City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

January 26, 2004

Ron Bohannan, PE
Tierra West LLC
8509 Jefferson NE
Albuquerque, NM 87113

Re: Chamisa Project Master Drainage Report
Engineer Stamp date 11-21-03 (B11/D6)

Dear Mr. Bohannan,

Based on information provided in your submittal dated 11-24-03, the above referenced report is approved as a Master Plan for the area denoted in the report. Prior to any development occurring in this basin, all applicable easements must be established for the drainage outfall. These easements may be in the form of a blanket drainage easement, public drainage corridor or roadway easement. This Master Plan must also be approved by AMAFCA. As you state in the report, a site-specific drainage report will also be a requirement of development.

If you have any questions, you can contact me at 924-3986.

Sincerely,

Bradley L. Bingham, PE
Sr. Engineer, Planning Dept
Development and Building Services

C: Lynn Mazur, AMAFCA
file

Albuquerque
Metropolitan
Arroyo
Flood
Control
Authority

2600 PROSPECT N.E. - ALBUQUERQUE, NM 87107
TELEPHONE (505) 884-2215 FAX (505) 884-0214

January 26, 2004

Mr. Ron Bohannan, P.E.
Tierra West, LLC
8509 Jefferson St. NE
Albuquerque, NM 87113

Re: Revised Drainage Report for Chamisa Project, ZAP B-10
Engineer's Stamp Dated November 21, 2003

Dear Mr. Bohannan:

AMAFCA has no objection to the drainage concept presented in the referenced report. Subsequent development of individual tracts will require an agreement among the land owners for construction of the primary storm drain trunk facilities. This agreement was discussed at our meeting with you on January 5, 2004.

If you have any questions, please call me at 884-2215.

Sincerely,
AMAFCA

Lynn M. Mazur

Lynn M. Mazur, P.E., C.F.M.
Development Review Engineer

Cc: Brad Bingham, City Hydrology

REVISED
DRAINAGE REPORT

for

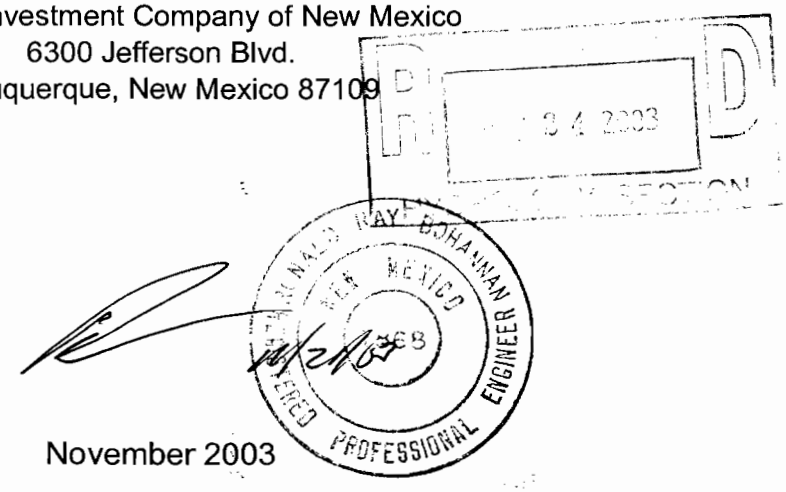
The Chamisa Project
Lyons Diversion/
Albuquerque, New Mexico

Prepared by

Tierra West, LLC
8509 Jefferson Blvd NE
Albuquerque, New Mexico 87113

Prepared for

Builders Investment Company of New Mexico
6300 Jefferson Blvd.
Albuquerque, New Mexico 87109



November 2003

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Appendix

PURPOSE

The purpose of this report is to provide a Master Drainage Plan that will allow the development of the subject property located at the southwest quadrant of Lyons Boulevard and Paradise Boulevard containing approximately 280 acres. The future development shall consist primarily of single-family residential uses with the potential for pockets of multiple-use development containing commercial, multi-family, and single-family residential uses. This report will present the permanent drainage solution and a temporary drainage solution that will allow the development of each property independent of the others. The methodology for this analysis is in accordance with the DPM Chapter 22. This report will provide the general framework for the multiple owners to submit site specific Drainage Management plans for approval.

INTRODUCTION

The subject of this report, as shown on the Exhibit A vicinity map, is an approximate 280-acre parcel of land located on the northwest mesa of Albuquerque. The subject area of this report is bound by the Vittoria at Ventana Ranch Subdivision on the west, Lyons Boulevard on the east, Paradise Boulevard on the north and undeveloped parcels of land of the Paradise Hills Subdivision on the south. The site is located on Zone Atlas pages B10, B-11 and is currently undeveloped. The subject properties have several owners. This site was the subject of several previously submitted drainage reports, specifically, the 'Piedras Marcadas Drainage Management Plan' by Molzen-Corbin (May, 1993), the 'Conceptual Design Analysis for Lyon (Unser) Boulevard/Paradise Boulevard Storm Drain' by Bohannan-Huston (June, 2000) and the 'Lyon Boulevard Storm Drain Mini Drainage Management Plan' by Bohannan-Huston (June, 2002). Most recently the ' Piedras Marcadas Watershed and Lyon Boulevard Storm Drain Analysis

Update- Final Report' was prepared by BHI, as well as several preliminary report by the author of this report. The scope of this report has been significantly reduced from the previous one submitted by this office. The subject of this report is limited to the area that will be diverted from the Piedras Marcadas watershed to the Calabacillas arroyo. The recommendations of these reports have yet to be fully implemented. The concepts presented within these previous reports have been incorporated into this Master Drainage study

EXISTING CONDITIONS

The site slopes from west to east with average grades between 2% to 8%. The site is currently in an undeveloped condition. The upstream basins for this area have been either diverted or contained within the temporary retention pond located within Vittoria at Ventana Ranch Subdivision. The ultimate discharge for this pond as dictated by the city of Albuquerque will be down the Paseo Del Norte Extension. As shown on Exhibit B the site consists of8 sub basins. The site currently discharges a total of 502.1 cfs at multiple points to the Petroglyph National Monument. The predominant discharge is through the Piedras Marcadas Canyon. The National Park Service (NPS) was contacted about the development within this basin, and the NPS notified the land owners that developed flows would not be allowed to enter the Petroglyph National Monument. Due to the lack of downstream facilities, this basin has remained dormant as far as development.

The entire basin is located within the watershed that drains to the Piedras Marcadas Dam, which is operated by AMAFCA. Due to the age of the Dam and the fact it was built with older Hydraulic parameters, the capacity was reanalyzed to determine what additional capacity is available for development within the Basin. This analysis was performed and documented within

the 'Piedras Marcadas Watershed and Lyon Boulevard Storm Drain Analysis Update- Final Report'. The analysis demonstrates that should this remaining undeveloped portion of the Piedras Marcadas Watershed develop, the Piedras Marcadas Dam would not have capacity to contain the storm water volumes generated. Within the previously mentioned report it was established that the Lyons storm drain would be increased in diameter and allow for 212 cfs to be diverted from the Piedras Marcadas watershed to the Calabacillas arroyo by connecting to the Lyons storm drain at the intersection of Lyons Blvd and Paradise Blvd.

PROPOSED CONDITIONS

The development of this site shall be completed in phases. Since the subject project has several owners, this report will set the overall framework for the drainage parameters to be used with the development of each property within this uppermost reach of the Piedras Marcadas Watershed. The ultimate drainage solution will be implemented once the Lyons Boulevard storm drain is completed by 2009. Development that occurs prior to the outfall construction will require either the construction of the required downstream drainage facilities or bonding of the adjacent drainage facility and temporarily retaining onsite the entire 100-year, 10-day developed storm volume. This Drainage Master plan will allow the economic development of this basin prior the completion of the ultimate downstream facilities.

The Proposed Overall Drainage Basin Map is shown on Exhibit C. As shown the entire site contains 5 sub basins. The western most basin has been omitted from this report based upon the acceptance by the City of the Vittoria at Ventana Ranch drainage plan. This basin contains 238.64 acres of which 209.8 that will be diverted to the Calabacillas Arroyo via the Lyons Boulevard Storm Drain. The design and analysis of this Lyons storm drain was addressed

within the 'Piedras Marcadas Watershed and Lyon Boulevard Storm Drain Analysis Update- Final Report'. Based upon the design report, the Lyons Storm drain improvement allows for the discharge of 212 cfs from the basin south of Paradise Boulevard. An excerpt from this report as well as the plan and profile of this facility is included within Appendix A. In order to limit the total flow from the contributing basins a linear detention/open space pond is proposed along the east side of the Unser Alignment. This pond will have a limited discharge rate of 212 CFS. As shown in appendix A, this pond will be greater than 10-acre feet and will not be bermed. Each contributing basin will be allowed free discharge. A storm drain located along each property Southern boundary will collect the flows from each basin. This storm drain is shown on the overall storm drain map located on Exhibit B. A profile of this 'Chamisa' Storm Drain is located within Appendix B. The routing of this storm sewer system was performed using 'Hydraflow-Storm Sewers 7.0'. The output file for the storm drain analysis as well as the site developed flow hydrology is included within Appendix C.

The eastern most basin will lie east of the Unser and due to the existing topography it can not reasonable drain the Unser Ponds. This basin contains 28.84 acres. The existing basin discharges directly to the Petroglyph National Monument. As addressed previously in this report, the National Park Service prohibits the discharge of the developed flow into the Piedras Marcadas Canyon. This basin will be diverted to the existing storm drain with Paradise Boulevard. The Paradise Boulevard storm drain was design by Mark Burack with a report date of 7/23/01. This report made assumptions for the yet to be developed contributing basins based upon their zoning. The tracts subsequently developed as single family residential rather that commercial as assumed. As shown in the Paradise hills Storm drainage design report, Tracts A2A and A2B of the Paradise Bluffs subdivision were assumed to discharge 151.4cfs when fully

developed. These tracts were developed as two separate residential tracts. The drainage report for Tract A2A, known as Paradise Ridge, was prepared by Isaacson and Arfman (B-11/D5). The Drainage report for Tract A2A, known as Paradise Vista was prepared by Mark Burack (B11/D02A). As shown in the two reports this basin discharges 134.50 cfs. Based upon what the Paradise Boulevard storm drain was designed to capture from this basin and what is actually captures, there is 16.9 cfs of excess capacity within the Paradise Boulevard storm drain at the intersection of Justin Drive and Paradise Boulevard. This reports proposed utilizing a portion of this capacity to drain basin 6 as shown on Exhibit D. Due to an undeveloped portion of land located between Justin and Lyons the author proposed to utilize only 10 cfs of this excess capacity allowing for 6.9 cfs to be used with the development of this intermediate property.

Due to the multiple ownership of the overall basin, the development schedule of the basin is impossible to predict. To accommodate the potential for leapfrog development, each tract must be able to develop independently, yet be designed such that the overall Master Drainage Plan will be enforced. This will be accomplished by the creation of drainage corridors that will connect each individual property to the ultimate outfall. The Storm Sewer layout shown on Exhibit D will assist development should certain properties develop independently within a basin. These Branches are subject to change based upon future subdivision within the basin. The development of each parcel will require either a temporary onsite ponding designed to retain the 10-year, 10-day onsite developed flow and upland undeveloped flow, or the construction of all of the downstream facilities. If the site constructs a temporary retention pond, the design must account for the ultimate drainage solution and provide assurances that the conversion is made when the downstream facilities are in place.

The entire basin has an underlying layer of Basalt. This layer of basalt ends east of this

basin at a steep face. This edge of the basalt is included in the Petroglyph National Monument. Due to the general nature of the Basalt layer, pond seepage and horizontal transport of the water is a concern. Prior to the construction of any ponding, geotechnical investigation must be done to locate and plug problematic fissures or else line the ponds shall be lined to eliminate the potential for seepage.

SUMMARY AND RECOMMENDATIONS

The subject of this report is approximately 280 acres of undeveloped land located on the northwest mesa. The continuation of historical drainage patterns is precluded by the policy determination of the Petroglyph National Monument. This report recommends the adoption, by the City of Albuquerque, of an overall drainage concept that allow for the development of the basin. This report also recommends diverting the developed flows from 209 acres from the Piedras Marcadas watershed to the Calabacillas arroyo by the construction of the Lyons Boulevard Storm Drain, and discharging the remaining 28.8 acres down the Paradise Boulevard Storm drain to the Piedras Marcadas Dam. The report also determines the drainage corridor alignments such that all properties are hydraulically connected to the outfall. This master drainage plan allows for the development of individual properties prior to the construction of the ultimate outfalls.

The development of each parcel will require the submittal and approval of a site-specific drainage management plan that will conform to this Drainage Master Plan. The development of this site is consistent with the DPM, Chapter 22, Hydrology section. Since this site encompasses more than five acres, a NPDES permit is required prior to any construction activity. Improvements are to occur within City right-of-way; therefore, Work Orders will be required for all public facilities.

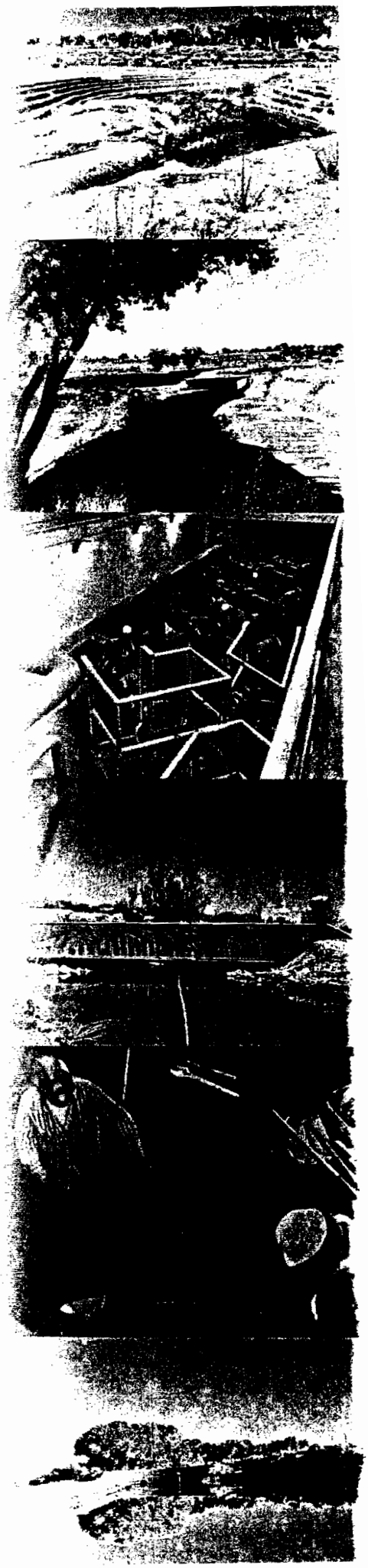
PIEDRAS MARCADAS WATERSHED AND LYON BOULEVARD

Storm Drain Analysis Update

Final Report

JANUARY 15, 2003

Prepared for:
Albuquerque Metropolitan Arroyo
Flood Control Authority
2600 Prospect NE
Albuquerque, NM 87107



Bohannan ▲ Huston Inc.

▲ ENGINEERING
▲ ADVANCED TECHNOLOGIES
▲ SPATIAL DATA

EXECUTIVE SUMMARY

The Piedras Marcadas Dam and Watershed, with particular focus on the area south of Paradise Boulevard, generally west of the Proposed Unser/Lyon Boulevard, and bordered on the west and south by the Piedras Marcadas Watershed Boundary, are the primary subjects of this analysis update report. The watershed that drains to the Piedras Marcadas Dam has undergone changes that affect the volume of drainage runoff and flow rates that reach the dam. At AMAFCAs direction the Molzen-Corbin Alternative 9 AHYMO program model for the watershed has been revised to reflect these changes for this analysis. Originally, prior to revising the entire AHYMO model, three alternatives for draining the area to the Calabacillas Arroyo were investigated. A fourth option examining pressure flow in the Paradise Boulevard/Lyon Boulevard storm drain system was added after review of the preliminary alternatives. Finally, after revision of the entire watershed model, scenarios were examined for reducing the area of diversion to the Calabacillas Arroyo to make maximum use of the Piedras Marcadas Dam capacity. This study is sponsored by the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA).

The first of the four options allows for upsizing of the existing Lyon Boulevard Storm Drain into the Calabacillas Arroyo, and southerly extension into the primary focus area without detention pond(s). The estimated construction cost of this option is $24,831,000 ($9,153,000 for the Paradise/Lyon storm drain). The second option does not allow for upsizing of the existing storm drain, but includes a single 65.4 ac-ft detention pond that requires approximately 9 acres of land. The estimated construction cost of this option is $26,429,000 ($6,040,000 for the Paradise/Lyon storm drain). The third option has several detention ponds and also leaves the existing system in place. The total combined storage of the ponds is 113.6 ac-ft and approximately 15 acres of land is required. The estimated construction cost of this option is $17,359,000 ($4,435,000 for the Paradise/Lyon storm drain). The fourth option is based on the existing storm drain, from the Calabacillas to Irving Boulevard being extended up Lyon and Paradise Boulevards and modeled for pressure flow. It can be used with Options 2 or 3. The purpose of this option is to determine the maximum flow rate that can be allowed from the southern study area without overwhelming the storm drain system. This maximum flow rate is 212 cfs. The estimated construction cost for the Paradise/Lyon Boulevard storm drain under this option is $4,690,000. The primary cost in each of the options is the basalt rock removal.

After revision of the Molzen-Corbin Alternative 9 AHYMO model two additional scenarios were investigated, one, maximize the area that can free discharge to the Lyon Blvd. storm drain and, two, provide a minimum of one foot of freeboard to the Piedras Marcadas Dam emergency spillway. Since both limitations could not be met simultaneously, two different drainage areas were developed to fit the two scenarios. In order to meet both criteria a variation of Option 4 is recommended. Given the smaller drainage basin of this scenario a single detention pond, or several smaller ponds, could be constructed to reduce the maximum flow rate to the Lyon Blvd. storm drain to 212 cfs while maintaining a minimum of one foot of freeboard in the dam.

Weighted E Method

Developed Basins

												100-Year, 6-hour			100-year, 10-day
Basin	Area (sf)	Area (sq.mi)	Area (acres)	Treatment A %	Treatment A (acres)	Treatment B %	Treatment B (acres)	Treatment C %	Treatment C (acres)	Treatment D %	Treatment D (acres)	Weighted E (ac-ft)	Volume (ac-ft)	Flow cfs	Volume (ac-ft)
1	909968.40	0.0326	20.890	5%	1.0445	14%	2.925	11%	2.2979	70%	14.623	1.744	3.036	84.24	4.827
2	2180613.60	0.0782	50.060	5%	2.503	14%	7.008	11%	5.5066	70%	35.042	1.744	7.275	201.87	11.568
3	1134738.00	0.0407	26.050	5%	1.3025	14%	3.647	11%	2.8655	70%	18.235	1.744	3.786	105.05	6.020
4	4449654.00	0.1596	102.150	5%	5.1075	14%	14.301	11%	11.2365	70%	71.505	1.744	14.846	411.93	23.605
5	1373882.40	0.0493	31.540	5%	1.577	14%	4.416	11%	3.4694	70%	22.078	1.744	4.584	127.19	7.288
6	1256096.16	0.0451	28.836	5%	1.4418	14%	4.037	11%	3.17196	70%	20.185	1.744	4.191	116.28	6.664
Total		0.41	259.526		12.9763		36.334		28.54786		181.668		37.718	1046.56	
Calabacillas diversion	9260246.16	0.33	209.80										30.49	846.04	48.48

Equations:

Weighted E = Ea*Aa + Eb*Ab + Ec*Ac + Ed*Ad / (Total Area)

Volume = Weighted D * Total Area

Flow = Qa * Aa + Qb * Ab + Qc * Ac + Qd * Ad

Where

Qa=	1.56	Ea=	0.53
Qb=	2.28	Eb=	0.78
Qc=	3.14	Ec=	1.13
Qb=	4.7	Ed=	2.12

Volumes for 100-year, 24-hour Storm

V10day=V360+AD(P10day-P360)/12

STORM DRAIN CACLULATIONS

ANALYIS POINT	CONTRIBUTING BASIN		
CALABACILLAS		=	
AP11=	5A	=	84.24
AP12=	AP11+5	=	286.11
AP13=	AP12+5B	=	391.16
AP14=	8	=	411.93
AP15=	ROUTED UNSER POND		

Chamisa SD.

Hydraflow Storm Sewers Summary Report

Line No.	Line ID	Flow Rate (cfs)	Line Size (Rise x Spa (inches)	Line Type	Invert Elev Down (ft)	Invert Elev Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor Loss (ft)	Dn Strm Line No.
1	1	391.16	66	Cir	5326.92	5331.53	1.58	5332.42	5336.77	4.36	End
2	2	391.16	66	Cir	5331.53	5344.13	1.58	5341.13	5351.98*	4.21	1
3	3	286.11	60	Cir	5344.13	5351.87	1.58	5356.19	5362.12*	3.3	2
4	4	286.11	60	Cir	5351.87	5371.87	2.5	5365.42	5376.57	3.46	3
5	5	84.24	36	Cir	5371.87	5383.5	1.69	5380.04	5391.01*	2.21	4
6	6	84.24	36	Cir	5383.5	5396.96	1.68	5393.22	5405.98*	2.21	5

NOTES:
Project file: SILVER.STM
I-D-F file: SAMPLE.IDF
Total number of lines: 6
Run date: 07-14-2003
* Indicates surcharge condition.Intensity = 56.76727 / (Tc + 11) ^ .7948174
Return period = 5 Yrs.

Lyons S.D.

Hydraflow Storm Sewers Summary Report

Line No.	Line ID	Flow Rate (cfs)	Line Size (Rise x Spa (inches)	Line Type	Invert Elev Down (ft)	Invert Elev Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor Loss (ft)	Dn Strm Line No.
1	1	212	72	Cir	5321	5323.23	0.38	5327	5328.22	1.1	End
2	2	212	66	Cir	5323.23	5324.94	0.38	5329.33	5331.14*	1.24	1
3	3	212	66	Cir	5324.94	5326.92	0.38	5332.37	5334.46*	1.24	2

NOTES:
Project file: LYONS.STM
I-D-F file: SAMPLE.IDF
Total number of lines: 3
Run date: 07-14-2003
* Indicates surcharge condition.Intensity = 56.76727 / (Tc + 11) ^ .7948174
Return period = 5 Yrs.

REVISED
DRAINAGE REPORT

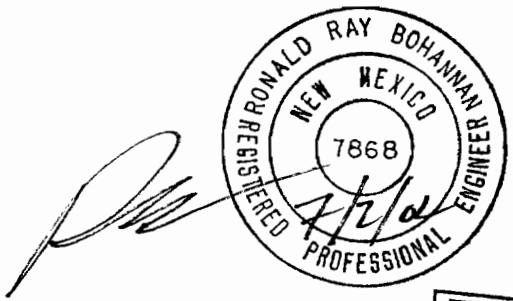
for

Chamisa Project/
Piedras Marcadas Storm Drain
Albuquerque, New Mexico

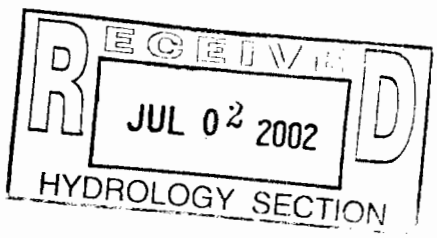
Prepared by

Tierra West, LLC
8509 Jefferson Blvd NE
Albuquerque, New Mexico 87113

Prepared for
Mr. Max Kiehne
Bedrock Partnership
PO Box 1417
Los Lunas, New Mexico 87031



May 2002



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Appendix

Map Pocket

PURPOSE

The purpose of this report is to provide a Master Drainage concept to allow the development of the subject property located at the southwest quadrant of Lyons Boulevard and Paradise Boulevard and contains approximately 872 acres. The proposed development shall consist of a multiple-use development containing Commercial, Multi-family, and Single-family uses, for use as a multi-user retail center. This report will present a temporary drainage solution as well as suggest a permanent drainage solution. The methodology for this analysis is in accordance with the DPM Chapter 22. This report will provide a general guideline in order for the multiple owners to submit site specific Drainage Management plans for approval.

INTRODUCTION

The subject of this report, as shown on the Exhibit A vicinity map, is an approximate 872-acre parcel of land located on the northwest mesa of Albuquerque. The subject area of this report is bound by Universe on the west, Lyons Boulevard on the east, Paradise Boulevard on the north and Paseo Del Norte on the south. The site is located on Zone Atlas pages B10, B-11, C-10, C-11 and is currently undeveloped. The subject properties have multiple ownerships. This site was the subject of several previously submitted drainage reports, specifically, the 'Piedras Marcadas Drainage Management Plan' by Molzen-Corbin (May, 1993), the 'Conceptual Design Analysis for Lyon (Unser) Boulevard/Paradise Boulevard Storm Drain' by Bohannan-Huston (June, 2000) and the 'Lyon Boulevard Storm Drain Preliminary Mini Drainage Management Plan' by Bohannan-Huston (July, 2001). The recommendations of these three reports were never implemented.

EXISTING CONDITIONS

The site slopes from west to east with average grades between 2% to 8%. The site is currently in an undeveloped condition. The offsite basin for this area extends approximately 800' west of Universe Boulevard. The site currently discharges a total of 1,125.8 cfs at multiple points to the Petroglyph National Monument. The predominant discharge is through the Piedras Marcadas Canyon. The National Park Service was contacted about the development within this basin, and they notified the land owners that developed flows would not be allowed to enter the Petroglyph National Monument. Due to the lack of downstream facilities, this basin was dormant as far as development.

PROPOSED CONDITIONS

The development of this site shall be completed in multiple phases. Since the subject parcel has multiple ownerships, this report will only offer an overall concept. The ultimate solution will be developed once the Paseo Del Norte corridor is constructed through the National Monument and a sufficient number of properties are developed to economically connect to the Paradise Storm drainage system. The interim solution will consist of retaining the entire 100-year, 10-day developed storm volume. This interim solution will allow the economic development of this basin prior the construction of the ultimate downstream facilities. The Overall Drainage Concept Plan, located in the Map Pocket, shows the site will be divided into two major drainage Basins.

Basin A consists of the northern portion of this site. This site will drain to a proposed 120 acre- foot pond located at the eastern Boundary. This pond will be hydraulically connected to the existing Paradise Boulevard Storm drain. This connection can be accomplished by the construction of a 24" diameter storm drain within Lyons Boulevard discharging into the existing channel located on the south side of Paradise Boulevard. In order for the pond to drain within 96

hours, the minimum discharge shall be 15.1 cfs. As shown in the drainage report for Paradise Ridge Subdivision (B11/D5), prepared by Isaacson & Arfman (3/29/02) the Paradise Boulevard Storm Drain has 22.1 CFS of excess capacity resulting from the predicted contributing basin 11 development being greater than the proposed.

Basin B consists of the southern portion of this site. This basin will drain to a proposed 85 acre-foot pond located at the site's eastern boundary. This pond will be hydraulically connected to the future drainage facilities to be constructed when Paseo Del Norte is extended through the Petroglyph National Monument. In order for this pond to drain within 96 hours, the minimum discharge shall be 10.7 cfs. The ultimate design of the Paseo Del Norte Storm drain will determine the allowable discharge from this pond. As shown in Appendix A, the Volume and peak discharge rates are calculated based upon the weighted E method described within Chapter 22 of the City of Albuquerque Development Process Manual. The minimum discharge calculations are also included in appendix A.

Due to the multiple ownership of the overall basin, the development schedule of the basin is impossible to predict. To accommodate the potential for leapfrog development, each tract must be able to develop independently, yet designed such that the overall master drainage plan will be enforced. This can be accomplished by the creation of drainage corridors that will connect each individual property to the ultimate ponding area. The proposed alignment of these corridors has been shown on the Overall Drainage Concept Plan. The development of each parcel will require either a temporary onsite ponding designed to retain the 10-year, 10-day onsite developed flow and upland undeveloped flow, or the connection to the ultimate pond. If the site constructs a temporary retention pond, the design must account for the ultimate drainage solution and provide assurances that the conversion is made when the downstream facilities are completed.

The entire basin has an underlying layer of Basalt. This layer of basalt ends east of this basin at a steep face. This edge of the basalt is included in the Petroglyph National Monument.

Due to the general nature of the Basalt layer, pond seepage and horizontal transport of the water is a concern. Prior to the construction of any ponding in this area, investigation must be done to locate and plug problematic fissures or else line the pond to eliminate the potential for seepage.

Seepage of pond

SUMMARY AND RECOMMENDATIONS

The subject of this report is approximately 872 acres of undeveloped land located on the northwest mesa. The continuation of historical drainage patterns is precluded by the policy determination of the Petroglyph National Monument. This report recommends the adoption, by the City of Albuquerque, of an overall drainage concept that allows the construction of tow interim retention ponds, which will contain 120 acre-feet and 85 acre-feet respectively. These ponds were sized to retain the entire 100-year, 10-day storm event based upon assumed land usage. The northern 120-acre foot pond will ultimately discharge to the Paradise Boulevard storm drain with a minimum discharge rate of 15.1 cfs. The southern 85 acre-foot pond will ultimately discharge to the extension of Paseo Del Norte and must have a minimum discharge rate of 10.7 cfs. These minimum discharge rates allow each pond to drain within the requisite 96 hours. Since the proposed ponds shall be larger than 10 acre-feet, the State Engineer approval must be obtained as well as the Corps of Engineers approval.

The development of each parcel will require the submittal and approval of a site-specific drainage management plan that will conform to this Overall Drainage Concept. The development of this site is consistent with the DPM, Chapter 22, Hydrology section. Since this site encompasses more than five acres, a NPDES permit is required prior to any construction activity. Improvements are to occur within City right-of-way; therefore, Work Orders will be required for all public facilities.

Weighted E Method

Existing Basin

										100-Year, 6-hour Storm		
Basin	Area	Treatment A		Treatment B		Treatment C		Treatment D		Weighted E	Volume	Flow
	(acres)	%	(acres)	%	(acres)	%	(acres)	%	(acres)	(ac-ft)	(ac-ft)	cfs
Entire Site	872.7	100%	872.7	0.0%	0.000	0.0%	0	0.0%	0.000	0.440	31.999	1125.78

Developed Basins

										100-Year, 6-hour Storm			100-year, 10-Day Storm	
Basin	Area	Treatment A		Treatment B		Treatment C		Treatment D		Weighted E	Volume	Flow	Impervious	Volume
	(acres)	%	(acres)	%	(acres)	%	(acres)	%	(acres)	(ac-ft)	(ac-ft)	cfs	area(ft)	(ac-ft)
A	519.7	0%	0	11.3%	58.726	15.9%	82.6323	72.8%	378.342	1.667	72.207	2009.72	378.342	118.554
B	354.6	0%	0	10.6%	37.588	14.9%	52.9063	74.5%	264.177	1.686	49.832	1382.60	264.177	82.194
TOTAL	874.3		0.000		96.314		135.539		642.519		122.040	3392.319		200.748

Equations:

Weighted E = Ea*Aa + Eb*Ab + Ec*Ac + Ed*Ad / (Total Area)

Volume = Weighted D * Total Area

Flow = Qa * Aa + Qb * Ab + Qc * Ac + Qd * Ad

Where

0.53		Qa=	1.56
0.78		Qb=	2.28
1.13		Qc=	3.14
2.12		Qd=	4.70

These equations and values taken from the Alb. DPM Section 22 (Hydrology)
The values utilized are for area 1 which lies west of the Rio Grande River

Volumes for 100-year, 24-hour storms

V10DAY=V360+AD(P10DAY-P360)/12

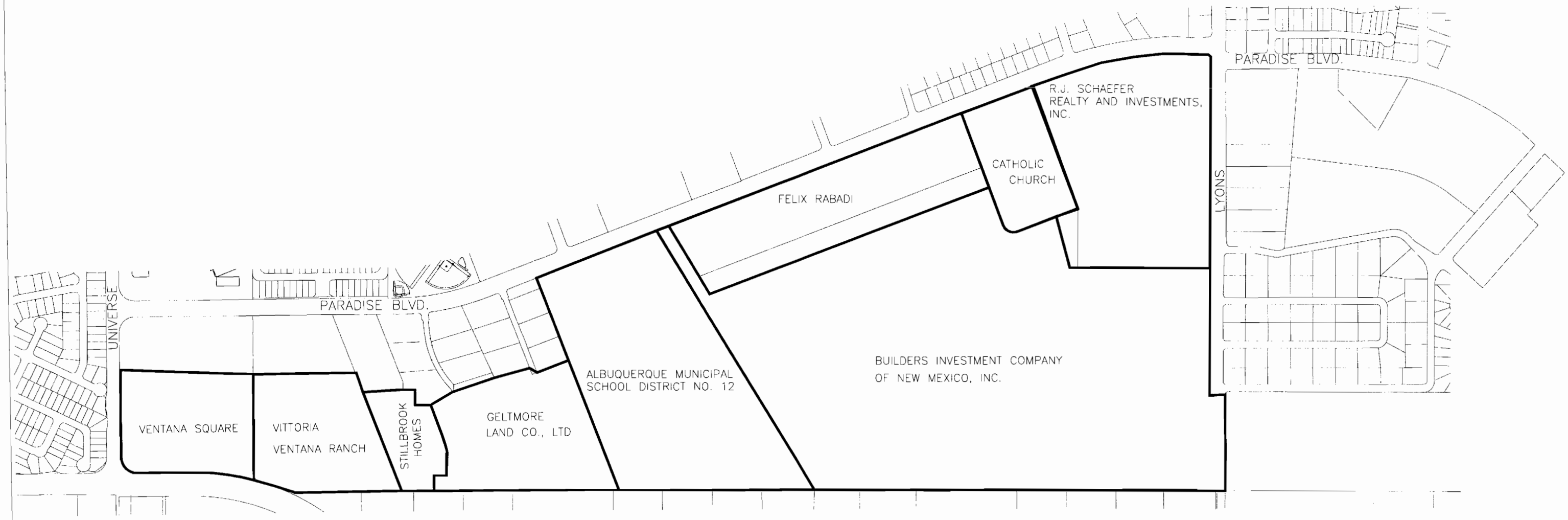
Discharge Rate Calculation

Pond A

5,227,200 cubic feet/ (345,600 seconds) =15.1 cfs

Pond B

3,702,600 cubic feet/ (345,600 seconds) = 10.7 cfs



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GRAPHIC SCALE

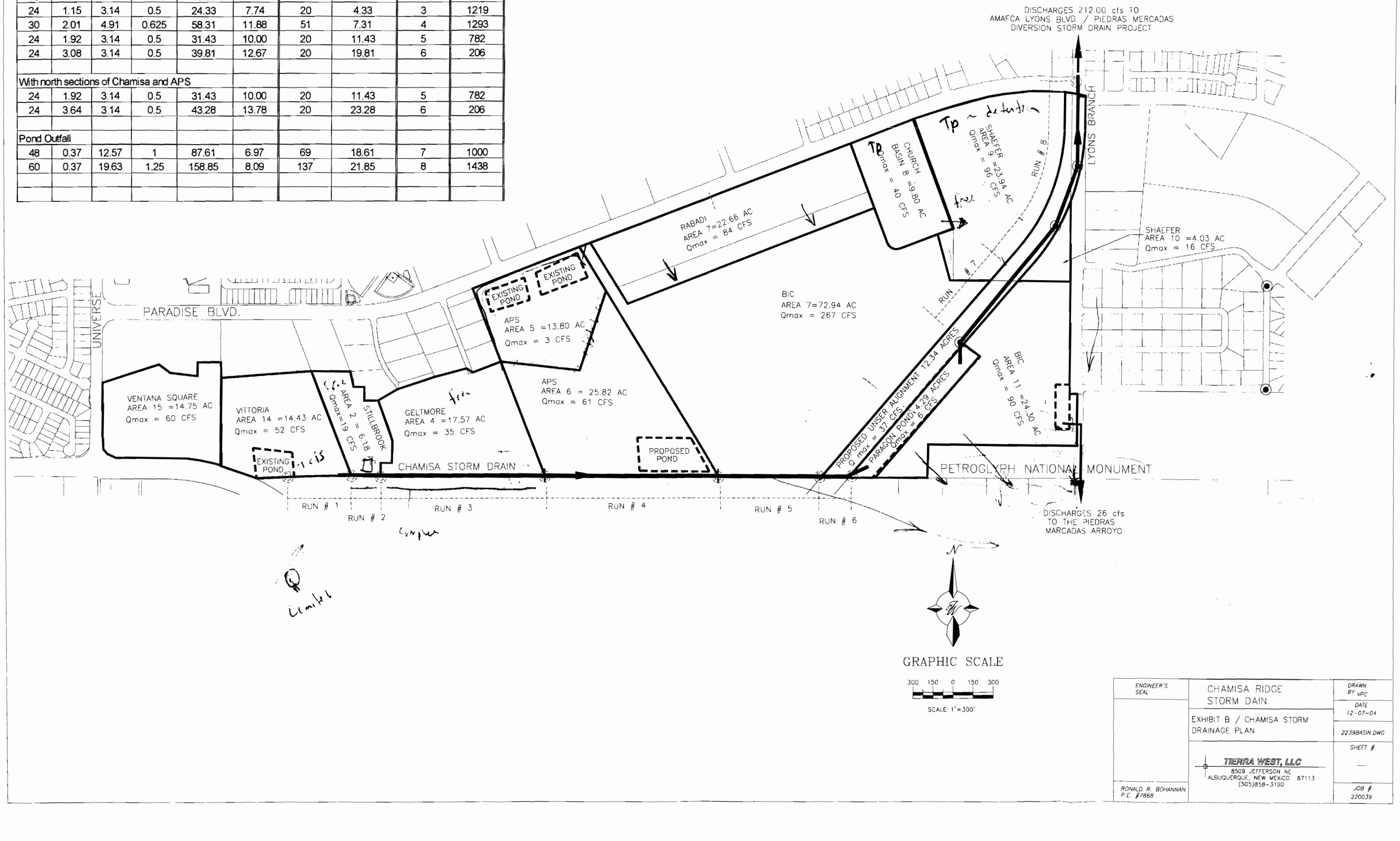
300 150 0 150 300

SCALE: 1"=300'

ENGINEER'S SEAL	CHAMISA DRAINAGE PLAN	DRAWN BY BDG
		DATE 11-03-04
	EXHIBIT A PROPERTY OWNERSHIP	2239BASIN.DWG
	TIERRA WEST, LLC 8509 JEFFERSON NE ALBUQUERQUE, NEW MEXICO 87113 (505)858-3100	SHEET # —
RONALD R. BOHANNAN P.E. #7868		JOB # 220039

South Master Storm Drain w/ Vittoria Detention pond releasing at developed rate-48CFS
No APS pond

D (in)	Slope (%)	Area (ft^2)	R	Q Provided (cfs)	Velocity (ft/s)	Q Req. (cfs)	Q Excess (cfs)	Run No.	Run Length (ft)
With south sections only									
18	0.91	1.77	0.375	10.05	5.69	7	3.05	1	550
18	1.53	1.77	0.375	13.03	7.37	8	5.03	2	215
24	1.15	3.14	0.5	24.33	7.74	20	4.33	3	1219
30	2.01	4.91	0.625	58.31	11.88	51	7.31	4	1293
24	1.92	3.14	0.5	31.43	10.00	20	11.43	5	782
24	3.08	3.14	0.5	39.81	12.67	20	19.81	6	206
With north sections of Chamisa and APS									
24	1.92	3.14	0.5	31.43	10.00	20	11.43	5	782
24	3.64	3.14	0.5	43.28	13.78	20	23.28	6	206
Pond Outfall									
48	0.37	12.57	1	87.61	6.97	69	18.61	7	1000
60	0.37	19.63	1.25	158.85	8.09	137	21.85	8	1438



ENGINEER'S SEAL	CHAMISA RIDGE STORM DAIN	DRAWN BY VPC
		DATE 12-07-04
	EXHIBIT B / CHAMISA STORM DRAINAGE PLAN	2239BASIN.DWG
	TIERRA WEST, LLC 8509 JEFFERSON NE ALBUQUERQUE, NEW MEXICO 87113 (505)858-3100	SHEET # —
RONALD R. BOHANNAN P.E. #7868		JOB # 220039