Plan & Profile Exhibit for the full build-out conditions has been completed.
 2. Plan & Profile Exhibit for the current conditions has not been prepared. WCI will need to complete prior to submittal.
 7. Tracking form of QA/QC comments.
 1. Comments are being tracked and logged for final form.
- WCI will prepare and deliver all 7 deliverable mentioned above.

Current Conditions HEC-HMS Analysis Comments:

8. Basin boundary verification for current conditions. Areas from the original agreement versus drainage reports were compared. Basin areas were checked based on aerial photography, approved G&D plans and field visit. A discrepancy was found in the Boulders drainage basins. The contributing basin area adjacent to the Chamisa Pond was found to be less than the Boulders drainage analysis (Unser Blvd basin).
 1. Drainage areas for Villa de la Chamisa basin, James Monroe MS, Paradise View Subdivision and the Boulders were updated based on measured areas versus original drainage report and Agreement areas.
 2. A basin comparison table has been prepared and added to the report showing areas, flows, volumes and percent impervious from the agreement, drainage report and WCI analysis for all Chamisa Basins.
9. Curve number verification.
 1. Curve numbers were checked based on percent impervious areas using Table 6.13 (Curve Numbers for various urban land uses) from Water Resources Engineering by David A. Chin, 2000. Residential areas were determined based on a DU per acre basis, while commercial areas were assumed to be 85% impervious based on Table 6.13. Impervious areas for James Monroe MS were measured using aerial photography.
 - i. Minor adjustments were made to all basin curve numbers.
10. Time to Peak verification.



1. Flow path lengths and Time of concentration calcs have been checked. Calcs are based on NMDOT drainage manual, upland method. We have 100' of overland flow and the remainder as shallow concentrated flow. Most lag times are 6 minutes, with the exception of the boulders.

Current Conditions StormCAD Analysis Comments:

11. Storm drain inverts have been checked versus as-built survey per AMAFCA comments.
 1. Inverts have been updated.
12. 4 manhole/catch basin inverts in the as-built survey appeared to drain in the wrong direction.
 1. WCI surveyors have double checked the upstream and downstream inverts based on field sketches.
13. Pipe size out of catch basin #15033 is labeled as a 24" in the as-built survey, while the analysis shows a 30" (based on as-built drawings)
 1. WCI checked the pipe size in the field. Catch basin was half full with sediment, but storm drain was determined to be 30". As-built survey map has been updated.
14. Manhole rims have been checked versus as-built survey. Manhole rims match up with as-built survey.
15. Flows in analysis have been checked. Storm drain upstream of the Chamisa Pond was not modeled due to no discharge to the pond. Discharge curve for the pond is based on the tailwater condition at Paradise Blvd. with the current conditions flow in the 90" Lyon SD.
 1. Discharge from the Chamisa pond in the hydraulics has been updated based on the HEC-HMS analysis. The intent of the analysis was to determine what the outflow is from the pond in the current conditions and model the storm drain according to this discharge.
 2. Discharge along the Lyon SD has been updated. Discharge points are at Paradise, Essex, Alder, Irving and at the Calabacillas. Alder Road flows are 32 cfs based on Lyon SD DAR, with 105 cfs bypass flow draining north to the cattle guard inlet at Irving.

Full Build-Out Conditions HEC-HMS Analysis Comments:

1. Basin boundary verification. Areas from the original agreement versus drainage reports were compared. Basin areas were checked based on aerial photography, approved G&D plans and field visit. A discrepancy was found in the Boulders drainage basins. The contributing basin area adjacent to the Chamisa Pond was found to be less than the Boulders drainage analysis (Unser Blvd basin).
 1. Drainage areas for Villa de la Chamisa basin, James Monroe MS, Paradise View Subdivision and the Boulders were updated based on measured areas versus original drainage report and Agreement areas.
2. Curve number verification.
 1. Curve numbers were checked based on percent impervious areas using Table 6.13 (Curve Numbers for various urban land uses) from Water Resources Engineering by David A. Chin, 2000. Residential areas were determined based on a DU per acre basis, while commercial areas were assumed to be 85% impervious based on Table 6.13. Impervious areas for James Monroe MS were measured using aerial photography.
 - i. Minor adjustments were made to all basin curve numbers.
3. Time to Peak verification.



1. Flow path lengths and Time of concentration calcs have been checked. Calcs are based on NMDOT drainage manual, upland method. We have 100' of overland flow and the remainder as shallow concentrated flow. Most lag times are 6 minutes, with the exception of the boulders.

"Hypothetical" Conditions StormCAD Analysis Comments:

4. Hydraulic analysis including all flows based on current conditions and conditions of the public and private agreements should be named "Hypothetical Conditions". This is based on the fact that the Chamisa storm drain system downstream of the Chamisa Pond cannot accommodate the flows from the public and private agreements.
5. Storm drain inverts have been checked versus as-built survey per AMAFCA comments.
 1. Inverts have been updated.
6. Manhole rims have been checked versus as-built survey. Manhole rims match up with as-built survey.
7. Flows in analysis have been checked. Discharge curve for the pond is based on the tailwater condition at Paradise Blvd. with the design flow of 615 cfs in the 90" Lyon SD.
 1. Discharge from the Chamisa pond in the hydraulics is based on the agreement flow of 69 cfs.
 2. Discharge along the Lyon SD has been updated. Discharge points are at Paradise, Essex, Alder, Irving and at the Calabacillas. Alder Road flows are 137 cfs based on Lyon SD DAR.

Executive Summary comments:

8. List all assumption in the memo.
 1. Tailwater condition at Paradise Blvd. and Unser Blvd. is based on Lyon SD design and has been used to determine the pond discharge curve.
 2. Boulders Phase 2 is completely developed is the current conditions, although all lots do not have homes built. This assumption is based on the fact that the subdivision is approved and homes are currently being built.
 3. Boulders Phase 3 is undeveloped, but is treated as a graded dirt road to calculate the curve number.
 4. Assumptions section has been added to the executive summary.
9. Add Adjustments/corrections section.
 1. Section has been added.

Exhibit Comments:

Note: Exhibit was not part of the original scope of services. As requested by AMAFCA, Literature review exhibit has been updated to include a flowrate comparison summary from the Agreements versus applicable Drainage Reports versus WCI HEC-HMS analysis.

10. Show drainage basins contributing to the Lyon SD.



1. Basins have been added to the Exhibit. A field visit was conducted to verify basin boundaries.

AMAFCA comments:

2. Double check the new table on the map. For example, AP5 never had 20 cfs from Boulders, right (the 20 cfs was from the APS surge pond)? Also, just a suggestion, but you might want to check the HGL tailwater assumption the Wilson made for the Paradise Blvd storm drain (where it connects to the Lyon SD).
 - i. The table has been checked and updated.
 - ii. The Lyon SD analysis included a segment of 72" Paradise Blvd. storm drain, so the tailwater was considered for the Paradise SD.
 3. the model pipe segments downstream of the pond don't match the survey and the survey possibly has conflicting pipe sizes (need to determine if it's 48" or 60")
 - i. WCI addressed by checking all storm drain inverts in the StormCAD model in comparison to as-built survey. Found about 8 manholes that needed correction in the model. In addition, Catch Basin 15029 appeared to be draining in the wrong direction. Field measurements were made that verified the as-built survey. Model has been updated to match the as-built survey.
 4. The model pipe inverts don't always match the survey (the drop at the manhole isn't modeled)
 - i. WCI checked the model inverts versus the as-built survey and have updated all inverts. StormCAD output profiles don't include both invert in and invert out. Most manholes did include the drop in manholes, but the few manholes that didn't were fixed.
 5. The Lyon SD additional Q's in the model don't match the exhibit (I realize the exhibit reflects the drainage report for the 212, but the flow for the sub-basins in the fully developed areas doesn't match either).
 - i. WCI has reviewed the flows input to the Lyon SD system downstream of Paradise Blvd. WCI has conducted a field review of the contributing basin. Basins shown in the Lyon SD DAR appear to be consistent with field conditions. Flows north of Paradise Blvd. were based on original hydrologic analysis completed by BHI using AHYMO. HEC-HMS analysis was not a part of the scope for this analysis. Flows were updated in the exhibit as well as the stormCAD analysis at 5 discharge points: Paradise, Essex, Alder, Irving and Calabacillas.
 6. StormCAD shows a 48" SD from manhole 15008 to manhole 6005 while the as-built survey shows a 60" SD for the most part, with a 48" SD in to manhole 6005.
 - i. WCI field checked the pipe size and measure it at 48", so the stormCAD model was correct. As-built survey has been updated.
-

TABLE 1 - Chamisa / Lyon Storm Drain Literature Review					
No.	Project Title	Consultant	Date	Project No.	Comments
1	Lyon Blvd. Storm Drain	Community Sciences Corp.	Jul 14, 1994	COA 4941.9	Ex 72" RCP, Q = 418.5 cfs from as-built drawing, superseded by the Lyon Blvd. Storm Drain extension
2	Ventana Square Tr. G, H, I, & J - Conceptual Grading & Drainage Plan	Bohannon Huston	Oct 30, 2001		Tamp retention pond, 7.63 ac-ft, 2 ft of freeboard (Ind. offsite flows of 61.2 cfs from Tract H sheet C2), Future 18" Connection, sheets C2 & 1 of 1
3	The Chamisa Project Lyons Division/West Piedras Marcadas Storm Drain	Tierra West	Jul-03		Exhibit D, Overall Storm Sewer Map showing free discharge from the properties through 36" (84.2 cfs) to 66" pipe (391.2 cfs) to the Unser Pond and 66" to 72" pipe (212 cfs) from pond to the Lyon Storm Drain, Report superseded by Nov 2003 report (Item 5)
4	Piedras Marcadas Watershed and Lyon Blvd. Storm Drain Drainage Management Plan	Bohannon Huston	Jul 29, 2003	AMAFCA 349.15	Option 4, maximize the existing outfall capacity with pressure flow, requires detention ponding, Appendix D, Hydraulic analysis report for option 4 shows a 72" pipe and peak flow of 212 cfs
5	The Chamisa Project Lyons Division/West Piedras Marcadas Storm Drain	Tierra West	Nov-03	AMAFCA ZAP B-10	Based on Chamisa Project/Piedras Marcadas Storm Drain but limited to the area diverted from Piedras Marcadas to Calabacillas Arroyo, Linear pond along Unser Blvd., 10.7 ac-ft, 212 cfs discharge
6	Villa de la Chamisa Subdivision	Rio Grande Engineering	May-04	COA 1003236	Temp Retention Pond, 1.17 ac-ft (100 yr, 10 day), future discharge 17.72 cfs, sheet 4 of 11
7	Lyon Blvd. Storm Drain Extension from Paradise Blvd. to Irving Blvd.	Wilson & Company	Mar 23, 2005	COA 7497.81	32.6 cfs from Essex Dr & 31.8 cfs from Alder Dr, Proposed 90" RCP, 937 cfs to existing 72" in Calabacillas Arroyo
8	Lyon Blvd. Storm Drain Design Analysis Report	Wilson & Company	Aug 20, 2004	-	60" stub out south of Paradise Blvd. for future discharge of 212 cfs per meeting with Tierra West on page 14 of Lyon Blvd. Storm Drain Design Analysis Report, Items 3 & 4
9A	Chamisa Storm Drain Drainage Improvement Agreement	-	Feb 8, 2005	-	Agreement between APS, Gellmore, Schaefer, BIC, and Clearbrook, Exhibits B & D indicating pipe size and peak flow of each basin
9B	Cooperative Funding Construction & Maint. Agreement for Lyon Blvd. Storm Drain Extension Project	-	Feb 8, 2005	AMAFCA B11-D100	Agreement between AMAFCA, COA, Bern County, APS & Private Developers, Exhibits B & D indicating pipe size and peak flow of each basin
9	Paradise View Subdivision Grading & Drainage Plan	Wilson & Company	Mar 13, 2005		47.1 cfs to Temporary Detention Pond for east basin, 1.0 ac-ft (18 cfs discharge from pond), 34.3 cfs sheet flow west, Sheet 1 of 2
10	Chamisa Ridge Subdivision Unit II - Utility, Paving, & Storm Drain Improvements	Tierra West	Apr-05	COA 759381	Temporary Retention Pond, 2.3 ac-ft, 5 ft deep, Existing 24" pipe S of property ties to 30" from pond, Sheets 3 & 10 of 11, 10 cfs, sheet 10 of 11 showing 48 cfs (20 cfs 24" RCP, 18 cfs 60" SD, 10 cfs 2-type D inlets) while exhibit B of agreement (Item 8) shows 51 cfs
11	Sundance Estates Subdivision Drainage Report	Tierra West	Apr 10, 2006		Phase 1A & B drain to the permanent detention pond discharging 33 cfs, 26 cfs per Exhibit B Item 3, Phase II to IV (Boulders) drain to Unser Pond, Allowable discharge 26 cfs per Chamisa Project Lyons Division / West Piedras Marcadas Storm Drain
12	James Monroe Mid Sch/Elm Sch Prototype No. 2, Master Drainage Report	High Mesa Consulting Group	Aug 31, 2007		Temporary Retention Pond, 4.67 ac-ft, 5.4 ft deep, Future Surge Pond, 4.4 ac-ft, Sheets C-101 to C-104
13	Drainage Report for St. Jude Thaddeus Church	Mark Goodwin & Associates	Sep-10		Temporary Retention Pond, 2.05 ac-ft, 6 ft deep, 24" or 30" RCP through adjacent property to convey 35.94 cfs per A/H/MO output to Unser Blvd.
14	The Boulders Phase I - Utility & Paving Improvements Construction Plans	Tierra West	Jul-11	COA 761786	Permanent Detention Pond 8,244 ac-ft, 2 ft of freeboard, Exist 48" RCP outlet transition to 60" RCP east of pond, 48.5 cfs offsite from Paradise View Subd, Sheet 26 of 33
15	Unser Blvd. North - Paseo Del Norte to Paradise Blvd. Drainage Report and Basin Map	Wilson & Company	Feb 24, 2011	COA 705005	Basin south of proposed Chamisa Storm Drain indicating 45 cfs - Not included in the Cooperative Funding Agreement.
15	Paseo Del Norte Drainage Report Golf Course Road to Kimmick Drive	Wilson & Company	Aug 16, 2004	-	Identifies an area from Volcano Heights to be diverted to the Calabacillas.
16	The Boulders Phase II - Utility & Paving Improvements Construction Plans	Tierra West	Oct-12		Permanent Detention Pond, Prv'd Vol = 8,244 ac-ft (part of Phase I), 2 ft of freeboard, Ex 48" RCP, 34 cfs Offsite from Paradise View Subd, Sheet 26 & 27 of 33
17	Chamisa Storm Drain	Tierra West	Mar-13	COA 761789	Exist 48" RCP transitions to 60" RCP approx 950 ft east of pond, Sheet 2 of 4
18	The Boulders Phase III Subdivision Drainage Report	Tierra West	Jan 24, 2014		Showing 20 cfs through a 24" line from APS Pond crossing Boulder Canyon Rd & tying to the 36" from Phase II, ultimate discharge of 158.9 cfs to existing 42" draining to Permanent Detention Pond, Prv'd Vol = 9,247 ac-ft
19	Chamisa/Lyon Storm Drain Current Conditions Hydraulic Analysis	Wilson & Company	May-14		Completed StormCAD model reflecting design flows currently draining to the system. Shows 67.3 cfs discharging from the Chamisa Pond
20	Chamisa/Lyon Storm Drain Full Build-Out Conditions Hydraulic Analysis	Wilson & Company	May-14		Completed StormCAD model reflecting design flows based on public and private agreements, as well as drainage reports that supercede the agreement with regard to flows entering the system. The analysis concludes that the Chamisa Pond cannot discharge 69 cfs to the downstream storm drain due to tail water conditions

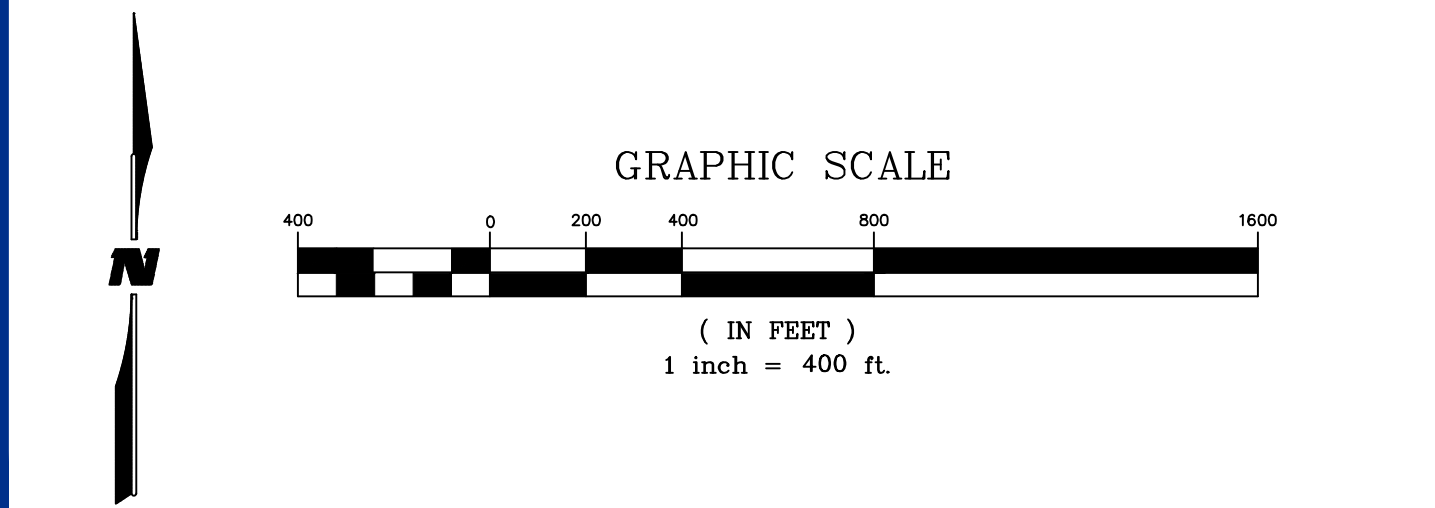
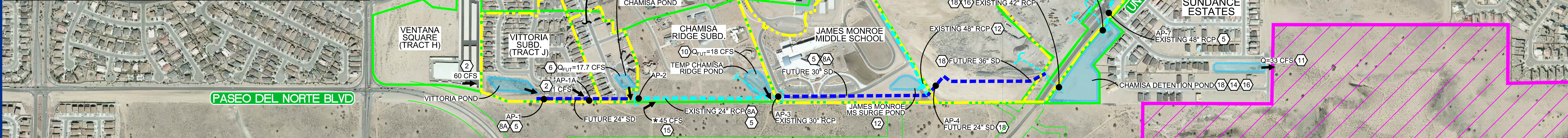
Table 3 - Chamisa Basins Comparison			
Document	Basin Area (ac)	Peak Flow (cfs)	Volume (ac-ft)
Ventana Square			
Agreement - Feb 8, 2005	14.70	60.00	-
Drainage Report - Oct 07, 2002	14.75	60.32	2.23
Vittoria			
Agreement - Feb 8, 2005	14.43	52.00	-
Drainage Report - Oct 07, 2002	14.69	51.97	1.82
Villa de Chamisa			
Agreement - Feb 8, 2005	6.18	19.00	-
Drainage Report - May 2004	6.04	20.32	0.71
Chamisa Ridge Subd			
Agreement - Feb 8, 2005	17.57	35.00	-
Construction Plan - April 2005	17.78	28.00	-
James Monroe MS			
Agreement - Feb 8, 2005	25.82	61.00	-
Drainage Report, Ph 3 -Aug 31, 2007	20.91	71.30	3.72
The Boulders			
Agreement - Feb 8, 2005	72.84	267.00	-
Drainage Report - Jan 24, 2014	79.76	278.13	9.32
Paradise View Subd			
Agreement - Feb 8, 2005	22.66	84.00	-
Construction Plan - March 13, 2005	24.00	81.48	-
Church			
Agreement - Feb 8, 2005	9.80	40.00	-
Drainage Report - Sept 2010	8.91	35.94	1.31
Schaffer			
Agreement - Feb 8, 2005	27.97	106.00	-
Drainage Report	-	-	-
Chamisa Pond			
Agreement - Feb 8, 2005	4.29	6.00	-
Drainage Report	3.73	10.71	0.31
Unser Blvd.			
Agreement - Feb 8, 20052	12.34	37.00	-
Drainage Report, May 05, 20113	6.70	18.67	0.60
1 Includes Unser Blvd. area north of Chamisa Pond draining into pond			
2 Includes Unser Blvd. from Chamisa Pond to Paradise Blvd.			
3 Draining to Chamisa Pond from the Boulders Ph 1 report			

Table 2 - Peak Flow Comparison (cfs)									
Analysis Point / Location	5 & 8		14	16	17	18	19	20	
	Exhibit B (Dec 7, 2004)		(July 2011)	(Oct 2012)	(March 2013)	(Jan 24, 2014)	Current Conditions Analysis	Full Build-Out Analysis	
	Provided	Required							
AP 1	10.05	7.00					0.00	7.00	
AP 1A	13.03	8.00					0.00	8.00	
AP 2	24.33	20.00					0.00	20.00	
AP 3	58.31	51.00					0.00	51.00	
AP 4	31.43	20.00					0.00	20.00	
AP 5, Chamisa Pond Inlet (S)	43.28	20*		137.00		158.90	85.2***	158.90	
AP 6, Chamisa Pond Inlet (N)	-	**	210.00				125.5***	210.00	
AP 7, Chamisa Pond Outlet	87.61	69.00	92.30	92.30	92.30		67.30	69.00	
AP 8	158.85	137.00			156.80		67.30	137.00	
AP 9	158.85	137.00			156.80		67.30	137.00	
AP 10	-	212.00					67.30	212.00	
AP 11	-	-					470.30	615.00	
AP 12	-	-					503.30	648.00	
AP 13	-	-					535.30	785.00	
AP 14	-	-					801.30	946.00	
AP 15	-	-					813.80	956.50	

* Based on the Cooperative Agreement, only flows from the APS Surge Pond drain to the Chamisa Pond at AP5.

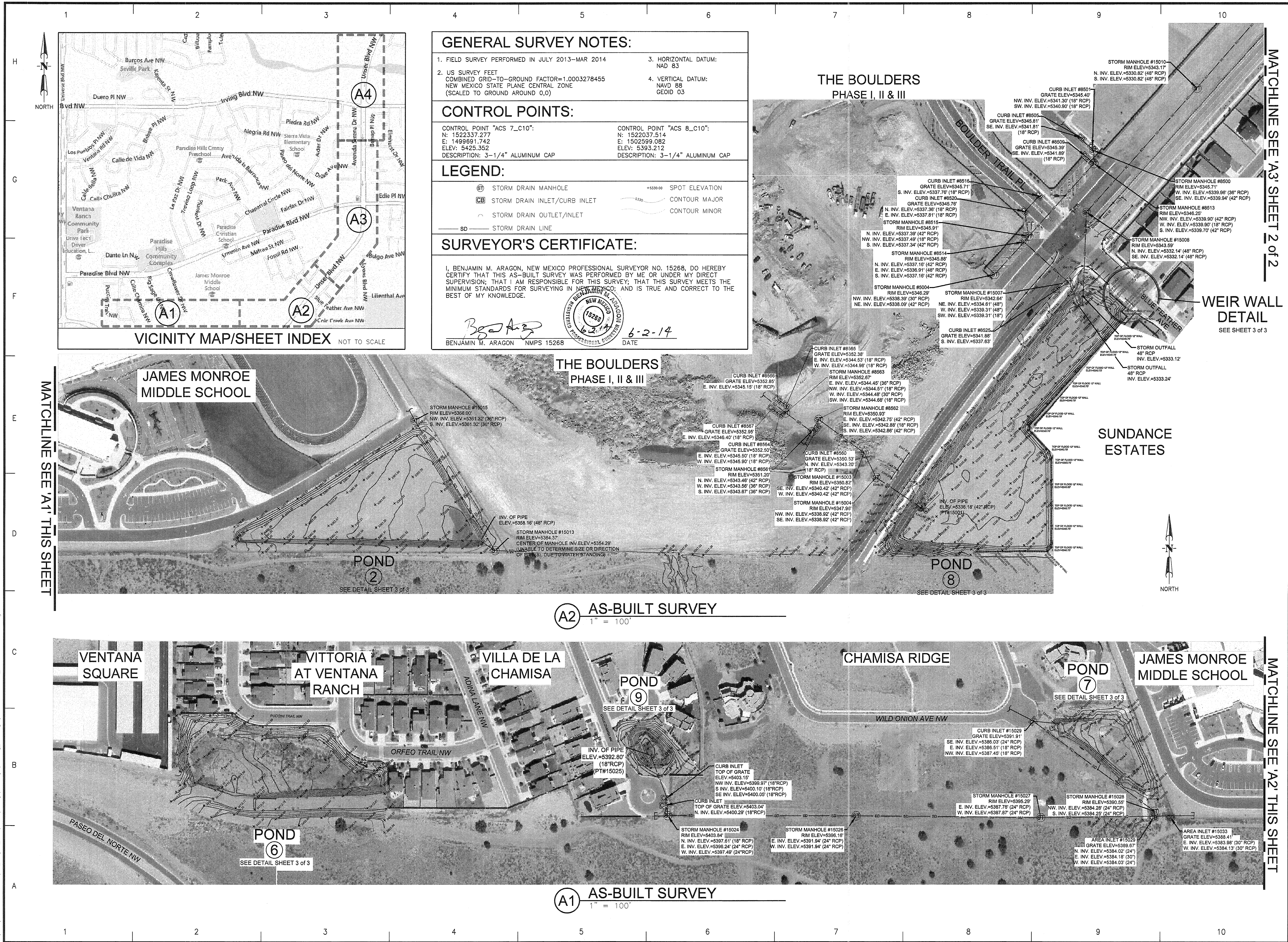
** Flows from the Boulders (BIC), Paradise View (Rabaud), and portion of Unser Blvd. to drain to the Chamisa Pond. In the Cooperative Agreement, the conveyance from these areas to the pond was to be determined in the future.

*** Flows are not per Cooperative Agreement. Flows are based on WCI HEC-HMS analysis using SCS methodology, which is not acceptable by the City of Albuquerque and resulted in flows up to 45% less than previous reports.



CHAMISA/LYON STORM DRAIN LITERATURE REVIEW EXHIBIT August 6, 2014

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GENERAL SURVEY NOTES:

1. FIELD SURVEY PERFORMED IN JULY 2013-MAR 2014

2. US SURVEY FEET
COMBINED GRID-TO-GROUND FACTOR=1.0003278455
NEW MEXICO STATE PLANE CENTRAL ZONE
(SCALED TO GROUND AROUND 0,0)

3. HORIZONTAL DATUM:
NAD 83

4. VERTICAL DATUM:
NAVD 88
GEOID 03

CONTROL POINTS:

CONTROL POINT "ACS 7_C10":
N: 1522337.277
E: 1499691.742
ELEV: 5425.352
DESCRIPTION: 3-1/4" ALUMINUM CAP

CONTROL POINT "ACS 8_C10":
N: 1522037.514
E: 1502599.082
ELEV: 5393.212
DESCRIPTION: 3-1/4" ALUMINUM CAP

LEGEND:

ST

STORM DRAIN MANHOLE

CB

STORM DRAIN INLET/CURB INLET

SD

STORM DRAIN OUTLET/INLET

SD

STORM DRAIN LINE

+5330.00

SPOT ELEVATION

5330

CONTOUR MAJOR

5330

CONTOUR MINOR

SURVEYOR'S CERTIFICATE:

I, BENJAMIN M. ARAGON, NEW MEXICO PROFESSIONAL SURVEYOR NO. 15268, DO HEREBY CERTIFY THAT THIS AS-BUILT SURVEY WAS PERFORMED BY ME OR UNDER MY DIRECT SUPERVISION; THAT I AM RESPONSIBLE FOR THIS SURVEY; THAT THIS SURVEY MEETS THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO; AND IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

BENJAMIN M. ARAGON

NMPS 15268

6-2-14

DATE

CONSULTANTS

AMAFCA

Wilson & Company

Chamisa - Lyon Storm Drain Survey

As-Built Survey

ALBUQUERQUE, NEW MEXICO

PROJECT NO: 14-300-010-01

DESIGNED BY:

DRAWN BY: AMT

CHECKED BY: BMA

DATE: JUNE 2014

SHEET TITLE

AS-BUILT SURVEY

SHEET NO:

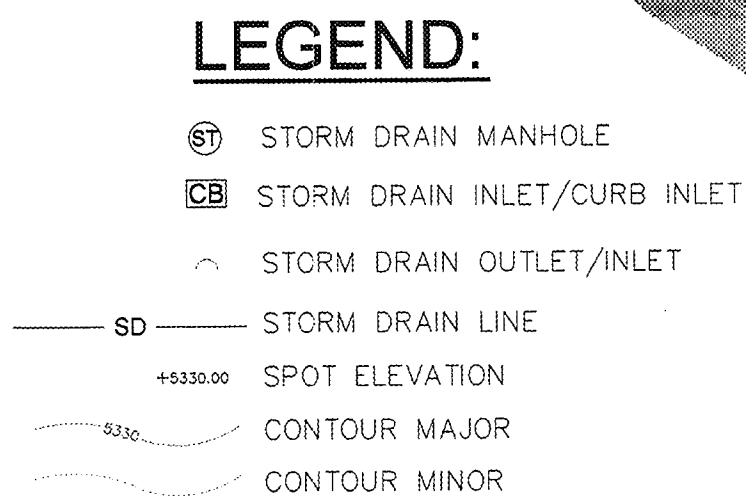
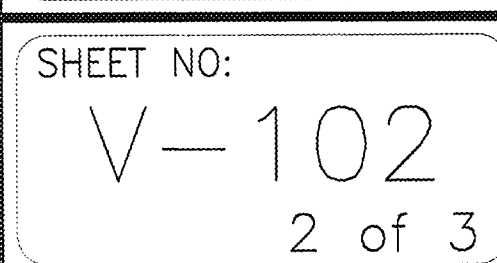
V-101

1 of 3

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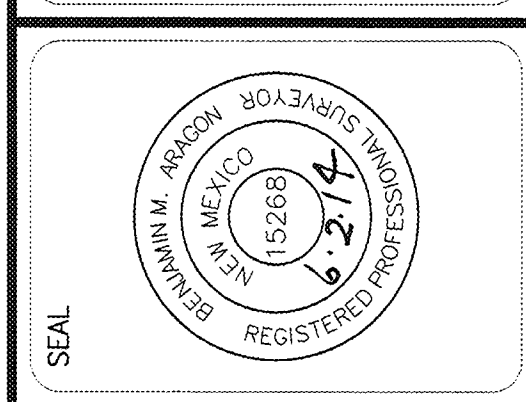
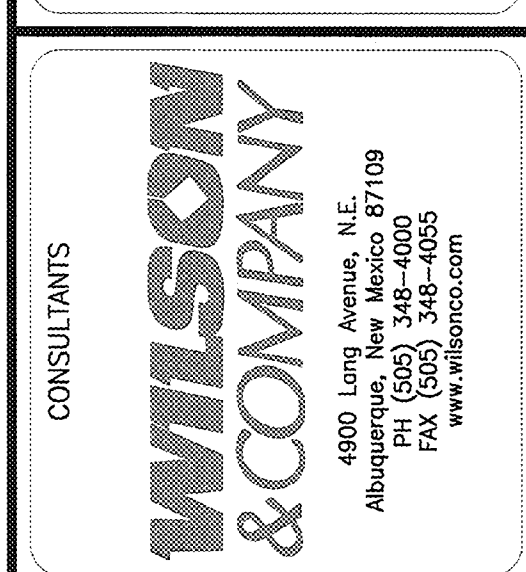
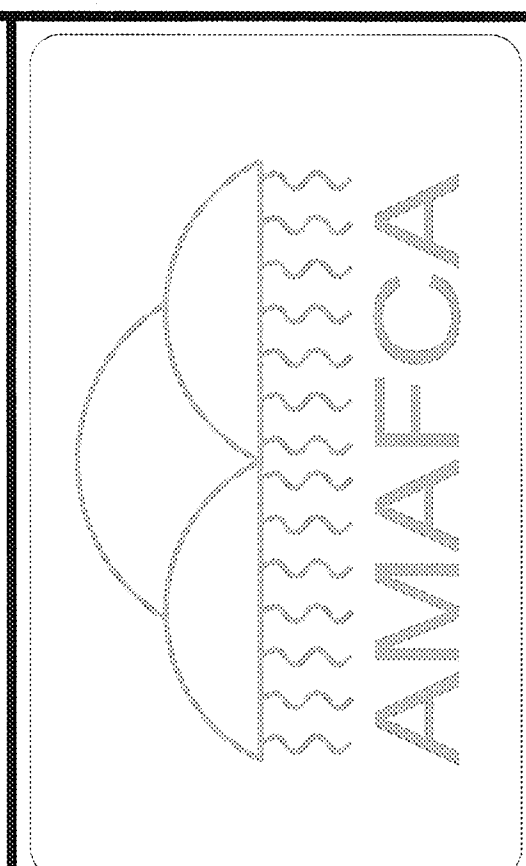
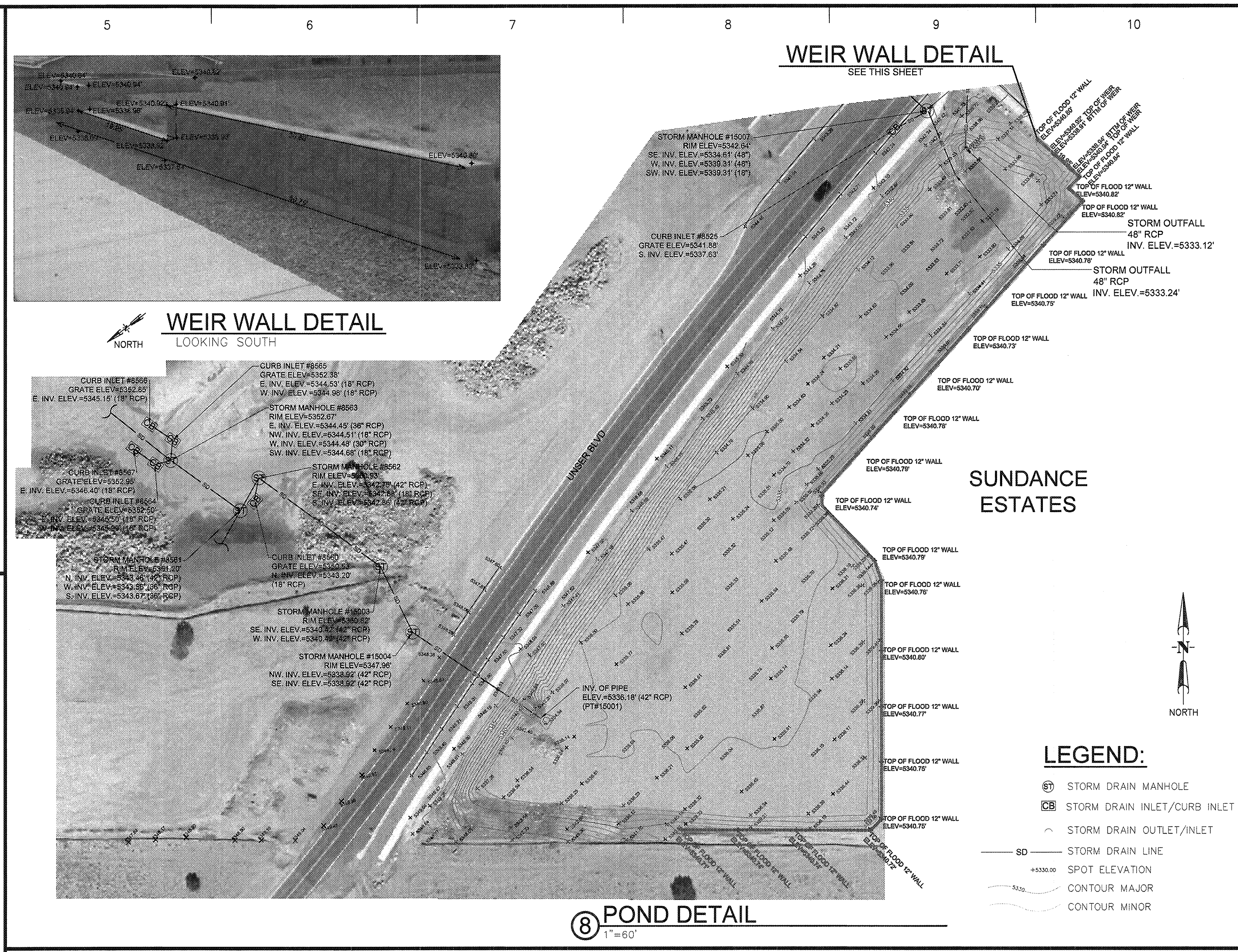
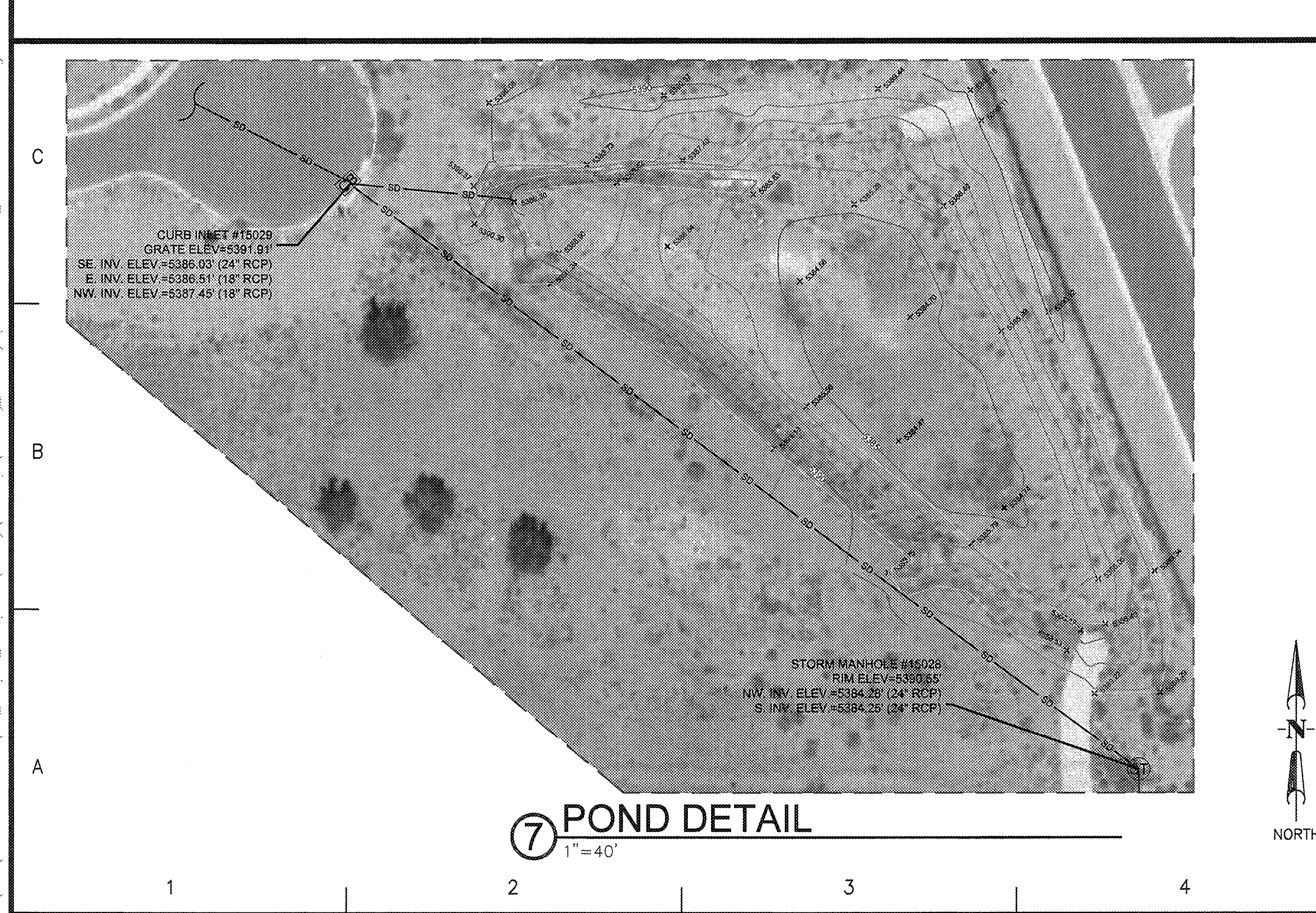
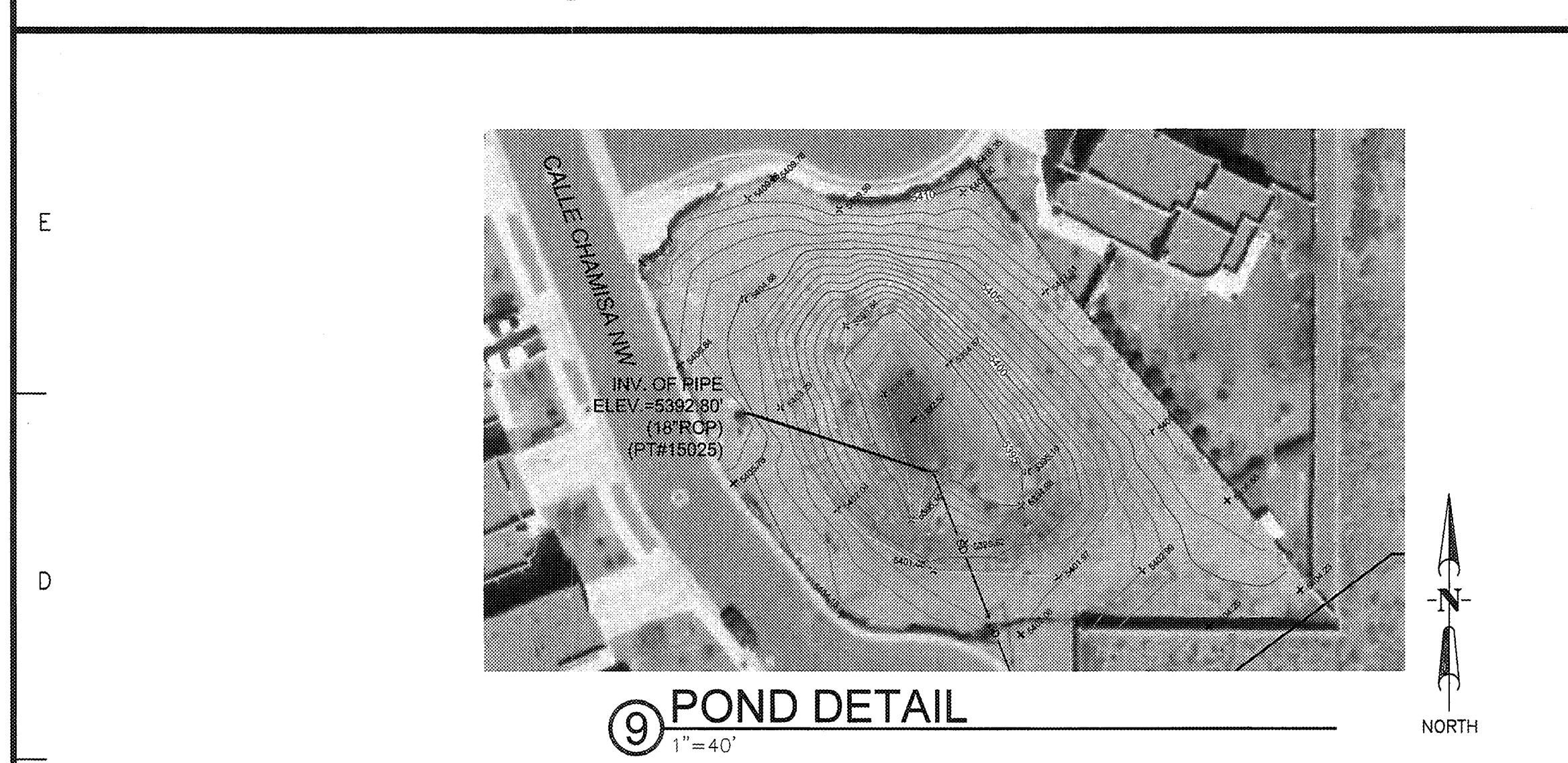
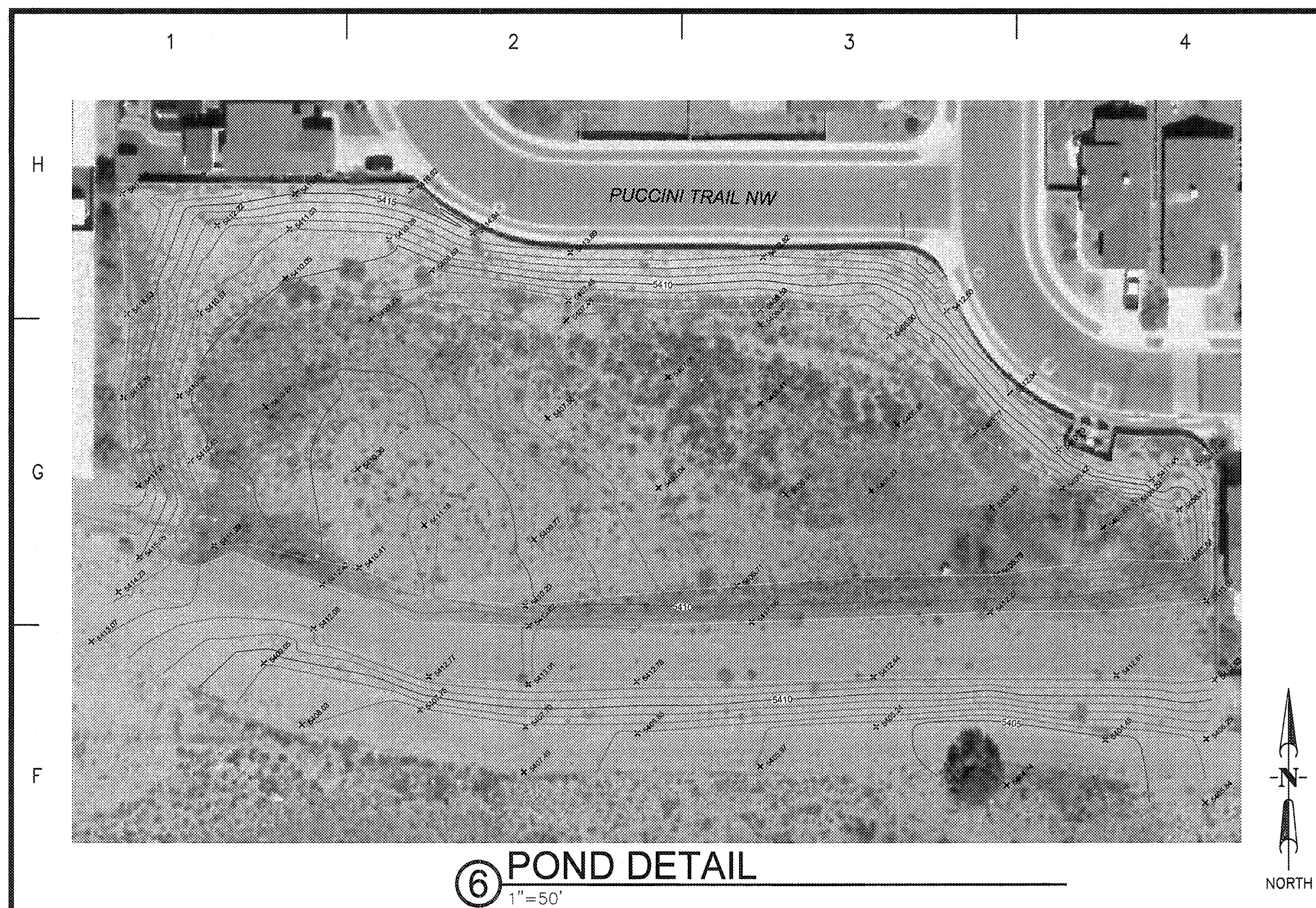
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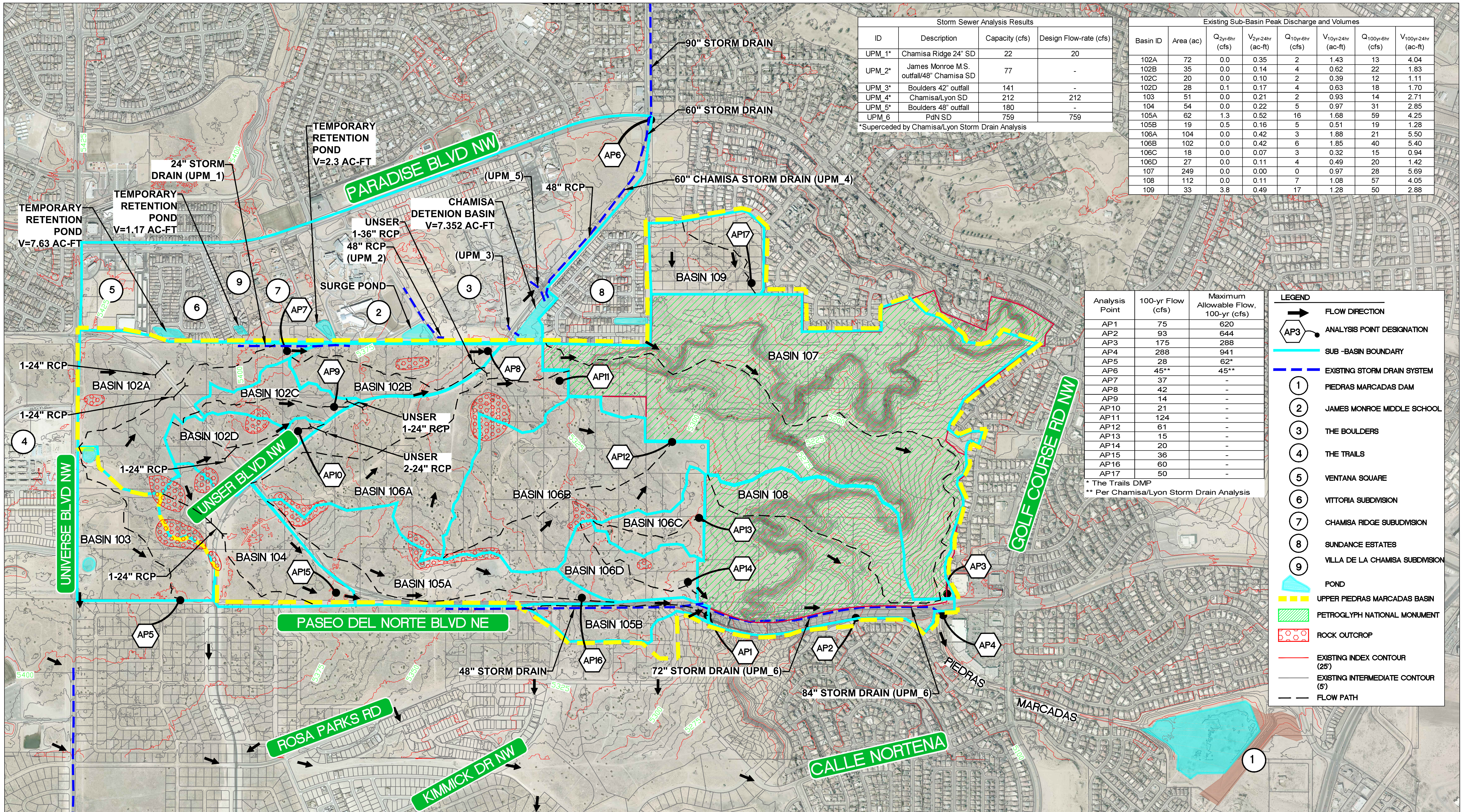
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PROJECT NAME	PROJECT NUMBER
AMAFCA Chamisa - Lyon Storm Drain As-Built Survey	ALBUQUERQUE, NEW MEXICO

DATE	DESCRIPTION	MARK
PROJECT NO: 14-300-010-01		
DESIGNED BY:		
DRAWN BY: AMT		
CHECKED BY: BMA		
DATE: JUNE 2014		
SHEET TITLE		
AS-BUILT SURVEY		
SHEET NO:		
V-103		
3 of 3		



UPPER PIEDRAS MARCADAS WATERSHED DRAINAGE
AND WATER QUALITY MANAGEMENT PLAN
FIGURE 2- EXISTING CONDITIONS BASIN MAP



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ALBUQUERQUE, NM 87109
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FAX: 505-348-4155 SECOND FLOOR
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& COMPANY

