

DRAFT

FINAL DRAINAGE REPORT

for

IHOP at Cottonwood Corners
Albuquerque, New Mexico

October, 2000

Prepared by

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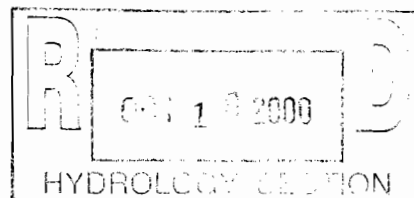


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SITE DESCRIPTION

International House of Pancakes (IHOP) is proposing to build a restaurant on proposed Tract C-1 of Cottonwood Corners. Please refer to Appendix A for a vicinity map of the site. Tracts C-1 and D-1 will be created by replatting Tracts C and D of Cottonwood Corners. The replat is pending approval by the City of Albuquerque Development Review Board (DRB 00440-00000-00778). This property is zoned SU-1 for IP Uses per Zone Atlas page A-14-Z.

The proposed 1.2034-acre site is currently undeveloped and surrounded by existing street and utility improvements constructed with the infrastructure for Cottonwood Corners. Cottonwood Corners is a retail development with a mix of rough-graded lots and fully developed lots. Tracts C-1 and D-1 are rough-graded lots currently being processed for development.

DRAINAGE ANALYSIS METHODOLOGY

The Hydrology and Hydraulic Report for Cottonwood Corners Shopping Center (A14-D7) was prepared by EKN Engineering. This Final Grading and Drainage Plan is prepared in accordance with the approved Hydrology and Hydraulic Report for Cottonwood Corners Shopping Center and the City of Albuquerque Development Process Manual, Volume 2, Chapter 22.

COTTONWOOD CORNERS DRAINAGE PLAN

The Hydrology and Hydraulic Report for Cottonwood Corners Shopping Center was prepared in October 1996 by Ebbie Nakhjavani of EKN Engineering. Appendix B contains the Cottonwood Corners basin map and pertinent hydraulics calculations. That report designated Basin 106A for the undeveloped, non-paved portion of Tracts C and D of Cottonwood Corners. The planned hydrologic conditions for Basin 106A listed in that report are tabulated below.

BASIN	BASIN AREA (acre)	LAND TREATMENT TYPE				100-YR, 24-HR STORM		
		%A	%B	%C	%D	PEAK DISCHARGE (cfs)	EXCESS PRECIPITATION (inch)	VOLUMETRIC RUNOFF (acre-feet)
106A	2.163	0	10	0	90	8.81	2.25	0.406

Runoff from Basin 106A is captured by the temporary detention pond on Tract D, which controls the discharge to a private storm drain system for Cottonwood Corners. The Hydrology and Hydraulic Report for Cottonwood Corners Shopping Center provides a total allowable release rate of 2.04 cfs from the temporary detention pond to the Cottonwood Corners storm drain system. The proportion of the undeveloped, non-paved portion of Tracts C to Basin 106A is 43%, resulting in an allowable discharge of 0.88 cfs. This Cottonwood Corners storm drain system crosses NM 528 and ultimately discharges to the Cabezon Channel.

EXISTING DRAINAGE CONDITIONS

Please refer to Appendix C for the hydrology calculations for the existing conditions. Proposed Tracts C-1 and D-1 include a portion of the existing private streets surrounding these lots, including Cottonwood Drive. Proposed Tract C-1 consists of two drainage sub-basins herein designated as Basins 1 and 2. Basin 1 consists of the private streets and drains east, where it is

detained in the private street and discharges to the Cottonwood Corners storm drain system. Basin 2 is the rough-graded portion that drains east to the temporary detention pond on Proposed Tract D-1. The slope across this basin is typically 5%, with an exception of 15% along Cottonwood Drive. The temporary pond on Proposed Tract D-1 discharges to the Cottonwood Corners storm drain system. The offsite drainage basin, herein designated as Basin 3, is that portion of the NM 528 right-of-way between the sidewalk and the right-of-way line.

Based on the Hydrology and Hydraulic Report for Cottonwood Corners Shopping Center, the calculated hydrologic conditions for proposed Tract C-1 are tabulated below.

BASIN	BASIN AREA (acre)	LAND TREATMENT TYPE				100-YR, 24-HR STORM		
		%A	%B	%C	%D	PEAK DISCHARGE (cfs)	EXCESS PRECIPITATION (inch)	VOLUMETRIC RUNOFF (acre-feet)
<i>ONSITE BASINS</i>								
1	0.268	0	0	0	100	1.16	2.43	0.054
2	--	--	--	--	--	0.88	--	--
<i>OFFSITE BASINS</i>								
3	0.133	0	100	0	0	0.28	0.67	0.007

Appendix D contains panel 109 of the Flood Insurance Rate Map (map no. 35001C0109 D), which designates this site as Zone X (areas determined to be outside the 500-year floodplain).

PROPOSED DRAINAGE CONDITIONS

Please refer to Appendix I for the Final Grading and Drainage Plan and Appendix E for the hydrology calculations for the proposed conditions. Based on the site layout shown on this plan, the hydrologic conditions for this proposed development are tabulated below. This site will continue to accept runoff from Basin 3. The runoff from Basin 2 will be collected in three proposed detention ponds onsite.

Runoff from Basin 2A is captured by a permanent detention pond (Pond A) at the southwest corner of the site. Runoff from Basins 2B and 3B are captured by a permanent detention pond (Pond B) at the northeast corner of the site. Runoff from Basin 2C is captured by a permanent detention pond (Pond C) at the southeast corner of the site. Runoff from Basins 2D and 3A are captured by a permanent retention pond (Pond D) at the northeast corner of the site.

BASIN	BASIN AREA (acre)	LAND TREATMENT TYPE				100-YR, 24-HR STORM		
		%A	%B	%C	%D	PEAK DISCHARGE (cfs)	EXCESS PRECIPITATION (inch)	VOLUMETRIC RUNOFF (acre-feet)
<i>ONSITE BASINS</i>								
1	0.441	0	6	5	88	1.81	2.24	0.082
2A	0.304	0	28	0	72	1.13	1.93	0.049
2B	0.237	0	32	0	68	0.86	1.86	0.037
2C	0.216	0	10	0	90	0.89	2.26	0.041
2D	0.005	0	100	0	0	0.01	0.67	0.000
<i>OFFSITE BASINS</i>								
3A	0.022	0	100	0	0	0.05	0.67	0.001
3B	0.115	0	96	0	4	0.25	0.73	0.007

RETENTION POND

The retention pond, designated as Pond D, is located at the northeast corner of the property. Due to the configuration of the adjacent detention pond, runoff from Basins 2D and 3A could not drain to the detention pond. Retaining this runoff in Pond D prevents the runoff from draining onto the adjacent property, Tract D-1. The volume of Pond D is not less than twice the volumetric runoff for the 100-year, 24-hour storm event ($\Sigma V_{100-24} = 0.0015$ acre-feet).

DETENTION PONDS

The design of each detention pond included three zones: sediment zone, detention zone and freeboard zone. The sediment zone is six inches below the lowest orifice of the outlet riser. The sediment zone allows sediment and trash to fall out of the water before entering the riser and discharging to the private storm drain. In the pond analysis, it is assumed that the retention zone is full and does not provide additional storage volume.

The detention zone is 18 inches above the sediment zone. The detention zone is designed for the 100-year, 24-hour storm event and analyzed using AHYMO (see Appendix G). The AHYMO input consists of a rating table that defines the outflow and storage characteristics of the detention pond. The detention time will not exceed 24 hours. The outflow will be controlled by a riser at the pond outlet. The riser will contain 1"-diameter holes spaced vertically 4 inches on center. Appendix H contains calculations for the outflow of the risers. The pond outlets will be connected by a private storm drain system to the Cottonwood Corners storm drain system. The cumulative discharge to the Cottonwood Corners storm drain system will not exceed 0.88 cfs.

The freeboard zone is six inches above the detention zone. The riser diameter is designed to convey the 100-year, 24-hour storm event within the freeboard zone.

	DETENTION POND PARAMETERS			
	POND A	POND B	POND C	TOTAL
Peak Discharge (cfs)	0.329	0.172	0.219	0.720
Maximum Water Surface Elevation (ft)	1.498	1.291	1.498	4.287
Maximum Storage (acre-ft)	0.0222	0.0264	0.0197	0.0683
Total Detention Time (hours)	19.25	18.25	17.50	N/A

PRIVATE STORM DRAIN SYSTEM

A private storm drain will be constructed in a private 15-foot drainage easement on Tract D-1 from the ponding system on Tract C-1 to the outfall pipe of the temporary detention pond on Tract D-1. The storm drain was analyzed using the Chezy-Manning equation for the 100-year storm event. Appendix H contains calculations for the hydraulic grade line of the storm drain.

CONCLUSION

This analysis has been conducted in accordance with City of Albuquerque DPM procedures. The detention ponds have been designed to restrict the runoff from the site to conform with the downstream limitation, namely 0.88 cfs from tract C-1 to tract D-1. The proposed 18-inch outfall culvert will be constructed within a 15-foot easement through tract D-1 to the existing detention pond.



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HYDROLOGY CALCULATIONS

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 Date: 10/12/00
 Date: 10-00

Computed by: Karen M. Stearns
 Checked by: TDS

Project Name: IHOP on Tract C-1 of Cottonwood Corners **Project No:** E300001558.01
Project Location: Southeast corner of NM528 and Cottonwood Drive

Calculation Description: To calculate the hydrologic conditions of the project. This calculation is in accordance with the City of Albuquerque Development Process Manual, Volume 2, Section 22.2, "Hydrology", Part A - Procedure for 40 Acre and Smaller Basins.

PRECIPITATION ZONE: 1

DEPTH AT 100-YEAR DESIGN STORM:

P ₆₀	P ₃₆₀	P ₁₄₄₀	P _{4 days}	P _{10 days}
1.87 inches	2.20 inches	2.66 inches	3.12 inches	3.67 inches

BASIN 1 -- ALLOWABLE ONSITE RUNOFF FREE DISCHARGE:

BASIN AREA AND LAND TREATMENT

TOTAL AREA			LAND TREATMENT TYPE			
			A	B	C	D
(ft ²)	(acres)	(mi ²)	(ft ²)	(ft ²)	(ft ²)	(ft ²)
11,684	0.268	0.000419	0	0	0	11,684
			0.0%	0.0%	0.0%	100.0%

WEIGHTED EXCESS PRECIPITATION, E, & VOLUMETRIC RUNOFF, V:

	EXCESS PRECIPITATION, E (inches)				Weighted E	VOLUMETRIC RUNOFF V (acre-feet)
	LAND TREATMENT TYPE					
	A	B	C	D		
2-YR	0.00	0.01	0.12	0.72	0.72	0.0161
10-YR	0.08	0.22	0.44	1.24	1.24	0.0277
100-YR	0.44	0.67	0.99	1.97	1.97	0.0440

WEIGHTED PEAK DISCHARGE, q, & PEAK RATE OF DISCHARGE, Q:

	PEAK DISCHARGE, q (cfs/acre)				Weighted q	PEAK RATE OF DISCHARGE Q (cfs)
	LAND TREATMENT TYPE					
	A	B	C	D		
2-YR	0.00	0.03	0.47	1.69	1.69	0.45
10-YR	0.24	0.76	1.49	2.89	2.89	0.78
100-YR	1.29	2.03	2.87	4.37	4.37	1.17



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Project Name: IHOP on Tract C-1 of Cottonwood Corners **Project No:** E300001558.01
Project Location: Southeast corner of NM528 and Cottonwood Drive

Calculation Description: To calculate the hydrologic conditions of the project. This calculation is in accordance with the City of Albuquerque Development Process Manual, Volume 2, Section 22.2, "Hydrology", Part A - Procedure for 40 Acre and Smaller Basins.

Basin 106A Area	$A_T = 0.003380 \text{ mi}^2$
Allowable discharge from Basin 106A	$Q_{\text{allowable}} = 2.043 \text{ cfs}$
Tract C-1 portion of Basin 106A	$A_{C-1} = 40740 \text{ ft}^2$
	$A_{C-1} = 0.001461 \text{ mi}^2$
	$A_{C-1} = 43.24\%$
Tract C-1 portion of allowable discharge from Basin 106A	$Q_{\text{allowable}} = 0.883 \text{ cfs}$



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Project Location: Southeast corner of NM528 and Cottonwood Drive

Calculation Description: To calculate the hydrologic conditions of the project. This calculation is in accordance with the City of Albuquerque Development Process Manual, Volume 2, Section 22.2, "Hydrology", Part A - Procedure for 40 Acre and Smaller Basins.

PRECIPITATION ZONE: 1

DEPTH AT 100-YEAR DESIGN STORM:

P ₆₀	P ₃₆₀	P ₁₄₄₀	P _{4 days}	P _{10 days}
1.87 inches	2.20 inches	2.66 inches	3.12 inches	3.67 inches

BASIN 3 -- EXISTING OFFSITE RUNOFF:

BASIN AREA AND LAND TREATMENT

TOTAL AREA			LAND TREATMENT TYPE			
(ft ²)	(acres)	(mi ²)	A (ft ²)	B (ft ²)	C (ft ²)	D (ft ²)
5,787	0.133	0.000208	0	5,787	0	0
			0.0%	100.0%	0.0%	0.0%

WEIGHTED EXCESS PRECIPITATION, E, & VOLUMETRIC RUNOFF, V:

	EXCESS PRECIPITATION, E (inches)				Weighted E	VOLUMETRIC RUNOFF V (acre-feet)
	LAND TREATMENT TYPE					
	A	B	C	D		
2-YR	0.00	0.01	0.12	0.72	0.01	0.0001
10-YR	0.08	0.22	0.44	1.24	0.22	0.0024
100-YR	0.44	0.67	0.99	1.97	0.67	0.0074

WEIGHTED PEAK DISCHARGE, q, & PEAK RATE OF DISCHARGE, Q:

	PEAK DISCHARGE, q (cfs/acre)				Weighted q	PEAK RATE OF DISCHARGE Q (cfs)
	LAND TREATMENT TYPE					
	A	B	C	D		
2-YR	0.00	0.03	0.47	1.69	0.03	0.00
10-YR	0.24	0.76	1.49	2.89	0.76	0.10
100-YR	1.29	2.03	2.87	4.37	2.03	0.27



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HYDROLOGY CALCULATIONS

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Reference: City of Albuquerque Development Process Manual, Volume 2, Section 22.2, "Hydrology", Part A - Procedure for 40 Acre and Smaller Basins.

Zone	Location
1	West of the Rio Grande.
2	Between the Rio Grande and San Mateo.
3	Between San Mateo and Eubank, north of Interstate 40; and between San Mateo and the east boundary of Range 4 East, south of Interstate 40.
4	East of Eubank, north of interstate 40; and east of the east boundary of Range 4 East, south of Interstate 40.

Zone	P ₆₀	P ₃₆₀	P ₁₄₄₀	P _{4 days}	P _{10 days}
1	1.87	2.20	2.66	3.12	3.67
2	2.01	2.35	2.75	3.30	3.95
3	2.14	2.60	3.10	3.95	4.90
4	2.23	2.90	3.65	4.70	5.95

Return Period (years)	Factor
50	0.900
25	0.800
10	0.667
5	0.567
2	0.434

Type	Land Condition
A	Soil uncompacted by human activity with 0 to 10 percent slopes. Native grasses, weeds and shrubs in typical densities with minimal disturbance to grading, groundcover and infiltration capacity.
B	Irrigated lawns, parks and golf courses with 0 to 10 percent slopes. Native grasses, weeds and shrubs, and soil uncompacted by human activity with slopes greater than 10 percent and less than 20 percent.
C	Soil compacted by human activity. Minimal vegetation. Unpaved parking, roads, trails. Most vacant lots. Gravel or rock on plastic (desert landscaping). Irrigated lawns and parks with slopes greater than 10 percent. Native grasses, weeds and shrubs, and soil uncompacted by human activity with slopes at 20 percent or greater. Native grass, weed and shrub areas with clay or clay loam soils and other soils of very low permeability as classified by SCS Hydrologic Soil Group D.
D	Impervious areas, pavement and roofs.

Zone	Land Treatment Type											
	A			B			C			D		
	A _{2-YR}	A _{10-YR}	A _{100-YR}	B _{2-YR}	B _{10-YR}	B _{100-YR}	C _{2-YR}	C _{10-YR}	C _{100-YR}	D _{2-YR}	D _{10-YR}	D _{100-YR}
1	0.00	0.08	0.44	0.01	0.22	0.67	0.12	0.44	0.99	0.72	1.24	1.97
2	0.00	0.13	0.53	0.02	0.28	0.78	0.15	0.52	1.13	0.79	1.34	2.12
3	0.00	0.19	0.66	0.06	0.36	0.92	0.20	0.62	1.29	0.89	1.50	2.36
4	0.02	0.28	0.80	0.11	0.46	1.08	0.27	0.73	1.46	1.01	1.69	2.64

Zone	Land Treatment Type											
	A			B			C			D		
	A _{2-YR}	A _{10-YR}	A _{100-YR}	B _{2-YR}	B _{10-YR}	B _{100-YR}	C _{2-YR}	C _{10-YR}	C _{100-YR}	D _{2-YR}	D _{10-YR}	D _{100-YR}
1	0.00	0.24	1.29	0.03	0.76	2.03	0.47	1.49	2.87	1.69	2.89	4.37
2	0.00	0.38	1.56	0.08	0.95	2.28	0.60	1.71	3.14	1.86	3.14	4.70
3	0.00	0.58	1.87	0.21	1.19	2.60	0.78	2.00	3.45	2.04	3.39	5.02
4	0.05	0.87	2.20	0.38	1.45	2.92	1.00	2.26	3.73	2.17	3.57	5.25



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Project Name: IHOP on Tract C-1 of Cottonwood Corners **Project No:** E300001558.01
Project Location: Southeast corner of NM528 and Cottonwood Drive

Calculation Description: To calculate the hydrologic conditions of the project. This calculation is in accordance with the City of Albuquerque Development Process Manual, Volume 2, Section 22.2, "Hydrology", Part A - Procedure for 40 Acre and Smaller Basins.

PRECIPITATION ZONE: 1

DEPTH AT 100-YEAR DESIGN STORM:

P ₆₀	P ₃₆₀	P ₁₄₄₀	P _{4 days}	P _{10 days}
1.87 inches	2.20 inches	2.66 inches	3.12 inches	3.67 inches

BASIN 1 -- PROPOSED ONSITE RUNOFF FREE DISCHARGE:

BASIN AREA AND LAND TREATMENT

TOTAL AREA			LAND TREATMENT TYPE			
(ft ²)	(acres)	(mi ²)	A (ft ²)	B (ft ²)	C (ft ²)	D (ft ²)
19,205	0.441	0.000689	0	1,234	1,002	16,969
			0.0%	6.4%	5.2%	88.4%

WEIGHTED EXCESS PRECIPITATION, E, & VOLUMETRIC RUNOFF, V:

	EXCESS PRECIPITATION, E (inches)				Weighted E	VOLUMETRIC RUNOFF V (acre-feet)
	LAND TREATMENT TYPE					
	A	B	C	D		
2-YR	0.00	0.01	0.12	0.72	0.64	0.0236
10-YR	0.08	0.22	0.44	1.24	1.13	0.0416
100-YR	0.44	0.67	0.99	1.97	1.84	0.0674

WEIGHTED PEAK DISCHARGE, q, & PEAK RATE OF DISCHARGE, Q:

	PEAK DISCHARGE, q (cfs/acre)				Weighted q	PEAK RATE OF DISCHARGE Q (cfs)
	LAND TREATMENT TYPE					
	A	B	C	D		
2-YR	0.00	0.03	0.47	1.69	1.52	0.67
10-YR	0.24	0.76	1.49	2.89	2.68	1.18
100-YR	1.29	2.03	2.87	4.37	4.14	1.83



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Project Location: Southeast corner of NM528 and Cottonwood Drive

Calculation Description: To calculate the hydrologic conditions of the project. This calculation is in accordance with the City of Albuquerque Development Process Manual, Volume 2, Section 22.2, "Hydrology", Part A - Procedure for 40 Acre and Smaller Basins.

PRECIPITATION ZONE: 1

DEPTH AT 100-YEAR DESIGN STORM:

P ₆₀	P ₃₆₀	P ₁₄₄₀	P _{4 days}	P _{10 days}
1.87 inches	2.20 inches	2.66 inches	3.12 inches	3.67 inches

BASIN 2A -- PROPOSED ONSITE RUNOFF TO DETENTION POND A (SOUTHWEST):

BASIN AREA AND LAND TREATMENT

TOTAL AREA			LAND TREATMENT TYPE			
(ft ²)	(acres)	(mi ²)	A (ft ²)	B (ft ²)	C (ft ²)	D (ft ²)
13,259	0.304	0.000476	0	3,731	0	9,528
			0.0%	28.1%	0.0%	71.9%

WEIGHTED EXCESS PRECIPITATION, E, & VOLUMETRIC RUNOFF, V:

	EXCESS PRECIPITATION, E (inches)				Weighted E	VOLUMETRIC RUNOFF V (acre-feet)
	LAND TREATMENT TYPE					
	A	B	C	D		
2-YR	0.00	0.01	0.12	0.72	0.52	0.0132
10-YR	0.08	0.22	0.44	1.24	0.95	0.0242
100-YR	0.44	0.67	0.99	1.97	1.60	0.0407

WEIGHTED PEAK DISCHARGE, q, & PEAK RATE OF DISCHARGE, Q:

	PEAK DISCHARGE, q (cfs/acre)				Weighted q	PEAK RATE OF DISCHARGE Q (cfs)
	LAND TREATMENT TYPE					
	A	B	C	D		
2-YR	0.00	0.03	0.47	1.69	1.22	0.37
10-YR	0.24	0.76	1.49	2.89	2.29	0.70
100-YR	1.29	2.03	2.87	4.37	3.71	1.13



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Project Location: Southeast corner of NM528 and Cottonwood Drive

Calculation Description: To calculate the hydrologic conditions of the project. This calculation is in accordance with the City of Albuquerque Development Process Manual, Volume 2, Section 22.2, "Hydrology", Part A - Procedure for 40 Acre and Smaller Ba

PRECIPITATION ZONE: 1

DEPTH AT 100-YEAR DESIGN STORM:

P ₆₀	P ₃₆₀	P ₁₄₄₀	P _{4 days}	P _{10 days}
1.87 inches	2.20 inches	2.66 inches	3.12 inches	3.67 inches

BASIN 2B -- PROPOSED ONSITE RUNOFF TO DETENTION POND B (NORTHEAST):

BASIN AREA AND LAND TREATMENT

TOTAL AREA			LAND TREATMENT TYPE			
(ft ²)	(acres)	(mi ²)	A (ft ²)	B (ft ²)	C (ft ²)	D (ft ²)
10,317	0.237	0.000370	0	3,342	0	6,975
			0.0%	32.4%	0.0%	67.6%

WEIGHTED EXCESS PRECIPITATION, E, & VOLUMETRIC RUNOFF, V:

	EXCESS PRECIPITATION, E (inches)				Weighted E	VOLUMETRIC RUNOFF V (acre-feet)
	LAND TREATMENT TYPE					
	A	B	C	D		
2-YR	0.00	0.01	0.12	0.72	0.49	0.0097
10-YR	0.08	0.22	0.44	1.24	0.91	0.0180
100-YR	0.44	0.67	0.99	1.97	1.55	0.0306

WEIGHTED PEAK DISCHARGE, q, & PEAK RATE OF DISCHARGE, Q:

	PEAK DISCHARGE, q (cfs/acre)				Weighted q	PEAK RATE OF DISCHARGE Q (cfs)
	LAND TREATMENT TYPE					
	A	B	C	D		
2-YR	0.00	0.03	0.47	1.69	1.15	0.27
10-YR	0.24	0.76	1.49	2.89	2.20	0.52
100-YR	1.29	2.03	2.87	4.37	3.61	0.86



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 (505) 345-3999(505) 345-8393 (fax)

HYDROLOGY CALCULATIONS

Page: 4 of 8
 Sheet: of
 Date: 10/12/00
 Date: 10/00

Computed by: Karen M. Stearns
 Checked by: TDS

Project Name: IHOP on Tract C-1 of Cottonwood Corners **Project No:** E300001558.01
Project Location: Southeast corner of NM528 and Cottonwood Drive

Calculation Description: To calculate the hydrologic conditions of the project. This calculation is in accordance with the City of Albuquerque Development Process Manual, Volume 2, Section 22.2, "Hydrology", Part A - Procedure for 40 Acre and Smaller Ba

PRECIPITATION ZONE: 1

DEPTH AT 100-YEAR DESIGN STORM:

P ₆₀	P ₃₆₀	P ₁₄₄₀	P _{4 days}	P _{10 days}
1.87 inches	2.20 inches	2.66 inches	3.12 inches	3.67 inches

BASIN 2C -- PROPOSED ONSITE RUNOFF TO DETENTION POND C (SOUTHEAST):

BASIN AREA AND LAND TREATMENT

TOTAL AREA			LAND TREATMENT TYPE			
(ft ²)	(acres)	(mi ²)	A (ft ²)	B (ft ²)	C (ft ²)	D (ft ²)
9,405	0.216	0.000337	0	907	0	8,498
			0.0%	9.6%	0.0%	90.4%

WEIGHTED EXCESS PRECIPITATION, E, & VOLUMETRIC RUNOFF, V:

	EXCESS PRECIPITATION, E (inches)				Weighted E	VOLUMETRIC RUNOFF V (acre-feet)
	LAND TREATMENT TYPE					
	A	B	C	D		
2-YR	0.00	0.01	0.12	0.72	0.65	0.0117
10-YR	0.08	0.22	0.44	1.24	1.14	0.0205
100-YR	0.44	0.67	0.99	1.97	1.84	0.0332

WEIGHTED PEAK DISCHARGE, q, & PEAK RATE OF DISCHARGE, Q:

	PEAK DISCHARGE, q (cfs/acre)				Weighted q	PEAK RATE OF DISCHARGE Q (cfs)
	LAND TREATMENT TYPE					
	A	B	C	D		
2-YR	0.00	0.03	0.47	1.69	1.53	0.33
10-YR	0.24	0.76	1.49	2.89	2.68	0.58
100-YR	1.29	2.03	2.87	4.37	4.14	0.89



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HYDROLOGY CALCULATIONS

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 Date: 10/00

Computed by: Karen M. Stearns
 Checked by: TDS

Project Name: IHOP on Tract C-1 of Cottonwood Corners **Project No:** E300001558.01
Project Location: Southeast corner of NM528 and Cottonwood Drive

Calculation Description: To calculate the hydrologic conditions of the project. This calculation is in accordance with the City of Albuquerque Development Process Manual, Volume 2, Section 22.2, "Hydrology", Part A - Procedure for 40 Acre and Smaller Ba

PRECIPITATION ZONE: 1

DEPTH AT 100-YEAR DESIGN STORM:

P ₆₀	P ₃₆₀	P ₁₄₄₀	P _{4 days}	P _{10 days}
1.87 inches	2.20 inches	2.66 inches	3.12 inches	3.67 inches

BASIN 2D -- PROPOSED ONSITE RUNOFF TO RETENTION POND D (NORTHEAST):

BASIN AREA AND LAND TREATMENT

TOTAL AREA			LAND TREATMENT TYPE			
(ft ²)	(acres)	(mi ²)	A (ft ²)	B (ft ²)	C (ft ²)	D (ft ²)
234	0.005	0.000008	0	234	0	0
			0.0%	100.0%	0.0%	0.0%

WEIGHTED EXCESS PRECIPITATION, E, & VOLUMETRIC RUNOFF, V:

	EXCESS PRECIPITATION, E (inches)				Weighted E	VOLUMETRIC RUNOFF V (acre-feet)
	LAND TREATMENT TYPE					
	A	B	C	D		
2-YR	0.00	0.01	0.12	0.72	0.01	0.0000
10-YR	0.08	0.22	0.44	1.24	0.22	0.0001
100-YR	0.44	0.67	0.99	1.97	0.67	0.0003

WEIGHTED PEAK DISCHARGE, q, & PEAK RATE OF DISCHARGE, Q:

	PEAK DISCHARGE, q (cfs/acre)				Weighted q	PEAK RATE OF DISCHARGE Q (cfs)
	LAND TREATMENT TYPE					
	A	B	C	D		
2-YR	0.00	0.03	0.47	1.69	0.03	0.00
10-YR	0.24	0.76	1.49	2.89	0.76	0.00
100-YR	1.29	2.03	2.87	4.37	2.03	0.01



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HYDROLOGY CALCULATIONS

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 Date: 10/00

Computed by: Karen M. Stearns
 Checked by: TJS

Project Name: IHOP on Tract C-1 of Cottonwood Corners **Project No:** E300001558.01
Project Location: Southeast corner of NM528 and Cottonwood Drive

Calculation Description: To calculate the hydrologic conditions of the project. This calculation is in accordance with the City of Albuquerque Development Process Manual, Volume 2, Section 22.2, "Hydrology", Part A - Procedure for 40 Acre and Smaller Ba

PRECIPITATION ZONE: 1

DEPTH AT 100-YEAR DESIGN STORM:

P ₆₀	P ₃₆₀	P ₁₄₄₀	P _{4 days}	P _{10 days}
1.87 inches	2.20 inches	2.66 inches	3.12 inches	3.67 inches

BASIN 3A -- PROPOSED OFFSITE RUNOFF TO RETENTION POND D (NORTHEAST):

BASIN AREA AND LAND TREATMENT

TOTAL AREA			LAND TREATMENT TYPE			
(ft ²)	(acres)	(mi ²)	A (ft ²)	B (ft ²)	C (ft ²)	D (ft ²)
950	0.022	0.000034	0	950	0	0
			0.0%	100.0%	0.0%	0.0%

WEIGHTED EXCESS PRECIPITATION, E, & VOLUMETRIC RUNOFF, V:

	EXCESS PRECIPITATION, E (inches)				Weighted E	VOLUMETRIC RUNOFF V (acre-feet)
	LAND TREATMENT TYPE					
	A	B	C	D		
2-YR	0.00	0.01	0.12	0.72	0.01	0.0000
10-YR	0.08	0.22	0.44	1.24	0.22	0.0004
100-YR	0.44	0.67	0.99	1.97	0.67	0.0012

WEIGHTED PEAK DISCHARGE, q, & PEAK RATE OF DISCHARGE, Q:

	PEAK DISCHARGE, q (cfs/acre)				Weighted q	PEAK RATE OF DISCHARGE Q (cfs)
	LAND TREATMENT TYPE					
	A	B	C	D		
2-YR	0.00	0.03	0.47	1.69	0.03	0.00
10-YR	0.24	0.76	1.49	2.89	0.76	0.02
100-YR	1.29	2.03	2.87	4.37	2.03	0.04



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HYDROLOGY CALCULATIONS

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 Date: 10/00

Computed by: Karen M. Stearns
 Checked by: TDS

Project Name: IHOP on Tract C-1 of Cottonwood Corners **Project No:** E300001558.01
Project Location: Southeast corner of NM528 and Cottonwood Drive

Calculation Description: To calculate the hydrologic conditions of the project. This calculation is in accordance with the City of Albuquerque Development Process Manual, Volume 2, Section 22.2, "Hydrology", Part A - Procedure for 40 Acre and Smaller Basins.

PRECIPITATION ZONE: 1

DEPTH AT 100-YEAR DESIGN STORM:

P ₆₀	P ₃₆₀	P ₁₄₄₀	P _{4 days}	P _{10 days}
1.87 inches	2.20 inches	2.66 inches	3.12 inches	3.67 inches

BASIN 3B -- PROPOSED OFFSITE RUNOFF TO DETENTION POND B (NORTHEAST):

BASIN AREA AND LAND TREATMENT

TOTAL AREA			LAND TREATMENT TYPE			
(ft ²)	(acres)	(mi ²)	A (ft ²)	B (ft ²)	C (ft ²)	D (ft ²)
4,992	0.115	0.000179	0	4,812	0	180
			0.0%	96.4%	0.0%	3.6%

WEIGHTED EXCESS PRECIPITATION, E, & VOLUMETRIC RUNOFF, V:

	EXCESS PRECIPITATION, E (inches)				Weighted E	VOLUMETRIC RUNOFF V (acre-feet)
	LAND TREATMENT TYPE					
	A	B	C	D		
2-YR	0.00	0.01	0.12	0.72	0.04	0.0003
10-YR	0.08	0.22	0.44	1.24	0.26	0.0025
100-YR	0.44	0.67	0.99	1.97	0.72	0.0068

WEIGHTED PEAK DISCHARGE, q, & PEAK RATE OF DISCHARGE, Q:

	PEAK DISCHARGE, q (cfs/acre)				Weighted q	PEAK RATE OF DISCHARGE Q (cfs)
	LAND TREATMENT TYPE					
	A	B	C	D		
2-YR	0.00	0.03	0.47	1.69	0.09	0.01
10-YR	0.24	0.76	1.49	2.89	0.84	0.10
100-YR	1.29	2.03	2.87	4.37	2.11	0.24

Reference: City of Albuquerque Development Process Manual, Volume 2, Section 22.2, "Hydrology", Part A - Procedure for 40 Acre and Smaller Basins.

TABLE A-1: BERNALILLO COUNTY PRECIPITATION ZONES	
Zone	Location
1	West of the Rio Grande.
2	Between the Rio Grande and San Mateo.
3	Between San Mateo and Eubank, north of Interstate 40; and between San Mateo and the east boundary of Range 4 East, south of Interstate 40.
4	East of Eubank, north of interstate 40; and east of the east boundary of Range 4 East, south of Interstate 40.

TABLE A-2: DEPTH (INCHES) AT 100-YEAR STORM					
Zone	P ₆₀	P ₃₆₀	P ₁₄₄₀	P _{4 days}	P _{10 days}
1	1.87	2.20	2.66	3.12	3.67
2	2.01	2.35	2.75	3.30	3.95
3	2.14	2.60	3.10	3.95	4.90
4	2.23	2.90	3.65	4.70	5.95

TABLE A-3: RETURN PERIOD FACTORS	
Return Period (years)	Factor
50	0.900
25	0.800
10	0.667
5	0.567
2	0.434

TABLE A-4: LAND TREATMENTS	
Type	Land Condition
A	Soil uncompacted by human activity with 0 to 10 percent slopes. Native grasses, weeds and shrubs in typical densities with minimal disturbance to grading, groundcover and infiltration capacity.
B	Irrigated lawns, parks and golf courses with 0 to 10 percent slopes. Native grasses, weeds and shrubs, and soil uncompacted by human activity with slopes greater than 10 percent and less than 20 percent.
C	Soil compacted by human activity. Minimal vegetation. Unpaved parking, roads, trails. Most vacant lots. Gravel or rock on plastic (desert landscaping). Irrigated lawns and parks with slopes greater than 10 percent. Native grasses, weeds and shrubs, and soil uncompacted by human activity with slopes at 20 percent or greater. Native grass, weed and shrub areas with clay or clay loam soils and other soils of very low permeability as classified by SCS Hydrologic Soil Group D.
D	Impervious areas, pavement and roofs.

TABLE A-8: EXCESS PRECIPITATION, E (INCHES) - 6 HOUR STORM												
Zone	Land Treatment Type											
	A			B			C			D		
	A _{2-YR}	A _{10-YR}	A _{100-YR}	B _{2-YR}	B _{10-YR}	B _{100-YR}	C _{2-YR}	C _{10-YR}	C _{100-YR}	D _{2-YR}	D _{10-YR}	D _{100-YR}
1	0.00	0.08	0.44	0.01	0.22	0.67	0.12	0.44	0.99	0.72	1.24	1.97
2	0.00	0.13	0.53	0.02	0.28	0.78	0.15	0.52	1.13	0.79	1.34	2.12
3	0.00	0.19	0.66	0.06	0.36	0.92	0.20	0.62	1.29	0.89	1.50	2.36
4	0.02	0.28	0.80	0.11	0.46	1.08	0.27	0.73	1.46	1.01	1.69	2.64

TABLE A-9: PEAK DISCHARGE (CFS/ACRE)												
Zone	Land Treatment Type											
	A			B			C			D		
	A _{2-YR}	A _{10-YR}	A _{100-YR}	B _{2-YR}	B _{10-YR}	B _{100-YR}	C _{2-YR}	C _{10-YR}	C _{100-YR}	D _{2-YR}	D _{10-YR}	D _{100-YR}
1	0.00	0.24	1.29	0.03	0.76	2.03	0.47	1.49	2.87	1.69	2.89	4.37
2	0.00	0.38	1.56	0.08	0.95	2.28	0.60	1.71	3.14	1.86	3.14	4.70
3	0.00	0.58	1.87	0.21	1.19	2.60	0.78	2.00	3.45	2.04	3.39	5.02
4	0.05	0.87	2.20	0.38	1.45	2.92	1.00	2.26	3.73	2.17	3.57	5.25

Emergency Overflow Capacity of Pond Outlet Riser Worksheet for Circular Orifice

Project Description	
Worksheet	Pond Outlet -- Riser Emergency Overflow
Type	Circular Orifice
Solve For	Discharge

Input Data	
Headwater Elevation	24.0 in
Centroid Elevation	18.0 in
Tailwater Elevation	0.0 in
Discharge Coefficient	0.60
Diameter	12 in

Results	
Discharge	2.67 cfs
Headwater Height Above Centroid	6.0 in
Tailwater Height Above Centroid	-18.0 in
Flow Area	0.8 ft ²
Velocity	3.40 ft/s

IHOP AT COTTONWOOD CORNERS

STAGE-STORAGE-DISCHARGE RATING TABLES FOR DETENTION PONDS

E300001558.01

WSE inch	WSE feet	POND A (SOUTHWEST) A_A (ft ²)= 644			POND B (NORTHEAST) A_B (ft ²)= 891			POND C (SOUTHEAST) A_C (ft ²)= 574		
		Q_{out} cfs	V ft ³	V acre-ft	Q_{out} cfs	V ft ³	V acre-ft	Q_{out} cfs	V ft ³	V acre-ft
0	0.000	0.00	0	0.00000	0.00	0	0.00000	0.00	0	0.00000
4	0.333	0.03	215	0.00493	0.02	297	0.00682	0.02	191	0.00439
8	0.667	0.09	429	0.00986	0.06	594	0.01364	0.06	383	0.00878
12	1.000	0.18	644	0.01478	0.12	891	0.02045	0.12	574	0.01318
16	1.333	0.27	859	0.01971	0.18	1188	0.02727	0.18	765	0.01757
18	1.500	0.33	966	0.02218	0.22	1337	0.03068	0.22	861	0.01977
24	2.000	3.12	1288	0.02957	2.97	1782	0.04091	2.97	1148	0.02635

Analysis Results

Scenario: Base

Title: IHOP at Cottonwood Corners
 Project Engineer: Karen Steams
 Project Date: 07/10/00
 Comments:

Inlet Rational Flows

Label	Inlet Area (acres)	Composite Rational C	Inlet CA (acres)	Carryover CA (acres)	Total Inlet CA (acres)	Time of Concentration (min)	Local Intensity (in/hr)	Local Rational Flow (cfs)	Additional Carryover (cfs)	Total Carryover Flow (cfs)	Total Flow To Inlet (cfs)
EX PON	0.00	0.00	0.00	0.00	0.00	12.00	0.00	0.000	0.000	0.000	0.000
I-1	0.00	0.00	0.00	0.00	0.00	12.00	0.00	0.000	0.000	0.000	0.000
I-2	0.00	0.00	0.00	0.00	0.00	12.00	0.00	0.000	0.000	0.000	0.000
I-3	0.00	0.00	0.00	0.00	0.00	12.00	0.00	0.000	0.000	0.000	0.000

Inlets

Label	Bypass Target	Inlet	Inlet Type	Total Flow To Inlet (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Capture Efficiency (%)
EX PON	N/A	Default 100%	Generic Inlet	0.000	0.000	0.000	100.0
I-1	N/A	Default 100%	Generic Inlet	0.000	0.000	0.000	100.0
I-2	N/A	Default 100%	Generic Inlet	0.000	0.000	0.000	100.0
I-3	N/A	Default 100%	Generic Inlet	0.000	0.000	0.000	100.0

Pipes For Network With Outlet: EX MH

Label	Dn. Pipe	Number of Sections	Section Shape	Section Size	Pipe Length (ft)	Pipe Slope (%)	Total System Flow (cfs)	Average Velocity (ft/s)	Up Invert (ft)	Dn Invert (ft)	HGL In (ft)	HGL Out (ft)
EX P1	EX P2	1	Circular	18 inch	21	0.76	1.139	1.81	5,029.74	5,029.58	5,030.28	5,030.21
EX P2	None	1	Circular	18 inch	41	0.78	1.859	3.05	5,029.58	5,029.26	5,030.21	5,029.77
P-1	P-2	1	Circular	18 inch	173	3.50	0.330	1.69	5,042.25	5,036.20	5,042.46	5,036.52
P-2	P-7	1	Circular	18 inch	133	3.23	0.720	3.00	5,036.20	5,031.90	5,036.52	5,032.17
P-5	P-6	1	Circular	18 inch	129	1.94	0.170	1.39	5,039.00	5,036.50	5,039.15	5,036.73
P-6	P-2	1	Circular	18 inch	15	2.00	0.390	1.85	5,036.50	5,036.20	5,036.73	5,036.52
P-7	P-8	1	Circular	18 inch	93	2.15	0.720	2.65	5,031.90	5,029.90	5,032.22	5,030.22
P-8	EX P2	1	Circular	18 inch	17	1.88	0.720	1.84	5,029.90	5,029.58	5,030.22	5,030.21

Structures For Network With Outlet: EX MH

Label	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)	Calculated Headloss (ft)	Total System Flow (cfs)	System Flow Time (min)	System Intensity (in/hr)
EX MH	5,029.77	5,029.77	0.00	1.859	15.41	0.00
EX PON	5,030.28	5,030.28	0.00	1.139	12.00	0.00
I-1	5,042.46	5,042.46	0.00	0.330	12.00	0.00
I-2	5,039.15	5,039.15	0.00	0.170	12.00	0.00
I-3	5,036.73	5,036.73	3.2e-3	0.390	13.55	0.00
J-1	5,036.52	5,036.52	1.86e-5	0.720	13.71	0.00
J-2	5,032.22	5,032.22	8.66e-4	0.720	14.44	0.00
J-3	5,030.21	5,030.21	1.19e-3	1.859	15.18	0.00
J-4	5,030.22	5,030.22	1.86e-3	0.720	15.03	0.00