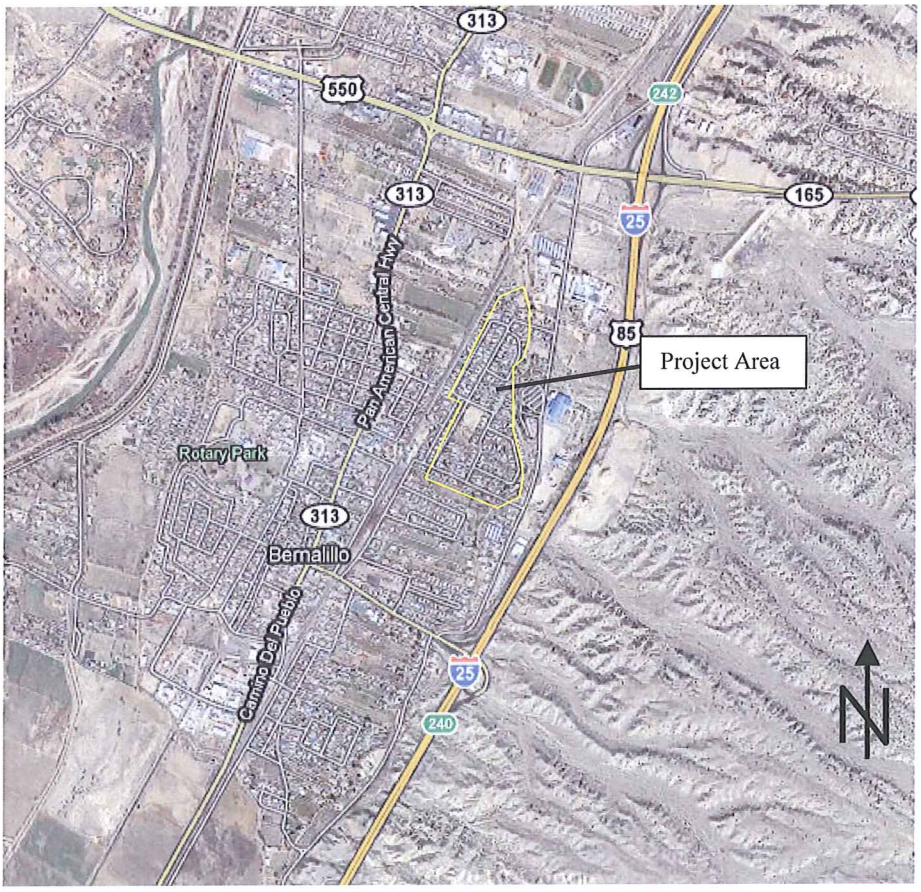
South Bernalillo, N.M. Area
Athena Avenue Pond and
Collection System Feasibility Study



Prepared by:

Wilson & Company, Inc.
2600 The American Road SE
Rio Rancho, New Mexico 87124
(505) 898-8021

Prepared for:

ESCAFCA
Eastern Sandoval County Arroyo Flood Control Authority

March 2011

SOUTH BERNALILLO, N.M. AREA
ATHENA AVENUE POND AND
COLLECTION SYSTEM FEASIBILITY STUDY

MARCH 2011

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

_____

Angela N. Valdez, P.E.
NMPE #15814

_____

Date

Table of Contents

1 Introduction

The ***Drainage Master Plan and Needs Assessment*** prepared for the Eastern Sandoval County Arroyo Flood Control Authority (ESCAFCA) by Wilson & Company in 2008 identified several drainage issues within the Town of Bernalillo. This report analyzes an area in South Bernalillo Watershed identified in the mentioned report as the problem area with reported flooding problems.

1.1 Authority

The Eastern Sandoval County Arroyo Flood Control Authority (ESCAFCA) is a political subdivision of the State of New Mexico. ESCAFCA's purpose is to acquire, equip, maintain, and operate a flood control system for the benefit of the residents of Eastern Sandoval County. ESCAFCA has authorized Wilson & Company to conduct this feasibility study on its behalf.

1.2 Purpose

The purpose of this report is to present a feasible underground storm drain system and temporary retention Alternative for the area in the South Bernalillo watershed that would mitigate flooding impacts to private property, public roadways, and ditches maintained by the Middle Rio Grande Conservancy District due to flows originating from the I-25 right-of-way and large basins upstream of I-25. Based on available mapping, analysis, and anecdotal information, it is the runoff from these large basins that cause the majority of the flooding problems in the South Bernalillo area. This report provides a conceptual analysis of retention and conveyance system and includes concept level cost estimates. This report is intended to serve as an aid to the ESCAFCA board in prioritizing the steps needed to mitigate flooding problems in the area.

1.3 Goals and Objectives

The goals and objectives of this report are to:

a. Evaluate existing drainage patterns and flooding potential within the study area
b. Recommend most suitable retention and conveyance system for the project site

2 Existing Conditions

Drainage problems in South Bernalillo Watershed like most of the areas in the ESCAFCA jurisdiction are due largely to the lack of adequate stormwater conveyance capacity between I-25 and the Rio Grande. Thus, large rainfall events have historically resulted in stormwater damage to private businesses, residences and public roadways.

2.1 Watershed Description

The project area is located in the South Bernalillo Watershed and majority of it is developed with residential properties. The area is flat and slopes in northeasterly to southwesterly direction. The area is bounded by South Hill Road and Bernalillo Acequia to the east, BNSF railway to the west, NM 550 to the north and Richardson Drive to the south. The project site was identified as problem area per Drainage Master Plan and

Needs Assessment prepared by Wilson & Company Inc. Figure 1 is a location map for the study area.

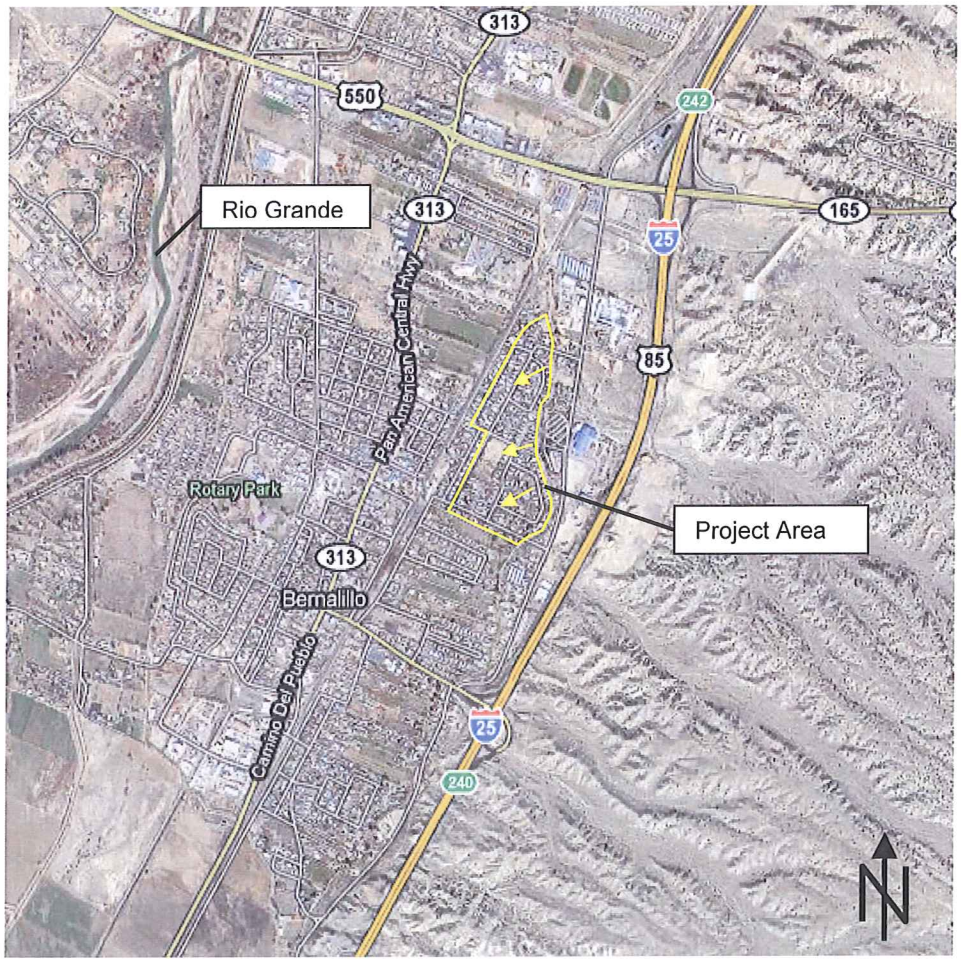


Figure 1 – Location Map

2.2 Existing Drainage Patterns

The South Bernalillo Watershed historically discharged to the Rio Grande. The watershed is south of NM 550. Majority of drainage problems in South Bernalillo watershed south of NM 550 occur between the BNSF railway and I-25. Runoffs upstream of I-25 are conveyed through existing culverts and sheet flow in a southwesterly direction to South Hill Road and pond against the Bernalillo Acequia embankment.

The MRGCD maintains an extensive network of acequias, canals, laterals, and drains within the ESCAFCA jurisdiction. Bernalillo Acequia is located downstream of South Hill

Road and conveys some flows south but during large storm event runoff overtops the Acequia and causing damage to adjacent private properties.

Due to flat grades and lack of conveyance system, accumulated runoff pond in the area and cause flooding during major storm event. The overall flow path is to south and southwest with BNSF railway blocking the runoff sheet flowing west. The existing residential development west of South Hill Road block the natural drainage path from east of I-25 and are at risk of flooding in large storm events. In some areas the street grades are higher than the adjacent properties causing flooding. Flooding has caused less damage to the areas that include mobile homes due to their raised elevation.

No topographic mapping was performed for this study and Lidar mapping was used to determine existing drainage patterns. Lidar mapping used was provided by Bohannan Huston, Inc. for the Town of Bernalillo. Due to the flat grades a detailed topographic mapping is recommended prior to final design.

2.3 Geotechnical Study

Amec Earth and Environmental, Inc. performed a field study to determine depth of groundwater below the referenced site. Two borings were drilled at the site to a depth of approximately 20 feet below existing grade. The soil samples indicate that the site consists primarily of sandy clay (CL) overlaying relatively clean sand (SP, SP-SM). The sandy clay is of medium plasticity and is moderately firm to firm in consistency. The sand is fine grained directly below the clay, increasing in coarseness with depth, is non-plastic, very loose to medium sand and contains a trace of gravel to ½ inch.
Groundwater was encountered at a depth of 13.5 to 13.75 feet. The Study recommended a maximum excavation depth of 9 feet below existing grade and subgrade soils suitable for construction of dry wells. Dry wells are vertical holes in ground filled with rocks designed to remove surface water.

3 Hydrologic Analysis

A hydrologic analysis of the watershed was completed using the Arid Lands Hydrologic Model (AHYMO) software. AHYMO computes a hydrograph for each sub-basin based on its physical properties. These hydrographs are then routed along waterways and drainage paths to determine a peak discharge at points of interest throughout the watershed. The AHYMO simulation developed for the Drainage Master Plan and Needs Assessment was edited and utilized to determine peak discharges and runoff volumes for the basins discharging to the project area. The rainfall depth for the 100-yr storm event was modified in the AHYMO simulation to represent the average rainfall condition for the specific basins draining to the South Bernalillo area. The total rainfall depth was reduced from 3.42 inches to 2.71 inches based on NOAA Atlas 14 precipitation depths to more accurately represent the smaller region tributary to the project area. See Table 1 for Precipitation and Frequency Estimates and Appendix or 100 year storm AHYMO output file.

TABLE 1: PRECIPITATION FREQUENCY ESTIMATES (INCHES)				
STORM YEAR	15 MIN	60 MIN	6 HR	24 HR
1	0.33	0.54	0.79	1.01
2	0.42	0.70	0.99	1.27
5	0.56	0.94	1.27	1.58
10	0.67	1.12	1.49	1.84
100	1.06	1.77	2.28	2.71

4 Proposed Improvements

The Drainage Master Plan and Needs Assessment identified the project site as the problem area and recognized the need for detention facilities upstream of the project area to alleviate the need for large conveyance system. Until the construction of South Bernalillo Detention Facility is in place, an underground conveyance system and a temporary retention pond can alleviate the flooding issues in the area although not completely eliminating it. The intent of this study is to analyze a system for maximum collection of runoff in the area and retaining it until an outlet from the pond can be added for a permanent detention facility.

The modified AHYMO model developed for the Drainage Master Plan and Needs Assessment was utilized to determine peak discharges and runoff volumes contributing to the proposed retention pond. Basins 304 and 306 of South Bernalillo Basins were used to determine the peak flow and runoff volume for the project site. See Watershed Area exhibit in the Appendix and Table 2 for Basin Summary.

TABLE 2: BASIN SUMMARY					
DRAINAGE AREA (AC)	STORM YEAR	100	10	5	2
63.9	Q Peak (cfs)	97.0	52.1	41.0	27.6
	Volume (ac-ft)	8.2	4.8	3.8	2.8
76.7*	Q Peak (cfs)	114.8	61.6	48.4	32.6
	Volume (ac-ft)	9.9	5.7	4.6	3.3

* POSSIBLE WITH DEEPER POND

Table 3 is a detailed list of all the contributing sub-basins for different storm year event.

	TABLE 3: SUB-BASIN PEAK FLOW AND RUNOFF VOLUME									
	BASIN ID	AREA	Q_{100}	V_{100}	Q_{10}	V_{10}	Q_5	V_5	Q_2	V_2
		AC	CFS	AC-FT	CFS	AC-FT	CFS	AC-FT	CFS	AC-FT
	101	3.57	6.3	0.46	3.5	0.27	2.7	0.22	1.9	0.16
SB 304	102	11.47	20.4	1.49	11.1	0.86	8.8	0.69	6.0	0.50
SB 304	103	1.98	3.5	0.26	1.9	0.15	1.5	0.12	1.0	0.09
SB 304	105A	2.98	5.3	0.39	2.9	0.22	2.3	0.18	1.6	0.13
SB 304	104	7.97	11.1	1.02	5.9	0.59	4.6	0.47	3.1	0.34
SB 306	105B	3.51	4.9	0.45	2.6	0.26	2.0	0.21	1.4	0.15
SB 306	106	11.72	16.4	1.51	8.7	0.87	6.8	0.70	4.6	0.50
SB 306	107	6.64	9.3	0.85	4.9	0.49	3.9	0.40	2.6	0.28
SB 306	109	7.15	10.0	0.92	5.3	0.53	4.2	0.43	2.8	0.31
SB 306	110	6.94	9.7	0.89	5.2	0.51	4.0	0.41	2.7	0.30
SB 306	**TOTAL**	**63.93**	**97.0**	**8.24**	**52.1**	**4.76**	**41.0**	**3.82**	**27.6**	**2.75**
SB 306	108	6.14	8.6	0.79	4.6	0.46	3.6	0.37	2.4	0.26
SB 306	111	4.74	6.6	0.61	3.5	0.35	2.8	0.28	1.9	0.20
SB 306	112	1.84	2.6	0.24	1.4	0.14	1.1	0.11	0.7	0.08
SB 306	**TOTAL***	**76.65**	**114.8**	**9.88**	**61.6**	**5.71**	**48.4**	**4.58**	**32.6**	**3.30**
	* DEEPER POND									

A pond location is considered at the southeast corner of the intersection of Melissa Road and Athena Avenue. Majority of the proposed site is developed leaving no other location for any other sizable pond. There are several deciding factors in determining the quantity of runoff that can be conveyed into the pond. Direction of existing grades, runoff travel distance, location of the proposed pond and its proximity to existing residential development and high water table in the area which limits the pond depth are some of the major factors in determining the pond retention volume. Different Pond Alternatives are proposed in order to choose which Alternative will be the most feasible one for the community.

Four conveyance systems were analyzed to convey accumulated runoff into the pond. The four systems collect runoff of an area of approximately 64 acres between west of Bernalillo Acequia and east of Carolina drive. The Overall Conveyance Layout exhibit is included in Appendix shows the three conveyance alignments. Plan & profile for the alignments are included in Appendix. Hydraflow Storm Sewer was used to analyze each alignment and determine the required pipe sizes. See hydraulic calculations in Appendix.

The First and Second systems collect runoff from north and northeast of Melissa Road. The Third system collects runoff from north of Athena Avenue. If a deeper pond was allowed to increase the pond depth from 5 feet to 8 feet and lower the invert elevation of pond inlet an additional 3 feet, the runoff contributing area may be increased to approximately 77 acres. Then, this alignment could convey additional runoff from south half of Carolina Drive and Garcia Lane. See Table 2, Basin Summary for information.

The Fourth system conveys runoff accumulated east and southeast of Mountain View Drive. The discharge point of this alignment could not be located in the public right of way and must go through private properties and therefore a need to purchase an easement along the pipe line. The three conveyance systems analyzed in this study convey a total of 97 cfs for the 100-year storm. With possibility of a deeper pond and larger pipes, total conveyance capacity could increase to 115 cfs. See Hydraflow calculations for deep pond in the Appendix.

Different factors play a role in determining the extents of a conveyance system. Factors like flat grades, site sloping in a southwesterly direction and away from the pond, its location and high water table. These factors make it impossible to convey runoff accumulated downstream of the pond and reversing the natural flow direction back into it. These factors are evident in areas southwest of Athena Avenue. See Table 4 for conceptual level cost estimates for the underground storm sewer system. This cost estimate does not reflect possibility of deeper pond.

TABLE 4: Conceptual Cost Estimate for Underground Storm Sewer

Item	Description	Unit	Unit Cost	Quantity	Total
1	24" RCP Pipe Class III, Incl. Trench, Backfill & Compaction, (0' to 10' depth), CIP	LF	$80	1,461.00	$116,880
2	30" RCP Pipe Class III, Incl. Trench, Backfill & Compaction, (0' to 10' depth), CIP	LF	$80	2,435.00	$194,800
3	36" RCP Pipe Class III, Incl. Trench, Backfill & Compaction, (0' to 10' depth), CIP	LF	$80	150.00	$12,000
4	Storm Sewer Fittings Incl. Type "C" Curb Inlets, 4' dia Manholes at depth of 0-6', Outfalls	LS	$175,000	1.00	$175,000
5	Underground Infiltration Galleries	LS	$30,000	1.00	$30,000
6	20' wide Easement Acquisition for pipe alignment 4	AC	$20,000	0.15	$3,000
7	Existing Asphalt Concrete Pavement Remove, Dispose & Replace	SY	$15	3,850.00	$57,750
				Subtotal	$531,680
				30% Contingency	$159,504
				Estimated Total	**$691,184**

4.1 Pond Alternatives

Four Pond Alternatives were analyzed to provide a better understanding in selection of preferred Pond Alternative for the area which would alleviate the existing problems until a permanent solution is developed. Peak discharges from the basins contributing to the pond were added to determine the required capacity of each Pond Alternative. It is

intended to discharge runoff to the pond from Bobby Place and Bernalillo Acequia from the north to Garcia Lane from the south. All four Alternatives include a 10 foot wide drivable access and one foot of freeboard. Each alternative can accommodate a field sport activity with approximate area of 36,000 sq. ft and additional area which could be dedicated as playground area. See Table 5 for a summary of each Pond Alternative.

TABLE 5: POND SUMMARY							
ALTERNATIVE	POND DATA				AVAILABLE VOLUME (AC-FT)		
	FREEBOARD ELEV (FT)	TOP ELEV (FT)	BOTTOM ELEV (FT)	SIDE SLOPE	TOTAL WITH FREEBOARD	TOTAL WITHOUT FREEBOARD	LOWER LEVEL
1	5057.0	5056.0	5051.0	6:1	15.89	12.40	N/A
2	5057.0	5056.0	5051.0	10:1	13.99	10.59	N/A
3	5057.0	5056.0	5051.0	6:1	13.09	9.71	4.15
4	5055.0	5054.0	5051.0	6:1	8.06	5.47	3.31

Bottom of ponds are graded towards the deepest corner of the pond near the intersection of Athena Avenue and Melisa Road. This grading will provide positive drainage into one corner since there is no outlet from the pond and discourage shallow water Ponding. Also as a temporary solution to drain the pond, underground infiltration galleries will be installed at this location to collect the 1 year storm volume. Dry wells will be needed to drain the collected runoff. A more detailed study is needed prior to design of dry wells.

Different Pond Alternatives, without possibility of deeper pond, are presented in this report to provide full potential of each alternative. Exhibits for each retention alternative are included in the following sections of this report along with cost estimates for each Alternative. To be able to use the maximum retention volume, each Pond Alternative was analyzed using different storm year. See Table 6 for a pond capacity summary.

TABLE 6: POND CAPACITY SUMMARY				
POND	STORM YEAR			
	100	10	5	2
1	YES	YES	YES	YES
2	YES	YES	YES	YES
3 OVERALL	YES	YES	YES	YES
3 LOWER	N/A	N/A	YES	YES
4 OVERALL	N/A	YES	YES	YES
4 LOWER	N/A	N/A	N/A	YES

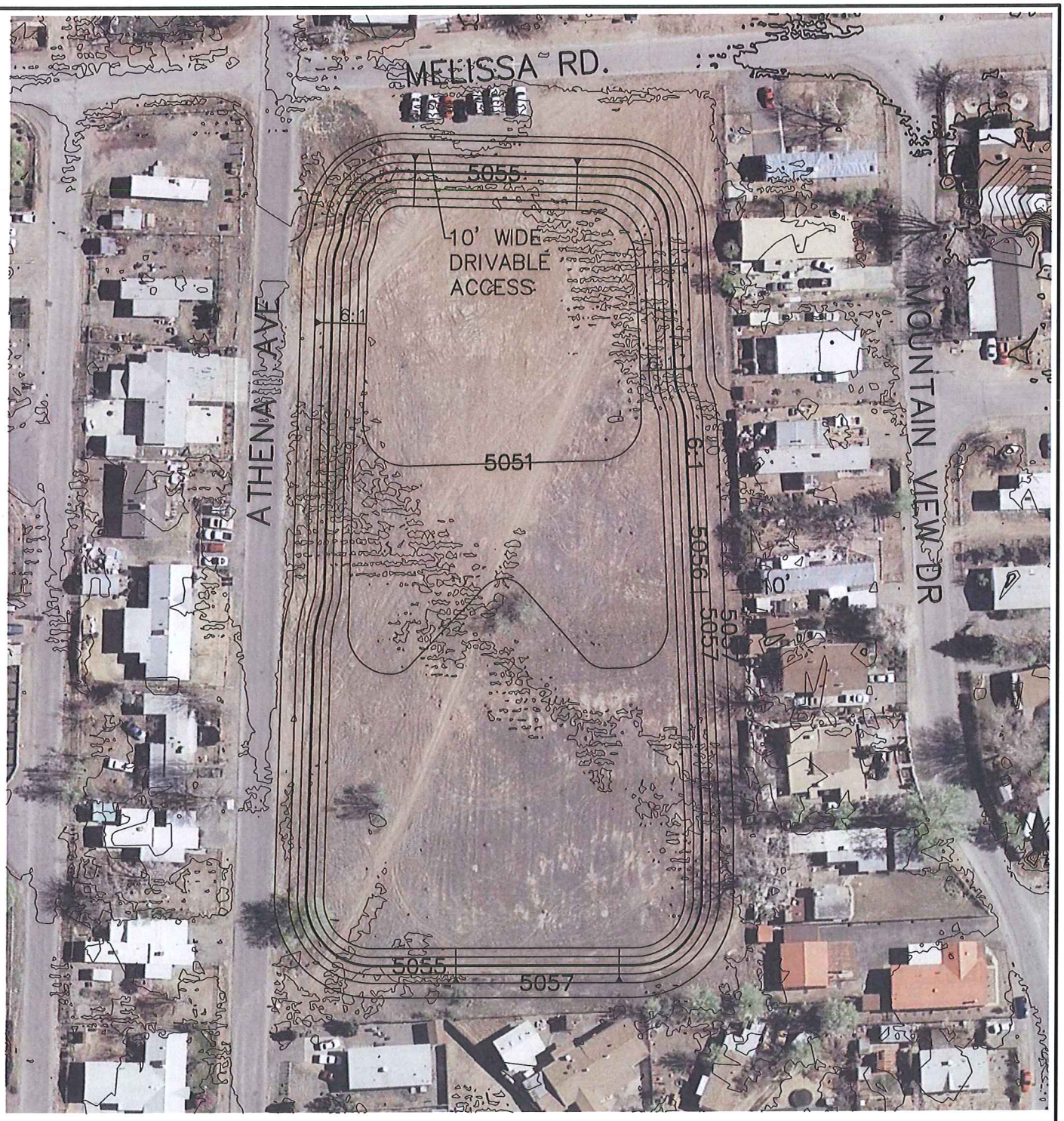
A summary of the pros and cons of each Pond Alternative, without possibility of deeper pond, is presented on the Alternatives analysis tables included in the Summary and Recommendations section.

4.1.1 Pond Alternative 1

Pond Alternative 1 has the capacity to contain 12.4 ac-ft with additional 1 ft of freeboard. The pond has a 6:1 side slope and will be 5 feet deep. See Exhibit 1, Pond Alternative 1. The top of pond elevation will be at 5056.00 and bottom elevation at 5051.00. The entire project site will provide retention volume for the accumulated runoff and can retain the 100-year storm. This Alternative will be a single level park and the site can be used for any park or play activity. A cost estimate for Pond Alternative 1 is included on Table 7.

Table 7: Cost Estimate for Pond Alternative 1

Item	Description	Unit	Unit Cost	Quantity	Total
1	Pond excavation	CY	$4.0	27,170	$108,680
2	10' Wide Access, 6" Gravel Base Course	SY	$7.0	2,110	$14,770
3	Perimeter Fence, Incl. Multiple entry Gates	LF	$10.0	1,900	$19,000
4	Furnish and install Play field, CIP.	LS	$20,000.0	1	$20,000
5	Sodded Turf, CIP	SY	$8.5	4,000	$34,000
6	Play Equipment, CIP	LS	$70,000.0	1	$70,000
7	Site Amenities Incl. Picnic tables, Benches, Trash Receptacles, Bicycle Rack, Shade Structure	LS	$125,000.0	1	$125,000
8	Irrigation System	LS	$80,000.0	1	$80,000
9	Native grass seeding & Mulch	AC	$2,500.0	4.34	$10,850
10	Pathway Lighting	LS	$50,000.0	1	$50,000
				Subtotal	$532,300
				30% Contingency	$159,690
				Estimated Total	**$691,990**



POND ALTERNATIVE 1 – 6:1 SIDE SLOPES
TOP OF POND ELEVATION INCLUDING FREEBOARD = 5057.00
BOTTOM OF POND ELEVATION = 5051.00
VOLUME = 12.53 AC.FT.

1" = 100'

WILSON & COMPANY
2600 THE AMERICAN RD. SE SUITE 100
RIO RANCHO, NM 87124
PHONE: 505-898-8021
FAX: 505-898-8501
www.wilsonco.com

PROJECT NAME

ATHENA AVENUE POND & COLLECTION SYSTEM FEASIBILITY STUDY

SEAL

ANGELA N. VALDEZ
NEW MEXICO
15814
LICENSED PROFESSIONAL ENGINEER

SHEET TITLE

EXHIBIT 1

PROJECT NO:	0960007007
DESIGNED BY:	MDG
DRAWN BY:	DEC
CHECKED BY:	ANV
DATE:	3/2011

SHEET NO:

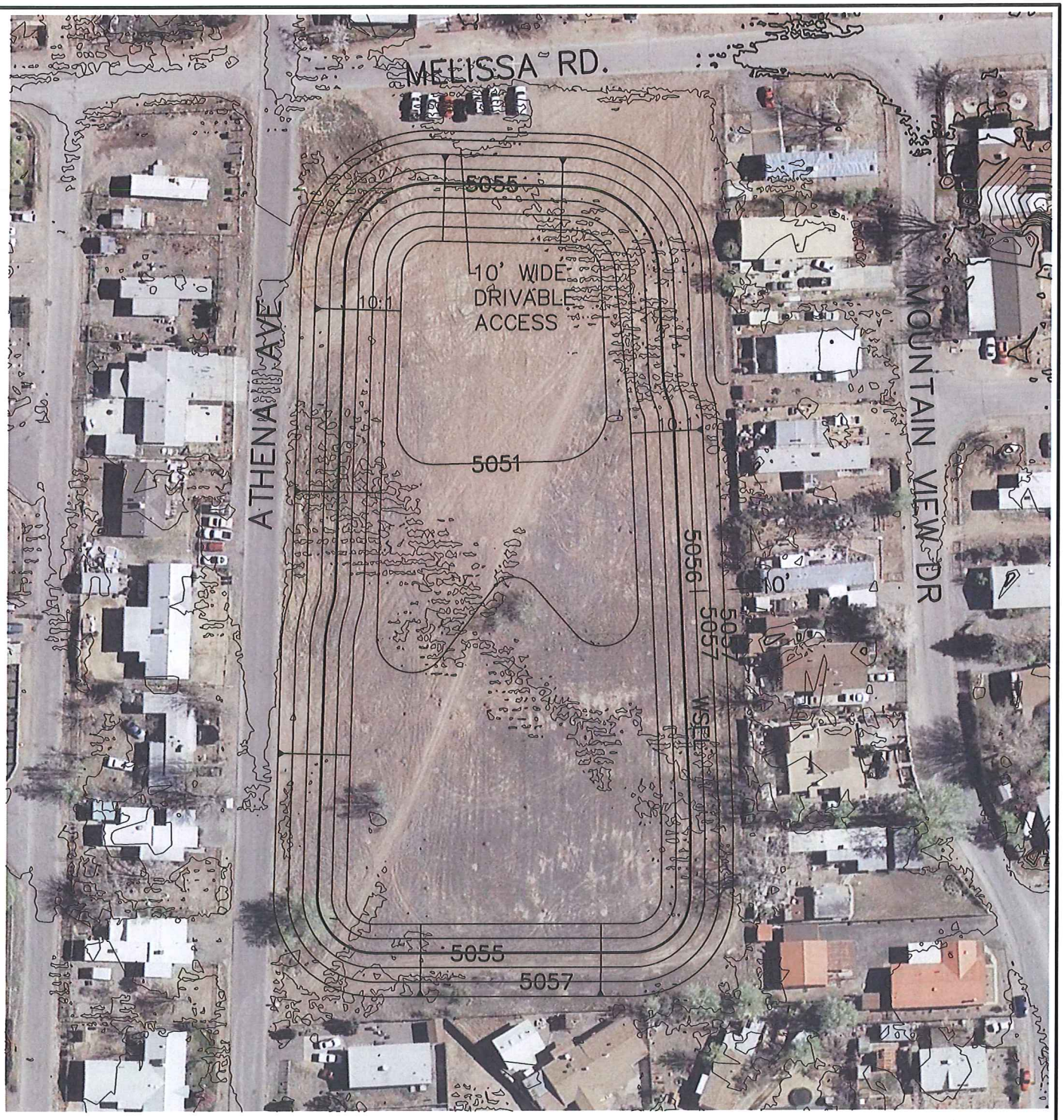
N:\IDS\09-600-070-07\CADD\SHEETS\POND DPT Layo 2/24/2011 10:38:24 AM MST

4.1.2 Pond Alternative 2

Pond Alternative 2 has the capacity to contain 10.6 ac-ft with 1 ft of freeboard. This pond Alternative includes a 10:1 side slope and will be 5 feet deep. See Exhibit 2, Pond Alternative 2. This Alternative will be very similar to the Alternative 1 with the exception of shallower side slopes of 10:1 which will result in less retention volume. This Alternative can retain the 100-year storm and will be a single level park to serve as the local community park. A cost estimate for Pond Alternative 2 is included on Table 8.

Table 8: Cost Estimate for Pond Alternative 2

Item	Description	Unit	Unit Cost	Quantity	Total
1	Pond excavation	CY	$4.0	24,110	$96,440
2	10' Wide Access, 6" Gravel Base Course	SY	$7.0	2,110	$14,770
3	Perimeter Fence, Incl. Multiple entry Gates	LF	$10.0	1,900	$19,000
4	Furnish and install Play field, CIP.	LS	$20,000.0	1	$20,000
5	Sodded Turf, CIP	SY	$8.5	4,000	$34,000
6	Play Equipment, CIP	LS	$70,000.0	1	$70,000
7	Site Amenities Incl. Picnic tables, Benches, Trash Receptacles, Bicycle Rack, Shade Structure	LS	$125,000.0	1	$125,000
8	Irrigation System	LS	$80,000.0	1	$80,000
9	Native grass seeding & Mulch	AC	$2,500.0	4.34	$10,850
10	Pathway Lighting	LS	$50,000.0	1	$50,000
				Subtotal	$520,060
				30% Contingency	$156,018
				Estimated Total	**$676,078**



POND ALTERNATIVE 2 – 10:1 SIDE SLOPES
TOP OF POND ELEVATION INCLUDING FREEBOARD = 5057.00
BOTTOM OF POND ELEVATION = 5051.00
VOLUME = 10.77 AC.FT. (INCLUDES 1' FREEBOARD)

1" = 100'

WILSON & COMPANY
2600 THE AMERICAN RD. SE SUITE 100
RIO RANCHO, NM 87124
PHONE: 505-898-8021
FAX: 505-898-8501
www.wilsonco.com

PROJECT NAME

ATHENA AVENUE POND & COLLECTION SYSTEM FEASIBILITY STUDY

SEAL

ANGELA N. VALDEZ NEW MEXICO 15814 LICENSED PROFESSIONAL ENGINEER

SHEET TITLE

EXHIBIT 2

PROJECT NO:	0960007007
DESIGNED BY:	MDG
DRAWN BY:	DEC
CHECKED BY:	ANV
DATE:	3/2011

SHEET NO:

N:\DS\09-600-070-07\CADD\SHEETS\POND DPT 2.dwg 2/24/2011 10:19:43 AM MST

4.1.3 Pond Alternative 3

Pond Alternative 3 has the overall capacity of 9.7 ac-ft with 1 ft of freeboard. This pond Alternative includes a 6:1 side slope and will have a total of 5 feet of depth. See Exhibit 3, Pond Alternative 3. This Alternative will be a multi level pond. The lower level portion of the pond is 3 feet deep and the upper portion has an additional 2 feet of depth. In smaller storm events only the lower level of pond will retain water and the higher level will remain dry. The lower level of the pond can contain a volume of 4.1 ac-ft. This Alternative can retain up to the 10-year storm. The lower level pond can retain only the 2-year storm. Since the upper level of the pond will remain drier than lower level, it would be better to allocate it for usages such as playground area. A cost estimate for Pond Alternative 3 is included on Table 9.

Table 9: Cost Estimate for Pond Alternative 3

Item	Description	Unit	Unit Cost	Quantity	Total
1	Pond excavation	CY	$4.0	20,420	$81,680
2	10' Wide Access, 6" Gravel Base Course	SY	$7.0	2,110	$14,770
3	Perimeter Fence, Incl. Multiple entry Gates	LF	$10.0	1,900	$19,000
4	Furnish and Install Play field, CIP.	LS	$20,000.0	1	$20,000
5	Sodded Turf, CIP	SY	$8.5	4,000	$34,000
6	Play Equipment, CIP	LS	$70,000.0	1	$70,000
7	Site Amenities Incl. Picnic tables, Benches, Trash Receptacles, Bicycle Rack, Shade Structure	LS	$125,000.0	1	$125,000
8	Irrigation System	LS	$80,000.0	1	$80,000
9	Native Grass Seeding & Mulch	AC	$2,500.0	4.34	$10,850
10	Pathway Lighting	LS	$50,000.0	1	$50,000
				Subtotal	$505,300
				30% Contingency	$151,590
				Estimated Total	**$656,890**

POND ALTERNATIVE 3 – 6:1 SIDE SLOPES
TOP OF POND = 5057.00
WSEL = 5056.00
BOTTOM OF POND = 5051.00
VOLUME = 9.70 AC.FT.

1" = 100'

WILSON & COMPANY
2600 THE AMERICAN RD. SE SUITE 100
RIO RANCHO, NM 87124
PHONE: 505-898-8021
FAX: 505-898-8501
www.wilsonco.com

PROJECT NAME

ATHENA AVENUE POND & COLLECTION SYSTEM FEASIBILITY STUDY

SEAL

ANGELA N. VALDEZ NEW MEXICO 15814 LICENSED PROFESSIONAL ENGINEER

SHEET TITLE

EXHIBIT 3

PROJECT NO:	0960007007
DESIGNED BY:	MDG
DRAWN BY:	DEC
CHECKED BY:	ANV
DATE:	3/2011

SHEET NO:

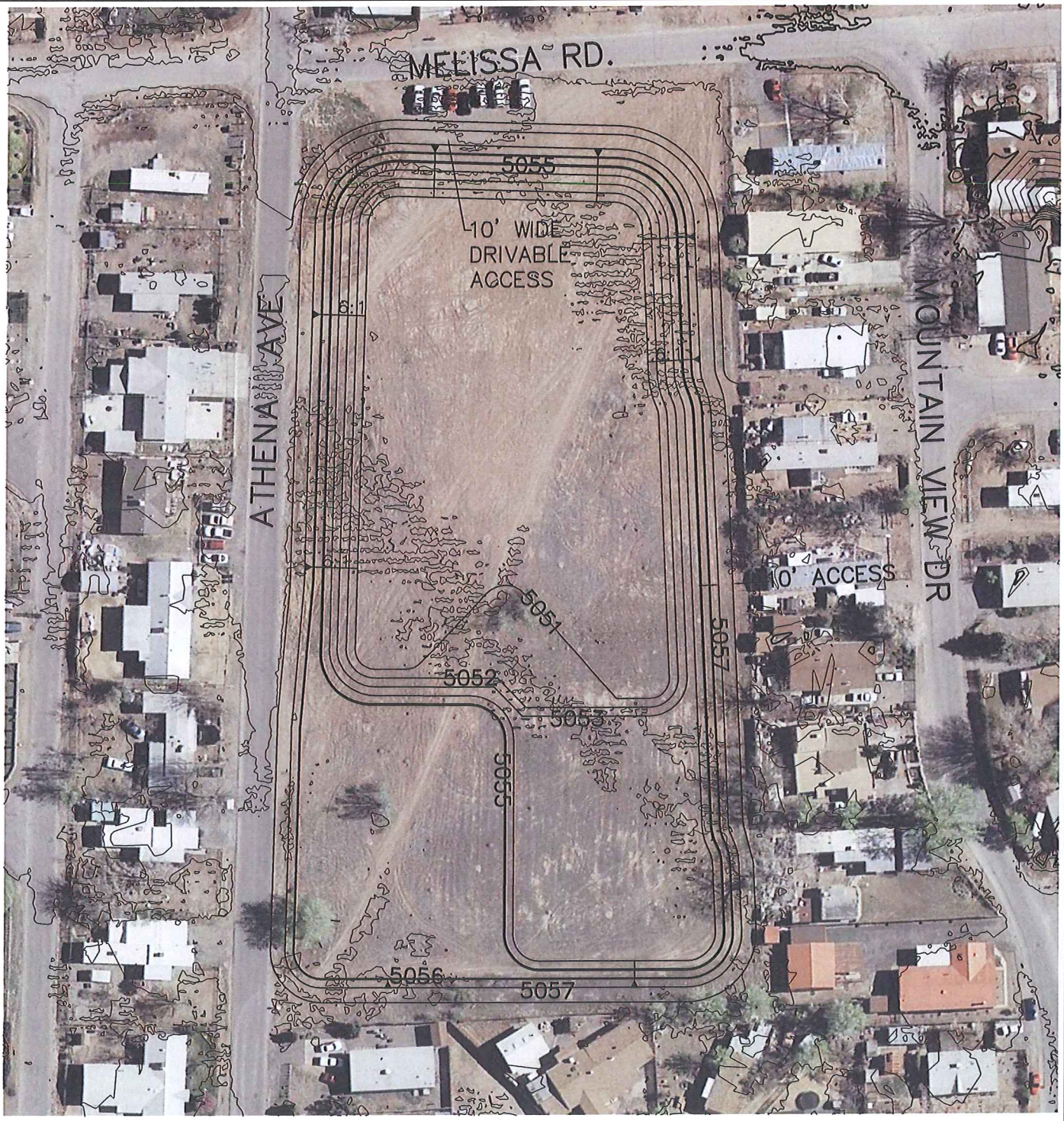
N:\IDS\09-600-070-07\CADD\SHEETS\POND OPT 3.dwg 2/24/2011 10:38:16 AM RST

4.1.4 Pond Alternative 4

Pond Alternative 4 has the overall capacity to contain 4.9 ac-ft with 1 ft of freeboard. This Pond Alternative includes a 6:1 side slope and will be 3 feet deep. See Exhibit 4, Pond Alternative 4. Similar to Alternative 3, it will also be a multi level pond. The lower level of the pond is 2 feet deep and the upper level has an additional 1 foot. In smaller storm events only the lower level of pond will retain water and the higher level will remain dry. The lower level of the pond can contain a volume of 3.3 ac-ft. This Alternative can retain up to the 5-year storm. The lower level pond can retain only the 2-year storm. An approximate area of 22,000 sq ft in the southwest corner of the pond which was not included in the pond volume calculations is graded higher than the freeboard elevation of the pond which is expected to remain dry and be fully usable at any time. A cost estimate for Pond Alternative 4 is included on Table 10.

Table 10: Cost Estimate for Pond Alternative 4

Item	Description	Unit	Unit Cost	Quantity	Total
1	Pond excavation	CY	$4.0	25,020	$100,080
2	10' Wide Access, 6" Gravel Base Course	SY	$7.0	2,110	$14,770
3	Perimeter Fence, Incl. Multiple entry Gates	LF	$10.0	1,900	$19,000
4	Furnish and install Play field, CIP.	LS	$20,000.0	1	$20,000
5	Sodded Turf, CIP	SY	$8.5	4,000	$34,000
6	Play Equipment, CIP	LS	$70,000.0	1	$70,000
7	Site Amenities Incl. Picnic tables, Benches, Trash Receptacles, Bicycle Rack, Shade Structure	LS	$125,000.0	1	$125,000
8	Irrigation System	LS	$80,000.0	1	$80,000
9	Native grass seeding & Mulch	AC	$2,500.0	4.34	$10,850
10	Pathway Lighting	LS	$50,000.0	1	$50,000
				Subtotal	$523,700
				30% Contingency	$157,110
				Estimated Total	**$680,810**



POND ALTERNATIVE 4 – 6:1 SIDE SLOPES
TOP OF POND = 5057.00
WSEL = 5055.00
BOTTOM OF POND = 5051.00
VOLUME = 7.30 AC.FT.

1" = 100'

WILSON &COMPANY
2600 THE AMERICAN RD. SE SUITE 100
RIO RANCHO, NM 87124
PHONE: 505-898-8021
FAX: 505-898-8501
www.wilsonco.com

PROJECT NAME

ATHENA AVENUE POND & COLLECTION SYSTEM FEASIBILITY STUDY

SEAL

ANGELA N. VALDEZ NEW MEXICO 15814 LICENSED PROFESSIONAL ENGINEER

SHEET TITLE

EXHIBIT 4

PROJECT NO:	0960007007
DESIGNED BY:	MDG
DRAWN BY:	DEC
CHECKED BY:	ANV
DATE:	3/2011

SHEET NO:

5 Summary and Recommendations

All ponds were analyzed as retention ponds since currently there is no immediate plan for addition of any outlet from the pond. When the South Bernalillo detention facility is in operation, the outlet from this pond can be connected into that system and function as a detention pond and be a permanent solution for the area. A pump is needed to allow discharge from the pond since the outlet is located downstream of the tying point into the future storm system.

Pond bottoms are graded towards the northwest corner of the pond to discourage shallow water Ponding. Installing underground infiltration galleries in the same area will drain the 1 year storm volume. In the interim conditions dry wells are a good solution to drain the collected runoff. A more detailed study is needed prior to design of dry wells.

One short term Alternative would be placement of roadside ditches to convey runoff to a certain point and then connecting it to the underground storm system. This Alternative is possible for the upstream side of alignment 1 and 2 since the direction of sheet flow is towards the pond. Alignments 3 and 4 are located downstream of the pond and runoff needs to be conveyed through underground storm sewer. Runoff from east of either alignment can travel to a certain point before connecting to the underground storm system. Installing bar ditches require re-grading of all private driveways and installation of driveway culverts. Bar ditches also require regular maintenance. It is assumed that with placement of bar ditches no pavement removal is required. See Table 11, conceptual cost estimate of Combination of Curbed Section and Bar Ditches Section Roadway.

Existing paved streets in some areas are higher than the adjacent residential properties which create local roadside Ponding. To eliminate this problem, topographic mapping of the site and a detailed study of the area is needed to ensure all runoff is directed into the streets. Positive grades need to be provided to convey runoff in the right flow path. To collect all generated runoff, placement of curb and gutter and lowering of street grades would be the best permanent solution. See Table 12, conceptual cost estimate of Curbed Section Roadway.

Table 13 provides an analysis for positive and negative features of each retention pond alternative along with their estimated cost. To provide a usable park/play area for the community, the site will need to be designed with all the necessities and amenities and be maintained throughout the year. A conceptual cost estimate is listed on Tables 7 through 10 under each pond alternative.

TABLE 11: Conceptual Roadway Cost Estimate, Combination of Curb & Gutter and Bar Ditches					
Item	**Description**	**Unit**	**Unit Cost**	**Quantity**	**Total**
1	Existing Asphalt Concrete Pavement up to 4 Inch Thick, Sawcut, Remove & Dispose , CIP	SY	$6.0	7,350.0	$44,100
2	Residential Asphalt Concrete Type A, 2-2 Inch Lifts, CIP	SY	$5.0	8,800.0	$44,000
3	Subgrade Prep, 12 Inch at 95% Compaction, CIP	SY	$1.7	8,800.0	$14,960
4	Aggregate Base Course, Crushed 6 Inch at 95% compaction, CIP	SY	$7.0	9,680.0	$67,760
5	Curb & Gutter, Standard, Portland Cement Concrete, Incl. Subgrade Prep., CIP	LF	$15.0	6,600.0	$99,000
6	Grading areas not to be paved, with less than 2' excavation, CIP at 95% compaction	SY	$2.0	2,700.0	$5,400
7	24" CMP Incl. Trench, Backfill & Compaction, CIP	LF	$40.0	4,400.0	$176,000
8	Driveway Grading	CY	$12.0	2,000.0	$24,000
9	Headwalls at each end of Driveway Culvert	LS	$110,000.0	1	$110,000
				Subtotal	$585,220
				30% Contingency	$175,566
				Estimated Total	**$760,786**

TABLE 12: Conceptual Roadway Cost Estimate, Curbed Section					
Item	**Description**	**Unit**	**Unit Cost**	**Quantity**	**Total**
1	Grading areas not to be paved, with less than 2' excavation, CIP at 95% compaction	SY	$3.0	2,200.0	$6,600.0
2	Export	CY	$3.0	300.0	$900.0
3	Existing Asphalt Concrete Pavement up to 4 Inch Thick, Sawcut, Remove & Dispose , CIP	SY	$6.0	25,350.0	$152,100.0
4	Residential Asphalt Concrete Type A, 2-2 Inch Lifts, CIP	SY	$5.0	30,400.0	$152,000.0
5	Subgrade Prep, 12 Inch at 95% Compaction, CIP	SY	$1.7	30,400.0	$51,680.0
6	Aggregate Base Course, Crushed 6 Inch at 95% compaction, CIP	SY	$7.0	33,440.0	$234,080.0
7	Curb & Gutter, Standard, Portland Cement Concrete, Incl. Subgrade Prep., CIP	LF	$15.0	22,800.0	$342,000.0
8	Lot/Drive Grading to Match	CY	$12.0	2,000.0	$24,000.0
				Subtotal	$963,360
				30% Contingency	$289,008
				Estimated Total	**$1,252,368**

Table 13: Retention Alternative Analysis Table			
Alternatives	**Pros**	**Cons**	**Cost**
Pond Alternative 1- Pond area covers the whole lot, 6:1 side slope, total retention volume 12.40 ac-ft	Provides a large retention volume	Pond bottom will contain runoff during big storm event untill complete absorption	$691,990
	Larger or multiple areas can be allocated as play area	May not be usable if retaining runoff	
	Can retain the 100-year storm runoff		
	One level park provides bigger usage area for the neighborhood		
Pond Alternative 2- Pond area covers the whole lot, 10:1 side slope, total retention volume 10.59 ac-ft	Provides a large retention volume	Pond bottom will contain runoff during big storm event	$676,078
	Larger or multiple areas can be allocated as play area	May not be usable if retaining runoff	
	Shallower side slopes	Less retention volume as compared to Alternative 1	
	Can retain the 100-year storm runoff		
Pond Alternative 3- Multi level pond, 6:1 side slopes, total retention volume 9.71 ac-ft	Upper level of pond can remain dry and be usable while the lower level retains runoff		$656,890
	Lower level can retain storm events up to the 10-year storm	Overall volume can retain the 100-year storm runoff	
Pond Alternative 4- Multi level pond, 6:1 side slopes, total retention volume 5.47 ac-ft	An area is excluded from the retention to remain dry and be usable at all times	Retention volume is reduced to provide more usable space	$680,810
	Lower level can retain storm events up to the 2-year storm	Overall volume can retain the 10-year storm runoff	
	Shallow pond		

ATHENA AVENUE POND
AND
COLLECTION SYSTEM FEASIBILITY STUDY

Appendix

100-YR AHYMO Output

Watershed Areas Exhibit

Overall Conveyance Plan

Hydraulic Calculations

Alignments Plan & profile Sheets

100-YR AHYMO OUTPUT

AHYMO PROGRAM SUMMARY TABLE (AHYMO_97) - - VERSION: 1997.02c RUN DATE (MON/DAY/YR) =03/01/2011
INPUT FILE = M:\IDS\0973AF~1\AE_DATA\CALCS\AHYMO\100YRR~1.DAT USER NO.= AHYMO-C-9803c01UNMLIB-AH

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	NOTATION

*S EASTERN SANDOVAL COUNTY ARROYO FLOOD CONTROL AUTHORITY (ESCAFCA)
*S STORMWATER MANAGEMENT PLAN AND NEEDS ASSESSMENT
*S WILSON & COMPANY ENGINEERS & ASSOCIATES
*S COMMANDS HAVE BEEN NUMBERED IN AN ATTEMPT TO PROVIDE BETTER ACCOUNTING OF
*S LOCATION WITHIN THE MODEL'S CODE. COMMAND NUMBERS APPEAR AS "(XX)"
*S
*S NOTES:
*S 1. WATERSHEDS UPSTREAM OF I-25 HAVE BEEN DELINEATED BASED ON MILEPOST.
*S (E.G, WATERSHED 1000 BASINS DISCHARGE ACROSS I-25 BETWEEN MP240-MP241)

*S	WATERSHED	MILEPOST	WATERSHED	MILEPOST
*S	0000	< MP240	5000	MP244-MP245
*S	1000	MP240-MP241	6000	MP245-MP246
*S	2000	MP241-MP242	7000	MP246-MP247
*S	3000	MP242-MP243	8000	MP247-MP248
*S	4000	MP243-MP244	9000	> MP248

*S 2. WITHIN EACH WATERSHED, MAJOR BASINS (THOSE WITH >1 SUBBASINS) WILL BE
*S DESIGNATED WITH A NON-ZERO VALUE IN THE 100s DIGIT; MINOR BASINS (ONLY
*S 1 SUBBASIN) BE DESIGNATED WITH A ZERO IN THE 100s DIGIT.
*S 3. SUBBASINS ARE NUMBERED BASED ON ELEVATION AT POINT OF CONCENTRATION,
*S BEGINNING WITH THE HIGHEST PT OF CONC ELEVATION.
*S EXAMPLE:
*S BASIN 7124
*S [7] DENOTES WATERSHED 7, BETWEEN MP & MP
*S [1] DENOTES MAJOR BASIN 1, SOUTHERNMOST MAJOR BASIN OF WATERSHED 7
*S [24] DENOTES SUBBASIN 24, WITH 23 SUBBASINS WITH A HIGHER PT OF CONC
*S ELEVATION
*S 4. TIME INCREMENTS HAVE BEEN ADJUSTED TO CAPTURE PEAK FLOWS FOR ROUTES IN
*S STEEP AREAS. NOTE THAT THIS PROCEDURE TRUNCATES THE AFFECTED HYDRO-
*S GRAPHS, THEREFORE THE VOLUMES ASSOCIATED WITH THIS MODEL ARE SIGNIF-
*S ICANTLY LESS THAN ACTUAL AND SHOULD NOT BE USED FOR VOLUME-DEPENDENT
*S CALCULATIONS (E.G., ROUTE RESERVOIR, ETC.)

START										TIME=	.00
LOCATION			SANDOVAL COUNTY								
*S 100 YEAR 24HR STORM											
RAINFALL TYPE= 2										RAIN24=	2.710
*S											
*S											
*S											
*S (1) BASIN 0998											
COMPUTE NM HYD	998.00	-	1	.00500	7.33	.218	.81665	1.500	2.291	PER IMP=	5.00
*S											
*S											
*S (2) BASIN 0999											
COMPUTE NM HYD	999.00	-	10	.02200	32.15	.958	.81665	1.500	2.283	PER IMP=	5.00
*S											
*S											
*S (3) BASIN 1001											
COMPUTE NM HYD	1001.00	-	11	.03700	54.06	1.612	.81665	1.500	2.283	PER IMP=	5.00
*S											
*S											

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	NOTATION

*S (4) BASIN 1002											
COMPUTE NM HYD	1002.00	-	12	.04600	67.21	2.004	.81665	1.500	2.283	PER IMP=	5.00
*S											
*S											
*S (5) BASIN 1003											
COMPUTE NM HYD	1003.00	-	13	.17400	208.56	7.579	.81665	1.550	1.873	PER IMP=	5.00
*S											
*S											
*S (6) BASIN 1004											
COMPUTE NM HYD	1004.00	-	14	.02000	24.57	.737	.69064	1.500	1.919	PER IMP=	5.00
*S											
*S											
*S (7) BASIN 1005											
COMPUTE NM HYD	1005.00	-	15	.02600	31.94	.958	.69064	1.500	1.919	PER IMP=	5.00
*S											
*S											
*S (8) BASIN 1006											
COMPUTE NM HYD	1006.00	-	16	.01100	13.52	.405	.69064	1.500	1.920	PER IMP=	5.00
*S											
*S											
*S (9-15) BASIN 1100											
COMPUTE NM HYD	1101.00	-	1	.14900	98.04	5.038	.63394	1.650	1.028	PER IMP=	5.00
ROUTE MCUNGE	1102.1R	1	2	.14900	96.22	5.009	.63033	2.150	1.009	CCODE =	.1
COMPUTE NM HYD	1102.00	-	1	.29400	262.41	12.178	.77665	1.650	1.395	PER IMP=	5.00
ADD HYD	1102.1+	1& 2	3	.44300	263.14	17.187	.72743	1.650	.928		
ROUTE MCUNGE	1103.1R	3	1	.44300	266.80	17.200	.72800	1.700	.941	CCODE =	2.0
COMPUTE NM HYD	1103.00	-	2	.25500	224.39	10.562	.77665	1.650	1.375	PER IMP=	5.00
ADD HYD	1103.1+	1& 2	17	.69800	478.84	27.762	.74577	1.650	1.072		
*S											
*S											
*S (16) BASIN 1007											
COMPUTE NM HYD	1007.00	-	18	.18000	165.83	7.840	.81665	1.650	1.439	PER IMP=	5.00
*S											
*S											
*S (17) BASIN 1008											
COMPUTE NM HYD	1008.00	-	19	.01000	14.23	.421	.78987	1.500	2.223	PER IMP=	5.00
*S											
*S											
*S (18) BASIN 1009											
COMPUTE NM HYD	1009.00	-	20	.06000	94.12	2.802	.87567	1.500	2.451	PER IMP=	5.00
*S											
*S											
*S (19) BASIN 2001											
COMPUTE NM HYD	2001.00	-	21	.01200	18.83	.560	.87567	1.500	2.452	PER IMP=	5.00
*S											
*S											
*S (20) BASIN 2002											
COMPUTE NM HYD	2002.00	-	22	.00500	7.86	.234	.87567	1.500	2.455	PER IMP=	5.00
*S											
*S											
*S (21-29) BASIN 2100 - CANON DEL AGUA											

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	NOTATION	
COMPUTE NM HYD	2101.00	-	1	.98400	879.44	54.936	1.04681	1.750	1.396	PER IMP=	5.00
ROUTE MCUNGE	2103.1R	1	2	.98400	879.42	54.983	1.04770	1.850	1.396	CCODE =	.2
COMPUTE NM HYD	2103.00	-	1	.78200	547.98	43.659	1.04681	1.900	1.095	PER IMP=	5.00
ADD HYD	2103.1+	1& 2	3	1.76600	1419.66	98.642	1.04730	1.900	1.256		

COMPUTE NM HYD	2102.00	-	1	1.21800	1012.64	68.001	1.04681	1.800	1.299	PER IMP= 5.00
ADD HYD	2103.2+	1& 3	2	2.98400	2412.60	166.643	1.04710	1.850	1.263	
ROUTE MCUNGE	2104.1R	2	1	2.98400	2383.27	166.259	1.04469	2.550	1.248	CCODE = .1
COMPUTE NM HYD	2104.00	-	2	1.04700	269.12	35.399	.63393	2.200	.402	PER IMP= 5.00
ADD HYD	2104.1+	1& 2	23	4.03100	2596.29	201.657	.93800	2.550	1.006	
*S										
*S										
*S (30) BASIN 2003										
COMPUTE NM HYD	2003.00	-	24	.01600	28.09	.848	.99335	1.500	2.744	PER IMP= 5.00
*S										
*S										
*S (31) BASIN 2004										
COMPUTE NM HYD	2004.00	-	25	.03400	55.08	1.646	.90773	1.500	2.531	PER IMP= 5.00
*S										
*S										
*S (32) BASIN 2005										
COMPUTE NM HYD	2005.00	-	26	.02400	42.13	1.271	.99335	1.500	2.743	PER IMP= 5.00
*S										
*S										
*S (33-39) BASIN 2200										
COMPUTE NM HYD	2201.00	-	1	.24100	132.75	8.721	.67848	1.750	.861	PER IMP= 5.00
ROUTE MCUNGE	2202.1R	1	2	.24100	131.94	8.710	.67761	2.100	.855	CCODE = .1
COMPUTE NM HYD	2202.00	-	1	.22700	234.25	9.724	.80321	1.600	1.612	PER IMP= 5.00
ADD HYD	2202.1+	1& 2	3	.46800	235.38	18.434	.73853	1.600	.786	
ROUTE MCUNGE	2203.1R	3	1	.46800	229.80	18.391	.73683	2.300	.767	CCODE = .1
COMPUTE NM HYD	2203.00	-	2	.82800	539.28	37.355	.84590	1.800	1.018	PER IMP= 5.00
ADD HYD	2203.1+	1& 2	27	1.29600	540.52	55.746	.80651	1.800	.652	
*S										
*S										
*S (40) BASIN 2006										
COMPUTE NM HYD	2006.00	-	28	.10400	145.60	4.308	.77665	1.500	2.188	PER IMP= 5.00
*S										
*S										
*S (41) BASIN 3001										
COMPUTE NM HYD	3001.00	-	29	.02100	35.67	1.073	.95795	1.500	2.654	PER IMP= 5.00
*S										
*S										
ADD HYD	3107.1+	1& 2	30	1.29600	540.52	55.746	.80651	1.800	.652	
RECALL HYD	3100.RES	-	30	4.18200	70.00	185.785	.83297	8.000	.026	
*S										
*S										
*S (58) BASIN 3002										
COMPUTE NM HYD	3002.00	-	31	.02600	44.87	1.353	.97565	1.500	2.696	PER IMP= 5.00
*S										
*S										
*S (59) BASIN 3003										
COMPUTE NM HYD	3003.00	-	32	.01100	20.49	.737	1.25588	1.500	2.911	PER IMP= 25.00
*S										
*S										

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	NOTATION

*S
*S
*S
*S
*S ********** S O U T H B E R N A L I L L O B A S I N S**********
*S
*S (353) BASIN SB100 - BETWEEN BOSQUE LATERAL #2 & RIO GRANDE

COMPUTE NM HYD	SB100	-	62	.21100	75.46	18.844	1.67453	3.100	.559	PER IMP=	57.00
*S											
*S											
*S (354) BASIN SB200 - BETWEEN BOSQUE LAT#1 & CALLE LAGUNA											
COMPUTE NM HYD	SB200	-	63	.06700	45.72	5.990	1.67641	2.200	1.066	PER IMP=	57.00
*S											
*S											
*S (355-402) BASIN SB300 - S BERNALILLO W OF BNSF & N OF AVENIDA BERNALILLO											
COMPUTE NM HYD	SB301	-	9	.04800	84.24	4.999	1.95255	1.600	2.742	PER IMP=	70.00
ROUTE MCUNGE	SB301.UR	30	8	4.18200	70.00	185.785	.83297	8.000	.026	CCODE =	.0
ADD HYD	SB301.U+	8& 9	1	4.23000	87.44	144.937	.64245	1.600	.032		
ROUTE MCUNGE	SB307.1R	1	2	4.23000	112.04	131.863	.58450	9.600	.041	CCODE =	.1
COMPUTE NM HYD	SB302	-	9	.11000	178.85	11.455	1.95254	1.600	2.541	PER IMP=	70.00
ADD HYD	SB302.U+	9&28	8	.21400	294.89	15.763	1.38108	1.550	2.153		
ROUTE MCUNGE	SB302.UR	29	9	.02100	36.10	1.073	.95799	1.550	2.686	CCODE =	2.0
ADD HYD	SB302.2U+	8& 9	1	.23500	330.98	16.836	1.34327	1.550	2.201		
ROUTE MCUNGE	SB304.1R	1	3	.23500	436.82	18.668	1.48944	1.850	2.904	CCODE =	2.0
COMPUTE NM HYD	SB303	-	8	.05900	133.81	6.144	1.95255	1.500	3.544	PER IMP=	70.00
ROUTE MCUNGE	SB303.UR	27	9	1.29600	540.59	55.750	.80656	1.850	.652	CCODE =	.2
ADD HYD	SB303.U+	9& 8	1	1.35500	579.95	61.894	.85646	1.850	.669		
ROUTE MCUNGE	SB304.2R	1	4	1.35500	577.90	61.902	.85658	2.000	.666	CCODE =	.2
COMPUTE NM HYD	SB304	-	1	.05100	58.05	4.237	1.55763	1.700	1.778	PER IMP=	50.00
*S	BASIN SB304 FLOWS GOING INTO RETENTION POND FROM SHEET FLOW										
DIVIDE HYD	111.10	1	**	.04879	46.00	4.053	1.55761	1.600	1.473		
	111.20	and	**	.00221	12.05	.183	1.55761	1.700	8.536		
*S											
*S											
ADD HYD	SB304.3+	1& 3	5	.28600	484.64	22.904	1.50159	1.850	2.648		
ADD HYD	SB304.4+	4& 5	1	1.64100	993.69	84.806	.96899	1.850	.946		
ROUTE MCUNGE	SB306.1R	1	3	1.64100	770.23	84.272	.96289	2.250	.733	CCODE =	.2
COMPUTE NM HYD	SB305	-	9	.08000	161.83	8.331	1.95255	1.550	3.161	PER IMP=	70.00
ADD HYD	SB305.U+	9&23	8	4.11100	2603.37	209.988	.95774	2.550	.989		
ADD HYD	SB305.2U+	8&24	9	4.12700	2603.83	210.836	.95788	2.550	.986		
ADD HYD	SB305.3U+	9&25	8	4.16100	2604.84	212.482	.95747	2.550	.978		
ADD HYD	SB305.4U+	8&26	1	4.18500	2605.54	213.753	.95768	2.550	.973		
ROUTE MCUNGE	SB306.2R	1	4	4.18500	2521.16	212.965	.95414	2.750	.941	CCODE =	.2
COMPUTE NM HYD	SB306	-	1	.12300	110.06	10.116	1.54202	1.850	1.398	PER IMP=	49.00
*S											
*S	BASIN SB306 FLOWS GOING INTO RETENTION POND FROM SHEET FLOW										
DIVIDE HYD	113.10	1	**	.11377	79.00	9.357	1.54201	1.700	1.085		
	114.10	and	**	.00923	31.06	.759	1.54201	1.850	5.258		
*S											
*S	ADD FLOWS INTO RETENTION POND										
ADD HYD	115.10	**&**	**	.16257	125.00	13.410	1.54669	1.700	1.201		
*S											

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	NOTATION	
*S											
ADD HYD	SB306.3+	1& 3	5	1.76400	833.41	94.388	1.00327	2.250	.738		
ADD HYD	SB306.4+	4& 5	1	5.94900	3087.83	307.353	.96871	2.750	.811		
ROUTE MCUNGE	SB309.1R	1	3	5.94900	2959.80	306.354	.96556	2.850	.777	CCODE =	.2
COMPUTE NM HYD	SB307	-	1	.66500	175.13	55.101	1.55360	3.550	.412	PER IMP=	50.00
ADD HYD	SB307.2+	1& 2	4	4.89500	216.52	186.964	.71615	4.300	.069		
ROUTE MCUNGE	SB310.1R	4	1	4.89500	183.90	166.453	.63759	5.700	.059	CCODE =	.2
COMPUTE NM HYD	SB308	-	9	.05400	114.67	6.101	2.11848	1.550	3.318	PER IMP=	80.00
ADD HYD	SB308.U+	9&18	8	.23400	262.04	13.941	1.11707	1.600	1.750		
ADD HYD	SB308.2U+	8&19	9	.24400	272.81	14.362	1.10366	1.550	1.747		
ADD HYD	SB308.3U+	9&20	8	.30400	358.22	17.164	1.05866	1.550	1.841		

ADD HYD	SB308.4U+	8&21	9	.31600	375.31	17.725	1.05171	1.550	1.856	
ADD HYD	SB308.5U+	9&22	2	.32100	382.43	17.958	1.04897	1.550	1.862	
ROUTE MCUNGE	SB309.2R	2	4	.32100	388.22	18.918	1.10503	1.950	1.890	CCODE = 2.0
COMPUTE NM HYD	SB309	-	9	.12000	124.22	9.969	1.55763	1.750	1.617	PER IMP= 50.00
ROUTE MCUNGE	SB309.UR	17	8	.69800	476.05	27.676	.74345	1.800	1.066	CCODE = .1
ADD HYD	SB309.U+	8& 9	2	.81800	598.26	37.645	.86289	1.800	1.143	
ADD HYD	SB309.3+	2& 3	5	6.76700	3033.98	343.999	.95315	2.850	.701	
ADD HYD	SB309.4+	4& 5	2	7.08800	3117.18	362.917	.96003	2.850	.687	
ROUTE MCUNGE	SB310.2R	2	3	7.08800	2825.00	359.898	.95205	3.200	.623	CCODE = .2
COMPUTE NM HYD	SB310	-	2	.55000	164.73	45.615	1.55504	3.300	.468	PER IMP= 50.00
ADD HYD	SB310.3+	1& 2	4	5.44500	221.77	212.068	.73026	5.650	.064	
ADD HYD	SB310.4+	3& 4	1	12.53300	3004.71	571.967	.85569	3.200	.375	
COMPUTE NM HYD	SB311	-	2	.25600	50.82	21.145	1.54874	4.350	.310	PER IMP= 50.00
ADD HYD	SB311.1+	1& 2	64	12.78900	3035.72	593.113	.86956	3.250	.371	

*S
*S
*S (403-418) BASIN SB400 - S BERNALILLO E OF BNSF & S OF AVENIDA BERNALILLO

COMPUTE NM HYD	SB401	-	9	.02800	27.99	.872	.58387	1.500	1.562	PER IMP= 5.00
ADD HYD	SB401.U+	16& 9	1	.03900	41.51	1.277	.61397	1.500	1.663	
ROUTE MCUNGE	SB404.1R	1	2	.03900	39.52	1.267	.60919	1.700	1.583	CCODE = .2
COMPUTE NM HYD	SB402	-	9	.04600	31.42	1.432	.58387	1.600	1.067	PER IMP= 5.00
ADD HYD	SB402.U+	13& 9	8	.22000	239.22	9.011	.76797	1.550	1.699	
ADD HYD	SB402.2U+	14&15	9	.04600	56.50	1.694	.69063	1.500	1.919	
ADD HYD	SB402.3U+	8& 9	1	.26600	291.35	10.705	.75460	1.550	1.711	
ROUTE MCUNGE	SB404.2R	1	3	.26600	485.35	10.393	.73260	1.900	2.851	CCODE = 2.0
COMPUTE NM HYD	SB403	-	9	.02900	28.99	.903	.58387	1.500	1.562	PER IMP= 5.00
ADD HYD	SB403.U+	11& 9	8	.06600	83.05	2.515	.71436	1.500	1.966	
ADD HYD	SB403.2U+	12& 8	1	.11200	150.26	4.518	.75637	1.500	2.096	
ROUTE MCUNGE	SB404.3R	1	4	.11200	83.13	3.372	.56444	2.350	1.160	CCODE = 2.0
COMPUTE NM HYD	SB404	-	1	.23100	191.49	19.190	1.55762	1.900	1.295	PER IMP= 50.00
ADD HYD	SB404.4+	1& 2	5	.27000	216.74	20.457	1.42062	1.850	1.254	
ADD HYD	SB404.5+	3& 5	1	.53600	692.37	30.850	1.07918	1.900	2.018	

*S
*S BERNALILLO, BNSF TO I-25/AVE BERNALILLO TO SANDIA PUEBLO

ADD HYD	SB404.6+	1& 4	65	.64800	726.51	34.222	.99021	1.900	1.752	

*S
*S
*S (419-420) BASIN SB500 - HILL RD TO I-25/LOS ARBOLES TO SANDIA PUEBLO

COMPUTE NM HYD	SB500	-	1	.02100	21.00	.654	.58387	1.500	1.562	PER IMP= 5.00
ADD HYD	SB500.1+	10& 1	66	.04300	53.15	1.612	.70295	1.500	1.931	

*S

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	NOTATION

*S
*S
*S (421-424) SOUTH BERNALILLO, TOTAL FLOWS

ADD HYD	SBTOT1	62&63	1	.27800	91.37	24.834	1.67498	2.800	.514
ADD HYD	SBTOT2	1&64	2	13.06700	3121.33	617.946	.88670	3.200	.373
ADD HYD	SBTOT3	2&65	1	13.71500	3153.51	652.168	.89159	3.200	.359
ADD HYD	SBTOT	1&66	2	13.75800	3153.83	653.779	.89100	3.200	.358

*S
*S
*S
FINISH