City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

October 6, 1999

Marvin R. Kortum
1605 Speakman Drive SE
Albuquerque New Mexico 87123

RE: Drainage at the Intersection of I-40 and Four Hills Road (L-23)

Dear Mr. Kortum:
We have received two letters from yourself dated August 4 and September 21 and from the District Three Engineer dated September 14, 1999. I have visited the site and reviewed your submittal for the proposed subdivision (The Breeze at Mountain Gate Subdivision).

I agree with Mr. Harris that the north offsite flow are historic and need to be accepted into your property and safely passed through. Also, if you accept the historic flows you must pass them to the historic outfall. If this outfall is changed then the capacity of the new downstream alignment must be analyzed, and overflow into public Right-of Way as a design feature is not acceptable. The developer must bear the design and construction costs if you decide to divert the north offsite flows in public property. Public funds are not available or intended for this purpose. The proposed design will have to be reviewed and approved by the City and the New Mexico State Highway Department. Since this is a development issue please address future correspondence to your drainage representative at the One Stop.

I hope this answers your questions on the offsite flows. If you have any questions please call me at 768-2654.

Sincerely,

Carlos A. Montoya
Project Manager

c: Steven P. Harris, District Three Engineer
Susan M. Calongne, City/County Floodplain Adm.

Believers Center

ALBUQUERQUE

- Background
- Basin Analysis
- Summary of Results
- Drainage / Grading Plan

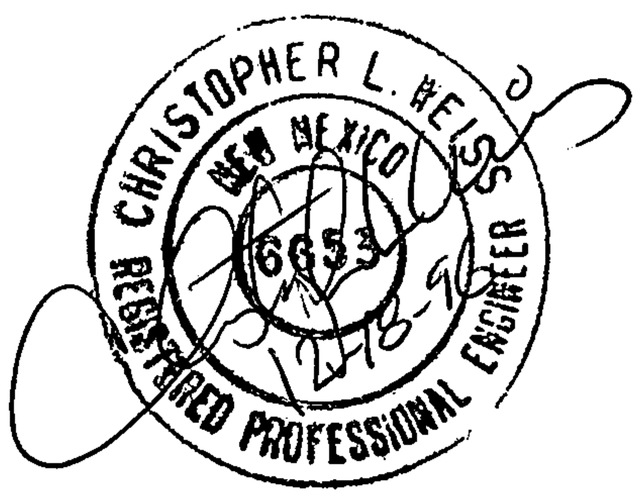
Drainage Report

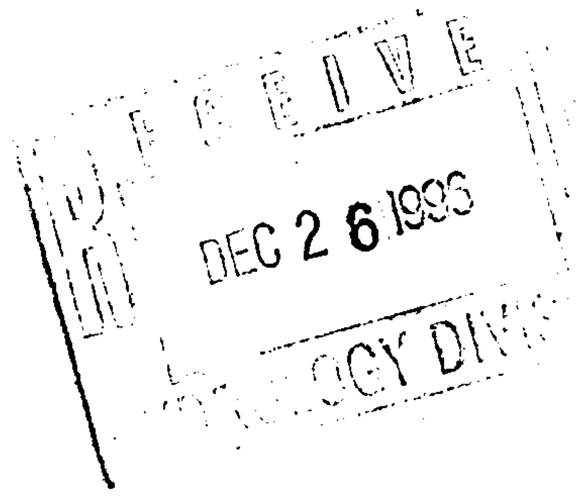
December 1996

C. L. Weiss Engineering, Inc.

Believers Center

ALBUQUERQUE





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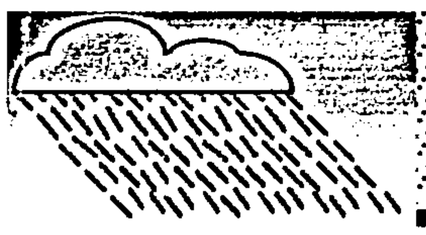


Drainage Report

December 1996
C. L. Weiss Engineering, Inc.

Background

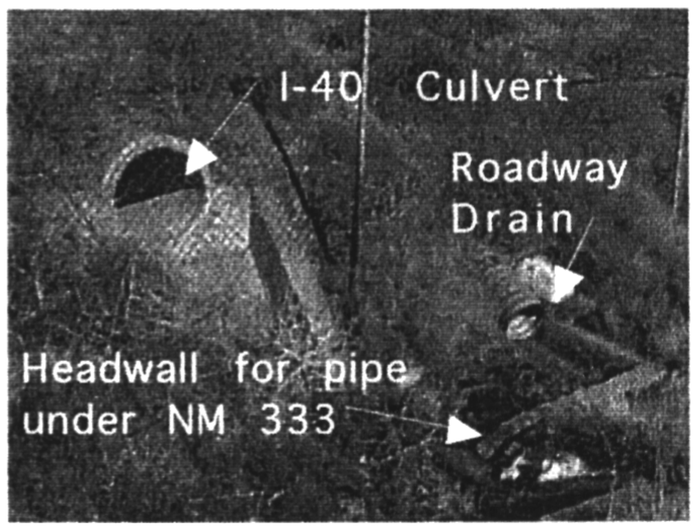
- Existing Site

The purpose of this drainage report is to analyze the existing and developed drainage patterns for the proposed Believers Center church facility located south of I-40 and east of Four Hills Road. More specifically, the site consists of the undeveloped 15.77 acre tract bordered by the I-40 Frontage Road (NM 333) on the north, with Waterfall Dr. and Carmellia Dr. forming a closed loop around the tract to the south.

General site topography ranges from relatively flat areas on the northern portion of the site, with the southern area slopes ranging from moderate to severe. The proposed development will occupy the northern two-thirds of the site, with the steeper areas left in the natural state as much as possible.

The varying slope of the ground sheds storm runoff in all directions, with the majority of flows finding paths to Waterfall Dr. Flows entering Waterfall Dr. from the northern portion of the tract collect in a low area on-site before entering the street. mid-way between NM 333 and Serenity Ct. Flows entering Waterfall Dr. from the southern portion of the tract are channelized by a natural arroyo for discharge into the street just above Poinsettia Pl...ace. All of these flows are then carried around the loop to the east and then a short distance north to a dip section outlet into a tributary to the Tijeras Arroyo. Carmellia Dr. picks up the remaining one-third of the site, with most of the flow entering the street from small rivulets formed in the side embankments. These flows travel south to the same dip section outlet which drains Waterfall Dr.

Off-site flows affecting the site are minimal. The existing streets surrounding the site intercept the majority of these flows. The only area which has direct discharge onto the tract comes from a 0.4 acre area north of I-40, formed by the west bound off-ramp to Central Ave. and the west bound on-ramp from Central to I-40. This area drains through a culvert installed under the I-40 embankment which outlets on the north side of NM 333. At this point, the 24" drain is joined by a 12" dia. roadway drain, both of which empty into a concrete headwall for a culvert located under NM 333 which "drains" to the site.

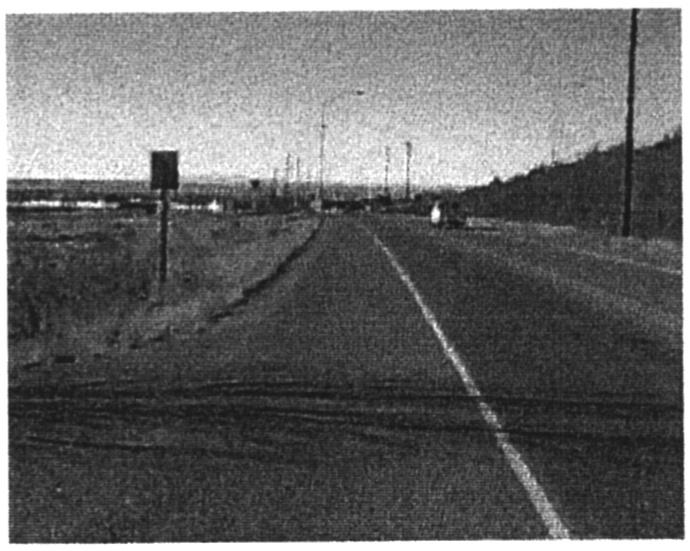


Site Map

(L-23-Z)

Scale: 1" = 500'

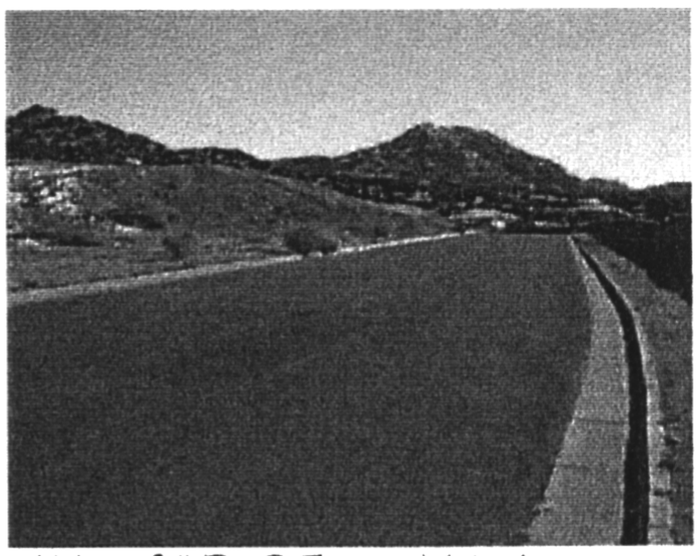
At least that is what appears to be the intent of the drainage system. In actuality, no visual evidence of the culvert outlet exists on the south side of NM 333 within the tract. There is evidence of some drainage in the general area of the outlet from the heavy weed growth. It appears that the pipe may be partially plugged or blocked at the outlet, thus forcing the majority of the flows at the headwall west, following the bar ditch on the north side of NM 333. These flows eventually pass either under or over NM 333 and follow natural swales to the south across an undeveloped tract east of Four Hills Rd.



NM 333 Looking West

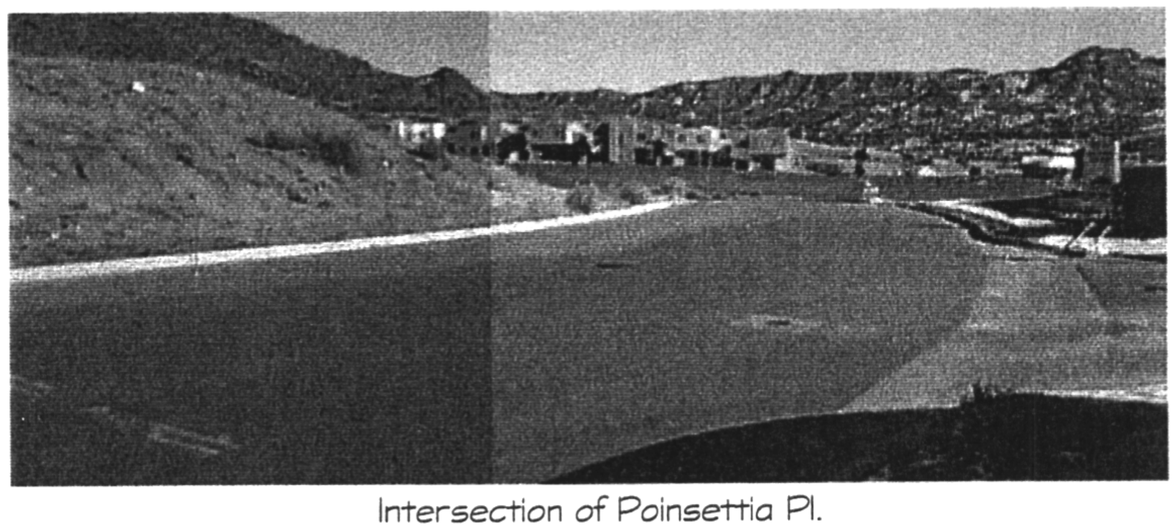
Waterfall Drive

The majority of existing and proposed site flows enter Waterfall Dr., which drains south and then east and back north a short distance to a dip section drain outlet into a tributary to the Tijeras Arroyo. The only contributing basins to the street are the Believers Center site and a small area adjacent to Poinsettia Place. The street grades vary, but all sections have the capacity to carry the proposed flow rates from the developed Believers Center site to the outlet.



Waterfall Dr.@ Future Main Access
looking South

Waterfall Dr.@ Future Main Access
looking North



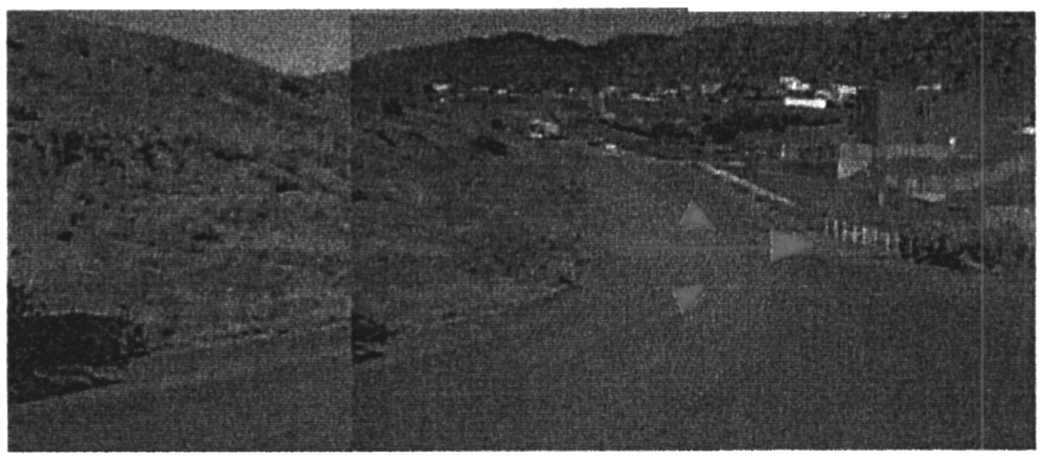
Intersection of Poinsettia Pl.
looking East

Carmellia Drive

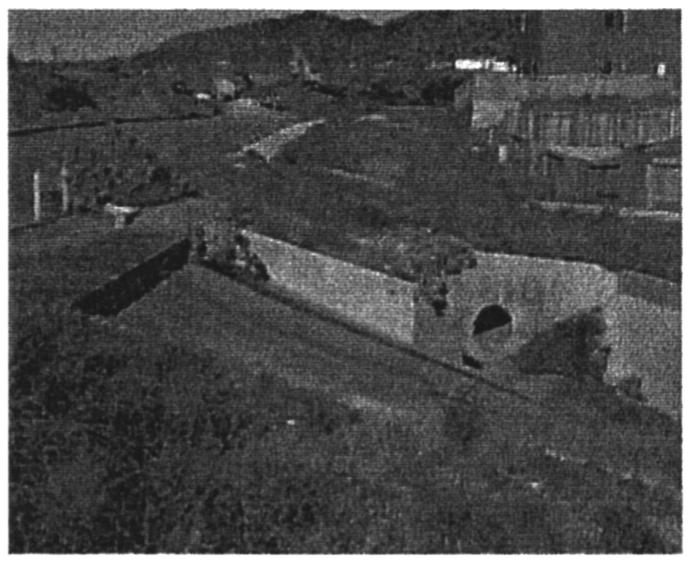
Carmellia Drive drains directly south from NM 333 into the dip section outlet. The street is isolated from up-land off-site flows due to an arroyo which lies adjacent to the east side of the street. The only contributing basin to the street is a portion of the eastern side of the Believers Center site. The street has the capacity to carry all proposed flow rates generated by development of the area.

Dip Section Outlet

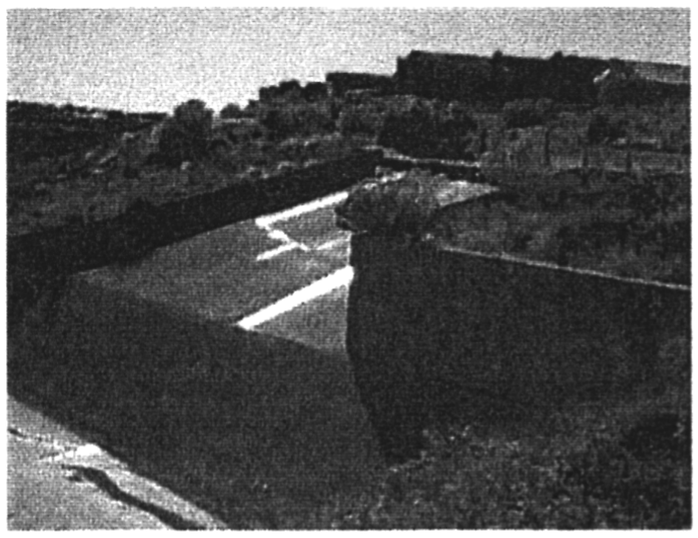
The street grades into the dip section from either direction are uniform, with the ground elevation on the west side rising up steeply into the site. Runoff draining from either direction will have little choice but to temporarily pond at the low spot while changing direction to the east to spill over the edge of the outlet into the arroyo.



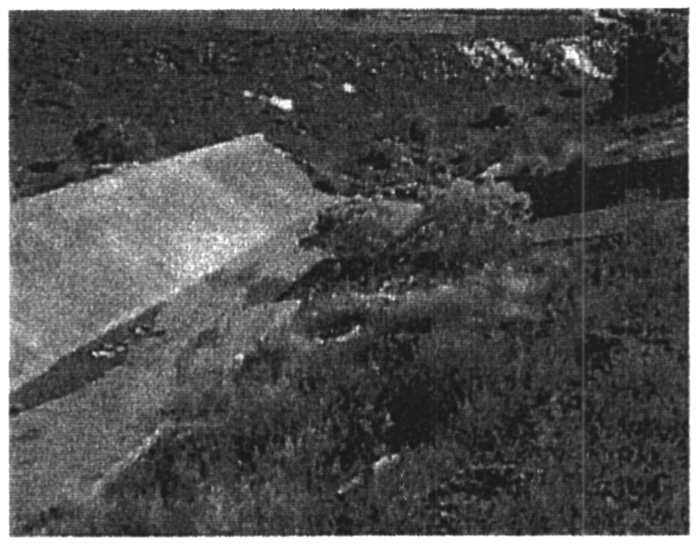
Dip Section looking North @ Carmellia Dr.



Rundown looking North



Rundown looking South

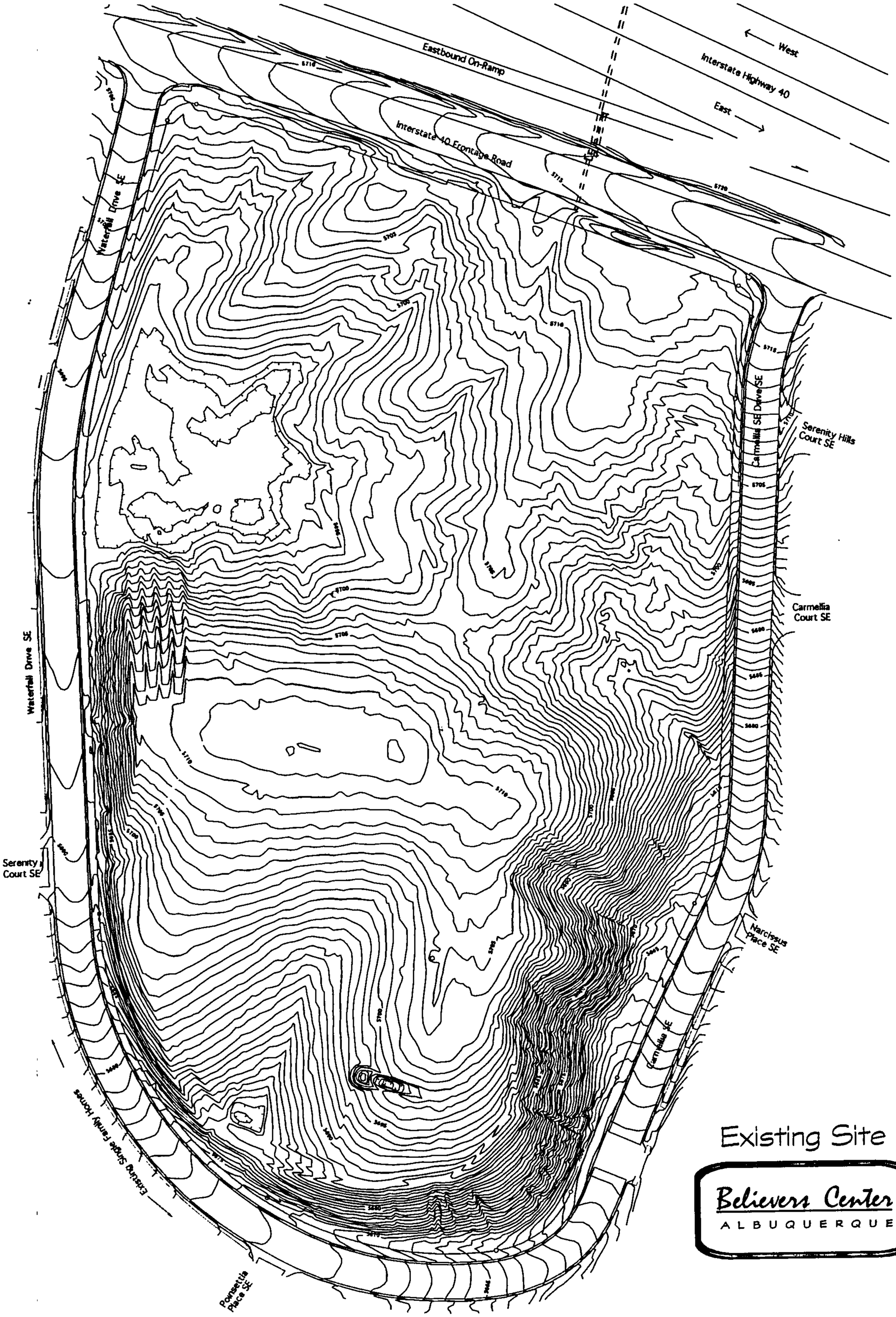


Outlet channel to Arroyo

• Phase 1 / Future Development

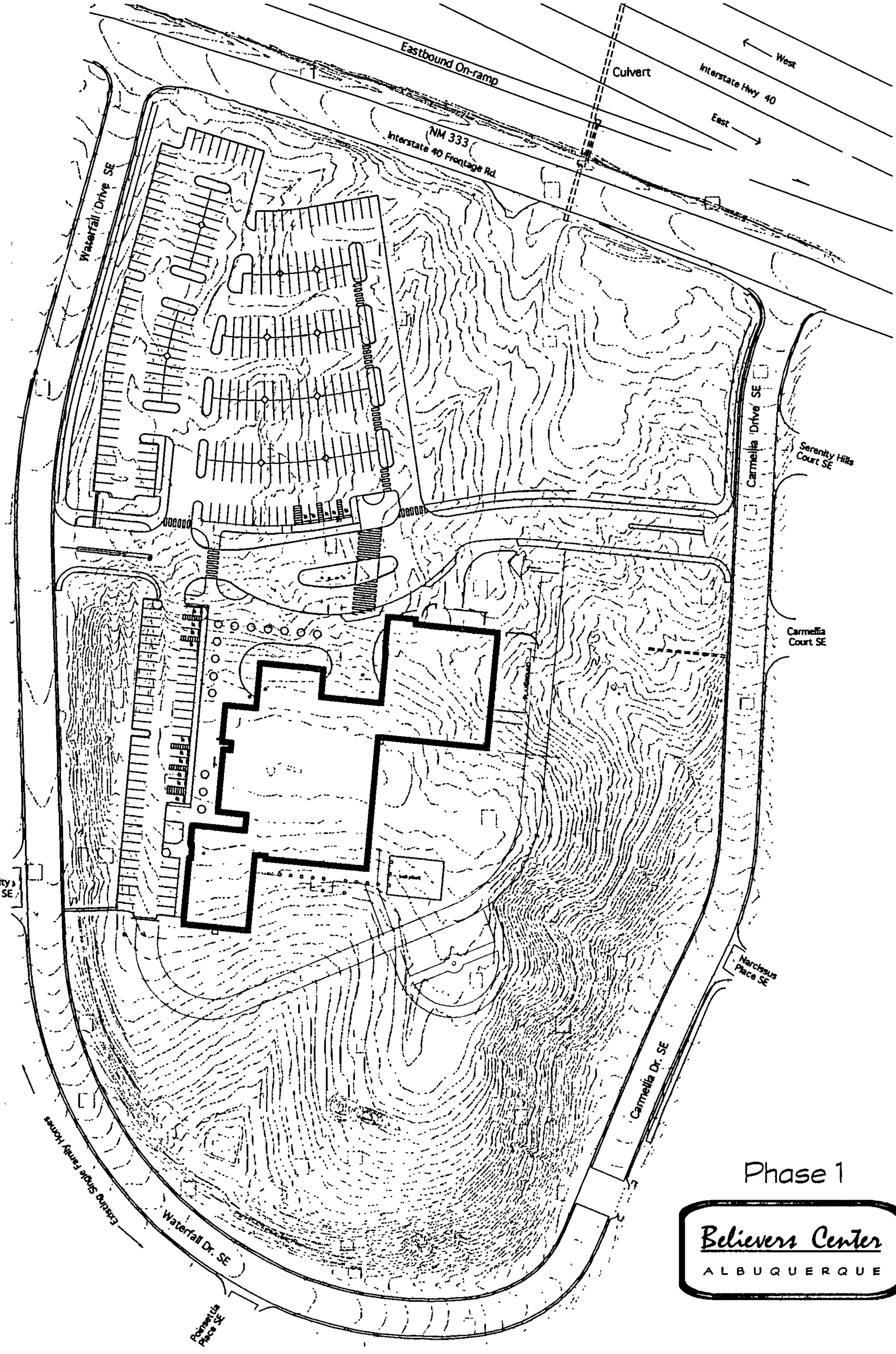
The first phase of development will involve construction of the main portion of the building and paving the west half of the main parking area. The developed areas will establish runoff patterns for the majority of the flows entering Waterfall Dr., with the bulk of the storm runoff being conveyed to the street via the western site access drive. Other parking and roof areas will be controlled at the source in order to reduce the possibility of eroding new paths across the undeveloped portion of the site. Areas left in the natural state will continue to drain following the historic runoff patterns.

The future phase was included as part of the master plan in order to establish the potential land use for parking expansion and building use in the steeper areas of the site. Additionally, the drainage report addresses the development through the future phase so that downstream drainage capacities could be verified. Some of the future parking expansion will drain to Waterfall Dr., but the majority of runoff from the future development will flow to Carmellia Dr., being conveyed to the street via the eastern site access. Discharge from future roof areas will have to be controlled to prevent erosion of the steep embankments sloping to the street.



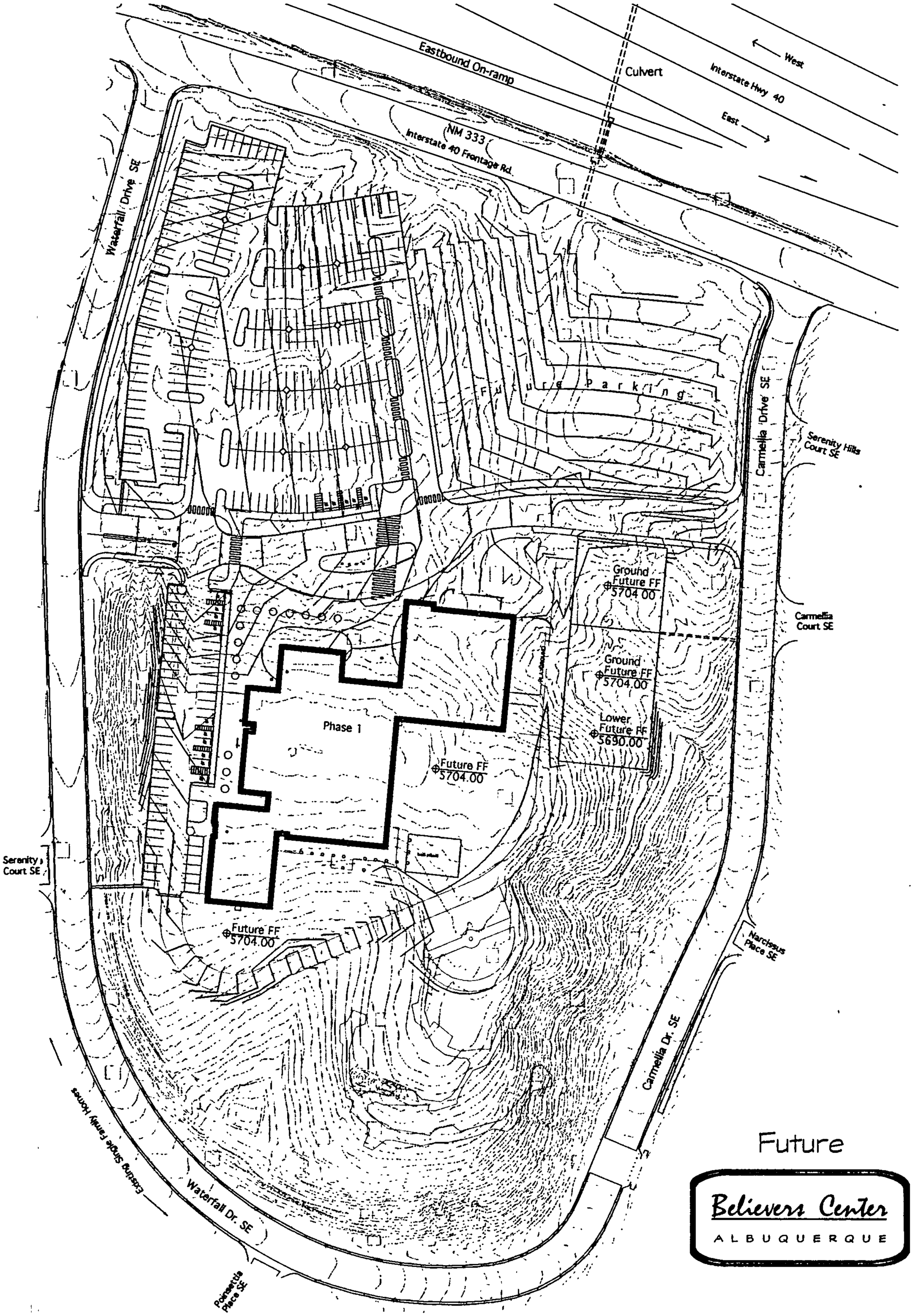
Existing Site

Believers Center
ALBUQUERQUE



Phase 1

Believers Center
ALBUQUERQUE



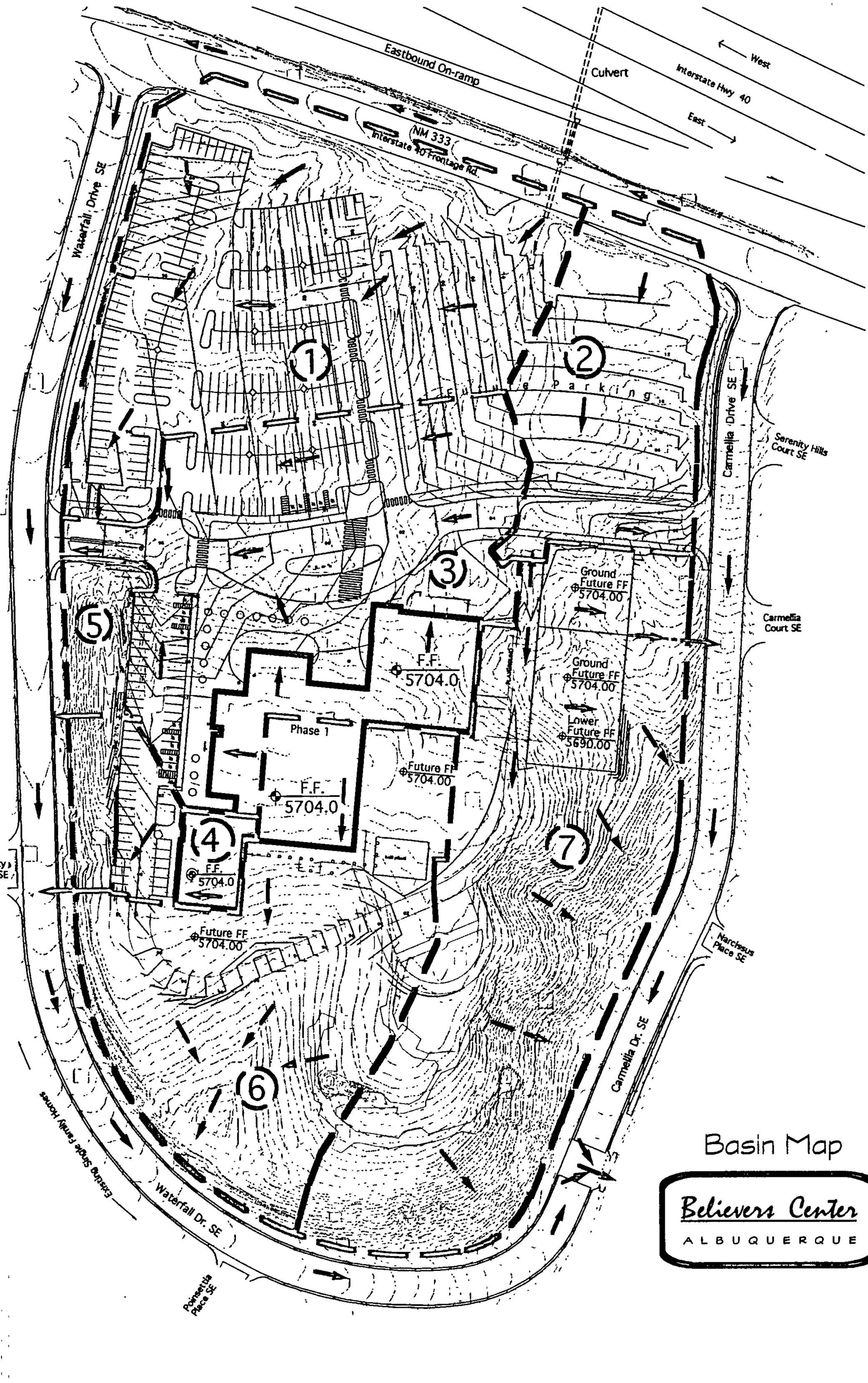
Future

Believers Center

ALBUQUERQUE

Basin Analysis

The following calculations address the developed conditions for the Believers Center , encompassing Phase I and the future expansion building program. The site is divided into seven (7) basins which reflect the flow patterns determined by the proposed finished elevations. For those areas left In the natural state, historic flow patterns determined the basin boundaries.



Basin Map

Believers Center
ALBUQUERQUE

Basin #1

AREA OF SITE: 161,467 SF = 3.71 Ac.

Calculations are based on the Drainage Design Criteria for Bernalillo County, Section 22.2, DPM, Vol 2, dated Jan., 1993

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	143,067	SF
Area b	=	0	SF
Area c	=	8,500	SF
Area d	=	9,900	SF
Total Area	=	161,467	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=	0	SF
Area b	=	53,591	SF
Area c	=	0	SF
Area d	=	107,876	SF
Total Area	=	161,467	SF

EXCESS PRECIPITATION:

Precip. Zone 3

Ea = 0.66
Eb = 0.92
Ec = 1.29
Ed = 2.36

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted } E = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E	=	0.80	in.	Developed E	=	1.88	in.

On-Site Volume of Runoff: $V360 = \frac{E*A}{12}$

Historic V360	=	10729	CF	Developed V360	=	25324	CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 3

Qpa	=	1.87	Qpc	=	3.45	
Qbb	=	2.60	Qpd	=	5.02	
Historic Qp	=	8.0 CFS	Developed Qp	=	15.6	CFS

Basin 1 comprises the parking area at the NW corner of the site associated with Phase 1 construction and a portion of the future parking located in the NE area of the site. Flows from this area will be drained south in a rectangular shaped concrete rundown from the parking area, onto the west access drive.

The flow rate from the parking area requires a 6' wide opening at the entrance to the rundown (Orifice Eq., where C=0.6, Q=15.6 cfs, h=0.7'). An 8" high curb needs to be extended back from the rundown opening, as shown on the DG plan, to contain the flow during the transition to the outlet. The rectangular rundown, based on Manning's Formula, requires a 4' wide section, where S=2.7%, Q=15.6 cfs, D=0.4', and V=9.3'/s. The direction of the rundown needs to incorporate a gentle sweeping curve at the outlet to help re-align flows toward Waterfall Dr. to reduce the potential of conflicts between the runoff and traffic on the access drive.

TOTAL FLOW

HISTORICAL	PROPOSED	Total of Historical	Prop
8.0	15.6	10729	25324
3.2	6.5	4184	10649
6.7	15.0	8667	25026
0.8	2.0	1064	3334
1.2	1.2	1572	1572
7.1	11.1	9087	16123
10.1	13.3	13426	18893
0.8	0.8	1001	1001
14.2	14.2	22806	22806
5.3	5.3	8514	8514
57.40	85.00	81050cf	133242cf
	↑ 27.60cfs	↑ 52192cf	

Basin #2

AREA OF SITE: 65,090 SF = 1.49 Ac.

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	57,490	SF
Area b	=	0	SF
Area c	=	5,300	SF
Area d	=	2,300	SF
Total Area	=	65,090	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=		SF
Area b	=	17,930	SF
Area c	=	0	SF
Area d	=	47,160	SF
Total Area	=	65,090	SF

EXCESS PRECIPITATION:

Precip. Zone 3

Ea = 0.66
Eb = 0.92
Ec = 1.29
Ed = 2.36

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted } E = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E	=	0.77	in.	Developed E	=	1.96	in.

On-Site Volume of Runoff: $V360 = \frac{E*A}{12}$

Historic V360	=	4184	CF	Developed V360	=	10649	CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 3

Qpa = 1.87
Qbb = 2.60
Qpc = 3.45
Qpd = 5.02

Historic Qp	=	3.2	CFS	Developed Qp	=	6.5	CFS

Basin 2 comprises a portion of the future parking area at the NE corner of the site. Flows from this area exit onto Carmellia Dr. from the main east access driveway.

Basin #3

AREA OF SITE: 141,471 SF = 3.25 Ac.

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	124,600	SF
Area b	=	0	SF
Area c	=	16,871	SF
Area d	=	0	SF
Total Area	=	141,471	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=	0	SF
Area b	=	23,306	SF
Area c	=	0	SF
Area d	=	118,165	SF
Total Area	=	141,471	SF

EXCESS PRECIPITATION:

Precip. Zone 3

Ea = 0.66
Eb = 0.92
Ec = 1.29
Ed = 2.36

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted } E = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E	=	0.74 in.	Developed E	=	2.12 in.

On-Site Volume of Runoff: $V360 = \frac{E^*A}{12}$

Historic V360	=	8667 CF	Developed V360	=	25026 CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 3

Qpa	=	1.87	Qpc	=	3.45
Qbb	=	2.60	Qpd	=	5.02
Historic Qp	=	6.7 CFS	Developed Qp	=	15.0 CFS

Basin 3 comprises the main portion of the Phase 1 building area, access drive and associated parking areas adjacent to the building. Flows from this area exit onto Waterfall Dr. from the main west access driveway .

Basin #4

AREA OF SITE: 19,344 SF = 0.44 Ac.

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	19,344	SF
Area b	=	0	SF
Area c	=	0	SF
Area d	=	0	SF
Total Area	=	19,344	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=		SF
Area b	=	3,916	SF
Area c	=		SF
Area d	=	15,428	SF
Total Area	=	19,344	SF

EXCESS PRECIPITATION:

Precip. Zone 3

Ea = 0.66
Eb = 0.92
Ec = 1.29
Ed = 2.36

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted } E = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E	=	0.66 in.	Developed E	=	2.07 in.

On-Site Volume of Runoff: $V360 = \frac{E*A}{12}$

Historic V360	=	1064 CF	Developed V360	=	3334 CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 3

Qpa	=	1.87	Qpc	=	3.45
Qbb	=	2.60	Qpd	=	5.02

Historic Qp	=	0.8 CFS	Developed Qp	=	2.0 CFS

Basin 4 reflects the basin division created by development of Phase 1, which includes a portion of the building and associated parking. The basin runoff will be collected by the parking improvements and directed down the existing slope in a rectangular shaped concrete rundown, through a COA Std. sidewalk drain onto Waterfall Dr.

The flow rate from the parking area requires a 2' wide opening at the entrance to the rundown (Orifice Eq., where C=0.6, Q=2 cfs, h=0.5'). The rectangular rundown, based on Manning's Formula, requires a 1' wide section, where S=20.4%, Q=2 cfs, D=0.2', and V=12.6'/s.

Basin #5

AREA OF SITE: 20,501 SF = 0.47 Ac.

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	0	SF
Area b	=	20,501	SF
Area c	=	0	SF
Area d	=	0	SF
Total Area	=	20,501	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=		SF
Area b	=	20,501	SF
Area c	=	0	SF
Area d	=	0	SF
Total Area	=	20,501	SF

EXCESS PRECIPITATION:

Precip. Zone 3

Ea = 0.66
Eb = 0.92
Ec = 1.29
Ed = 2.36

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted } E = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E	=	0.92 in.	Developed E	=	0.92 in.

On-Site Volume of Runoff: $V360 = \frac{E^*A}{12}$

Historic V360	=	1572 CF	Developed V360	=	1572 CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 3

Qpa	=	1.87	Qpc	=	3.45
Qbb	=	2.60	Qpd	=	5.02
Historic Qp	=	1.2 CFS	Developed Qp	=	1.2 CFS

Basin 5 is comprised of the area adjacent to the mid portion of Waterfall Dr. Its steep side slopes will remain in the natural condition, left untouched by developement. Historic flow pattern from the basin is sheet flow, which enters directly into the street.

Basin #6

AREA OF SITE: 127,471 SF = 2.93 Ac.

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	31,671	SF
Area b	=	95,800	SF
Area c	=	0	SF
Area d	=	0	SF
Total Area	=	127,471	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=	0	SF
Area b	=	0	SF
Area c	=	100,331	SF
Area d	=	27,140	SF
Total Area	=	127,471	SF

EXCESS PRECIPITATION:

Precip. Zone 3

Ea = 0.66
Eb = 0.92
Ec = 1.29
Ed = 2.36

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted } E = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E	=	0.86	in.	Developed E	=	1.52	in.

On-Site Volume of Runoff: $V360 = \frac{E*A}{12}$

Historic V360	=	9087	CF	Developed V360	=	16123	CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 3

Qpa	=	1.87		Qpc	=	3.45	
Qbb	=	2.60		Qpd	=	5.02	
Historic Qp	=	7.1	CFS	Developed Qp	=	11.1	CFS

Basin 6 consists of the Southwestern portion of the site, adjacent to the lower portion of Waterfall Dr. The south portion of the basin is comprised of steep slopes, which will be left in the natural state. The north portion of the basin will be used for Phase 1 construction and a future building addition. Additional improvements within the basin will include a graveled fire lane constructed around the south side of the building. Flows discharged by the proposed building addition will be released on a lawn area back of the building, and join other surface flows which will cross the fire lane at the dip section and collect in a natural swale for direct discharge into Waterfall Dr.

Basin #7

AREA OF SITE: 162,971 SF = 3.74 Ac.

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	77,971	SF
Area b	=	0	SF
Area c	=	85,000	SF
Area d	=		SF
Total Area	=	162,971	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=	12,821	SF
Area b	=	0	SF
Area c	=	127,200	SF
Area d	=	22,950	SF
Total Area	=	162,971	SF

EXCESS PRECIPITATION:

Precip. Zone 3

Ea = 0.66
Eb = 0.92
Ec = 1.29
Ed = 2.36

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted } E = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E	=	0.99 in.	Developed E	=	1.39 in.

On-Site Volume of Runoff: $V360 = \frac{E*A}{12}$

Historic V360	=	13426 CF	Developed V360	=	18893 CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 3

Qpa	=	1.87	Qpc	=	3.45
Qbb	=	2.60	Qpd	=	5.02
Historic Qp	=	10.1 CFS	Developed Qp	=	13.3 CFS

Basin 7 consists of the Southeastern portion of the site, adjacent to Carmellia St. The majority of the basin is comprised of steep slopes which will be left in the natural state. The only planned development of the basin will be a future building addition located on the north end of the basin. All runoff will continue to leave the basin in the form of the existing sheet flow patterns, to be intercepted by Carmellia St. for direct discharge into the street sump leading to the arroyo.

Any flows discharged by the proposed building addition should combine the gutter outlets to provide erosion protection down the slope to the street. This erosion protection can be established either with hard-lined channel or rip-rap swale systems. A rip-rap swale would have the following characteristics: a triangular section, 4' wide w/ 2:1 ss, S=7.8%. Q=1.5 cfs from roof area, D=0.4, V=4'/s. The outlet would have to be routed through a sidewalk drain within the R/W, per standard COA practice.

Offsite Area North of I-40

AREA OF SITE: 18,200 SF = 0.42 Ac.

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	18,200	SF
Area b	=	0	SF
Area c	=	0	SF
Area d	=	0	SF
Total Area	=	18,200	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=	18,200	SF
Area b	=	0	SF
Area c	=	0	SF
Area d	=	0	SF
Total Area	=	18,200	SF

EXCESS PRECIPITATION:

Precip. Zone

Ea	=	3
Eb	=	0.66
Ec	=	0.92
Ed	=	1.29
		2.36

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted E} = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E	=	0.66 in.	Developed E	=	0.66 in.

On-Site Volume of Runoff: $V360 = \frac{E^*A}{12}$

Historic V360	=	1001 CF	Developed V360	=	1001 CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 3

Qpa	=	1.87	Qpc	=	3.45
Qbb	=	2.60	Qpd	=	5.02
Historic Qp	=	0.8 CFS	Developed Qp	=	0.8 CFS

This basin is comprised of the area formed by the exit ramp from I-40 to Central Ave and the on-ramp to I-40 from east bound Central Ave. The open area is graded to form a sump with an inlet at the lowest point connected to a 24" dia. RCP. This pipe extends south through the I-40 embankment and outlets on the north side of NM 333. At this point, the 24" drain is joined by a 12" dia. roadway drain, both of which empty into a concrete headwall for a culvert located under NM 333 which drains to the site.

At least that is what appears to be the intent of the drainage system. In actuality, no visual evidence of the culvert outlet exists on the south side of NM 333. There is evidence of some drainage in the general area of the outlet from the heavy weed growth. It appears that the pipe may be partially plugged or blocked at the outlet, thus forcing the majority of the flows west, following the bar ditch on the north side of NM 333. These flows eventually pass either under or over NM 333 and follow natural swales across an undeveloped tract south to the Tijeras Arroyo adjacent to Four Hills Rd

Waterfall Drive from NM 333 to Dip Section Outlet

AREA OF SITE: 140,400 SF = 3.22 Ac.

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	0	SF
Area b	=	0	SF
Area c	=	53,900	SF
Area d	=	86,500	SF
Total Area	=	140,400	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=	0	SF
Area b	=	0	SF
Area c	=	53,900	SF
Area d	=	86,500	SF
Total Area	=	140,400	SF

EXCESS PRECIPITATION:

Precip. Zone

Ea	=	3
Eb	=	0.66
Ec	=	0.92
Ed	=	1.29
		2.36

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted } E = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E	=	1.95 in.	Developed E	=	1.95 in.

On-Site Volume of Runoff: $V360 = \frac{E^*A}{12}$

Historic V360	=	22806 CF	Developed V360	=	22806 CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 3

Qpa	=	1.87	Qpc	=	3.45
Qbb	=	2.60	Qpd	=	5.02
Historic Qp	=	14.2 CFS	Developed Qp	=	14.2 CFS

The Waterfall Drive basin is comprised of the street and the R/W area. No runoff from the development along the west and south side of Waterfall Dr.from NM 333 down to Poinsetta Place SE drains to the street. A short section of Poinsetta Place SE and a portion of an adjoining house on the SE corner of the intersection drains to Waterfall Dr.

Total peak flow onto Waterfall Dr. from Basins #1,3, 4, 5, 6 and the off-site / street area is 59.9 cfs. The minimum slope of the street just prior to Serenity Court is 0.83%. The basins contributing flow at that point are #1, 3, 5, the off-site area and a portion of the street, for a total peak flow of 39.6 cfs. From the DPM street capacity charts (Plate 22.3 D-2), for a 40 wide street, depth at top of curb of 8", total capacity = 64 cfs, which is greater than the total sum of flows from the contributing areas. Actual depth of flow for the flat section = 0.29' and a velocity of 1.8'/s.

The next flat slope of the street is 1.25%, the section just prior to Poinsetta Place. All the upstream basins, except for a portion of the street area, will be contributing flows at this point, for a total peak flow of 56 cfs. From the DPM street capacity charts (Plate 22.3 D-2), for a 40 wide street, depth at top of curb of 8", total capacity = 80 cfs, which is greater than the total sum of flows from the contributing areas. Actual depth of flow for the flat section = 0.3' and a velocity of 2.4'/s.

The final slope of the street is 3%, the section just prior to the dip section. From the DPM street capacity charts (Plate 22.3 D-2), for a 40 wide street, depth at top of curb of 8", total capacity = 124 cfs, which is greater than the total sum of flows from the contributing areas, or 59.9 cfs. Actual depth of flow for the flat section = 0.27' and a velocity of 3.2'/s.

To enable a change in direction across the dip section to the arroyo, assuming total loss of dynamic energy ($D + V^2/2g$), ponding depth at the curb would increase to 0.43'. It is recognized that the upstream slope leading into the dip section is steeper, which will lead to higher flow velocities into the flatter area before the momentum is dissipated to match the flatter slope. Even projecting the velocity of the higher slope of 6% into the dip section, or 4.3'/s, the total depth at the curb = 0.56', which is less than the height of the curb. Capacity exists within the dip section to contain the runoff while flows change direction toward the outfall.

While the Tc of all the basins was established at the minimum time of 12 min., in reality, the off-site basin from I-40 will probably never make it to this outfall point due to the lack of clean hydraulics through the existing culvert. Additionally, flows from Carmellia Dr. will peak much sooner than the areas contributing to Waterfall Dr. The flows referenced above are conservative representations of the actual conditions, but even so, there is adequate capacity within the existing street system for these flows to reach the tributary arroyo outfall.

Carmellia Drive from NM 333 to Dip Section Outlet

AREA OF SITE: 51,000 SF = 1.17 Ac.

HISTORIC FLOWS:

On-Site Historic Land Condition

Area a	=	0	SF
Area b	=	0	SF
Area c	=	17,000	SF
Area d	=	34,000	SF
Total Area	=	51,000	SF

DEVELOPED FLOWS:

On-Site Developed Land Condition

Area a	=	0	SF
Area b	=	0	SF
Area c	=	17,000	SF
Area d	=	34,000	SF
Total Area	=	51,000	SF

EXCESS PRECIPITATION:

Precip. Zone

Ea	=	3
Eb	=	0.66
Ec	=	0.92
Ed	=	1.29
		2.36

On-Site Weighted Excess Precipitation (100-Year, 6-Hour Storm)

$$\text{Weighted E} = \frac{EaAa + EbAb + EcAc + EdAd}{Aa + Ab + Ac + Ad}$$

Historic E	=	2.00 in.	Developed E	=	2.00 in.

On-Site Volume of Runoff: $V360 = \frac{E^*A}{12}$

Historic V360	=	8514 CF	Developed V360	=	8514 CF

On-Site Peak Discharge Rate: Qp = QpaAa+QpbAb+QpcAc+QpdAd / 43,560

For Precipitation Zone 3

Qpa	=	1.87	Qpc	=	3.45
Qbb	=	2.60	Qpd	=	5.02
Historic Qp	=	5.3 CFS	Developed Qp	=	5.3 CFS

The Carmellia Drive basin is comprised of the street and the R/W area. From NM 333 down to the dip section, the street is isolated from any drainage from the east because of an existing arroyo adjacent to Carmellia Dr. which intercepts flows.

Total peak flow onto Carmellia Dr. from Basins #2, 7 and the street area is 25.1 cfs. The minimum slope of the street is 2.9%, the section just prior to the dip section. From the DPM street capacity charts (Plate 22.3 D-2), for a 40 wide street, depth at top of curb of 8", total capacity = 120 cfs, which is greater than the total sum of flows from the contributing areas. Actual depth of flow for the flat section = 0.22' and a velocity of 2.6'/s.

To enable a change in direction across the dip section to the arroyo, assuming total loss of dynamic energy ($D + V^2/2g$), ponding depth at the curb would increase to 0.32'. It is recognized that the upstream slope leading into the dip section is steeper, which will lead to higher flow velocities into the flatter area before the momentum is dissipated to match the flatter slope. Even projecting the velocity of the higher slope of 6% into the dip section, or 3.5'/s, the total depth at the curb = 0.4', which is less than the height of the curb. Capacity exists within the dip section to contain the runoff while flows change direction toward the outfall.

Summary of Results

This site is remarkably unaffected by off-site drainage. The unique topography of the site and the excellent drainage of surrounding areas has left this project with few of the problems associated with other developments in the area.

Developed site conditions will release storm flows to surrounding streets substantially following the historic outlet locations. The increased flow rates associated with development can be handled within the street and drainage systems with capacity to spare. Because the general area is an established neighborhood, there is little likelihood of additional burden being placed on the streets/drainage system. The intended land use should prove to be a good neighbor in terms of the drainage impact on the area.

Summarizing the details for on-site drainage improvements:

- The entrance to the rundown from the main parking area onto the west access drive and from the secondary west parking area will need to be wider than the subsequent channel width. All transitions should be constructed with smooth curves and grade changes to minimize hydraulic disturbances in the respective system.

- The outlet alignment of the rundown from the main parking area onto the west access drive should be curved to direct the flow in a westerly direction, rather than discharging at right angles to the traffic patterns.

- Where a rundown from a parking area or roof drain enters the street, standard COA guidelines for construction of drains within the R/W will have to be followed.

- Where roof drains outlet onto natural ground, every effort should be made to dissipate the concentration of the flow and velocity to reduce erosion potential. If erosion begins to form, immediate attention should be directed to checking the erosion and stabilizing the flow path.

- All newly disturbed areas should be reseeded with native grasses to stabilize the slopes from erosion. The establishment of grasses, bushes and other native landscaping on all the slopes steeper than 3:1 will be ~~beneficial~~ critical to reducing sediment transfer to the streets.

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

May 4, 1998

Chris Weiss
C.L. Weiss Engineering, Inc.
P.O. Box 97
Sandia Park, NM 87047

RE: ENGINEER CERTIFICATION FOR BELIEVERS CENTER OF ALBUQUERQUE (L-23/D1), ENGINEER CERTIFICATION STATEMENT DATED 4/28/98

Dear Mr. Weiss:

Based on the information provided on your April 28, 1998 submittal, Engineer Certification for the above referenced site is acceptable.

If I can be of any further assistance, please feel free to contact me at 924-3330.

C: File

Sincerely,

Andrew Garcia

Andrew Garcia
Drainage Inspector

DRAINAGE INFORMATION SHEET

PROJECT TITLE: Believers Center of Albuquerque ZONE ATLAS / DRNG. FILE #: L-23 001

LEGAL DESCRIPTION: Tract B-1 of North Four Hills Subdivision, NM

CITY ADDRESS: N/A 320 Waterfall N.E.

ENGINEERING FIRM: C.L. Weiss Engineering CONTACT: Chris Weiss

ADDRESS: P.O. Box 97, Sandia Park NM, 87047 PHONE: 281-1800

OWNER: CONTACT:

ADDRESS: PHONE:

ARCHITECT: Gregory Hicks & Assoc. CONTACT: David Kines

ADDRESS: 112 2nd SW 87102 PHONE:

SURVEYOR: Forstbauer Surveying Co. CONTACT: Ron Forstbauer

ADDRESS: 1100 Alvarado Dr. NE - 87110 PHONE: 268-2112

CONTRACTOR FIRM: N/A CONTACT:

ADDRESS: PHONE:

PRE-DESIGN MEETING:

_____YES

_____NO

_____COPY OF CONFERENCE RECAP SHEET PROVIDED

DRB NO._____

EPC NO. Z-96-127

PROJ. NO._____

TYPE OF SUBMITTAL:

_____DRAINAGE REPORT

_____DRAINAGE PLAN

_____CONCEPTUAL GRADING & DRAINAGE PLAN

_____GRADING PLAN

_____EROSION CONTROL PLAN

__X__ENGINEER'S CERTIFICATION

CHECK TYPE OF APPROVAL SOUGHT:

_____SKETCH PLAT

_____PRELIMINARY PLAT

_____SITE DEVELOPMENT PLAN

_____FINAL PLAT

_____BUILDING PERMIT

_____FOUNDATION PERMIT

__X__CERT. OF OCCUPANCY

_____ROUGH GRADING PERMIT

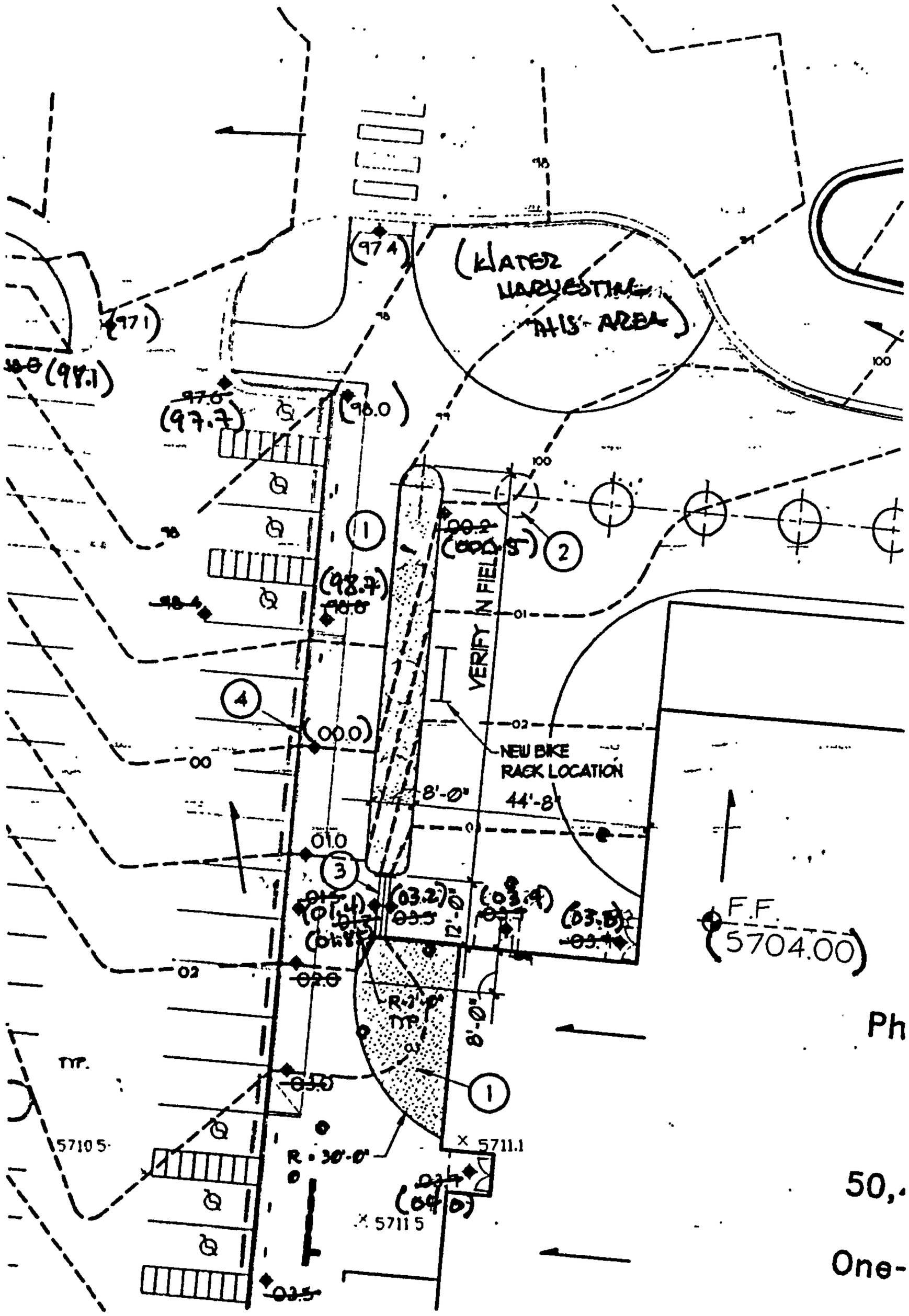
_____GRADING / PAVING PERMIT

_____OTHER_____

RECEIVED
APR 28 1998
HYDROLOGY SECTION

DATE SUBMITTED: April 28, 1998

BY: C.L. Weiss Engineering, Inc.



ASI #15 – REVISED GRADING

SCALE: 1" = 30'-0"

0 10 30 60

ASI # 15 - REVISED GRADING	proj. no: 9604 acad file: 604ASI15 date: 9/29/97	sheet no: ASI15 A
BELIEVERS CENTER OF ALBUQUERQUE NEW CHURCH FACILITY 320 Waterfall Drive S.E. Albuquerque, New Mexico	GREGORY T. HICKS & ASSOC., P.C. ARCHITECTS · PLANNERS • designing today designing tomorrow •	

CITY OF
Albuquerque
Public Works Department
January 29, 1997

Martin J. Chávez, Mayor

Robert E. Gurulé, Director

Chris Weiss
C.L. Weiss Engineering, Inc
P.O. Box 97
Sandia Park, NM 87047

RE: BELIEVERS CENTER OF ALBUQUERQUE (L23-D1). DRAINAGE REPORT SUBMITTAL FOR BUILDING PERMIT. ENGINEER'S STAMP DATED DECEMBER 20, 1996.

Dear Mr. Weiss:

Based on the information provided on your January 21, 1997 letter and your December 26, 1996 submittal, the above referenced project is approved for Building Permit.

Prior to Certificate of Occupancy, an Engineer's Certification will be required.

If I can be of further assistance, please feel free to contact me at 924-3984.

Sincerely,

Lisa Ann Manwill
Engineering Assoc./Hyd.

c: Andrew Garcia
File

Weiss Engineering

C.L. Weiss Engineering, Inc
Post Office Box 97
Sandia Park, N.M. 87047

Phone / Fax (505) 281-1800
Alvarado Office (505) 266-3444

January 21, 1997

Ms. Lisa Ann Manwill
Public Works Dept. / Hydrology Department - Rm. 301
POBox 1293
Albuquerque, NM 87102

RE: Tijeras Canyon Believers Center Site (L-23 - D1)

Dear Ms. Manwill:

Thank you for your prompt review for the above referenced project. My responses coincide with your letter of comments dated January 6, 1997.

- 1. We provided calculations in the report to verify the capacity of the streets to deliver the basin runoff to the outfall structure. Our initial inspection of the area gave us confidence of downstream capacity, but in response to your question about the drainage system between the street sump and the Tijeras Arroyo, we had our surveyor provide additional as-built topo because limited hard data was available for this area The rundown from the street sump has a sharp grade from the sidewalk culverts into the concrete trapezoidal channel, which in turn leads directly into the unlined arroyo. Depth of flow in the sump rundown is 0.22' (see attached printouts). Depth of flow in the concrete outlet channel is 0.59'. Depth of flow in the natural arroyo section is 0.31'. The total flow generated by the site and contiguous areas draining to the street is 85 cfs., and all downstream systems have capacity to handle this peak. The increased flow rate generated by this development would increase the flow depth in the arroyo by 0.06' and the velocity by 0.8'/s. This will be a minor factor in the effects of erosion in the arroyo.

- 2. The only information we could find for the area referenced a Drainage and Grading Plan for the North Four Hills Subdivision, prepared in 1987. We utilized the master plan only to verify that the intent of the design was followed. Design calculations for the site are based on current criteria and the ability of the downstream system to accept these flows.

- 3. The architect has completed a DRB review today for Site Plan approval and has been deferred to the Jan. 28th meeting to address transportation comments and hydrology approval. Additionally, the contractor has obtained an earth moving permit and started general site grading.

This letter will be faxed to you @ 768-2765, with the original sent in the mail. Thank you in advance for your prompt processing of this submittal. If you have any questions concerning this response, please call me at 281-1800.

Sincerely,

Christopher L. Weiss, P.E.
C.L. Weiss Engineering, Inc.

Concrete Outlet Channel
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\haestad\fmw\believer.fm2
Worksheet	Outlet Channel
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.031300	ft/ft
Left Side Slope	1.500000	H : V
Right Side Slope	1.500000	H : V
Bottom Width	10.00	ft
Discharge	85.00	cfs

Results		
Depth	0.59	ft
Flow Area	6.42	ft^2
Wetted Perimeter	12.13	ft
Top Width	11.77	ft
Critical Depth	1.23	ft
Critical Slope	0.002590	ft/ft
Velocity	13.24	ft/s
Velocity Head	2.72	ft
Specific Energy	3.31	ft
Froude Number	3.16	
Flow is supercritical.		

Concrete Sump Rundown
Worksheet for Rectangular Channel

Project Description	
Project File	c:\haestad\fmw\believer.fm2
Worksheet	Sump Rundown
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.890000	ft/ft
Bottom Width	10.00	ft
Discharge	85.00	cfs

Results		
Depth	0.22	ft
Flow Area	2.22	ft^2
Wetted Perimeter	10.44	ft
Top Width	10.00	ft
Critical Depth	1.31	ft
Critical Slope	0.003069	ft/ft
Velocity	38.36	ft/s
Velocity Head	22.87	ft
Specific Energy	23.09	ft
Froude Number	14.37	
Flow is supercritical.		

Notes:

Flows must pass through 9 - 1' wide by 0.7' high sidewalk culvert drains prior to entering the sump rundown. Area of available openings, combined with the weir effect over the steel plates, will create a high water elevation of 57.2 to pass the 85 cfs. Top of curb on the opposite side of the street is 57.3, as is the top of the wall adjacent to the end of the sidewalk culverts. Flow will remain contained within the sump area while making the transition to the channel.

Natural Arroyo Channel
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\haestad\fmw\believer.fm2
Worksheet	Outlet Arroyo
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.071400	ft/ft
Left Side Slope	0.250000	H : V
Right Side Slope	0.033000	H : V
Bottom Width	45.00	ft
Discharge	85.00	cfs

Results		
Depth	0.31	ft
Flow Area	14.07	ft^2
Wetted Perimeter	45.63	ft
Top Width	45.09	ft
Critical Depth	0.48	ft
Critical Slope	0.017173	ft/ft
Velocity	6.04	ft/s
Velocity Head	0.57	ft
Specific Energy	0.88	ft
Froude Number	1.91	
Flow is supercritical.		

CITY OF
Albuquerque

January 6, 1997

Martin J. Chávez, Mayor

Chris Weiss
C.L. Weiss Engineering, Inc
P.O. Box 97
Sandia Park, NM 87047

RE: BELIEVERS CENTER OF ALBUQUERQUE (L23-D1). DRAINAGE REPORT SUBMITTAL FOR BUILDING PERMIT. ENGINEER'S STAMP DATED DECEMBER 20, 1996.

Dear Mr. Weiss:

Based on the information provided on your December 26, 1996 submittal, City Hydrology has the following comments.

1. The total flow entering the existing outfall, increases with this development by 27.6 cfs (100-year event). The total volume increases 52192 cubic feet with this development. You have shown that there is street capacity. I feel certain that there is capacity in the Tijeras Arroyo for the increased flow. Please discuss capacity in the natural channel section between the outfall and the Tijeras Arroyo. Is the existing outfall structure adequate? The velocity is increasing substantially through this channel. Discuss erosion in the earthen channel.

2. Is there a master plan for this area?

3. Will you be required to get Site Plan approval from DRB for this site?

If I can be of further assistance, please feel free to contact me at 768-3622.

Sincerely,

Lisa Ann Manwill
Engineering Assoc./Hyd.

c: Andrew Garcia
File

DRAINAGE INFORMATION SHEET

PROJECT TITLE: Believers Center of Albuquerque ZONE ATLAS / DRNG. FILE #: L-23 / 11 /

LEGAL DESCRIPTION: Tract B-1 of North Four Hills Subdivision, NM

CITY ADDRESS: N/A

ENGINEERING FIRM: C.L. Weiss Engineering CONTACT: Chris Weiss

ADDRESS: P.O. Box 97, Sandia Park NM, 87047 PHONE: 281-1800

OWNER: CONTACT:

ADDRESS: PHONE:

ARCHITECT: Gregory Hicks & Assoc. CONTACT: David Kines

ADDRESS: 112 2nd SW 87102 PHONE:

SURVEYOR: Forstbauer Surveying Co. CONTACT: Ron Forstbauer

ADDRESS: 1100 Alvarado Dr. NE - 87110 PHONE: 268-2112

CONTRACTOR FIRM: N/A CONTACT:

ADDRESS: PHONE:

PRE-DESIGN MEETING:

_____ YES

_____ NO

_____ COPY OF CONFERENCE RECAP SHEET PROVIDED

DRB NO._____

EPC NO. Z-96-127

PROJ. NO._____

TYPE OF SUBMITTAL:

_____ DRAINAGE REPORT

__X__ DRAINAGE PLAN

_____ CONCEPTUAL GRADING & DRAINAGE PLAN

__X__ GRADING PLAN

_____ EROSION CONTROL PLAN

_____ ENGINEER'S CERTIFICATION

CHECK TYPE OF APPROVAL SOUGHT:

_____SKETCH PLAT

_____PRELIMINARY PLAT

_____SITE DEVELOPMENT PLAN

_____FINAL PLAT

__X__ BUILDING PERMIT

_____FOUNDATION PERMIT

_____CERT. OF OCCUPANCY

_____ROUGH GRADING PERMIT

_____GRADING / PAVING PERMIT

_____OTHER_____

D20096

DATE SUBMITTED: December 19, 1996

BY: C.L. Weiss Engineering, Inc.

RECEIVED
DEC 26
Division