Presidio
ENGINEERING, INC.

4582 N. 1ST AVENUE, SUITE 120, TUCSON, ARIZONA 85718
(520) 795-7255 FAX (520) 795-6747

MEMORANDUM

TO: Paul Baughman, EIT
Town of Marana

FROM: Tanya Grahn

DATE: August 29, 2006

SUBJECT: The Pines Phase I Soils Report, ENG0511-015
Presidio Engineering Job No. 104023-03-0500

COPIES TO: Gerrie Gray, Standard Pacific Homes w/ attachment
John D. Wood, P.E., Presidio Engineering w/o attachment

In response to your July 14, 2006 memo regarding the above referenced project, please find attached two copies Terracon's August 21, 2006, Addendum 7 to the Geotechnical Engineering Report for review and approval.

Let us know if you have any questions or require additional information.

Attachment

Terracon
Consulting Engineers & Scientists

355 South Euclid, Suite 107
Tucson, Arizona 85719
Phone 520.770.1789
Fax 520.792.2539
www.terracon.com

August 21, 2006

Standard Pacific of Tucson
4578 North First Avenue
Tucson, Arizona 85718-5748

Attn: Mr. Bob Storie

RE: Addendum 7 to Geotechnical Engineering Report
Phase I Residential Development at the Pines
At the Pines Golf Course
North of Cortaro Road and West of Interstate 10
Marana, Arizona
Terracon Project No. 63045225, Addendum 7

Terracon has completed the geotechnical engineering report for the Residential Development at the Pines (Terracon project 63045525 dated December 8, 2004). We have been contacted by John Wood at Presidio Engineering to provide additional information concerning Continental Links Drive for this project. We have previously provided information concerning Continental Links Drive in Addendum 2, dated June 6, 2005.

Based on revised anticipated traffic volumes for Continental Links Drive, considering traffic generated from The Pines Phase I, The Pines Phase II, and the golf course, the anticipated traffic volume will be 3,750 ADT. Revised traffic volumes were provided by Scott Beck of Kimley-Horn associates.

The site soils have a correlated R-value of 49 which equates to a resilient modulus value M_r of 23,385 psi using a seasonal variation factor of 1.7 for Marana. Based on an ADT of 3,750 we estimate 1,112,246 design ESAL's. Using this data and ADOT/AASHTO design procedures a required structural number of 2.20 is calculated. A minimum pavement section consisting of 3.5 inches of asphalt (PAG Mix No. 2) over 6 inches of aggregate base course has a structural number of 2.20 and is recommended for design. Alternatively, a pavement section of 3.0 inches of asphalt over 8 inches of aggregate base course has a structural number of 2.20 and may also be used.

Materials and construction of pavements for the project should be in accordance with the requirements and specifications of the Pima County/City of Tucson Standard Specifications for Public Improvements.

Please see the attached calculation sheets for our assumed traffic distribution and information concerning the parameters used to design the pavement section.

All other recommendations previously provided remain valid. If you have any questions regarding this letter please contact us.

Sincerely,

TERRACON

Bryan W. Reed, P.E.
Project Manager

Oleg B. Lysyj, P.E.
Geotechnical Services Manager

Copies: Addressee (3)
Presidio Engineering (1) Attn: John Wood

Design Traffic Analysis

- All Truck Factors are 18-kip equivalents per vehicle per ADOT

Initial Data

PROJECT DATA

Project name:	The Pines
Location:	Marana, Arizona
TCW Project No.	63045225

STREET DATA

Street Name	Continental Links Drive - Revision 1
Design Average Daily Traffic (ADT)	3,750
Design Period (years)	20
Number of Traffic Lanes (2, 4 or 6)	2

Equivalent 18-kip Axle Load Analysis

Vehicle Type	% of Traffic	No. of Vehicles/Day	18-kip Factor	Design Years	Equivalent Axle Loads
Non-Commercial Vehicles					
Automobiles	66.0%	2,475	0.0008	20.00	14,454
Buses	0.0%	0	0.2500	20.00	0
All Non-Commercial Vehicles	66.0%	2,475			14,454
Commercial Vehicles					
Light Trucks (LT)	31.0%	1,163	0.0100	20.00	84,863
Medium Trucks	1.5%	56	0.4000	20.00	164,250
Tractor and Semi-Trailer (TS)	1.5%	56	2.0668	20.00	848,680
Truck and Trailer (TT)	0.0%	0	2.0227	20.00	0
Tractor and Semi-Trailer (TST)	0.0%	0	3.1506	20.00	0
All Commercial Vehicles	34.0%	1,275			1,097,792
All Vehicles	**100.0%**	**3,750**			**1,112,246**

Traffic Summary

TOTALS

Equivalent Axle Loads (EAL's)	1,112,246
Directional Factor	1.00
Lane Factor	1.00
Design Equivalent Axle Loads	**1,112,246**
Design Traffic Number (DTN)	**152**

Flexible Pavement Design Analysis

Design Criteria

Project Name: Continental Links Drive - Revision 1
Project Number: 630453225

PROJECT DATA

Design Life (years)	20
Equivalent Axle Loads/Day	**
Total EAL's	1,112,246
Seasonal Variation Factor	1.6
Reliability	90%
Overall Standard Deviation	0.35

SUBGRADE CONDITIONS

AASHTO Classification	**
% Passing #200 Sieve	**
Plasticity Index	**
Correlated R-Value	49
Resilient Modulus MR (psi)	23,385
Design Modulus (psi)	23,385

SERVICEABILITY

Present (2.5 to 5.0)	4.1
Terminal (1.5 to 4.1)	2.6

LAYER COEFFICIENTS	Structural	Drainage
Asphalt Rubber Asphaltic Concrete	0.55	N/A
Asphalt Concrete Surface Course	0.44	N/A
Aggregate Base Course	0.12	0.92
Cement or Bituminous Subgrade	0.23	1.00
Cement or Bituminous Treated Base	0.28	1.00

Design Calculations

Target Structural Number SN: 2.20

Alternative	Recommended Pavement Section Thickness Inches					Total Structural Number
	Asphalt Rubber Concrete	Asphalt Concrete Surface	Aggregate Base Course	Plant-Mixed Bituminous Base	Total	
A		3.0	6		9.0	1.98
B		3.5	6.0		9.5	2.20
C		3.0	8		11.0	2.20

10403a4-c2- 05PC
Rec 10/21/04

Terracon
Consulting Engineers & Scientists

355 South Euclid, Suite 107
Tucson, Arizona 85719
Phone 520.770.1789
Fax 520.792.2539
www.terracon.com

September 29, 2004

Standard Pacific of Tucson
4578 North First Avenue
Suite 160
Tucson, Arizona 85718-5748

Attn: Mr. Bob Storie

RE: Preliminary Geotechnical Site Evaluation
Proposed Phase II Residential Developments at the Pines Golf Course
North of Cortaro Road and West of Interstate 10
Marana, Arizona
Terracon Project No. 63045195

Terracon Consultants, Inc. (Terracon) has completed our preliminary review of the proposed Phase II Residential Development at the Pines Golf Course. Our preliminary evaluation was performed in general accordance with our proposal number D6304220, dated September 24, 2004.

Introduction

We understand the proposed project consists of Phase II of the area presently known as the Pines Golf Course. Phase II covers about 56 acres and is planned for both single and multi-family housing. Phase II was formerly a golf course.

Presidio Engineering has provided us with a geotechnical report for the Phase II area (performed by Pattison Evanoff Engineering). We have also been provided with a preliminary site exhibit for Phase I (prepared by WLB).

Work Performed

We visited the site on September 27, 2004 and reviewed the site conditions. We reviewed the preliminary site exhibit and geotechncial report provided to us.

Preliminary Findings and Conclusions

This site is surrounded by an existing golf course. The site had previously been a golf course and some of the golf course features are still visible. The geotechnical report we reviewed appeared fairly comprehensive and the field and laboratory work performed appeared typical of the level of work to provide recommendations for a residential subdivision at this site. The

SUBMITTAL NO. PRV-05154

report provided recommendations for the design of foundations, floor slabs, pavements, and earthwork. The report identified existing fills and recommended further evaluation to help better identify the vertical and lateral extents of those fills. We believe this may be accomplished by performing shallow backhoe test pits, focusing on areas around where existing fills were identified in the soil borings. Any existing site slopes steeper than about 2 to 1 (horizontal to vertical) will likely need to be flattened.

If you have any questions regarding this preliminary evaluation, please contact us.

Sincerely,

TERRACON CONSULTANTS, INC.

Oleg B. Lysyj, P.E.
Geotechnical Services Manager

N:\PUBLIC\04georept\63045195\63045195B.rpt.doc

FOLLOW-UP TO PRELIMINARY
GEOTECHNICAL SITE EVALUATION

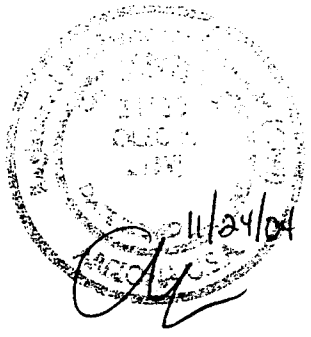
PROPOSED PHASE II RESIDENTIAL DEVELOPMENTS
AT THE PINES GOLF COURSE
CONTINENTAL LINKS AND ARIZONA PAVILIONS ROAD
MARANA, ARIZONA

TERRACON PROJECT NO. 63045218
NOVEMBER 24, 2003

Prepared for:

STANDARD PACIFIC OF TUCSON
4578 NORTH FIRST AVENUE
SUITE 160
TUCSON, ARIZONA 85718

ATTN: MR. BOB STORIE



Prepared by:

TERRACON
355 SOUTH EUCLID AVENUE, SUITE 107
TUCSON, ARIZONA 85719
Phone (520) 770-1789 Fax (520) 792-2539

SUBMITTAL NO. 1
PRV - 05154

Terracon

Terracon
Consulting Engineers & Scientists

355 South Euclid, Suite 107
Tucson, Arizona 85719
Phone 520.770.1789
Fax 520.792.2539
www.terracon.com

November 24, 2004

Standard Pacific of Tucson
4578 North First Avenue
Suite 160
Tucson, Arizona 85718-5748

Attn: Mr. Bob Storie

RE: Follow-Up to Preliminary Geotechnical Site Evaluation
Proposed Phase II Residential Developments at the Pines Golf Course
Continental Links and Arizona Pavilions Road
Marana, Arizona
Terracon Project No. 63045218

Terracon Consultants, Inc. (Terracon) has completed the follow-up investigation to our preliminary review of the proposed Phase II Residential Development at the Pines Golf Course. Our follow-up investigation was performed in general accordance with our proposal number D6304242, dated September 24, 2004, also reference Terracon Report 63055195 dated September 29, 2004.

Introduction

We understand the proposed project consists of Phase II of the area presently known as the Pines Golf Course. Phase II covers about 56 acres and is planned for both single and multi-family housing. Phase II was formerly a golf course.

Presidio Engineering has provided us with a geotechnical report for the Phase II area (performed by Pattison Evanoff Engineering). We have also been provided with a preliminary site exhibit for Phase I (prepared by WLB).

The original geotechnical report (performed by Pattison Evanoff Engineering) identified existing fill in one area of the golf course. The purpose of this investigation is to evaluate the extents, both in depth and laterally, of existing fills at the site, evaluate slope areas and recommend geometry for cut and fill slopes, and determine the applicability of the original recommendations for portions of the site now planned for multi-family housing.

Work Performed

On November 4 and 8, 2004 we performed 17 test pits with a John Deere 310G tractor mounted backhoe using an 18-inch wide bucket. The test pits were extended to depths of approximately 5 feet below existing grade at the locations shown on the Site Plan, Figure 1.

The test-pits were located in the field by measurements from property lines and existing site features. The accuracy of test-pit locations should only be assumed to the level implied by the methods used to determine each.

Continuous lithologic logs of each test-pit were recorded by the geotechnical engineer during the excavation. At selected test-pits, samples of the subsurface materials were obtained from excavated trench material.

Groundwater conditions were evaluated in each boring at the time of site exploration.

Findings and Conclusions

This site is surrounded by an existing golf course. The site had previously been a golf course and some of the golf course features are still visible. The geotechnical report we reviewed appeared fairly comprehensive and the field and laboratory work performed appeared typical of the level of work to provide recommendations for a residential subdivision at this site. The report appears to have provided adequate recommendations for the design of foundations, floor slabs, pavements, and earthwork.

Although it was difficult to delineate the existing fill from the native material, it appears that the hill features created during the sculpting of the old golf course contain a minimum of three to four feet of fill material, therefore we recommend the high points be removed. It appears that most of these features will be taken down for the construction of house pads and grading for site drainage.

For permanent slopes in compacted fill and cut native areas, recommended maximum configurations for on-site materials are 2 to 1 (horizontal to vertical). Slopes steeper than 3 to 1 (horizontal to vertical) should be re-vegetated to help reduce surface erosion.

The face of all slopes should be compacted to the minimum specification for fill embankments. Alternately, fill slopes can be over-built and trimmed to compacted material. If any slope in cut or fill will exceed 25 feet in height, the grading plan should include mid-height benches to intercept surface drainage and divert flow from the face of the embankment.

Slopes with inclinations between 2 to 1, and 1 to 1 may be constructed provided they are surfaced with grouted rip-rap or grout at least 6-inches thick, and integrated with a vertical toe-down. The grout toe-down should extend to depths of 1 foot below the base of the slope for slopes 0-5 feet high, 2 feet for slopes 5 to 10 feet high, and 3 feet for slopes 10 to 15 feet high.

If you have any questions regarding this preliminary evaluation, please contact us.

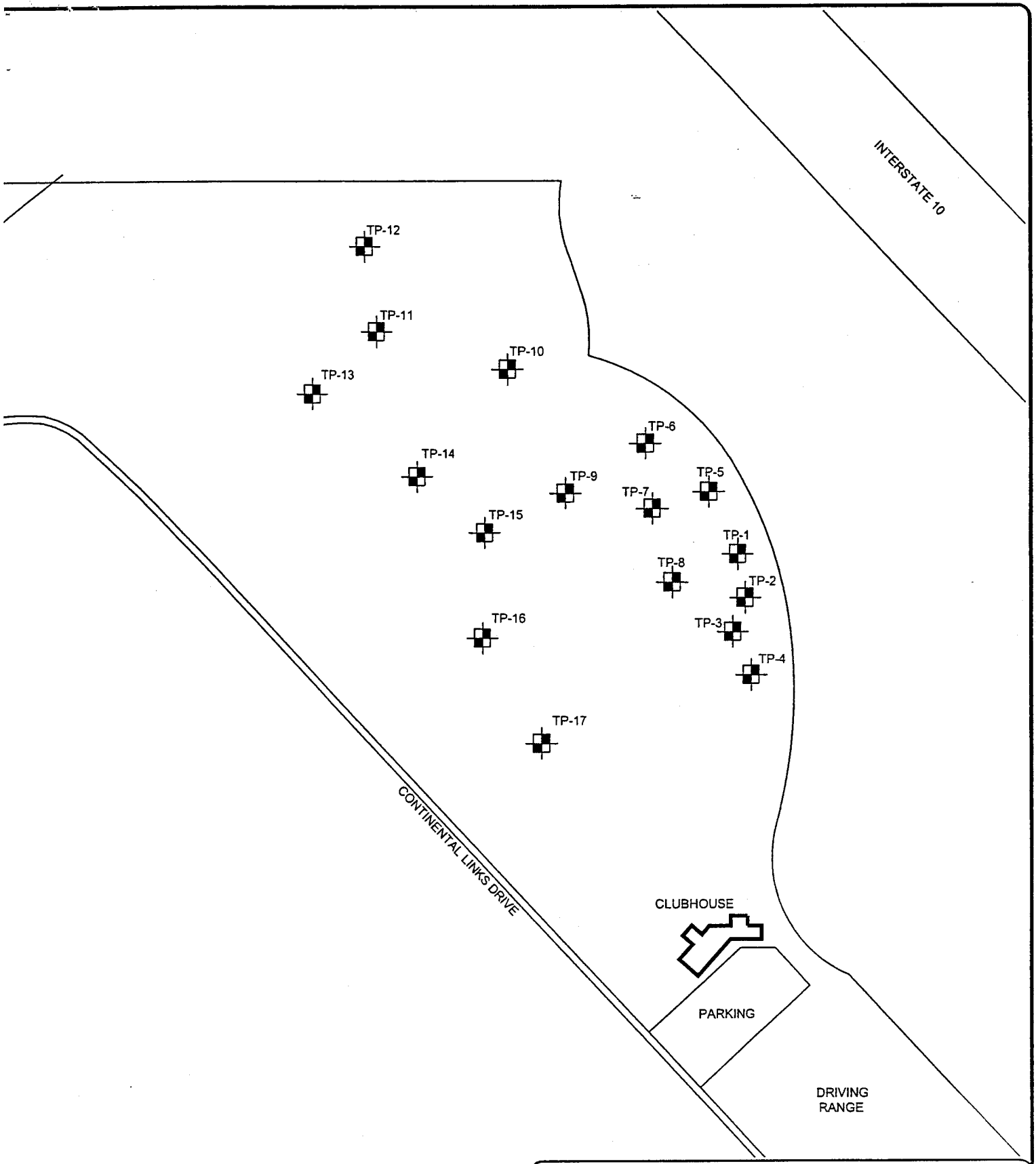
Sincerely,

TERRACON CONSULTANTS, INC.

Bryan W. Reed, E.I.T.
Project Manager

Oleg B. Lysyj, P.E.
Geotechnical Services Manager

N:\public\04georept\63045218.rpt



LEGEND

APPROXIMATE TEST-PIT LOCATION

N

SITE PLAN AND BORING LOCATIONS
THE PINES - PHASE II
CONTINENTAL LINKS AND ARIZONA PAVILIONS ROAD
MARANA, ARIZONA
STANDARD PACIFIC OF TUCSON

Project Mngr: BWR	Terracon	Project No.	63045218
Designed By:		Scale:	None
Checked By:	355 South Euclid, Suite 107 Tucson, Arizona 85719	Date:	11-22-04
Approved By: OBL		Drawn By:	BWR(63)
File Name: n:\public\04georept\63045218\63045218.dwg L(Layout1)		Figure No.	1

DIAGRAM IS FOR GENERAL LOCATION ONLY,
AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

LOG OF TEST PIT NO. TP-01

CLIENT **Standard Pacific of Tucson**

SITE **The Pines Golf Course**
Marana, Arizona

PROJECT
Phase II Residential Developments

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (in)	SAMPLES BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS Liquid Limit	TESTS PLASTICITY INDEX	TESTS -200
	FILL: SANDY CLAY/SILT; dark brown, low plasticity fines, moist		CL-ML	1	BS							
3												
	SANDY CLAY SILT; brown, low plasticity fines, moist		CL									
5		5										
	Bottom of Test Pit											

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ None WD	▼ None AB
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	11-4-04		
BORING COMPLETED	11-4-04		
RIG	JD 310G	FOREMAN	BWR
Approved	OBL	JOB #	63045218

BOREHOLE 2000 63045218.GPJ TERR2000.GDT 11/23/04

LOG OF TEST PIT NO. TP-02

CLIENT **Standard Pacific of Tucson**

SITE **The Pines Golf Course**
Marana, Arizona

PROJECT
Phase II Residential Developments

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (in)	SAMPLES BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS Liquid Limit	TESTS PLASTICITY INDEX	TESTS -200
	SILTY SAND; light brown, non-plastic fines, moist		SM	1	BS							
	5	5										
	Bottom of Test Pit											

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ None WD	▼ None AB
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	11-4-04		
BORING COMPLETED	11-4-04		
RIG	JD 310G	FOREMAN	BWR
Approved	OBL	JOB #	63045218

BOREHOLE 2000 63045218.GPJ TERR2000.GDT 11/23/04

LOG OF TEST PIT NO. TP-03

CLIENT **Standard Pacific of Tucson**

SITE **The Pines Golf Course**
Marana, Arizona

PROJECT
Phase II Residential Developments

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (in)	SAMPLES BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS Liquid Limit	TESTS PLASTICITY INDEX	TESTS -200
	SANDY CLAY/SILT; low plasticity fines, moist		CL-ML	1	BS							
	5	5										
	Bottom of Test Pit											

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ None WD	▼ None AB
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	11-4-04		
BORING COMPLETED	11-4-04		
RIG	JD 310G	FOREMAN	BWR
Approved	OBL	JOB #	63045218

BOREHOLE 2000 63045218.GPJ TERR2000.GDT 11/23/04

LOG OF TEST PIT NO. TP-04

CLIENT **Standard Pacific of Tucson**

SITE **The Pines Golf Course**
Marana, Arizona

PROJECT
Phase II Residential Developments

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (in)	SAMPLES BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS Liquid Limit	TESTS PLASTICITY INDEX	TESTS -200
	SANDY CLAY/SILT; brown, low plasticity fines, moist		CL-ML	1	BS							
		5										
	Bottom of Test Pit	5										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ None WD	▼ None AB
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	11-4-04		
BORING COMPLETED	11-4-04		
RIG	JD 310G	FOREMAN	BWR
Approved	OBL	JOB #	63045218

BOREHOLE 2000 63045218.GPJ TERR2000.GDT 11/23/04

LOG OF TEST PIT NO. TP-05

CLIENT **Standard Pacific of Tucson**

SITE **The Pines Golf Course**
Marana, Arizona

PROJECT
Phase II Residential Developments

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (in)	SAMPLES BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS Liquid Limit	TESTS PLASTICITY INDEX	TESTS -200
	SILTY SAND; light brown, non-plastic fines, moist		SM	1	BS							
	5	5										
	Bottom of Test Pit											

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ None WD	▼ None AB
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	11-4-04		
BORING COMPLETED	11-4-04		
RIG	JD 310G	FOREMAN	BWR
Approved	OBL	JOB #	63045218

BOREHOLE 2000 63045218.GPJ TERR2000.GDT 11/23/04

LOG OF TEST PIT NO. TP-06

CLIENT: **Standard Pacific of Tucson**

SITE: **The Pines Golf Course**
Marana, Arizona

PROJECT: **Phase II Residential Developments**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (in)	SAMPLES BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS Liquid Limit	TESTS PLASTICITY INDEX	TESTS -200
	SANDY CLAY/SILT; brown, low plasticity fines, moist		CL-ML	1	BS							
3												
	SILTY SAND TRACE GRAVEL; light brown, non-plastic fines, moist		SM									
5		5										
	Bottom of Test Pit											

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft			
WL	▽ None WD	▼ None AB	
WL	▽	▼	
WL	Backfilled Upon Completion		

Terracon

BORING STARTED	11-4-04		
BORING COMPLETED	11-4-04		
RIG	JD 310G	FOREMAN	BWR
Approved	OBL	JOB #	63045218

BOREHOLE 2000 63045218.GPJ TERR2000.GDT 11/23/04

LOG OF TEST PIT NO. TP-07

CLIENT **Standard Pacific of Tucson**

SITE **The Pines Golf Course**
Marana, Arizona

PROJECT
Phase II Residential Developments

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (in)	SAMPLES BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS Liquid Limit	TESTS PLASTICITY INDEX	TESTS -200
	SANDY CLAY/SILT; brown, low plasticity fines, moist		CL-ML	1	BS							
4												
	SILTY SAND; non-plastic fines, moist		SM									
5												
	Bottom of Test Pit	5										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ None WD	▼ None AB
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	11-4-04		
BORING COMPLETED	11-4-04		
RIG	JD 310G	FOREMAN	BWR
Approved	OBL	JOB #	63045218

BOREHOLE 2000 63045218.GPJ TERR2000.GDT 11/23/04

LOG OF TEST PIT NO. TP-08

CLIENT **Standard Pacific of Tucson**

SITE **The Pines Golf Course**
Marana, Arizona

PROJECT
Phase II Residential Developments

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (in)	SAMPLES BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS Liquid Limit	TESTS PLASTICITY INDEX	TESTS -200
	SANDY CLAY/SILT; brown, low plasticity fines, moist		CL-ML	1	BS							
	5	5										
	Bottom of Test Pit											

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ None WD	▼ None AB
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	11-4-04		
BORING COMPLETED	11-4-04		
RIG	JD 310G	FOREMAN	BWR
Approved	OBL	JOB #	63045218

BOREHOLE 2000 63045218.GPJ TERR2000.GDT 11/23/04

LOG OF TEST PIT NO. TP-09

CLIENT: **Standard Pacific of Tucson**

SITE: **The Pines Golf Course, Marana, Arizona**

PROJECT: **Phase II Residential Developments**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY (in)	SAMPLES: BLOWS/FT.	TESTS: WATER CONTENT, %	TESTS: DRY DENSITY pcf	TESTS: Liquid Limit	TESTS: PLASTICITY INDEX	TESTS: -200
	SANDY SILT WITH ORGANIC MATERIAL; loose, non-plastic fines, moist, roots and grass		ML	1	BS							
	2											
	SILTY SAND; very loose, non-plastic fines, moist		SM									
	2.5											
	SANDY LEAN CLAY; brown, loose to medium dense, medium plasticity fines, moist		CL									
	5	5										
	Bottom of Test Pit											

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ None WD	▼ None AB
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	11-8-04		
BORING COMPLETED	11-8-04		
RIG	JD 310G	FOREMAN	BWR
Approved	OBL	JOB #	63045218

BOREHOLE 2000 63045218.GPJ TERR2000.GDT 11/23/04

LOG OF TEST PIT NO. TP-10

CLIENT **Standard Pacific of Tucson**

SITE **The Pines Golf Course**
Marana, Arizona

PROJECT
Phase II Residential Developments

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (in)	SAMPLES BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS Liquid Limit	TESTS PLASTICITY INDEX	TESTS -200
	SANDY SILT WITH ORGANIC MATERIAL; loose, low plasticity fines, moist		ML	1	BS							
	1.5											
	SANDY LEAN CLAY; brown, loose to medium dense, medium plasticity fines, moist		CL									
	5	5										
	Bottom of Test Pit											

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ None WD	▼ None AB
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	11-8-04		
BORING COMPLETED	11-8-04		
RIG	JD 310G	FOREMAN	BWR
Approved	OBL	JOB #	63045218

BOREHOLE 2000 63045218.GPJ TERR2000.GDT 11/23/04

LOG OF TEST PIT NO. TP-11

CLIENT: Standard Pacific of Tucson

SITE: The Pines Golf Course, Marana, Arizona

PROJECT: Phase II Residential Developments

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (in)	SAMPLES BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS Liquid Limit	TESTS PLASTICITY INDEX	TESTS -200
	SANDY SILT WITH ORGANIC MATERIAL; loose, medium plasticity fines, moist	2	CL	1	BS							
	SANDY LEAN CLAY; brown, loose to medium dense, medium plasticity fines, moist	5	CL									
	Bottom of Test Pit	5										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ None WD	▼ None AB
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	11-8-04		
BORING COMPLETED	11-8-04		
RIG	JD 310G	FOREMAN	BWR
Approved	OBL	JOB #	63045218

BOREHOLE 2000 63045218.GPJ TERR2000.GDT 11/23/04

LOG OF TEST PIT NO. TP-12

CLIENT: Standard Pacific of Tucson

SITE: The Pines Golf Course, Marana, Arizona

PROJECT: Phase II Residential Developments

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (in)	SAMPLES BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS Liquid Limit	TESTS PLASTICITY INDEX	TESTS -200
	SANDY SILT WITH ORGANIC MATERIAL; medium plasticity fines, moist	0.5	CL	1	BS							
	SANDY LEAN CLAY; medium plasticity fines, moist	5	CL									
	Bottom of Test Pit											

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ None WD	▼ None AB
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	11-8-04		
BORING COMPLETED	11-8-04		
RIG	JD 310G	FOREMAN	BWR
Approved	OBL	JOB #	63045218

BOREHOLE 2000 63045218.GPJ TERR2000.GDT 11/23/04

LOG OF TEST PIT NO. TP-13

CLIENT **Standard Pacific of Tucson**

SITE **The Pines Golf Course**
Marana, Arizona

PROJECT
Phase II Residential Developments

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (in)	SAMPLES BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS Liquid Limit	TESTS PLASTICITY INDEX	TESTS -200
	SANDY SILT WITH ORGANIC MATERIAL; loose, non-plastic fines, moist	1	ML	1	BS					0	0	60
	SANDY SILT; loose, non-plastic fines, moist	5	ML									
	Bottom of Test Pit	5										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ None WD	▼ None AB
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	11-8-04		
BORING COMPLETED	11-8-04		
RIG	JD 310G	FOREMAN	BWR
Approved	OBL	JOB #	63045218

BOREHOLE 2000 63045218.GPJ TERR2000.GDT 11/23/04

LOG OF TEST PIT NO. TP-14

CLIENT **Standard Pacific of Tucson**

SITE **The Pines Golf Course**
Marana, Arizona

PROJECT
Phase II Residential Developments

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (in)	SAMPLES BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS Liquid Limit	TESTS PLASTICITY INDEX	TESTS -200
	SANDY SILT WITH ORGANIC MATERIAL; loose, non-plastic fines, moist		ML	1	BS							
1												
	SANDY LEAN CLAY; loose to medium dense, non-plastic fines, moist		ML									
5												
	Bottom of Test Pit	5										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ None WD	▼ None AB
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	11-8-04		
BORING COMPLETED	11-8-04		
RIG	JD 310G	FOREMAN	BWR
Approved	OBL	JOB #	63045218

BOREHOLE 2000 63045218.GPJ TERR2000.GDT 11/23/04

LOG OF TEST PIT NO. TP-15

CLIENT **Standard Pacific of Tucson**

SITE **The Pines Golf Course**
Marana, Arizona

PROJECT **Phase II Residential Developments**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (in)	SAMPLES BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS Liquid Limit	TESTS PLASTICITY INDEX	TESTS -200
	SANDY SILT WITH ORGANIC MATERIAL; loose, low plasticity fines, moist		ML	1	BS					28	6	79
	2											
	SANDY SILT; loose to medium dense, low plasticity fines, moist		ML									
	5											
	Bottom of Test Pit	5										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ None WD	▼ None AB
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	11-8-04		
BORING COMPLETED	11-8-04		
RIG	JD 310G	FOREMAN	BWR
Approved	OBL	JOB #	63045218

BOREHOLE 2000 63045218.GPJ TERR2000.GDT 11/23/04

LOG OF TEST PIT NO. TP-16

CLIENT: **Standard Pacific of Tucson**

SITE: **The Pines Golf Course**
Marana, Arizona

PROJECT: **Phase II Residential Developments**

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (in)	SAMPLES BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS Liquid Limit	TESTS PLASTICITY INDEX	TESTS -200
	SANDY SILT WITH ORGANIC MATERIAL; loose, non-plastic fines, moist		ML	1	BS							
1												
	SANDY LEAN CLAY; brown, loose to medium dense, medium plasticity fines, moist		CL									
5												
	Bottom of Test Pit	5										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ None WD	▼ None AB
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	11-8-04		
BORING COMPLETED	11-8-04		
RIG	JD 310G	FOREMAN	BWR
Approved	OBL	JOB #	63045218

BOREHOLE 2000 63045218.GPJ TERR2000.GDT 11/23/04

LOG OF TEST PIT NO. TP-17

CLIENT: Standard Pacific of Tucson

SITE: The Pines Golf Course, Marana, Arizona

PROJECT: Phase II Residential Developments

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (in)	SAMPLES BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS Liquid Limit	TESTS PLASTICITY INDEX	TESTS -200
	SANDY CLAY WITH ORGANIC MATERIAL; loose top soil, low plasticity fines, moist		ML	1	BS					25	10	65
	1.5											
	SANDY LEAN CLAY; loose to medium dense, medium plasticity fines, moist		CL									
	5	5										
	Bottom of Test Pit											

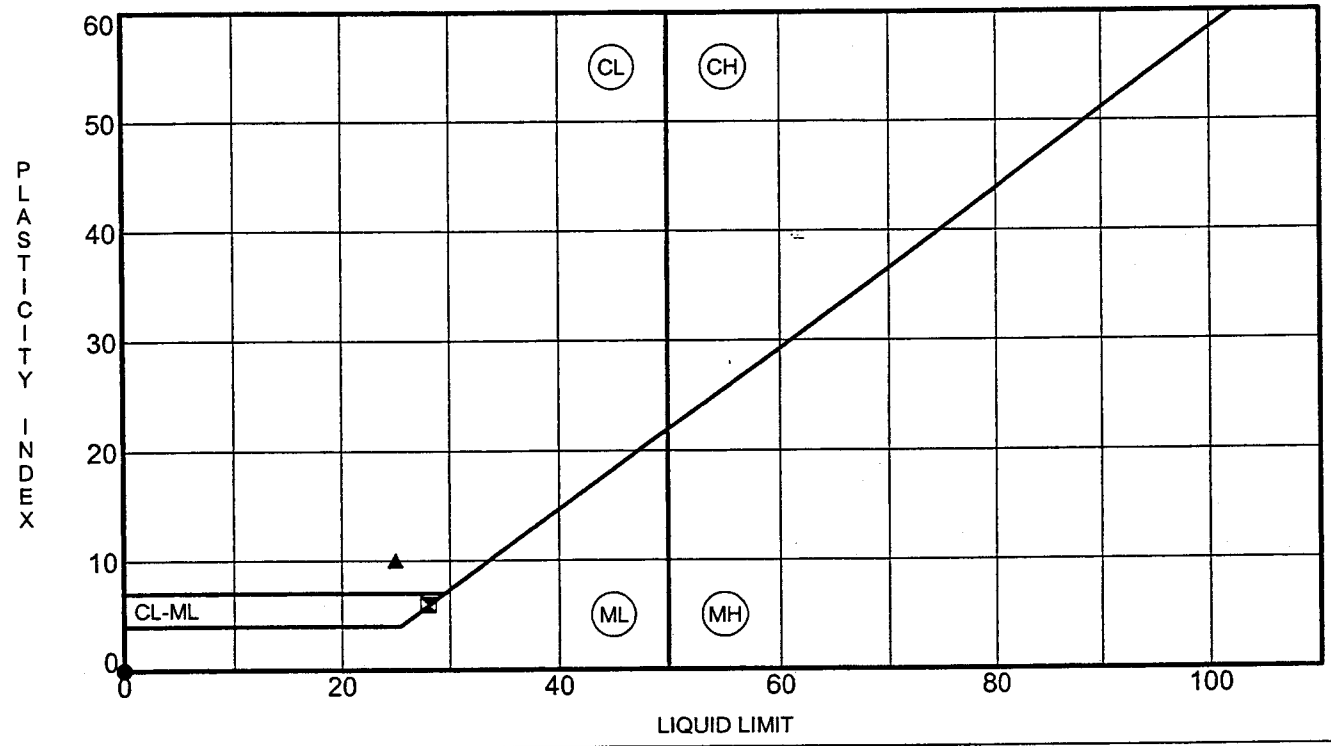
The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ None WD	▼ None AB
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED	11-8-04		
BORING COMPLETED	11-8-04		
RIG	JD 310G	FOREMAN	BWR
Approved	OBL	JOB #	63045218

BOREHOLE 2000 63045218.GPJ TERR2000.GDT 11/24/04



Specimen Identification		LL	PL	PI	%Fines	Classification
● TP-13	0.0ft	NP	NP	NP	60	SANDY SILT WITH ORGANIC MATERIAL (ML)
⊠ TP-15	0.0ft	28	22	6	79	SANDY SILT WITH ORGANIC MATERIAL (ML)
▲ TP-17	0.0ft	25	15	10	65	SANDY CLAY WITH ORGANIC MATERIAL (CL)

Terracon

ATTERBERG LIMITS RESULTS

Project: Phase II Residential Developments
Site: The Pines Golf Course Marana, Arizona
Job #: 63045218
Date: 11-24-04

TC ATTERBERG LIMITS 63045218.GPJ TERRACON.GDT 11/24/04

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Remolded Expansion				Corrosivity				Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Dry Density (pcf)	Water Content (%)	Surcharge (psf)	Expansion (%)	pH	Resistivity (ohm-cm)	Water Soluble Salts (ppm)	Sulfates (ppm)	
						LL	PL	PI									
TP-13	0.0	ML			60	NP	NP	NP									
TP-15	0.0	CL-ML			79	28	22	6									
TP-17	0.0	CL			65	25	15	10									

REMARKS

1. Dry density and/or moisture determined from one or more rings of a multi-ring sample.
2. Visual Classification.
3. Submerged to approximate saturation.
4. Compacted density (approximately 95% of ASTM D698 maximum density at moisture content slightly below optimum).

Terracon

SUMMARY OF LABORATORY RESULTS

Project: Phase II Residential Developments
Site: The Pines Golf Course Marana, Arizona
Job #: 63045218
Date: 11-23-04

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1-3/8" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube - 2" O.D., unless otherwise noted	PA:	Power Auger
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB:	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value". For 3" O.D. ring samplers (RS) the penetration value is reported as the number of blows required to advance the sampler 12 inches using a 140-pound hammer falling 30 inches, reported as "blows per foot," and is not considered equivalent to the "Standard Penetration"or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	N/E:	Not Encountered
WCI:	Wet Cave in	WD:	While Drilling		
DCI:	Dry Cave in	BCR:	Before Casing Removal		
AB:	After Boring	ACR:	After Casing Removal		

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
< 500	<2	Very Soft
500 – 1,000	2-3	Soft
1,001 – 2,000	4-6	Medium Stiff
2,001 – 4,000	7-12	Stiff
4,001 – 8,000	13-26	Very Stiff
8,000+	26+	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Ring Sampler (RS) Blows/Ft.	Relative Density
0 – 3	0-6	Very Loose
4 – 9	7-18	Loose
10 – 29	19-58	Medium Dense
30 – 49	59-98	Dense
50+	99+	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75 mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 – 12
Modifiers	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1-10
Medium	11-30
High	30+

Terracon

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]					Soil Classification	
					Group Symbol	Group Name[B]
Coarse Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]		GW	Well-graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3$[E]		GP	Poorly graded gravel[F]
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH		GM	Silty gravel[F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]		SW	Well-graded sand[I]
			$Cu < 6$ and/or $1 > Cc > 3$[E]		SP	Poorly graded sand[I]
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH		SM	Silty sand[G,H,I]
			Fines Classify as CL or CH		SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above "A" line[J]		CL	Lean clay[K,L,M]
			PI < 4 or plots below "A" line[J]		ML	Silt[K,L,M]
		organic	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OL	Organic clay[K,L,M,N] / Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line		CH	Fat clay[K,L,M]
			PI lots below "A" line		MH	Elastic Silt[K,L,M]
		organic	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OH	Organic clay[K,L,M,P] / Organic silt[K,L,M,Q]
Highly organic soils	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

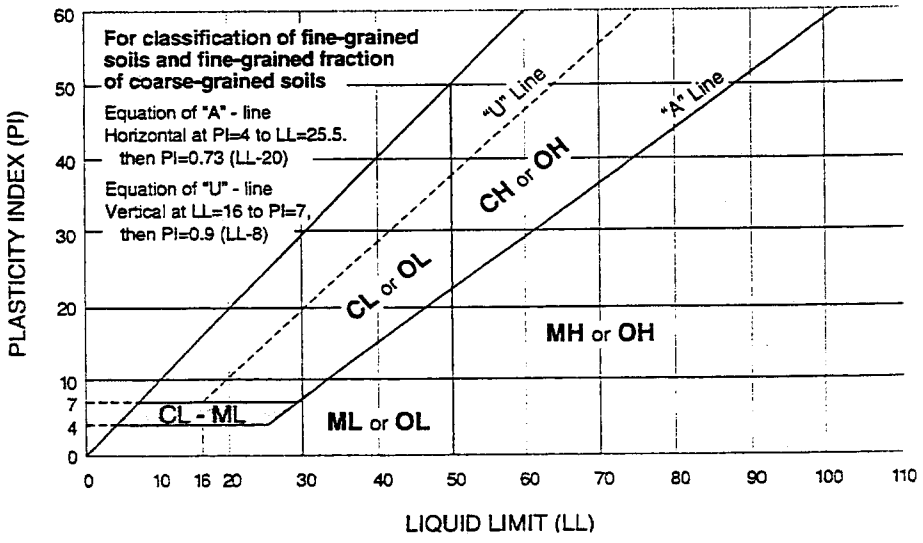
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

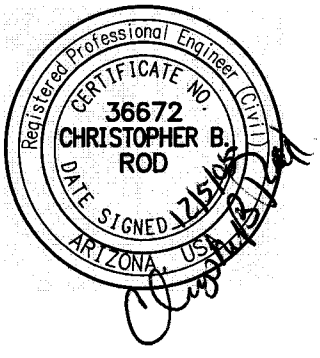
[Q] PI plots below "A" line.



Terracon

HYDROLOGY AND HYDRAULICS REPORT FOR THE PINES II

PRV - 05154



December 2, 2005

Prepared by:

MMLA Psomas
800 E. Wetmore Road, Suite 110
Tucson, AZ 85719

MMLA Psomas: 05082-78

SUBMITTAL NO. 1

MMLA
PSOMAS

HYDROLOGY AND HYDRAULICS REPORT
FOR
THE PINES II

Location:
The proposed site is located in the
SE ¼ of Section 22, NE ¼ of Section 27, NW ¼ of Section 26,
Township 12 South, Range 12 East
In Marana, Arizona

Prepared for:
BCIF Group, LLC
6262 N. Swan Road, Suite 125
Tucson, AZ 85718

Submitted
December 2, 2005

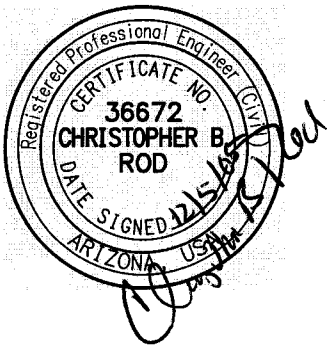
Drainage Report Pursuant to Tentative Plat Approval

Prepared by:
MMLA Psomas
800 E. Wetmore Road, Suite 110
Tucson, AZ 85719

MMLA Psomas 05082-78

MMLA
PSOMAS

TABLE OF CONTENTS



List of Figures

List of Tables

List of Appendices

1.0 INTRODUCTION

The following text will serve as the Drainage Report for The Pines II. The subdivision, proposed by Southern Pacific Homes will consists of 280 single-family detached homes encompassing 55.3 acres. The overall project will have a density of 5.1 houses per acre. The Pines II will be situated within Continental Reserve Master Planned Community. The Parcel lies with the southeast ¼ of Section 22 and the northwest ¼ of Section 26 and the northeast ¼ of Section 27 all within Township 12 South, Range 12 East. The parcel is bordered along the northern boundary by the I-10 Frontage Road. The Santa Cruz River lies south of the project, though it does not form an actual boundary with the parcel. A golf course immediately borders the development area on all sides. A location map (Figure 1) is provided on Page 2.

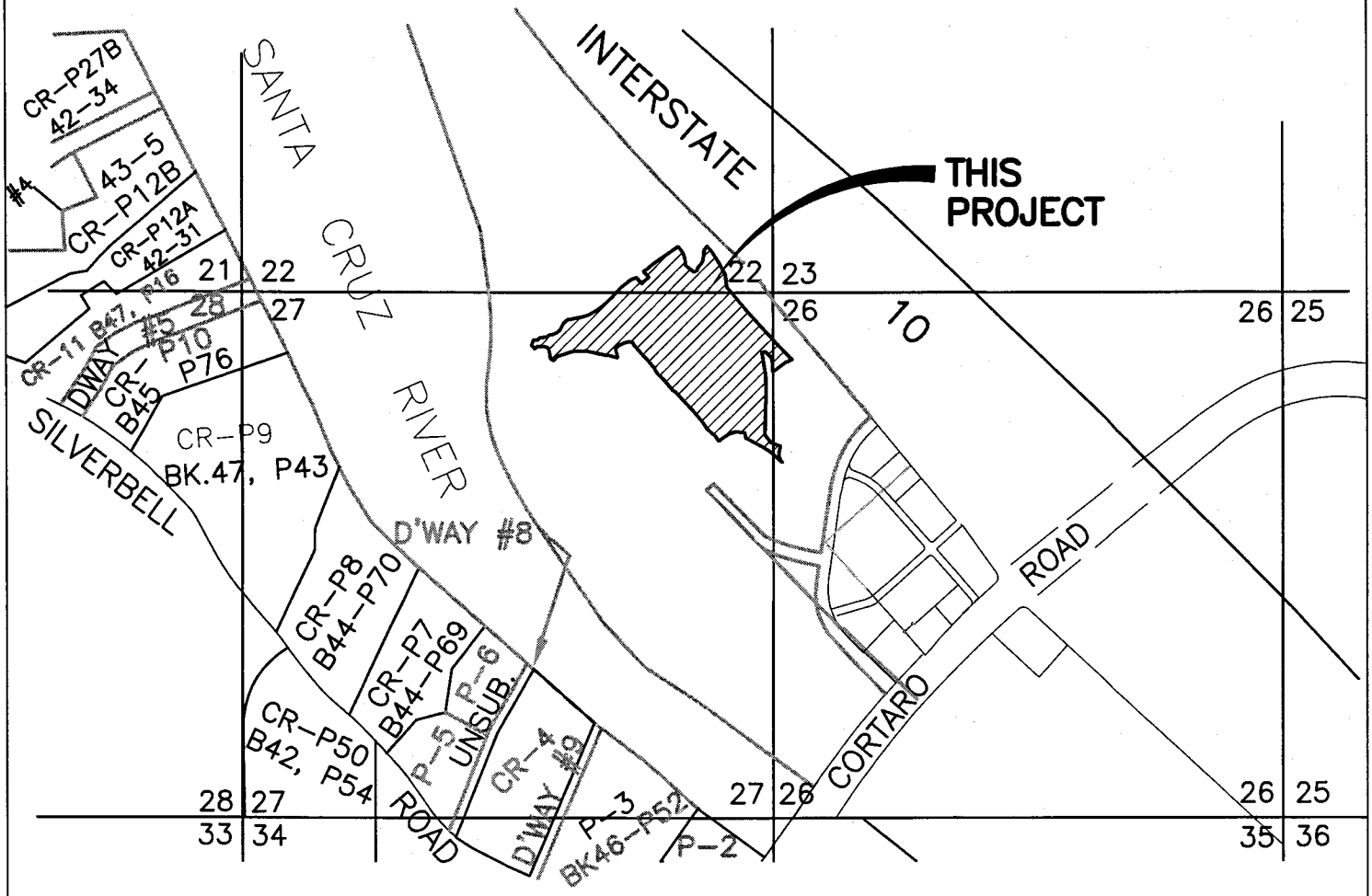


FIGURE 1
LOCATION MAP

SCALE 3" = 1 mile

BEING A PORTION OF THE SOUTH 1/2 OF SECTION 22, THE WEST 1/2 OF SECTION 26, AND THE EAST 1/2 OF SECTION 27, T12S, R12E, G&SRB&M, TOWN OF MARANA, PIMA COUNTY, ARIZONA

M M L A
PSOMAS

2.0 OBJECTIVES

As implied in Section 1.0, the proposed subdivision is part of a large master planned community, Continental Reserve. As such previous studies have been submitted and approved by the Town of Marana and needed to be incorporated into the design concept. In addition the design needed to provide a drainage scheme to convey storm runoff safely and efficiently through the property limits.

The following tasks were completed as part of the drainage study for Pines II:

- The peak discharges were calculated as part of the Developed Conditions Analysis outlined in the "Master Drainage Report for Marana Golf, Blocks 1, 3, 4, & 5 and San Xavier Aggregate Pit, Block 2 at Continental Ranch" (Reference 3). These discharges were reviewed and recreated to assure accuracy.
- An on-site field investigation of the drainage structures was performed. This investigation was combined with a review of previous study for the I-10 Corridor to obtain the peak flow entering the property from these sources (Reference 1).
- The peak discharges generated by the development of on-site watersheds were quantified.
- Drainage structures were located and sized for the safe and efficient conveyance of on-site runoff.

The remainder of this report describes the proposed drainage for the site and off-site drainage systems impacted by the proposed project. Maps depicting existing and developed conditions are provided in the pocket folders at the end of the text and supporting calculations are contained within the appendix. This report is being submitted pursuant to Tentative Plat approval.

3.0 EXISTING CONDITIONS

3.1 Hydrologic Analysis

The upper bound of the 90% confidence interval point precipitation frequency estimates from NOAA Atlas 14 was used (Appendix 1) to generate the hydrologic analysis, both existing and developed conditions. Discharge values were obtained using the Pima County Methodology. Initial results illustrated zero cfs for the 2-year event. In order to produce feasible discharges, the 2-year, 6-hour rainfall was increased from 1.38" to 1.43". This modification was utilized in all hydrologic calculations.

The existing conditions scenario presented in this report was recreated to match the previously calculated peak discharges (Reference 2). Due to different values for the input parameters, the generated peak discharges differ between those produced by MMLA Psomas and those from the previous study. Table 1 summarizes the results for the onsite existing conditions hydrology. The offsite hydrology analysis for Pines II was derived from a previous study (Reference 1). Watershed maps from Reference 1 have been reproduced for this report to match the current site conditions and project boundary limits Figure 2. Per these reports, runoff from two off-site culverts impact the project area. The culvert outlets are located at NR3 and NR4. Flow entering the site from NR3 was determined from Reference 1. The maximum capacity for the culvert at NR4 was used to predict the runoff entering the site from this source. Details regarding the existing hydraulic structures are supplied in Appendix 3.

Table 1: Summary of Hydrologic Analysis (Existing Conditions)

Concentration Point	Contributing Watersheds	Area (ac)	Channel Length (ft)	Length to Centroid (ft)	Basin Factor	% Impervious	Mean Slope (%)	Soil Type	T_c (min)	100-year Discharge (cfs)
5	5	25.52	1843	922	0.031	45	1.3	100%B	7	86
5*	5	23.80	1160	580	0.031	45	0.7	100%B	7.5	146
6	6	31.44	2480	1240	0.025	69	0.7	100%B	11	130
6*	6	49.4	2800	1400	0.025	69	0.5	100%B	12	300
9	9	12.72	2406	1203	0.033	26	0.9	100%B	16	32
9*	9	16.35	2400	1200	0.033	26	0.5	100%B	16	71

*Reference 2

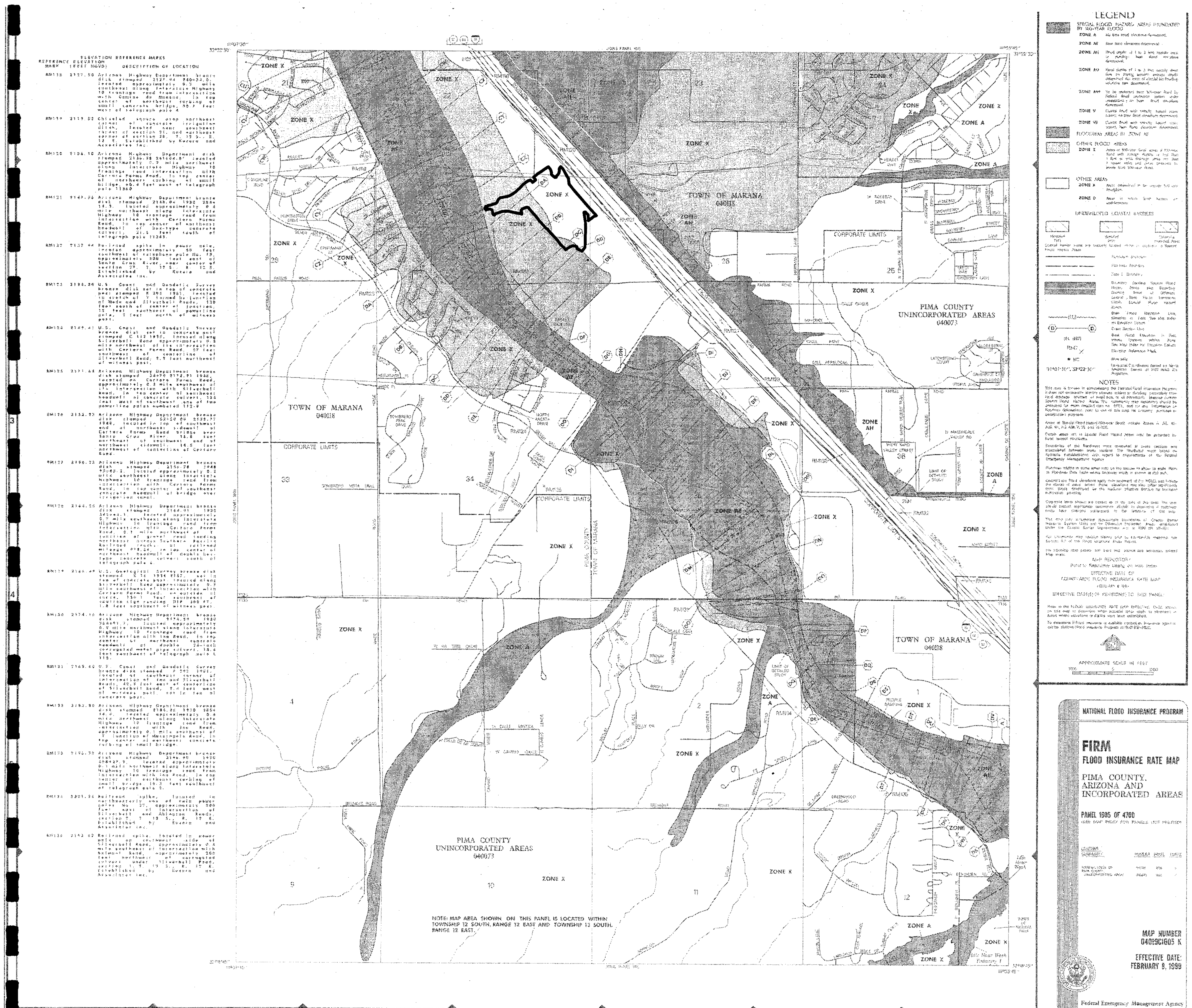
3.2 Existing Drainage Structures

Two drainage structures and one drainage channel exists within the project limits. One 24" RCP culvert outlet exists at CP NR-4. The capacity of the culvert is 26 cfs. The second existing structure is a 2 cell 6'x3' RCBC located at NR3. The peak flow of the culvert, in breakout conditions, is 1101 cfs. The northeast property boundary has been modified into an earthen drainage swale to direct sheet-flow in the direction of the existing off-site culverts located at NR-1 and NR-3. These structures are described in detail in References 1 and 2, and structure designations are consistent with those assigned in References 1 and 2.

3.3 Existing Floodplains and Erosion Hazard Setbacks

Per the Federal Emergency Management Agency (FEMA), Pines II is located within Zone X (shaded) and Zone X (unshaded) (FIRM Panel 04019C1605 K, February 8, 1999). Zone X (shaded) denotes areas of the 500-year flood; areas of the 100-year flood with average depths of less than one-foot or drainage areas less than one square-mile; and areas protected by levees from the 100-year flood. Zone X (unshaded) denotes areas determined to be outside the 500-year floodplain. Approximately the southwest third of the project area is within Zone X (shaded) and is associated with the Santa Cruz River floodplain limits. The FEMA limits are depicted on Figure 4, FIMA FIRM Panel.

There are no other FIMA floodplains located within the project limits. The main channel (Channel 8, 18, 22) carries 1101 cfs, previously defined by the Hydrologic and Hydraulic Report for the I-10 Corridor Study – Pima County Ruthrauff Road to Tangerine Road (Reference #), is controlled by the 2-6'x3' RCBC located at NR3. The flow is conveyed from the upstream watershed and will be contained within the channel banks and adequate freeboard has been provided.



M M L A
PSOMAS
800 E. Wetmore Road, Suite 110, Tucson, AZ 85719
Tel (520) 292-2300 (800) 441-5875
Fax (520) 292-1290
www.mmla-psomas.com

Figure 4
FIRM Panel
FOR
PINES II
MAP # 04019C1605K
EFFECTIVE DATE: February 8, 1999

PROJ NO: 05082-78 SCALE:HORIZ 1" = 2000'
DATE: 11/01/2005 VERT 1" = N/A 1 OF 1

4.0 DEVELOPED CONDITIONS

4.1 On-site Hydrology

The project was divided into nineteen onsite watersheds (Watershed D1-D6, D8-D12, D14, D15, D17-D22) and six offsite watersheds (Watershed OS-1 – OS-6). In general, the runoff from these watersheds will be conveyed in the streets and within storm drain systems. The runoff will be transitioned from the street to the drainage structures via sidewalk scuppers and into various constructed drainage ways. The Pima County Rational Method was used to calculate peak discharges from onsite watersheds and at successive concentration points. The delineated watersheds and concentration points are shown on Figure 3. Appendix 2 contains supporting calculations. Table 3 summarizes the 100-year peak discharges under developed conditions.

Table 2: Summary of Hydrologic Analysis (Developed Conditions)

Concentration Point	Contributing Watersheds	Area (ac)	Channel Length (ft)	Length to Centroid (ft)	Basin Factor	% Impervious	Mean Slope (%)	Soil Type	T_c (min)	100-year Discharge (cfs)
D1	D1	6.87	**967**	484	0.022	60	0.5	100%B	6	34
D2	D2	0.44	136	69	0.035	0	0.5	100%B	5	1.3
D2	D1,D2,OS-1, NR-4*	16.36	2066	1033	0.029	25	0.5	100%B	16	66
D3	D3	0.26	288	144	0.035	0	0.5	100%B	6	0.7
D4	D4	4.04	546	273	0.022	60	0.5	100%B	5	21
D4	D3,D4, OS-6	4.53	843	422	0.027	54	0.5	100%B	7	20
D5	D5	0.50	435	218	0.035	0	0.5	100%B	8	1.2
D5	D3,D4,D5, OS-6	5.03	1278	639	0.030	48	0.5	100%B	11	18
D6	D6	5.04	821	411	0.022	60	0.5	100%B	5	26
D7	D3,D4,D5,D6, OS-6	10.07	1529	764	0.033	54	0.5	100%B	13	35
D8	D8	1.65	475	238	0.035	0	0.5	100%B	8	4
D8	NR-3	Based on Results Listed in the I-10 Corridor Study								1101
D9	D9	0.51	320	160	0.025	100	0.5	100%B	5	3
D10	D10	2.44	516	258	0.022	60	0.5	100%B	5	13
D11	D11	0.34	230	115	0.035	0	0.5	100%B	5	1.0
D11	D10,D11	2.78	746	373	0.026	53	0.5	100%B	6	13
D12	D12	2.81	591	296	0.022	60	0.5	100%B	5	15
D13	D10,D11,D12	5.59	956	478	0.025	56	0.5	100%B	7	26
D14	D14	3.25	497	249	0.022	60	0.5	100%B	5	17
D15	D15	5.26	888	444	0.022	60	0.5	100%B	6	26
D15	D15,OS-2	5.72	1033	517	0.024	55	0.5	100%B	7	26
D16	D14, D15, OS-2	8.97	1117	559	0.025	57	0.5	100%B	8	39
D17	D17	3.60	627	314	0.022	60	0.5	100%B	5	19

Concentration Point	Contributing Watersheds	Area (ac)	Channel Length (ft)	Length to Centroid (ft)	Basin Factor	% Impervious	Mean Slope (%)	Soil Type	T_c (min)	100-year Discharge (cfs)
D17	D17, OS-5	4.04	924	463	0.026	53	0.5	100%B	7	18
D18	D18	3.91	1156	578	0.035	0	0.5	100%B	15	7
D18	NR-3	Based on Results Listed in the I-10 Corridor Study								1101
D19	D19	3.43	902	451	0.022	60	0.5	100%B	6	17
D20	D20	5.40	587	294	0.022	60	0.5	100%B	5	28
D21	D21	0.32	132	66	0.035	0	0.5	100%B	5	0.9
D21	D20, D21	5.72	719	360	0.024	57	0.5	100%B	5	29
D22	D22	0.79	244	122	0.035	0	0.5	100%B	5	2
D22	NR-3	Based on Results Listed in the I-10 Corridor Study								1101
OS-1	OS-1	9.05	963	482	0.035	0	0.5	100%B	13	18
OS-1	OS-1, NR-4*	9.05	963	482	0.035	0	0.5	100%B	13	44
OS-2	OS-2	0.46	145	73	0.035	0	0.5	100%B	5	1.3
OS-3	OS-3	6.62	903	452	0.035	0	0.5	100%B	13	13
OS-3	NR-3	Based on Results Listed in the I-10 Corridor Study								1101
OS-4	OS-4	1.65	870	435	0.035	0	0.5	100%B	13	3
OS-5	OS-5	0.44	297	149	0.035	0	0.5	100%B	6	1.2
OS-6	OS-6	0.23	101	51	0.035	0	0.5	100%B	6	0.6
NR-4	NR-4	Based on the Culvert Capacity (Assuming 4-feet of Available Headwater)								26

4.2 Roadway Design

Approximately 2.00 miles of paved roadway will be constructed with the project. The typical 55-foot right-of-way will include two 16-foot travel lanes, 5-inch high rolled curbs and a 5-foot sidewalk. The typical roadway will consist of super-elevated sections with a continuous 1% cross-slope.

To demonstrate that the roads have sufficient capacity to convey the 100-year runoff for a variety of slopes, rating tables were created for the typical street sections. The rating table and a typical cross-section are included in Appendix 2. Where storm water approaches a low point from two directions, the runoff component on each side was determined independently to verify adequate street capacity.

4.3 Inlet Design

As part of the drainage design, runoff from the roadways will be discharged into drainage channel via ten concrete sidewalk scuppers and four depressed curbs. These structures, located within the interior of the project, were sized to convey the entire 100-year event below the curb line using the weir equation and assuming a 6-inch total opening height.

Table 4 summarizes the hydraulic analysis for the inlets. The locations of the scuppers and depressed curb listed in Table 3 are indicated by concentration points on Figure 4. The widths for scuppers listed in Table 3 represent the width of the effective opening. The final inlet sizes will be shown on both paving and grading plans. Calculations for the required effective opening length are included in Appendix 2.

Table 3: Summary of Proposed Inlet Design

Concentration Point	Q_{des} (cfs))	Depth of Opening (ft)	Type of Opening	Effective Opening (ft)
D1	34	0.50	Scupper	15
D3	1	0.50	Depressed Curb	1
D4	20	0.50	Scupper	9
D6	26	0.50	Scupper	12
D9	3	0.50	Depressed Curb	4
D10	13	0.50	Scupper	6
D12	15	0.50	Scupper	7
D14	17	0.42	Catch Basin	14
D15	26	0.50	Scupper	12
D17	18	0.50	Scupper	8
D19	17	0.50	Scupper	8
D20	28	0.50	Scupper	13
OS-2	1	0.50	Depressed Curb	1
OS-4	3	0.50	Depressed Curb	4
OS-5	1	0.50	Depressed Curb	1
OS-6	1	0.50	Depressed Curb	1

4.4 Channel Design

Twelve channels will be constructed within the project limits as part of the drainage design. The channels were sized using Manning's Equation. Four of the channels will be rock-lined with Filter Fabric. Table 5 summarizes the hydraulic analysis for channels designated by the concentration points shown on Figure 3. Calculation sheets and freeboard calculations are provided in Appendix 2.

Table 4: Summary of Proposed Channel Design

Channel	Concentration Point	100-year Discharge (cfs)	Flow Depth (ft)	Manning's "N"	Slope (%)	Side Slope (H:V)	Channel Depth (ft)	Channel Bottom Width (ft)	Channel Top Width (ft)	Flow Velocity (fps)
1*	OS-1	44	1.75	0.035	0.5	3:1	2.0	3	15	3.05
2	D3	1	0.29	0.030	0.5	12:1	0.5	0	7	0.97
3	D2	66	1.61	0.030	1.0	6:1	1.75	0	21	4.25
4	D5	18	0.76	0.030	1.0	12:1	1.0	0	24	2.59
5*	D7	35	1.34	0.035	1.0	3:1	1.75	3	13.5	3.72
6	D11	13	0.67	0.030	1.0	12:1	1.0	0	24	2.39
7	OS-5	1	0.29	0.030	0.5	12:1	0.5	0	6	0.97
8*	D13	26	1.16	0.035	1.0	3:1	1.5	3	12	3.44
9*	D16	39	1.41	0.035	1.0	3:1	1.75	3	13.5	3.83
10*	D17	18	0.97	0.035	1.0	3:1	1.5	3	12	3.12
11	D21	29	0.91	0.030	0.5	12:1	1.25	0	30	2.92
12	D8	1101	2.32	0.030	0.39	8:1	2.80	80	125	4.82
12	D18	1101	2.32	0.030	0.39	8:1	2.80	80	125	4.82
12	D22	1101	2.32	0.030	0.39	8:1	2.80	80	125	4.82

*Rock Lined – D50 = 6" T = 1' with Filter Fabric

4.5 Culvert Design

Three culvert crossings will be constructed as part of the drainage design to convey runoff from the constructed channels beneath proposed roadways. The first culvert will be constructed at CP D5 to convey runoff to the rock-lined channel at CP D7. The second will be constructed at CP D8 to convey runoff to the earthen channel u/s of CP D18. The third will be constructed at CP D18 to convey runoff to the earthen channel u/s of CP D22. The hydraulic analysis of these culverts is included in Appendix 2 and is summarized in Table 6. Rip-rap bank protection will be placed at the outfall of Culverts 2 and 3, as discussed in Section 4.6 (Erosion Protection). Culvert hydraulics were analyzed using a computer program based on methods presented in the Federal Highway Administration Hydraulic Design Series No. 5 (HDS-5).

Table 5: Summary of Proposed Culvert Design

Culvert	Conc. Point u/s Location	Culvert Type	$Q_{des.}$ (cfs)	Slope (%)	Length (ft)	Req. HW (ft)	Vel. (fps)
1	D5	1-24 RCP	18	1.0	65	2.64	7.99
2	D8	5-10' x 4' RCBC	1101	0.71	55	3.78	11.48
3	D18	5-10' x 4' RCBC	1101	0.71	55	3.78	11.48

4.6 Erosion Protection

To prevent scour at the outlets of the various drainage structures located within the project limits, additional erosion protection will be constructed within the drainage channels and basins constructed as part of the infrastructure. A total of twelve splash pads will be constructed at scupper, culvert, storm drain and channel outlets.

Using West Consultant's software program based on the Army Corps of Engineers HEC-11 design package, the minimum rock size for the splash pads is 6 inches. The splash pads are summarized in Table 7 and depicted on Figure 4. The calculation sheets are provided in Appendix 2.

Table 6: Summary of Proposed Splash Pad Design

Splash Pad ID	Conc. Point(s)	Q_{des} (cfs)	Depth of Opening (ft)	Type of Opening	Mean Rock Size (d_{50})	Width of Splash Pad (ft)	Length of Splash Pad (ft)	Thickness of Splash Pad (ft)
1	D1	44	3	3' RCP, Scupper	6"	30	26	1.0
2	D2	40	0.5	Channel	6"	42	9	1.0
3	D4	20	0.5	Scupper	6"	27	10	1.0
4	D7	35	1.34	Channel	6"	33	9	1.0
5	D8, D9	1101	4	5 - 4' x 10 RCBC	9"	120	33	1.5
6	D10	13	0.5	Scupper	6"	39	5	1.0
7	D13	13	2	2' RCP	6"	6	14	1.0
8	D16	17	2	2' RCP	6"	6	18	1.0
9	D17	18	0.5	Scupper	6"	36	5	1.0
10	D18, D19	1101	4	5 - 4' x 10 RCBC, Scupper	9"	120	33	1.0
11	D20	28	0.5	Scupper	6"	56	5	1.0
12	D22	1101	2.32	Channel	6"	250	18	1.0

Note: All splash pads will be underlined with filter fabric.
Smaller Rock may be used, with a minimum d_{50} equal to 6", if the splash pad is wire tied.

4.7 Storm Drain Design

As part of the drainage design, three storm drain systems will be constructed within the project limits. The preliminary storm drain calculations assumed a consistent slope of 0.5% and 1.0-foot of cover. Table 8 summarizes the storm drain design.

System 1 will capture the runoff at CP OS-1. The system includes a headwall at the inlet and four 36" segments. The second segment will have a curvature radius of 532.9'. The flow will be conveyed west then north and is ultimately discharged d/s of CP D1 onto a splash pad.

System 2 will capture the runoff at CP D11. The system includes a headwall at the inlet and two 24" segments. The flow will be conveyed west then south and is ultimately discharged u/s of CP D13 onto a rock-lined channel.

System 3 will capture the runoff at CP D14. The system includes a catch basin at the inlet and three 24" segments. The flow will be conveyed southwest then northwest and is ultimately discharged u/s of CP D16 onto a rock-lined channel.

Table 7: Summary of Proposed Storm Drain Design

Pipe	C.P. Downstream	C.P. Upstream	Pipe Diameter	Pipe Length	Inlet Length	Q_{des} (cfs)	Slope (%)	V_{pipe} (fps)
System 1 CP OS-1/CP D1								
SD1	CP D1 (Outlet)	MH1	36	15	--	44	0.5	6.23
SD2	MH1	MH2	36	305	--	44	0.5	6.23
SD3	MH2	MH3	36	89	--	44	0.5	6.23
SD4	MH4	OS-1	36	27	--	44	0.5	6.23
System 2 CP D11/ CP D13								
SD5	CP D13 (Outlet)	MH 5	24	15	--	13	0.5	4.14
SD6	MH 5	CP D11	24	110	--	13	0.5	4.14
System 3 CP D16/ CP D14								
SD14	CP D16 (Outlet)	MH 6	24	34	--	17	0.5	5.41
SD15	MH 6	MH 7	24	261	--	17	0.5	5.41
SD16	MH 7	CP D14	24	372	15'	17	0.5	5.41

4.8 Retention/Detention Design

Due to the close proximity of the project to a major river, no detention/retention structures will be constructed as part of the development of Pines II. It is the intent of this development to discharge all flows to Santa Cruz River before the peak discharge from the upstream watershed approaches the development. By not disturbing the peak discharge of the upstream watershed, designated by the U.S. Army Corps of Engineers. Per this designation, it was determined that development will not disturb any jurisdictional waters.

4.9 401/404 Application

There are no jurisdictional watercourses for the Pines II, designated by the U.S. Army Corps of Engineers. Per this designation, it was determined that development will not disturb any jurisdictional waters.

As part of NPDES processes, a SWPPP will be submitted to The Town of Marana prior to the commencement of the construction portion of this project for review. A copy of the NOI will be submitted to both the Arizona Department of Environmental Quality and the Town of Marana.

5.0 CONCLUSION

The Pines II is located southwest of the Interstate-10 and northeast of the Santa Cruz River, near the intersection of Sections 22, 26, and 27 of Township 12S, Range 12E. The development will have an approximate density of 3.7 houses per acre and approximately 2.00 miles of paved roadway.

The hydrology and hydraulics have been analyzed and designed such that storm runoff off will be conveyed safely and effectively through the development area. Interior streets will convey storm water to scuppers, depressed curbs or catch basins which will discharge into constructed channels. The channels will be earthen or rock-lined, with side-slopes ranging from 3:1 to 12:1, and bottom widths of 0', 3' and 80'. Three storm drain systems and three culverts will be utilized to convey flow through the development. All flow generated by Pines II will discharge through concentration point D22 and ultimately into the Santa Cruz River. The measures discussed in this report and presented on the Tentative Plat were designed in accordance with Town of Marana Standards.

6.0 REFERENCES

1) Arizona Department of Transportation, Hydrologic and Hydraulic Report for I-10 Corridor Study – Pima County, Ruthrauff Road to Tangerince Road, March 1991

2) The WLB Group, Inc., Master Drainage Report for Marana Golf, Block 1, 3, 4 & 5, and The San Xavier Aggregate Pit, Block 2 at Continental Ranch.

3) Pima County Department of Transportation and Flood Control District; Hydrology Manual for Engineering Design and Floodplain Management within Pima County, Arizona, September 1979.

SCALE 1:100

SUMMARY OF HYDROLOGIC ANALYSIS OF DEVELOPED CONDITIONS

Concentration Point	Contributing Watersheds	Area (ac)	Channel Length (ft)	Length to Centroid (ft)	Basin Factor	% Impervious	Mean Slope (%)	Soil Type	Tc (min)	100-year Discharge (cfs)
5	5	25.52	1843	922	0.031	45	1.3	100SB	7	86
5*	5	23.80	1166	580	0.031	45	0.7	100SB	7.5	146
6	6	31.44	2480	1240	0.025	69	0.7	100SB	11	150
6*	6	49.4	2800	1400	0.025	69	0.5	100SB	12	300
9	9	12.72	2406	1203	0.033	26	0.9	100SB	16	32
9*	9	16.35	2400	1200	0.033	26	0.5	100SB	16	71

LEGEND

EXISTING WATERSHED BOUNDARY
EXISTING CONCENTRATION POINTS
PROPERTY BOUNDARY

M M L A
P S O M A S
800 E. Wetmore Road, Suite 110, Tucson, AZ 85719
Tel (520) 292-2300 (800) 441-5875
Fax (520) 292-1290
www.mmla-psomas.com

FIGURE 2
EXISTING CONDITIONS MAP
FOR
THE PINES II

PROJ NO: 05082-78 SCALE:HORIZ 1" = 100'
DATE: 12/02/05 VERT 1" = N/A

S:\05\0821\Hydro\Existing Conditions.dwg Layout: JPrietto Fri, 02 Dec 2005, 8:50am Last Saved By: JPrietto

SCALE: 1:100

SUMMARY OF HYDROLOGIC ANALYSIS OF DEVELOPED CONDITIONS

Concentration Point	Contributing Watersheds	Area (ac)	Channel Length (ft)	Length to Centroid (ft)	Basin Factor	% Impervious	Mean Slope (%)	Soil Type	Tc (min)	100-year Discharge (cfs)
D1	D1	6.87	967	484	0.022	60	0.5	100%B	6	34
D2	D2	0.44	136	69	0.035	0	0.5	100%B	5	1.3
D2	D1,D2,OS-1 NR-4*	16.36	2066	1033	0.029	25	0.5	100%B	16	66
D3	D3	0.26	288	144	0.035	0	0.5	100%B	6	0.7
D4	D4	4.04	546	273	0.022	60	0.5	100%B	5	21
D4	D3,D4,OS-6	4.53	843	422	0.027	54	0.5	100%B	7	20
D5	D5	0.50	435	218	0.035	0	0.5	100%B	8	1.2
D5	D3,D4,D5, OS-6	5.03	1278	639	0.030	48	0.5	100%B	11	18
D6	D6	5.04	821	411	0.022	60	0.5	100%B	5	26
D7	D3,D4,D5,D6, OS-6	10.07	1529	764	0.033	54	0.5	100%B	13	35
D8	D8	1.65	475	238	0.035	0	0.5	100%B	8	4
D8	NR-3		Based on Results Listed in the I-10 Corridor Study							1101
D9	D9	0.51	320	160	0.025	100	0.5	100%B	5	3
D10	D10	2.44	516	258	0.022	60	0.5	100%B	5	13
D11	D11	0.34	230	115	0.035	0	0.5	100%B	5	1.0
D11	D10,D11	2.78	746	373	0.026	53	0.5	100%B	6	13
D12	D12	2.81	591	296	0.022	60	0.5	100%B	5	15
D13	D10,D11,D12	5.59	956	478	0.025	56	0.5	100%B	7	26
D14	D14	3.25	497	249	0.022	60	0.5	100%B	5	17
D15	D15	5.26	888	444	0.022	60	0.5	100%B	6	26
D15	D15,OS-2	5.72	1033	517	0.024	55	0.5	100%B	7	26
D16	D14, D15, OS-2	8.97	1117	559	0.025	57	0.5	100%B	8	39
D17	D17	3.60	627	314	0.022	60	0.5	100%B	5	19
D17	D17, OS-5	4.04	924	463	0.026	53	0.5	100%B	7	18
D18	D18	3.91	1156	578	0.035	0	0.5	100%B	15	7
D18	NR-3		Based on Results Listed in the I-10 Corridor Study							1101
D19	D19	3.43	902	451	0.022	60	0.5	100%B	6	17
D20	D20	5.40	587	294	0.022	60	0.5	100%B	5	28
D21	D21	0.32	132	66	0.035	0	0.5	100%B	5	0.9
D21	D20, D21	5.72	719	360	0.024	57	0.5	100%B	5	29
D22	D22	0.79	244	122	0.035	0	0.5	100%B	5	2
D22	NR-3		Based on Results Listed in the I-10 Corridor Study							1101
OS-1	OS-1	9.05	963	482	0.035	0	0.5	100%B	13	18
OS-1	OS-1, NR-4*	9.05	963	482	0.035	0	0.5	100%B	13	44
OS-2	OS-2	0.46	145	73	0.035	0	0.5	100%B	5	1.3
OS-3	OS-3	6.62	903	452	0.035	0	0.5	100%B	13	13
OS-3	NR-3		Based on Results Listed in the I-10 Corridor Study							1101
OS-4	OS-4	1.65	870	435	0.035	0	0.5	100%B	13	3
OS-5	OS-5	0.44	297	149	0.035	0	0.5	100%B	6	1.2
OS-6	OS-6	0.23	101	51	0.035	0	0.5	100%B	6	0.6
NR-4	NR-4	Based on the Culvert Capacity (Assuming 4 feet of Available Headwater)								26

*Calculated by directly summing the flow from OS 1 with the culvert capacity of existing 24 RCP at NR4 (Q_{cap}= 26 cfs)

SUMMARY OF PROPOSED CHANNEL ANALYSIS

Channel	Concentration Point	100-year Discharge (cfs)	Flow Depth (ft)	Manning's "N"	Slope (%)	Side Slope (H:V)	Channel Depth (ft)	Channel Bottom Width (ft)	Channel Top Width (ft)	Flow Velocity (fps)
1*	OS-1	44	1.75	0.035	0.5	3:1	2.0	3	15	3.05
2	D3	1	0.29	0.030	0.5	12:1	0.5	0	6	0.97
3	D2	66	1.61	0.030	1.0	6:1	1.75	0	21	4.25
4	D5	18	0.76	0.030	1.0	12:1	1.0	0	24	2.59
5*	D7	35	1.34	0.035	1.0	3:1	1.75	3	13.5	3.72
6	D11	13	0.67	0.030	1.0	12:1	1.0	0	24	2.39
7	OS-5	1	0.29	0.030	0.5	12:1	0.5	0	6	0.97
8*	D13	26	1.16	0.035	1.0	3:1	1.5	3	12	3.44
9*	D16	39	1.41	0.035	1.0	3:1	1.75	3	13.5	3.83
10*	D17	18	0.97	0.035	1.0	3:1	1.5	3	12	3.12
11	D21	29	0.91	0.030	0.5	12:1	1.25	0	30	2.92
12	D8	1101	2.32	0.030	0.39	8:1	2.80	80	125	4.82
12	D18	1101	2.32	0.030	0.39	8:1	2.80	80	125	4.82
12	D22	1101	2.32	0.030	0.39	8:1	2.80	80	125	4.82

*Rock Lined - D50= 6" T=1' with Filter Fabric

SUMMARY OF PROPOSED SPLASH PAD DESIGN

Splash Pad ID	Conc. Point(s)	Qdes (cfs)	Depth of Opening (ft)	Type of Opening	Mean Rock Size (d 50)	Width of Splash Pad (ft)	Length of Splash Pad (ft)	Thickness of Splash Pad (ft)
1	D1	44	3	3' RCP, Scupper	6"	30	26	1.0
2	D2	66	1.75	Channel	6"	42	8	1.0
3	D4	20	0.5	Scupper	6"	27	10	1.0
4	D7	35	1.34	Channel	6"	33	9	1.0
5	D8, D9	1101	4	5 cell 4' x 10 RCBC	9"	120	33	1.5
6	D10	13	0.5	Scupper	6"	39	5	1.0
7	D13	26	1.5	Channel	6"	36	6	1.0
8	D16	39	1.75	Channel	6"	27	7	1.0
9	D17	18	0.5	Scupper	6"	36	5	1.0
10	D18, D19	1101	4	5 cell 4' x 10 RCBC, Scupper	9"	120	33	1.5
11	D20	28	0.5	Scupper	6"	56	5	1.0
12	D22	1101	2.32	Channel	6"	250	18	1.0

Note: All splash pads will be underlined with filter fabric.
Smaller Rock may be used, with a minimum d 50 equal to 6", if the splash pad is wire tied.

SUMMARY OF PROPOSED INLET DESIGN

Conc. Point	Qdes (cfs)	Depth of Opening (ft)	Type of Opening	Effective Opening (ft)
D1	34	0.50	Scupper	15
D3	1	0.50	Depressed Curb	1
D4	20	0.50	Scupper	9
D6	26	0.50	Scupper	12
D9	3	0.50	Depressed Curb	4
D10	13	0.50	Scupper	6
D12	15	0.50	Scupper	7
D14	17	0.42	Catch Basin	14
D15	26	0.50	Scupper	12
D17	18	0.50	Scupper	8
D19	17	0.50	Scupper	8
D20	28	0.50	Scupper	13
OS-2	1	0.50	Depressed Curb	1
OS-4	3	0.50	Depressed Curb	4
OS-5	1	0.50	Depressed Curb	1
OS-6	1	0.50	Depressed Curb	1

SUMMARY OF PROPOSED STORM DRAIN DESIGN

Pipe	C.P. Downstream	C.P. Upstream	Pipe Diameter	Pipe Length	Inlet Length	Qdes (cfs)	Slope (%)	V_{pipe} (fps)
		System 1 CP OS-1/ CP D1						
SD1	CP D1 (Outlet	) MH1	36	15	--	44	0.5	6.23
SD2	MH1	MH2	36	305	--	44	0.5	6.23
SD3	MH2	MH3	36	89	--	44	0.5	6.23
SD4	MH4	OS-1	36	27	--	44	0.5	6.23
		System 2 CP D11/ CP D13						
SD 5	CP D1 3 (Outlet	) MH 5	24	15	--	13	0.5	4.14
SD 6	MH 5	CP D11	24	110	--	13	0.5	4.14
		System 3 CP D16/ CP D14						
SD1 4	CP D16 (Outlet	) MH 6	24	34	--	17	0.5	5.41
SD15	MH 6	MH 7	24	261	--	17	0.5	5.41
SD16	MH 7	CP D14	24	372	15'	17	0.5	5.41

SUMMARY OF PROPOSED CULVERT DESIGN

Culvert	Conc. Point u/s Location	Culvert Type	Qdes. (cfs)	Slope (%)	Length (ft)	Req. HW (ft)	Vel. (fps)
1	D5	1-24 RCP	18	1.0	65	2.64	7.99
2	D8	5 10' x 4' RCBC	1101	0.71	55	3.78	11.48
3	D18	5 10' x 4' RCBC	1101	0.71	55	3.78	11.48

LEGEND

DEVELOPED WATERSHED BOUNDARY

DEVELOPED CONCENTRATION POINTS

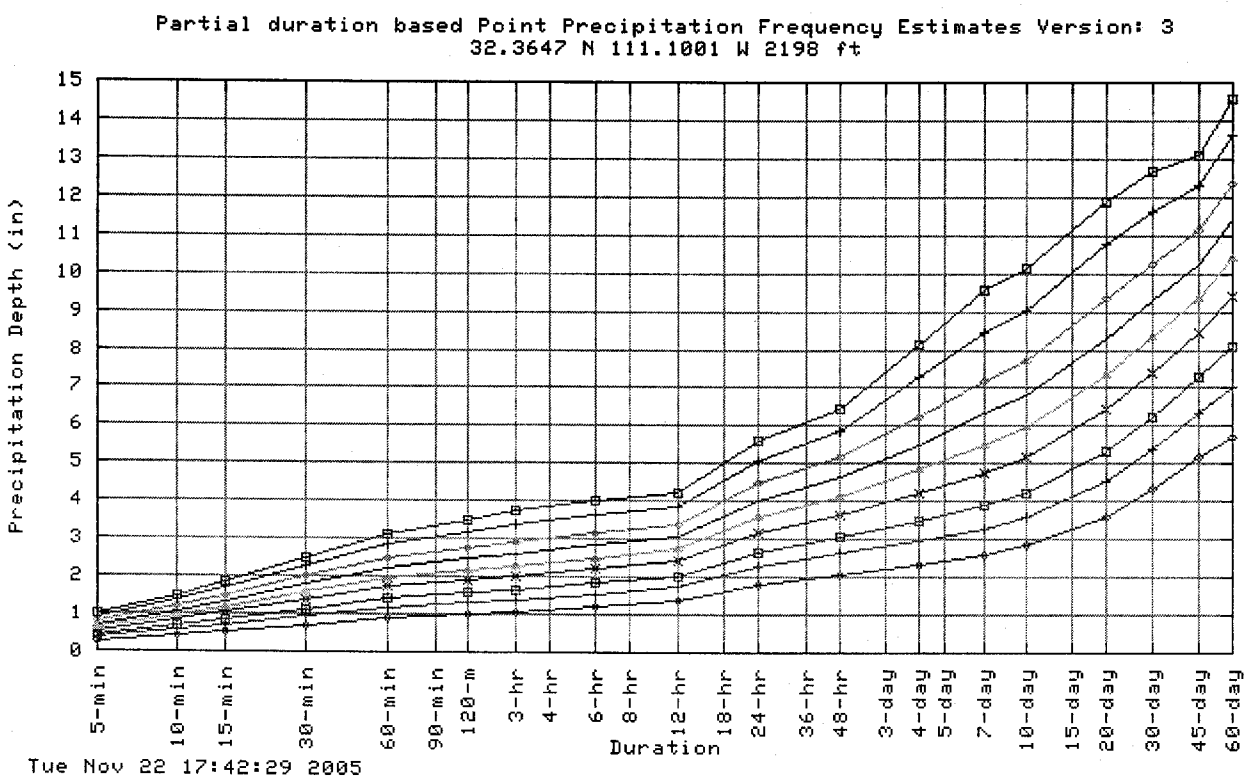
FLOW DIRECTION

M M L A
PSOMAS
800 E. Wetmore Road, Suite 110, Tucson, AZ 85719
Tel (520) 292-2300 (800) 441-5875
Fax (520) 292-1290
www.mmla-psomas.com

FIGURE 3
DEVELOPED CONDITIONS MAP
FOR
THE PINES II

PROJ NO: 05082-78 SCALE: HORIZ 1" = 100'
DATE: 12/02/05 VERT 1" = N/A

RAINFALL DATA



Confidence Limits -

*** Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)**

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
2	0.32	0.49	0.60	0.81	1.01	1.15	1.21	[illegible]	1.55	2.16	2.43	2.65	2.99	3.27	4.10	4.81	5.67	6.27
5	0.42	0.65	0.80	1.08	1.33	1.50	1.56	1.74	1.94	2.71	3.05	3.36	3.79	4.13	5.18	5.97	7.00	7.72
10	0.50	0.77	0.95	1.28	1.58	1.77	1.84	2.04	2.25	3.15	3.57	3.96	4.47	4.87	6.07	6.92	8.01	8.83
25	0.61	0.94	1.16	1.56	1.93	2.15	2.24	2.46	2.68	3.78	4.28	4.82	5.51	5.95	7.33	8.22	9.33	10.31
50	0.70	1.07	1.32	1.78	2.21	2.45	2.56	2.80	3.04	4.28	4.87	5.54	6.42	6.86	8.36	9.26	10.32	11.43
100	0.80	1.21	1.50	2.02	2.50	2.77	2.91	[illegible]	3.40	[illegible]	5.46	6.32	7.40	7.88	9.52	10.39	11.34	12.55
200	0.89	1.36	1.68	2.27	2.81	3.10	3.29	3.56	3.81	5.38	6.09	7.20	8.48	8.97	10.72	11.53	12.36	13.66
500	1.03	1.56	1.94	2.61	3.23	3.59	3.85	4.15	4.37	6.18	6.96	8.48	10.06	10.58	12.48	13.14	13.74	15.20
1000	1.13	1.72	2.13	2.87	3.56	3.98	4.30	4.64	4.84	6.80	7.71	9.57	11.47	12.02	13.97	14.47	14.81	16.37

* The upper bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are greater than.
** These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to the documentation for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

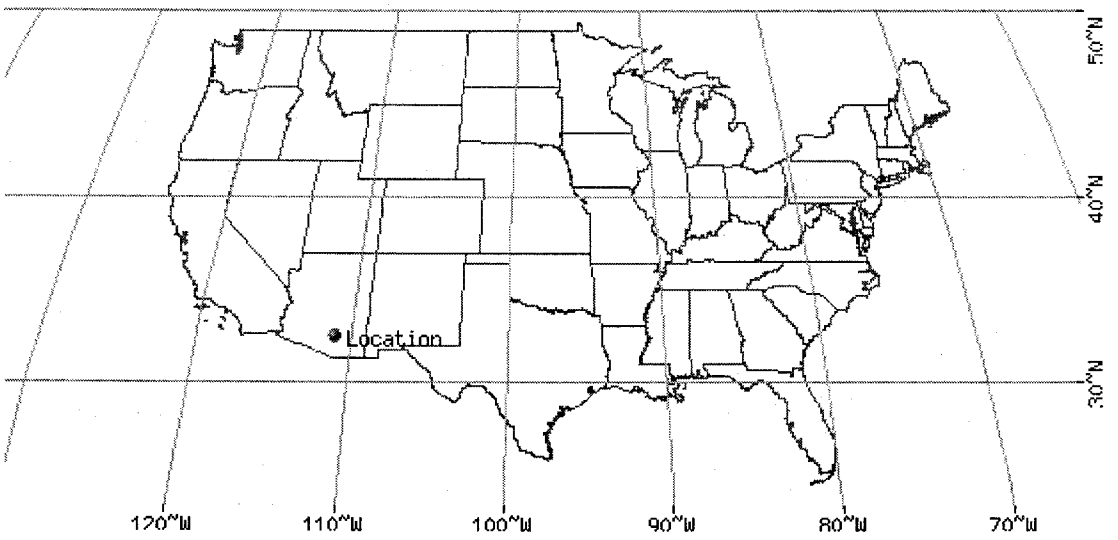
*** Lower bound of the 90% confidence interval Precipitation Frequency Estimates (inches)**

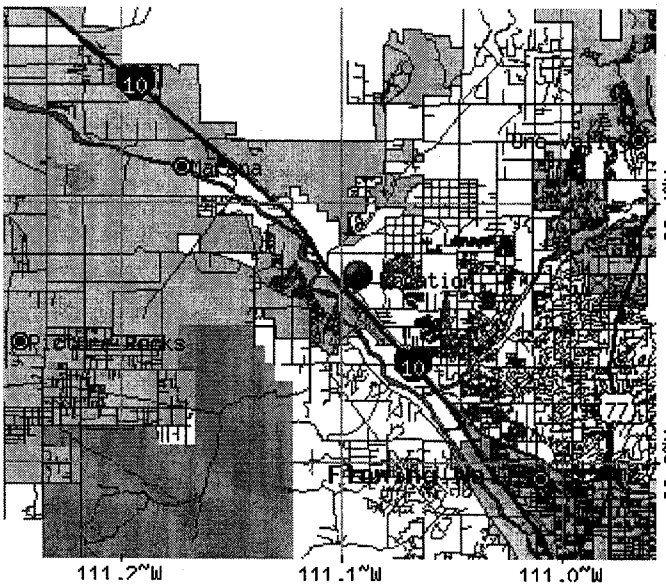
ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
2	0.25	0.38	0.47	0.64	0.79	0.91	0.96	1.10	1.26	1.58	1.83	2.04	2.27	2.49	3.20	3.92	4.69	5.22
5	0.33	0.51	0.63	0.84	1.05	1.19	1.24	1.39	1.57	1.96	2.29	2.59	2.88	3.14	4.03	4.85	5.76	6.42
10	0.39	0.60	0.74	1.00	1.24	1.40	1.45	1.62	1.82	2.28	2.65	3.04	3.39	3.69	4.70	5.61	6.57	7.35
25	0.47	0.72	0.90	1.21	1.49	1.68	1.75	1.93	2.15	2.71	3.13	3.66	4.12	4.45	5.62	6.62	7.62	8.54
50	0.53	0.81	1.01	1.35	1.68	1.89	1.96	2.17	2.39	3.04	3.52	4.17	4.72	5.07	6.35	7.38	8.39	9.39
100	0.59	0.90	1.12	1.50	1.86	2.10	2.18	2.40	2.63	3.38	3.90	4.68	5.35	5.73	7.11	8.14	9.13	10.24
200	0.65	0.99	1.23	1.65	2.04	2.30	2.40	2.64	2.88	3.72	4.30	5.22	6.01	6.41	7.89	8.95	9.84	11.04
500	0.72	1.10	1.36	1.83	2.27	2.56	2.69	2.95	3.19	4.18	4.83	5.95	6.92	7.32	8.90	9.93	10.74	12.05
1000	0.77	1.18	1.46	1.96	2.43	2.75	2.91	3.19	3.42	4.53	5.21	6.50	7.64	8.04	9.66	10.66	11.38	12.74

* The **lower** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are less than.
** These precipitation frequency estimates are based on a partial duration maxima series. ARI is the Average Recurrence Interval.

Please refer to the documentation for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

Maps -





These maps were produced using a direct map request from the U.S. Census Bureau Mapping and Cartographic Resources Tiger Map Server.

Please read disclaimer for more information.

LEGEND

State	Connector
County	Stream
Indian Resv	Military Area
Lake/Pond/Ocean	National Park
Street	Other Park
Expressway	City
Highway	County

Scale 1:228583 0 2 4 6 8 mi / 0 2 4 6 8 10 km

*average--true scale depends on monitor resolution

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Arizona 32.3647 N 111.1001 W 2198 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 1, Version 3
G.M. Bonnin, D. Todd, B. Lin, T. Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2003

Extracted: Tue Nov 22 2005

Confidence Limits | Seasonality | Location Maps | Other Info. | GIS data | Maps | Help | D

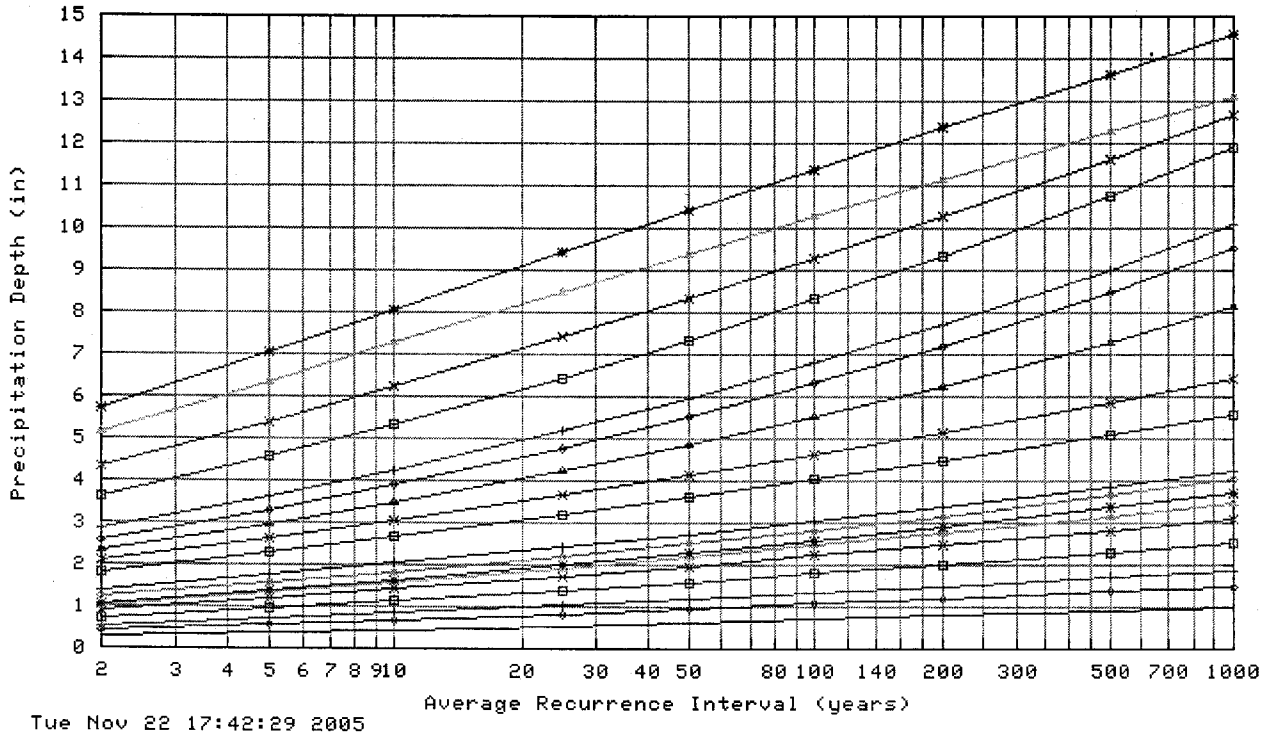
Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
2	0.28	0.43	0.53	0.71	0.88	1.02	1.07	1.23	1.39	1.82	2.08	2.32	2.59	2.85	3.61	4.33	5.15	5.71
5	0.38	0.57	0.71	0.95	1.18	1.33	1.38	1.55	1.74	2.29	2.62	2.94	3.29	3.60	4.56	5.38	6.35	7.04
10	0.45	0.68	0.84	1.14	1.41	1.57	1.64	1.83	2.02	2.67	3.05	3.47	3.89	4.24	5.34	6.24	7.27	8.06
25	0.55	0.83	1.03	1.39	1.72	1.92	2.00	2.21	2.42	3.19	3.66	4.22	4.77	5.17	6.45	7.41	8.47	9.41
50	0.62	0.95	1.18	1.58	1.96	2.19	2.28	2.51	2.73	3.60	4.14	4.84	5.51	5.95	7.36	8.33	9.37	10.41
100	0.70	1.07	1.33	1.79	2.22	2.47	2.59	2.83	3.06	4.03	4.63	5.51	6.32	6.80	8.31	9.28	10.27	11.39
200	0.79	1.20	1.49	2.00	2.48	2.76	2.91	3.17	3.39	4.48	5.16	6.24	7.20	7.71	9.33	10.26	11.14	12.37
500	0.90	1.37	1.70	2.28	2.83	3.16	3.37	3.64	3.86	5.09	5.86	7.28	8.47	9.02	10.75	11.60	12.28	13.63
1000	0.98	1.50	1.86	2.50	3.10	3.47	3.73	4.04	4.23	5.58	6.42	8.13	9.55	10.12	11.90	12.65	13.12	14.56

Text version of table

* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval. Please refer to the documentation for more information. NOTE: Formatting forces estimates near zero to appear as zero.

Partial duration based Point Precipitation Frequency Estimates Version: 3
32.3647 N 111.1001 W 2198 ft



Tue Nov 22 17:42:29 2005

Duration			
5-min	120-m	48-hr	30-day
10-min	3-hr	4-day	45-day
15-min	6-hr	7-day	60-day
30-min	12-hr	10-day	
60-min	24-hr	20-day	

HYDROLOGIC CALCULATIONS

EXISTING CONDITIONS

PROJECT NAME AND LOCATION: THE PINES II (Existing Conditions)

DRAINAGE CONCENTRATION POINT: 5 (WS 5)

WATERSHED AREA (A): 25.52 acres

LENGTH OF WATERCOURSE (Lc): 1843. ft

LENGTH TO CENTER OF GRAVITY (Lca): 922. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1843.	24.0

MEAN SLOPE (Sc): .0130 ft BASIN FACTOR (Nb): .0310

WATERSHED TYPE(S): Existing

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

47. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %
53. % B, CN= 74, COVER TYPE= URBAN LAWNS , COVER DENSITY= 80 %

IMPERVIOUS COVER= 45. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.399	.438	.475	.524	.564	.600
Tc (FUNCTION OF i) :	22.56	21.74	21.04	20.24	19.64	19.17
SOLUTION OF Tc (MINUTES):	18	15	13	12	10	10
RAINFL INT. @ Tc (IN/HR):	1.850	2.667	3.325	4.058	4.957	5.557
RUNOFF RATE @ Tc (IN/HR):	.738	1.168	1.580	2.125	2.796	3.333
PEAK DISCHARGE (CFS) :	19.	30.	41.	55.	72.	86.

PROJECT NAME AND LOCATION: THE PINES II (Existing Conditions)

DRAINAGE CONCENTRATION POINT: 6 (WS 6)

WATERSHED AREA (A): 31.44 acres

LENGTH OF WATERCOURSE (Lc): 2480. ft

LENGTH TO CENTER OF GRAVITY (Lca): 1240. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
2480.	17.0

MEAN SLOPE (Sc): .0069 ft BASIN FACTOR (Nb): .0250

WATERSHED TYPE(S): Existing

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

76. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %
24. % B, CN= 74, COVER TYPE= URBAN LAWNS , COVER DENSITY= 80 %

IMPERVIOUS COVER= 69. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.606	.648	.678	.712	.740	.763
Tc (FUNCTION OF i) :	23.77	23.14	22.73	22.29	21.95	21.68
SOLUTION OF Tc (MINUTES):	19	16	14	13	12	11
RAINFL INT. @ Tc (IN/HR):	1.797	2.596	3.230	3.929	4.627	5.372
RUNOFF RATE @ Tc (IN/HR):	1.090	1.683	2.189	2.799	3.422	4.099
PEAK DISCHARGE (CFS) :	35.	53.	69.	89.	108.	130.

PROJECT NAME AND LOCATION: THE PINES II (Existing Conditions)

DRAINAGE CONCENTRATION POINT: 9 (WS 9)

WATERSHED AREA (A): 12.72 acres

LENGTH OF WATERCOURSE (Lc): 2406. ft

LENGTH TO CENTER OF GRAVITY (Lca): 1203. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft 2406.

INCREMENTAL CHANGE IN ELEV (Hi) - ft 21.0

MEAN SLOPE (Sc): .0087 ft

BASIN FACTOR (Nb): .0330

WATERSHED TYPE(S): Existing

RAINFALL VALUES

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 26. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.235	.309	.366	.435	.491	.539
Tc (FUNCTION OF i) :	40.89	36.65	34.24	31.94	30.44	29.33
SOLUTION OF Tc (MINUTES):	38	28	24	20	18	16
RAINFL INT. @ Tc (IN/HR):	1.198	1.918	2.453	3.205	3.856	4.569
RUNOFF RATE @ Tc (IN/HR):	.281	.592	.897	1.394	1.893	2.461
PEAK DISCHARGE (CFS) :	3.60	7.59	11.51	17.88	24.27	31.56

DEVELOPED CONDITIONS

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D1 (WS D1)

WATERSHED AREA (A): 6.87 acres

LENGTH OF WATERCOURSE (Lc): 967. ft

LENGTH TO CENTER OF GRAVITY (Lca): 484. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
967.	4.8

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0220

WATERSHED TYPE(S): Moderate Urban

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 60. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.529	.582	.619	.662	.696	.725
Tc (FUNCTION OF i) :	14.25	13.71	13.38	13.02	12.76	12.56
SOLUTION OF Tc (MINUTES):	10	8	8	7	6	6
RAINFL INT. @ Tc (IN/HR):	2.378	3.497	4.074	5.073	6.096	6.833
RUNOFF RATE @ Tc (IN/HR):	1.257	2.035	2.521	3.357	4.241	4.952
PEAK DISCHARGE (CFS) :	8.71	14.09	17.46	23.25	29.37	34.29

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D1 (WS D1, OS-1)

WATERSHED AREA (A): 15.92 acres

LENGTH OF WATERCOURSE (Lc): 1930. ft

LENGTH TO CENTER OF GRAVITY (Lca): 966. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
967.	4.8
963.	4.8

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0280

WATERSHED TYPE(S): Moderate Urban

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 26. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.235	.309	.366	.435	.491	.539
Tc (FUNCTION OF i) :	37.98	34.04	31.80	29.67	28.27	27.24
SOLUTION OF Tc (MINUTES):	35	26	22	18	16	15
RAINFL INT. @ Tc (IN/HR):	1.260	2.000	2.575	3.382	4.076	4.693
RUNOFF RATE @ Tc (IN/HR):	.296	.617	.942	1.471	2.001	2.528
PEAK DISCHARGE (CFS) :	4.74	9.90	15.12	23.61	32.11	40.57

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D2 (WS D2)

WATERSHED AREA (A): .44 acres

LENGTH OF WATERCOURSE (Lc): 136. ft

LENGTH TO CENTER OF GRAVITY (Lca): 69. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
136.	.7

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0350

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 0. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.010	.100	.172	.262	.334	.397
Tc (FUNCTION OF i) :	34.54	13.68	10.98	9.29	8.43	7.87
SOLUTION OF Tc (MINUTES):	31	8	6	5	5	5
RAINFL INT. @ Tc (IN/HR):	1.356	3.497	4.524	5.604	6.389	7.162
RUNOFF RATE @ Tc (IN/HR):	.013	.348	.780	1.467	2.135	2.840
PEAK DISCHARGE (CFS) :	.01	.15	.35	.65	.95	1.26

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D2 (WS D1, D2 OS-1)

WATERSHED AREA (A): 16.36 acres

LENGTH OF WATERCOURSE (Lc): 2066. ft

LENGTH TO CENTER OF GRAVITY (Lca): 1033. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
967.	4.8
963.	4.8
136.	1.4

MEAN SLOPE (Sc): .0052 ft BASIN FACTOR (Nb): .0290

WATERSHED TYPE(S): Moderate Urban

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 25. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.226	.300	.358	.428	.485	.533
Tc (FUNCTION OF i) :	40.94	36.53	34.05	31.70	30.17	29.04
SOLUTION OF Tc (MINUTES):	38	28	24	20	18	16
RAINFL INT. @ Tc (IN/HR):	1.198	1.918	2.453	3.205	3.856	4.569
RUNOFF RATE @ Tc (IN/HR):	.271	.576	.879	1.373	1.869	2.436
PEAK DISCHARGE (CFS) :	4.46	9.50	14.50	22.64	30.83	40.18

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D3 (WS D3)

WATERSHED AREA (A): .26 acres

LENGTH OF WATERCOURSE (Lc): 288. ft

LENGTH TO CENTER OF GRAVITY (Lca): 144. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft 288.

INCREMENTAL CHANGE IN ELEV (Hi) - ft 1.4

MEAN SLOPE (Sc): .0050 ft

BASIN FACTOR (Nb): .0350

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 0. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.010	.100	.172	.262	.334	.397
Tc (FUNCTION OF i) :	53.95	21.37	17.15	14.52	13.16	12.29
SOLUTION OF Tc (MINUTES):	56	14	10	8	7	6
RAINFL INT. @ Tc (IN/HR):	.925	2.772	3.679	4.815	5.783	6.833
RUNOFF RATE @ Tc (IN/HR):	.009	.276	.635	1.260	1.932	2.709
PEAK DISCHARGE (CFS) :	.00	.07	.17	.33	.51	.71

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D4 (WS D4)

WATERSHED AREA (A): 4.04 acres

LENGTH OF WATERCOURSE (Lc): 546. ft

LENGTH TO CENTER OF GRAVITY (Lca): 273. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
546.	2.7

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0220

WATERSHED TYPE(S): Moderate Urban

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 60. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.529	.582	.619	.662	.696	.725
Tc (FUNCTION OF i) :	10.11	9.73	9.49	9.24	9.06	8.91
SOLUTION OF Tc (MINUTES):	7	6	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	2.775	3.883	4.742	5.604	6.389	7.162
RUNOFF RATE @ Tc (IN/HR):	1.467	2.259	2.934	3.709	4.446	5.190
PEAK DISCHARGE (CFS) :	5.97	9.20	11.95	15.10	18.10	21.14

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D4 (WS D3,D4 OS-6)

WATERSHED AREA (A): 4.53 acres

LENGTH OF WATERCOURSE (Lc): 843. ft

LENGTH TO CENTER OF GRAVITY (Lca): 422. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
546.	2.7
297.	1.5

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0270

WATERSHED TYPE(S): Moderate Urban

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 54. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.477	.534	.574	.622	.660	.692
Tc (FUNCTION OF i) :	16.78	16.04	15.58	15.09	14.74	14.46
SOLUTION OF Tc (MINUTES):	12	10	9	8	7	7
RAINFL INT. @ Tc (IN/HR):	2.220	3.158	3.870	4.815	5.783	6.483
RUNOFF RATE @ Tc (IN/HR):	1.058	1.685	2.222	2.994	3.815	4.485
PEAK DISCHARGE (CFS) :	4.83	7.69	10.15	13.67	17.42	20.48

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D5 (WS D5)

WATERSHED AREA (A): .50 acres

LENGTH OF WATERCOURSE (Lc): 435. ft

LENGTH TO CENTER OF GRAVITY (Lca): 218. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft 435.

INCREMENTAL CHANGE IN ELEV (Hi) - ft 2.2

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0350

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 0. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.010	.100	.172	.262	.334	.397
Tc (FUNCTION OF i) :	69.08	27.37	21.96	18.59	16.86	15.74
SOLUTION OF Tc (MINUTES):	79	20	14	10	9	8
RAINFL INT. @ Tc (IN/HR):	.714	2.327	3.230	4.348	5.214	6.154
RUNOFF RATE @ Tc (IN/HR):	.007	.232	.557	1.138	1.742	2.440
PEAK DISCHARGE (CFS) :	.00	.12	.28	.57	.88	1.23

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D5 (WS D3,D4 OS-6, D5)

WATERSHED AREA (A): 5.03 acres

LENGTH OF WATERCOURSE (Lc): 1278. ft

LENGTH TO CENTER OF GRAVITY (Lca): 639. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
546.	2.7
297.	1.5
435.	2.2

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0300

WATERSHED TYPE(S): Moderate Urban

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 48. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.425	.485	.529	.582	.623	.659
Tc (FUNCTION OF i) :	25.08	23.78	22.96	22.12	21.51	21.04
SOLUTION OF Tc (MINUTES):	20	16	15	13	12	11
RAINFL INT. @ Tc (IN/HR):	1.753	2.596	3.107	3.929	4.627	5.372
RUNOFF RATE @ Tc (IN/HR):	.745	1.260	1.645	2.286	2.885	3.540
PEAK DISCHARGE (CFS) :	3.78	6.39	8.34	11.59	14.63	17.95

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D6 (WS D6)

WATERSHED AREA (A): 5.04 acres

LENGTH OF WATERCOURSE (Lc): 821. ft

LENGTH TO CENTER OF GRAVITY (Lca): 411. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft 821.

INCREMENTAL CHANGE IN ELEV (Hi) - ft 4.1

MEAN SLOPE (Sc): .0050 ft

BASIN FACTOR (Nb): .0220

WATERSHED TYPE(S): Moderate Urban

RAINFALL VALUES

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 60. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.529	.582	.619	.662	.696	.725
Tc (FUNCTION OF i) :	12.91	12.43	12.12	11.80	11.57	11.38
SOLUTION OF Tc (MINUTES):	9	8	7	6	6	5
RAINFL INT. @ Tc (IN/HR):	2.501	3.497	4.292	5.347	6.096	7.162
RUNOFF RATE @ Tc (IN/HR):	1.322	2.035	2.656	3.538	4.241	5.190
PEAK DISCHARGE (CFS) :	6.72	10.34	13.49	17.98	21.55	26.37

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D7 (WS D3-D6 OS-6)

WATERSHED AREA (A): 10.07 acres

LENGTH OF WATERCOURSE (Lc): 1529. ft

LENGTH TO CENTER OF GRAVITY (Lca): 764. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
546.	2.7
288.	1.4
101.	.5
455.	2.5
159.	.8

MEAN SLOPE (Sc): .0051 ft BASIN FACTOR (Nb): .0330

WATERSHED TYPE(S): Moderate Urban

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 54. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.477	.534	.574	.622	.660	.692
Tc (FUNCTION OF i) :	29.04	27.76	26.96	26.11	25.50	25.02
SOLUTION OF Tc (MINUTES):	24	20	18	16	14	13
RAINFL INT. @ Tc (IN/HR):	1.585	2.327	2.862	3.575	4.351	5.022
RUNOFF RATE @ Tc (IN/HR):	.756	1.242	1.643	2.223	2.870	3.474
PEAK DISCHARGE (CFS) :	7.67	12.61	16.68	22.56	29.13	35.27

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D8 (WS D8)

WATERSHED AREA (A): 1.65 acres

LENGTH OF WATERCOURSE (Lc): 475. ft

LENGTH TO CENTER OF GRAVITY (Lca): 238. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
475.	2.4

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0350

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 0. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.010	.100	.172	.262	.334	.397
Tc (FUNCTION OF i) :	72.82	28.85	23.15	19.59	17.77	16.59
SOLUTION OF Tc (MINUTES):	85	21	15	11	9	8
RAINFL INT. @ Tc (IN/HR):	.677	2.257	3.107	4.203	5.214	6.154
RUNOFF RATE @ Tc (IN/HR):	.007	.225	.536	1.100	1.742	2.440
PEAK DISCHARGE (CFS) :	.01	.37	.89	1.83	2.90	4.06

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D9 (WS D9)

WATERSHED AREA (A): .51 acres

LENGTH OF WATERCOURSE (Lc): 320. ft

LENGTH TO CENTER OF GRAVITY (Lca): 160. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

320. 1.6

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0250

WATERSHED TYPE(S): Moderate Urban

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.874	.903	.916	.928	.937	.943
Tc (FUNCTION OF i) :	6.82	6.73	6.69	6.66	6.63	6.61
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	3.065	4.070	4.742	5.604	6.389	7.162
RUNOFF RATE @ Tc (IN/HR):	2.680	3.677	4.345	5.204	5.986	6.757
PEAK DISCHARGE (CFS) :	1.38	1.89	2.23	2.68	3.08	3.47

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D10 (WS D10)

WATERSHED AREA (A): 2.44 acres

LENGTH OF WATERCOURSE (Lc): 516. ft

LENGTH TO CENTER OF GRAVITY (Lca): 258. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
516.	2.6

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0220

WATERSHED TYPE(S): Moderate Urban

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 60. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.529	.582	.619	.662	.696	.725
Tc (FUNCTION OF i) :	9.77	9.41	9.18	8.93	8.76	8.61
SOLUTION OF Tc (MINUTES):	6	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	2.924	4.070	4.742	5.604	6.389	7.162
RUNOFF RATE @ Tc (IN/HR):	1.546	2.368	2.934	3.709	4.446	5.190
PEAK DISCHARGE (CFS) :	3.80	5.82	7.22	9.12	10.93	12.77

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D11 (WS D11)

WATERSHED AREA (A): .34 acres

LENGTH OF WATERCOURSE (Lc): 230. ft

LENGTH TO CENTER OF GRAVITY (Lca): 115. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft 230.

INCREMENTAL CHANGE IN ELEV (Hi) - ft 1.1

MEAN SLOPE (Sc): .0050 ft

BASIN FACTOR (Nb): .0350

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 0. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.010	.100	.172	.262	.334	.397
Tc (FUNCTION OF i) :	47.14	18.67	14.99	12.68	11.50	10.74
SOLUTION OF Tc (MINUTES):	46	12	9	7	6	5
RAINFL INT. @ Tc (IN/HR):	1.057	2.947	3.870	5.073	6.096	7.162
RUNOFF RATE @ Tc (IN/HR):	.010	.293	.667	1.328	2.037	2.840
PEAK DISCHARGE (CFS) :	.00	.10	.23	.46	.70	.97

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D11 (WS D10, D11)

WATERSHED AREA (A): 2.78 acres

LENGTH OF WATERCOURSE (Lc): 746. ft

LENGTH TO CENTER OF GRAVITY (Lca): 373. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
516.	2.6
230.	1.1

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0260

WATERSHED TYPE(S): Moderate Urban

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 53. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.468	.526	.567	.615	.654	.686
Tc (FUNCTION OF i) :	15.13	14.44	14.01	13.56	13.24	12.98
SOLUTION OF Tc (MINUTES):	11	9	8	7	7	6
RAINFL INT. @ Tc (IN/HR):	2.299	3.322	4.074	5.073	5.783	6.833
RUNOFF RATE @ Tc (IN/HR):	1.076	1.746	2.309	3.120	3.780	4.690
PEAK DISCHARGE (CFS) :	3.02	4.89	6.47	8.74	10.59	13.14

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D12 (WS D12)

WATERSHED AREA (A): 2.81 acres

LENGTH OF WATERCOURSE (Lc): 591. ft

LENGTH TO CENTER OF GRAVITY (Lca): 296. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
591.	3.0

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0220

WATERSHED TYPE(S): Moderate Urban

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 60. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.529	.582	.619	.662	.696	.725
Tc (FUNCTION OF i) :	10.60	10.20	9.95	9.69	9.50	9.34
SOLUTION OF Tc (MINUTES):	7	6	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	2.775	3.883	4.742	5.604	6.389	7.162
RUNOFF RATE @ Tc (IN/HR):	1.467	2.259	2.934	3.709	4.446	5.190
PEAK DISCHARGE (CFS) :	4.15	6.40	8.31	10.51	12.59	14.70

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D13 (WS D10-D13)

WATERSHED AREA (A): 5.59 acres

LENGTH OF WATERCOURSE (Lc): 956. ft

LENGTH TO CENTER OF GRAVITY (Lca): 478. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
516.	2.6
230.	1.1
210.	1.0

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0250

WATERSHED TYPE(S): Moderate Urban

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 56. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.494	.550	.589	.635	.672	.703
Tc (FUNCTION OF i) :	16.52	15.83	15.40	14.94	14.61	14.35
SOLUTION OF Tc (MINUTES):	12	10	9	8	7	7
RAINFL INT. @ Tc (IN/HR):	2.220	3.158	3.870	4.815	5.783	6.483
RUNOFF RATE @ Tc (IN/HR):	1.097	1.736	2.279	3.058	3.885	4.556
PEAK DISCHARGE (CFS) :	6.18	9.78	12.84	17.23	21.89	25.67

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D14 (WS D14)

WATERSHED AREA (A): 3.25 acres

LENGTH OF WATERCOURSE (Lc): 497. ft

LENGTH TO CENTER OF GRAVITY (Lca): 249. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
497.	2.5

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0220

WATERSHED TYPE(S): Moderate Urban

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 60. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.529	.582	.619	.662	.696	.725
Tc (FUNCTION OF i) :	9.55	9.19	8.97	8.73	8.56	8.42
SOLUTION OF Tc (MINUTES):	6	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	2.924	4.070	4.742	5.604	6.389	7.162
RUNOFF RATE @ Tc (IN/HR):	1.546	2.368	2.934	3.709	4.446	5.190
PEAK DISCHARGE (CFS) :	5.06	7.76	9.61	12.15	14.56	17.00

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D15 (WS D15)

WATERSHED AREA (A): 5.26 acres

LENGTH OF WATERCOURSE (Lc): 888. ft

LENGTH TO CENTER OF GRAVITY (Lca): 444. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
888.	4.4

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0220

WATERSHED TYPE(S): Moderate Urban

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 60. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.529	.582	.619	.662	.696	.725
Tc (FUNCTION OF i) :	13.54	13.03	12.71	12.37	12.13	11.93
SOLUTION OF Tc (MINUTES):	10	8	7	6	6	6
RAINFL INT. @ Tc (IN/HR):	2.378	3.497	4.292	5.347	6.096	6.833
RUNOFF RATE @ Tc (IN/HR):	1.257	2.035	2.656	3.538	4.241	4.952
PEAK DISCHARGE (CFS) :	6.67	10.79	14.08	18.76	22.49	26.25

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D15 (WS D15, OS-2)

WATERSHED AREA (A): 5.72 acres

LENGTH OF WATERCOURSE (Lc): 1033. ft

LENGTH TO CENTER OF GRAVITY (Lca): 517. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
888.	4.4
145.	.7

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0240

WATERSHED TYPE(S): Moderate Urban

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 55. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.485	.542	.582	.628	.666	.697
Tc (FUNCTION OF i) :	16.73	16.01	15.56	15.09	14.74	14.47
SOLUTION OF Tc (MINUTES):	12	10	9	8	7	7
RAINFL INT. @ Tc (IN/HR):	2.220	3.158	3.870	4.815	5.783	6.483
RUNOFF RATE @ Tc (IN/HR):	1.077	1.710	2.251	3.026	3.850	4.521
PEAK DISCHARGE (CFS) :	6.21	9.86	12.98	17.45	22.20	26.07

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D16 (WS D15, D14 OS-2)

WATERSHED AREA (A): 8.97 acres

LENGTH OF WATERCOURSE (Lc): 1117. ft

LENGTH TO CENTER OF GRAVITY (Lca): 559. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
888.	4.4
145.	.7
84.	.4

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0250

WATERSHED TYPE(S): Moderate Urban

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 57. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.503	.558	.596	.642	.678	.708
Tc (FUNCTION OF i) :	18.01	17.28	16.82	16.33	15.98	15.70
SOLUTION OF Tc (MINUTES):	13	11	10	9	8	8
RAINFL INT. @ Tc (IN/HR):	2.149	3.053	3.679	4.574	5.490	6.154
RUNOFF RATE @ Tc (IN/HR):	1.080	1.702	2.194	2.935	3.720	4.358
PEAK DISCHARGE (CFS) :	9.77	15.39	19.84	26.54	33.64	39.41

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D17 (WS D17)

WATERSHED AREA (A): 3.60 acres

LENGTH OF WATERCOURSE (Lc): 627. ft

LENGTH TO CENTER OF GRAVITY (Lca): 314. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
627.	3.1

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0220

WATERSHED TYPE(S): Moderate Urban

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 60. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.529	.582	.619	.662	.696	.725
Tc (FUNCTION OF i) :	10.98	10.57	10.31	10.04	9.84	9.68
SOLUTION OF Tc (MINUTES):	7	6	6	5	5	5
RAINFL INT. @ Tc (IN/HR):	2.775	3.883	4.524	5.604	6.389	7.162
RUNOFF RATE @ Tc (IN/HR):	1.467	2.259	2.799	3.709	4.446	5.190
PEAK DISCHARGE (CFS) :	5.32	8.20	10.16	13.46	16.13	18.83

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D17 (WS D17, OS-5)

WATERSHED AREA (A): 4.04 acres

LENGTH OF WATERCOURSE (Lc): 924. ft

LENGTH TO CENTER OF GRAVITY (Lca): 463. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
627.	3.1
297.	1.5

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0260

WATERSHED TYPE(S): Moderate Urban

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 53. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.468	.526	.567	.615	.654	.686
Tc (FUNCTION OF i) :	17.20	16.42	15.93	15.42	15.05	14.76
SOLUTION OF Tc (MINUTES):	13	11	9	8	8	7
RAINFL INT. @ Tc (IN/HR):	2.149	3.053	3.870	4.815	5.490	6.483
RUNOFF RATE @ Tc (IN/HR):	1.006	1.604	2.193	2.962	3.588	4.450
PEAK DISCHARGE (CFS) :	4.10	6.53	8.93	12.06	14.61	18.12

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D18 (WS D18)

WATERSHED AREA (A): 3.91 acres

LENGTH OF WATERCOURSE (Lc): 1156. ft

LENGTH TO CENTER OF GRAVITY (Lca): 578. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1156.	5.8

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0350

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 0. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.010	.100	.172	.262	.334	.397
Tc (FUNCTION OF i) :	124.20	49.20	39.49	33.42	30.31	28.30
SOLUTION OF Tc (MINUTES):	180	42	29	21	18	15
RAINFL INT. @ Tc (IN/HR):	.398	1.485	2.194	3.108	3.856	4.693
RUNOFF RATE @ Tc (IN/HR):	.004	.148	.378	.813	1.288	1.861
PEAK DISCHARGE (CFS) :	.02	.58	1.49	3.21	5.08	7.33

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D19 (WS D19)

WATERSHED AREA (A): 3.43 acres

LENGTH OF WATERCOURSE (Lc): 902. ft

LENGTH TO CENTER OF GRAVITY (Lca): 451. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
902.	4.5

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0220

WATERSHED TYPE(S): Moderate Urban

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 60. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.529	.582	.619	.662	.696	.725
Tc (FUNCTION OF i) :	13.66	13.15	12.83	12.49	12.24	12.04
SOLUTION OF Tc (MINUTES):	10	8	7	7	6	6
RAINFL INT. @ Tc (IN/HR):	2.378	3.497	4.292	5.073	6.096	6.833
RUNOFF RATE @ Tc (IN/HR):	1.257	2.035	2.656	3.357	4.241	4.952
PEAK DISCHARGE (CFS) :	4.35	7.03	9.18	11.61	14.66	17.12

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D20 (WS D20)

WATERSHED AREA (A): 5.40 acres

LENGTH OF WATERCOURSE (Lc): 587. ft

LENGTH TO CENTER OF GRAVITY (Lca): 294. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
587.	2.9

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0220

WATERSHED TYPE(S): Moderate Urban

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 60. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.529	.582	.619	.662	.696	.725
Tc (FUNCTION OF i) :	10.56	10.16	9.91	9.65	9.46	9.31
SOLUTION OF Tc (MINUTES):	7	6	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	2.775	3.883	4.742	5.604	6.389	7.162
RUNOFF RATE @ Tc (IN/HR):	1.467	2.259	2.934	3.709	4.446	5.190
PEAK DISCHARGE (CFS) :	7.98	12.30	15.97	20.19	24.20	28.25

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D20 (WS D20, D21)

WATERSHED AREA (A): 5.72 acres

LENGTH OF WATERCOURSE (Lc): 719. ft

LENGTH TO CENTER OF GRAVITY (Lca): 360. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
587.	24.0
132.	.7

MEAN SLOPE (Sc): .0232 ft BASIN FACTOR (Nb): .0310

WATERSHED TYPE(S): Moderate Urban

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 57. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.503	.558	.596	.642	.678	.708
Tc (FUNCTION OF i) :	9.28	8.90	8.66	8.41	8.23	8.09
SOLUTION OF Tc (MINUTES):	6	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	2.924	4.070	4.742	5.604	6.389	7.162
RUNOFF RATE @ Tc (IN/HR):	1.470	2.270	2.828	3.597	4.330	5.073
PEAK DISCHARGE (CFS) :	8.48	13.09	16.31	20.74	24.97	29.25

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D21 (WS D21)

WATERSHED AREA (A): .32 acres

LENGTH OF WATERCOURSE (Lc): 132. ft

LENGTH TO CENTER OF GRAVITY (Lca): 66. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
132.	.7

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0350

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 0. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.010	.100	.172	.262	.334	.397
Tc (FUNCTION OF i) :	33.78	13.38	10.74	9.09	8.24	7.70
SOLUTION OF Tc (MINUTES):	30	8	6	5	5	5
RAINFL INT. @ Tc (IN/HR):	1.392	3.497	4.524	5.604	6.389	7.162
RUNOFF RATE @ Tc (IN/HR):	.014	.348	.780	1.467	2.135	2.840
PEAK DISCHARGE (CFS) :	.00	.11	.25	.47	.69	.92

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: D22 (WS D22)

WATERSHED AREA (A): .79 acres

LENGTH OF WATERCOURSE (Lc): 244. ft

LENGTH TO CENTER OF GRAVITY (Lca): 122. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
244.	1.2

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0350

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 0. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.010	.100	.172	.262	.334	.397
Tc (FUNCTION OF i) :	48.84	19.35	15.53	13.14	11.92	11.13
SOLUTION OF Tc (MINUTES):	49	13	9	7	6	5
RAINFL INT. @ Tc (IN/HR):	1.013	2.854	3.870	5.073	6.096	7.162
RUNOFF RATE @ Tc (IN/HR):	.010	.284	.667	1.328	2.037	2.840
PEAK DISCHARGE (CFS) :	.01	.23	.53	1.06	1.62	2.26

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: OS-1 (WS OS-1)

WATERSHED AREA (A): 9.05 acres

LENGTH OF WATERCOURSE (Lc): 963. ft

LENGTH TO CENTER OF GRAVITY (Lca): 482. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
963.	4.8

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0350

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 0. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.010	.100	.172	.262	.334	.397
Tc (FUNCTION OF i) :	111.29	44.09	35.38	29.95	27.16	25.36
SOLUTION OF Tc (MINUTES):	154	36	25	19	15	13
RAINFL INT. @ Tc (IN/HR):	.444	1.649	2.385	3.285	4.186	5.022
RUNOFF RATE @ Tc (IN/HR):	.004	.164	.411	.860	1.399	1.991
PEAK DISCHARGE (CFS) :	.04	1.50	3.75	7.84	12.76	18.16

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: OS-2 (WS OS-2)

WATERSHED AREA (A): .46 acres

LENGTH OF WATERCOURSE (Lc): 145. ft

LENGTH TO CENTER OF GRAVITY (Lca): 73. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
145.	.7

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0350

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 0. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.010	.100	.172	.262	.334	.397
Tc (FUNCTION OF i) :	35.72	14.15	11.36	9.61	8.72	8.14
SOLUTION OF Tc (MINUTES):	32	9	6	5	5	5
RAINFL INT. @ Tc (IN/HR):	1.330	3.322	4.524	5.604	6.389	7.162
RUNOFF RATE @ Tc (IN/HR):	.013	.331	.780	1.467	2.135	2.840
PEAK DISCHARGE (CFS) :	.01	.15	.36	.68	.99	1.32

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: OS-3 (WS OS-3)

WATERSHED AREA (A): 6.62 acres

LENGTH OF WATERCOURSE (Lc): 903. ft

LENGTH TO CENTER OF GRAVITY (Lca): 452. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
903.	4.5

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0350

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 0. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.010	.100	.172	.262	.334	.397
Tc (FUNCTION OF i) :	107.08	42.42	34.04	28.81	26.13	24.40
SOLUTION OF Tc (MINUTES):	146	35	24	18	15	13
RAINFL INT. @ Tc (IN/HR):	.461	1.673	2.453	3.382	4.186	5.022
RUNOFF RATE @ Tc (IN/HR):	.005	.166	.423	.885	1.399	1.991
PEAK DISCHARGE (CFS) :	.03	1.11	2.82	5.91	9.33	13.29

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: OS-4 (WS OS-4)

WATERSHED AREA (A): 1.65 acres

LENGTH OF WATERCOURSE (Lc): 870. ft

LENGTH TO CENTER OF GRAVITY (Lca): 435. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
870.	4.3

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0350

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 0. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.010	.100	.172	.262	.334	.397
Tc (FUNCTION OF i) :	104.73	41.49	33.30	28.18	25.56	23.87
SOLUTION OF Tc (MINUTES):	142	33	23	17	14	13
RAINFL INT. @ Tc (IN/HR):	.471	1.731	2.507	3.479	4.351	5.022
RUNOFF RATE @ Tc (IN/HR):	.005	.172	.432	.910	1.454	1.991
PEAK DISCHARGE (CFS) :	.01	.29	.72	1.51	2.42	3.31

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: OS-5 (WS OS-5)

WATERSHED AREA (A): .44 acres

LENGTH OF WATERCOURSE (Lc): 297. ft

LENGTH TO CENTER OF GRAVITY (Lca): 149. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
297.	1.5

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0350

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 0. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.010	.100	.172	.262	.334	.397
Tc (FUNCTION OF i) :	54.93	21.76	17.47	14.78	13.41	12.52
SOLUTION OF Tc (MINUTES):	57	15	11	8	7	6
RAINFL INT. @ Tc (IN/HR):	.916	2.667	3.557	4.815	5.783	6.833
RUNOFF RATE @ Tc (IN/HR):	.009	.265	.613	1.260	1.932	2.709
PEAK DISCHARGE (CFS) :	.00	.12	.27	.56	.86	1.20

PROJECT NAME AND LOCATION: THE PINES II (Developed Conditions)

DRAINAGE CONCENTRATION POINT: OS-6 (WS OS-6)

WATERSHED AREA (A): .23 acres

LENGTH OF WATERCOURSE (Lc): 297. ft

LENGTH TO CENTER OF GRAVITY (Lca): 149. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
297.	1.5

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0350

WATERSHED TYPE(S): VALLEY

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	.88	1.17	1.36	1.61	1.84	2.06
P 2	1.07	1.40	1.63	1.91	2.18	2.43
P 3	1.19	1.56	1.80	2.12	2.40	2.69
P 6	1.43	1.85	2.14	2.50	2.83	3.16
P24	2.16	2.81	3.25	3.81	4.32	4.82

SOIL GROUPS

100. % B, CN= 82, COVER TYPE= DESERT BRUSH , COVER DENSITY= 25 %

IMPERVIOUS COVER= 0. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.010	.100	.172	.262	.334	.397
Tc (FUNCTION OF i) :	54.93	21.76	17.47	14.78	13.41	12.52
SOLUTION OF Tc (MINUTES):	57	15	11	8	7	6
RAINFL INT. @ Tc (IN/HR):	.916	2.667	3.557	4.815	5.783	6.833
RUNOFF RATE @ Tc (IN/HR):	.009	.265	.613	1.260	1.932	2.709
PEAK DISCHARGE (CFS) :	.00	.06	.14	.29	.45	.63

ROADWAY RATING CALCULATIONS

Roadway Rating Table

Project Description	
Worksheet	2-16' Lanes w/5in Rolled Curb and Sidewalk 1% Super
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	0.005000	ft/ft
Water Surface Elevation	100.09	ft

Results		
Mannings Coefficient	0.015	
Elevation Range	99.56 to 100.42	
Discharge	40.00	cfs
Flow Area	12.5	ft²
Wetted Perimeter	40.01	ft
Top Width	39.90	ft
Actual Depth	0.54	ft
Critical Elevation	100.10	ft
Critical Slope	0.004877	ft/ft
Velocity	3.21	ft/s
Velocity Head	0.16	ft
Specific Energy	100.25	ft
Froude Number	1.01	
Flow Type	Supercritical	

Natural Channel Points

Station (ft)	Elevation (ft)
0+95.00	100.10
1+00.00	100.00
1+00.25	99.97
1+00.50	99.90
1+00.75	99.80
1+01.00	99.69
1+01.25	99.61
1+01.50	99.57
1+01.75	99.56
1+02.00	99.58
1+18.00	99.74
1+34.00	99.90
1+34.25	99.88
1+34.50	99.89
1+34.75	99.93
1+35.00	100.01
1+35.25	100.12
1+35.50	100.22
1+35.75	100.29
1+36.00	100.32
1+41.00	100.42

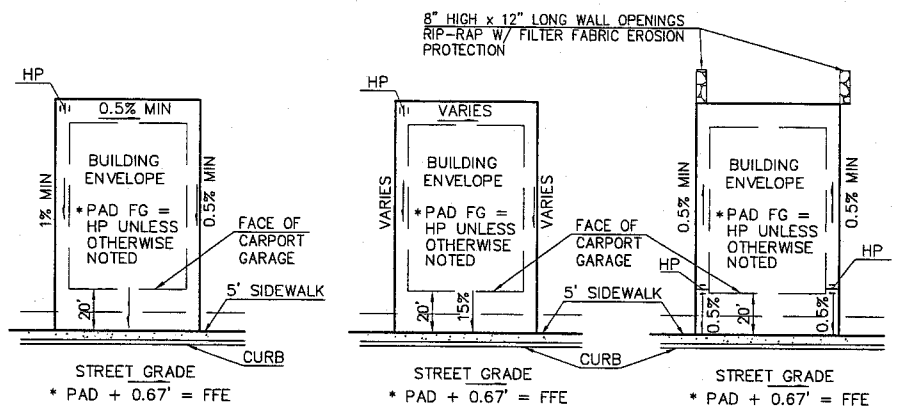
Roadway Rating Table

Project Description	
Worksheet	2-16' Lanes w/5in Rolled Curb and Sidewalk 1% Super
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

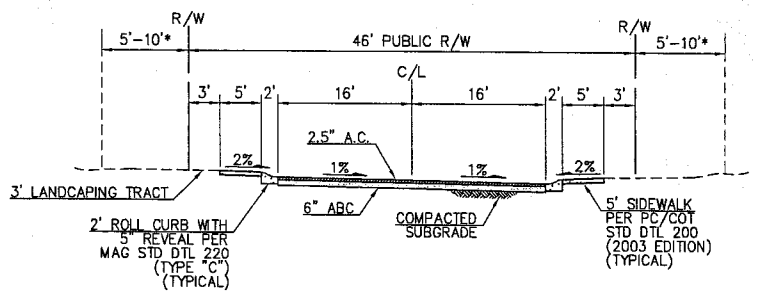
Input Data	
Water Surface Elevation	100.09 ft

Attribute	Minimum	Maximum	Increment
Channel Slope (ft/ft)	0.005000	0.030000	0.002000

Channel Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)
0.005000	40.00	3.21	12.5	40.01	39.90
0.007000	47.33	3.79	12.5	40.01	39.90
0.009000	53.67	4.30	12.5	40.01	39.90
0.011000	59.33	4.76	12.5	40.01	39.90
0.013000	64.50	5.17	12.5	40.01	39.90
0.015000	69.28	5.55	12.5	40.01	39.90
0.017000	73.76	5.91	12.5	40.01	39.90
0.019000	77.98	6.25	12.5	40.01	39.90
0.021000	81.98	6.57	12.5	40.01	39.90
0.023000	85.79	6.88	12.5	40.01	39.90
0.025000	89.44	7.17	12.5	40.01	39.90
0.027000	92.95	7.45	12.5	40.01	39.90
0.029000	96.33	7.72	12.5	40.01	39.90

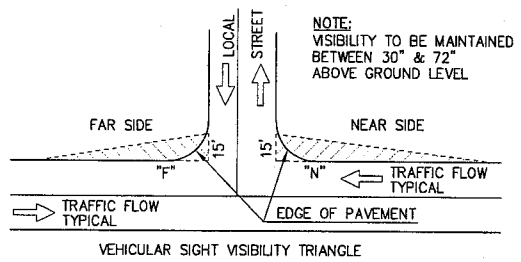


A TYPICAL LOT DRAINAGE
NTS



*: PUBLIC UTILITY, ROADWAY MAINTENANCE, SIGNAGE & LANDSCAPE EASEMENT- SEE PLAN SHEETS FOR LOCATIONS

B TYPICAL SUPER ELEVATED STREET SECTION
PUBLIC STREETS
NTS



VEHICULAR SIGHT VISIBILITY TRIANGLE

C SIGHT VISIBILITY TRIANGLE DETAIL

LOCAL STREETS:	"F" = 190'	"N" = 240'
COCHIE CANYON TRAIL:	"F" = 470'	"N" = 600'
ADONIS ROAD :	"F" = 470'	"N" = 600'

NTS

M M L A
P S O M A S
800 E. Wetmore Road, Suite 110, Tucson, AZ 85719
Tel (520) 292-2300 (800) 441-5875
Fax (520) 292-1290
www.mmla-psomas.com
MMLA JOB 05082-01-1025

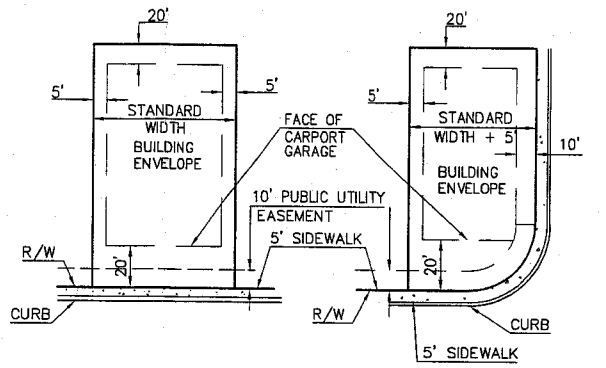
SCHEDULE B

PART TWO:

1. SECOND INSTALLMENT OF 2004 TAXES A LIEN, PAYABLE ON OR BEFORE MARCH 1, 2005., AND DELINQUENT MAY 1, 2005
2. ANY CHARGE UPON SAID LAND BY REASON OF ITS INCLUSION IN CONTINENTAL RANCH BUSINESS PARK ASSOCIATION. (ALL ASSESSMENTS DUE AND PAYABLE ARE PAID.)
3. ANY CHARGE UPON SAID LAND BY REASON OF ITS INCLUSION IN CORTARE WATER USERS ASSOCIATION AND /OR CORTARO MARANA IRRIGATION DISTRICT. (ALL ASSESSMENTS DUE AND PAYABLE ARE PAID.)
4. RESERVATIONS OR EXCEPTIONS IN PATENTS, OR IN ACTS AUTHORIZING THE ISSUANCE THERCOF.
5. WATER RIGHTS, CLAIMS OR TITLE TO WATER, WHETHER OR NOT SHOWN BY THE PUBLIC RECORDS.
6. ANY MATTER ARISING BY REASON OF RESERVATION OF UNDERGROUND WATER AS SET FORTH IN INSTRUMENT RECORDED IN BOOK 314 OF DEEDS, PAGE 445, AND INCLUSION OF SAID LAND WITHIN THE BOUNDARIES OF THE CORTARO-MARANA IRRIGATION DISTRICT AND/OR THE CORTARO WATER USER'S ASSOCIATION.
7. THE RIGHTS OR CLAIMS OF TITLE, IF ANY. BY THE STATE OF ARIZONA TO ANY PORTION OF THE PROPERTY DESCRIBED IN SCHEDULE A BEING LOCATED IN THE BED OF ANY RIVER OF DRY WASH
8. COVENANTS, CONDITIONS AND RESTRICTIONS IN THE DOCUMENT RECORDED AS DOCKET 6512, PAGE 605 AND IN DOCKET 6512, PAGE 611 OF OFFICIAL RECORDS, (AFFECTS THAT PORTION LYING OUT OF THE SUBDIVIDED PORTION OF SECTION 27) BUT DELETING ANY COVENANT, CONDITION OR RESTRICTION INDICATING A PREFERENCE , LIMITATION OR DISCRIMINATION BASED ON RACE, COLOR, RELIGION, SEC, RESTRICTIONS VIOLATE TITLE 42, SECTION 3604(C), OF THE UNITED STATES CODES.
9. COVENANTS, CONDITIONS AND RESTRICTIONS IN THE DOCUMENT RECORDED AS DOCKET 6528, PAGE 790 OF OFFICIAL RECORDS. (AFFECTS THAT PORTION LYING OUT OF THE SUBDIVIDED PORTION OF SECTION 27) BUT DELETING ANY COVENANT, CONDITION OR RESTRICTION INDICATING A PREFERENCE , LIMITATION OR DISCRIMINATION BASED ON RACE, COLOR, RELIGION, SEC, HANDICAP. FAMILIAR STATUS OR NATIONAL ORIGIN, TO THE EXTENT SUCH COVENANTS, CONDITIONS OR RESTRICTIONS VIOLATE TITLE 42, SECTION 3604(C), OF THE UNITED STATES CODES.
10. COVENANTS, CONDITIONS AND RESTRICTIONS IN THE DOCUMENT RECORDED AS DOCKET 7724, PAGE 1059, DOCKET 8796, PAGE 1591, DOCKET 9727, PAGE 1958 AND DOCKET 10231, PAGE 113, ASSIGNMENT IN DOCKET 7643, PAGE 101, DOCKET 9301, PAGE 1761, DOCKET 9665, PAGE 1507 AND DOCKET 12041, PAGE 574 OF OFFICIAL RECORDS, BUT DELETING ANY COVENANT, CONDITION OR RESTRICTION INDICATING A PREFERENCE, LIMITATION OR DISCRIMINATION BASED ON RACE, COLOR, RELIGION, SEX, HANDICAP, FAMILIAL STATUS, OR NATIONAL ORIGIN, TO THE EXTENT SUCH COVENANTS, CONDITIONS OR RESTRICTIONS VIOLATE TITLE 42, SECTION 3604(C). OF THE UNITED STATES CODES.
11. COVENANTS, CONDITIONS AND RESTRICTIONS IN THE DOCUMENT RECORDED AS DOCKET 10695, PAGE 282 OF OFFICIAL RECORDS, BUT DELETING ANY COVENANT, CONDITION OR RESTRICTIONINDICATING A PREFERENCE, LIMITATION OR DISCRIMINATION BASED ON RACE, COLOR, RELIGION, SEC, HANDICAP, FAMILIAL STATUS, OR NATIONAL ORIGIN, TO THE EXTENT SUCH COVENANTS, CONDITIONS OR RESTRICTIONS VIOLATE TITLE 42, SECTION 3604(C), OF THE UNITED STATES CODES.
12. EASEMENTS, RESTRICTIONS, RESERVATIONS, CONDITIONS AND SET-BACK LINES AS SET FORTH ON THE PLAT RECORDED IN BOOK ___ OF MAPS, PAGE ___ BUT DELETING ANY COVENANT, CONDITION OR RESTRICTION INDICATING A PREFERENCE, LIMITATION OR DISCRIMINATION BASED ON RACE, COLOR, RELIGION, SEX, HANDICAP, FAMILIAL STATUS OR NATIONAL ORIGIN TO THE EXTENT SUCH COVENANTS, CONDITIONS OR RESTRICTIONS VIOLATE 42 USC 3604(C).

    RELEASE BY SOUTHWEST GAS CORPORATION OF EASEMENTS SET FORTH IN SAID INSTRUMENT RECORDED IN DOCKET 10915, PAGE 531 RELEASE BY TUCSON ELECTRIC POWER COMPANY, AN ARIZONA CORPORATION OF EASEMENTS SET FORTH IN SAID INSTRUMENT RECORDED IN DOCKET 10918, PAGE 2784 RESOLUTION NO. 2000-02 ABANDONING EASEMENTS LOCATED IN PEPPERTREE RANCH BUSINESS PARK PLAT, RECORDED IN DOCKET 11209. PAGE 1479, RE-RECORDED IN DOCKET 11580, PAGE 3055. PARTIAL RELEASE OF SEWER EASEMENTS RECORDED IN DOCKET 11555, PAGE 1145.

    RELEASE BY SOUTHWEST GAS CORPORATION OF EASEMENTS SET FORTH IN SAID INSTRUMENT RECORDED IN DOCKET 10915, PAGE 531. RELEASE BY TUCSON ELECTRIC POWER COMPANY, AN ARIZONA CORPORATION OF EASEMENTS SET FORTH IN SAID INSTRUMENT RECORDED IN DOCKET 10918, PAGE 2784. RESOLUTION NO. 2000-02 ABANDONING EASEMENTS LOCATED IN PEPPERTREE RANCH BUSINESS PARK PLAT, RECORDED IN DOCKET 11209, PAGE 1479, RE-RECORDED IN DOCKET 11580, PAGE 3055.
13. LACK OF ACCESS TO INTERSTATE 10 AND GRANT OF ACCESS TO A TWO-WAY FRONTAGE ROAD CONNECTION WITH INTERSTATE HIGHWAY 10 AND CORTARO INTERCHANGE AS CONTAINED IN ORDER OF CONDEMNATION RECORDED DECEMBER 27, 1956 IN DOCKET 2647, PAGE 20. (BLOCK 2)
14. AGREEMENT BETWEEN PIMA COUNTY, ARIZONA, A BODY POLITIC, AND STEWART TITLE & TRUST OF TUCSON, AS TRUSTEE UNDER TRUST NO. 1746, RECORDED SEPTEMBER 19, 1979, IN DOCKET 6116, PAGE 719.
15. AGREEMENT BY AND BETWEEN PIMA COUNTY, ARIZONA, AND STEWART TITLE & TRUST OF TUCSON, UNDER TRUST NO. 1746, RECORDED NOVEMBER 30, 1979 IN DOCKET 6165, PAGE 1435.
16. AN EASEMENT FOR WATER LINES AND FACILITIES AND INCIDENTAL PURPOSES, RECORDED AS DOCKET 6829, PAGE 980 OF OFFICIAL RECORDS, (BLOCK 2)
17. AGREEMENT BETWEEN UNION ROCK AND MATERIALS CORPORATION AND CORTARO WATER USER'S ASSOCIATION AND CORTARO-MARANA IRRIGATION DISTRICT RECORDED OCTOBER 9, 1984 IN DOCKET 7384, PAGE 1103. (AFFECTS THAT PORTION LYING OUT OF THE SUBDIVIDED PORTION OF SECTION 27)
18. ALL MATTERS CONTAINED IN THE GOLF COURSE WATER AGREEMENT, BETWEEN CORTARO WATER USER'S ASSOCIATION, AN ARIZONA NON-PROFIT CORPORATION ACTING AS AGENT FOR CORTARO MARANA IRRIGATION DISTRICT, AND SVP LINKS, L.L.C. AND ARIZONA LIMITED LIABILITY COMPANY, RECORDED IN DOCKET 1066, PAGE 368.
19. ALL MATTERS BY REASON OF THE AGREEMENT FOR WATER SERVICES WITH THE CITY OF TUCSON, AS SET FORTH IN THE INSTRUMENT RECORDED DECEMBER 17, 1998 IN DOCKET 10945, PAGE 1021. (ALL PARCELS)
20. ALL MATTERS BY REASON OF ORDINANCE NO. 9931 BY THE MAYOR AND COUNCIL OF THE TOWN OF MARANA, ARIZONA RECORDED IN DOCKET 11196, PAGE 1175. (BLOCK LAND PORTION BLOCK 2)
21. RESERVATIONS OF EXISTING SEWER, GAS, WATER OR SIMILAR PIPELINES AND APPURTENANCES, CANALS LATERALS OR DITCHES AND APPURTENANCES, ELECTRIC, TELEPHONE AND SIMILAR LINES AND APPURTENANCES IN THE RESOLUTION NO 2000-02 ABANDONING EASEMENTS LOCATED IN PEPPERTREE RANCH BUSINESS PARK PLAT, RECORDED IN DOCKET 11209, PAGE E1479, RE-RECORDED IN DOCKET 11580, PAGE 3055.
22. ALL MATTERS AS SET FORTH IN THE EASEMENT AND COVENANT AND RIGHTS INCIDENT THERETO, IN INSTRUMENT RECORDED IN DOCKET 11577, PAGE 3809.
23. RESOLUTION NO. 2002.01 AMENDING THE CONTINENTAL RANCH SPECIFIC PLAN BY THE MAYOR AND COUNCIL OF THE TOWN OF MARANA. ARIZONA RECORDED IN DOCKET 11742, PAGE 2744.
24. AN EASEMENT FOR ELECTRIC AND COMMUNICATION LINES AND FACILITIES AND INCIDENTAL PURPOSES RECORDED AS DOCKET 11855, PAGE 1276 OF OFFICIAL RECORDS.
25. AN EASEMENT FOR ELECTRIC AND COMMUNICATION LINES AND FACILITIES AND INCIDENTAL PURPOSES, RECORDED AS DOCKET 11995, PAGE 6299 OF OFFICIAL RECORDS.
26. AN EASEMENT FOR ELECTRIC AND COMMUNICATION LINES AND FACILITIES AND INCIDENTAL PURPOSES, RECORDED AS DOCKET 12158, PAGE 754 OF OFFICIAL RECORDS.



D TYPICAL LOT SETBACKS
SEE 08:06 OF LAND DEVELOPMENT CODE
NTS

PRELIMINARY PLAT
FOR S01-024

THE PINES PHASE II

LOTS 1-284 & COMMON AREAS 'A' & 'B'
COMMON AREAS USES: 'A' RECREATION AND OPEN SPACE
'B' DRAINAGE AND OPEN SPACE

BEING A RESUBDIVISION OF A PORTION OF OF BLOCK 1 AND BLOCK 3 OF FINAL BLOCK PLAT, MARANA GOLF, CONTINENTAL RANCH, BK. 58 M&P, PG. 15 IN A PORTION OF THE S 1/2 OF SECTION 22, THE NW 1/4 OF SECTION 26 AND THE N 1/2 OF SECTION 27, T 12 S, R 12 E, G&SRB&M, TOWN OF MARANA, PIMA COUNTY, ARIZONA.

RES-99-159
C9-84-65

DATE 11-15-05 SCALE 1"=40' SHEET 9 OF 9

BOOK PAGE

S:\05\082\01\PLANNING\SUBMITC-2001P06.dwg Layout: Fidencio Siqueiros Wed, 16 Nov 2005, 10:18am Last Saved By: Fsiqueiros

SCUPPER DESIGN

MMLA
McGovern MacVittie Lodge & Associates, Inc.

Project Name: Pines II
Project Number # : 05082-01 Made by CBR Date 12/1/2005
Reference: PC DEV SERV Checked By _____ Date _____

PIMA COUNTY SCUPPER DESIGN

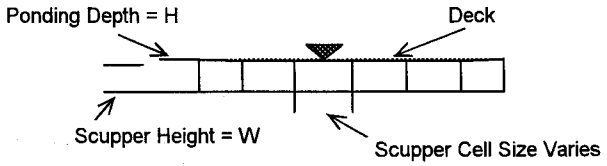
General Equations

Orifice

$$Q = C_s A H^{1/2}$$

where

A = Effective Area
Cs = Orifice Coefficient 5.35
Cf = Clogging Factor 1.00
H = Depth of ponding in feet
Q = 100-year Peak Discharge (cfs)



For Sidewalk Scupper

Solution D1

Orifice

Q_{100} = 34
C_s = 5.35
C_f = 1.00
H = 0.75
A = 7.3

A=WL
where
W = Opening Height = 0.500 feet
L = Effective Length of Opening in feet
L = 15 feet

Concentration Point	Q_{100} (cfs)	Ponding Depth (ft)	Area (ft^2)	Opening Height (ft)	Effective Length (ft)
D1	34	0.75	7.3	0.5	15
D4	20	0.75	4.3	0.5	9
D6	26	0.75	5.6	0.5	12
D10	13	0.75	2.8	0.5	6
D12	15	0.75	3.2	0.5	7
D15	26	0.75	5.6	0.5	12
D17	18	0.75	3.9	0.5	8
D19	17	0.75	3.7	0.5	8
D20	28	0.75	6.0	0.5	13

DEPRESSED CURB DESIGN

MMLA
McGovern MacVittie Lodge & Associates, Inc.

Sheet1

Project Name: Pines II
Project Number # : 05082-02 Made by CBR Date 12/1/05
Reference: COT SMDDFM Checked By _____ Date _____

Depressed Curb Calculations

General Equation

$$L = C_f \frac{Q}{C_s Y^{3/2}}$$

where
- L = Length of Opening (ft)
- C_D = Weir Coefficient = 3 for L>12 2.3 for L<12
- Y = Height of Opening (ft)
- Q = 100-year Peak Discharge (cfs)

Solution

For 5-inch Depressed Curb (D3)

- Q = 1 cfs
- C_D = 2.3
- Y = 0.5 ft
- **L = 1 ft**

Concentration Point	Q_{100} (cfs)	Opening Height (ft)	Effect. Length (ft)
D3	1	0.5	1
D9	3	0.5	4
OS-2	1	0.5	1
OS-4	3	0.5	4
OS-5	1	0.5	1
OS-6	1	0.5	1

CATCH BASIN DESIGN

MMLA
McGovern MacVittie Lodge & Associates, Inc.

Project Name: Pines II
Project Number # : 05082-01 Made by CBR Date 11/27/2005
Reference: PC DEV SERV Checked By _____ Date _____

CATCH BASIN DESIGN

General Equations

Orifice

$$Q = C_s A H^{1/2} (C_f^{-1})$$

where

A = Effective Area
Cs = Orifice Coefficient 5.35
Cf = Clogging Factor 1.50
H = Depth of ponding in feet
Q = 100-year Peak Discharge (cfs)

Solution CP 1

Orifice

Q_{100} = 17
C_s = 5.35
C_f = 1.50
H = 0.75
A = 5.5

A=WL
where
W = Opening Height = 0.417 feet
L = Effective Length of Opening in feet = 14 feet

Concentration Point	Q_{100} (cfs)	Ponding Depth (ft)	Area (ft^2)	Opening Height (ft)	Effective Length (ft)
D14	17	0.75	5.5	0.4167	14

CHANNEL DESIGN CALCULATIONS

Channel Calculations

CHANNEL 1 – CP OS-1

Project Description	
Worksheet	CP OS-1
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Channel Slope	0.005000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	3.00	ft
Discharge	44.00	cfs

Results		
Depth	1.75	ft
Flow Area	14.4	ft^2
Wetted Perimeter	14.06	ft
Top Width	13.49	ft
Critical Depth	1.27	ft
Critical Slope	0.020121	ft/ft
Velocity	3.05	ft/s
Velocity Head	0.14	ft
Specific Energy	1.89	ft
Froude Number	0.52	
Flow Type	Subcritical	

Channel Calculations

CHANNEL 2 – CP D3

Project Description	
Worksheet	D3
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.005000	ft/ft
Left Side Slope	12.00	H : V
Right Side Slope	12.00	H : V
Discharge	1.00	cfs

Results		
Depth	0.29	ft
Flow Area	1.0	ft²
Wetted Perimeter	7.06	ft
Top Width	7.03	ft
Critical Depth	0.21	ft
Critical Slope	0.027806	ft/ft
Velocity	0.97	ft/s
Velocity Head	0.01	ft
Specific Energy	0.31	ft
Froude Number	0.45	
Flow Type	Subcritical	

Channel Calculations

CHANNEL 3 – CP D2

Project Description	
Worksheet	CP D2
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.010000	ft/ft
Left Side Slope	6.00	H : V
Right Side Slope	6.00	H : V
Discharge	66.00	cfs

Results		
Depth	1.61	ft
Flow Area	15.5	ft²
Wetted Perimeter	19.58	ft
Top Width	19.31	ft
Critical Depth	1.50	ft
Critical Slope	0.014711	ft/ft
Velocity	4.25	ft/s
Velocity Head	0.28	ft
Specific Energy	1.89	ft
Froude Number	0.83	
Flow Type	Subcritical	

Channel Calculations

CHANNEL 4 – CP D5

Project Description	
Worksheet	D5
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.010000	ft/ft
Left Side Slope	12.00	H : V
Right Side Slope	12.00	H : V
Discharge	18.00	cfs

Results		
Depth	0.76	ft
Flow Area	6.9	ft²
Wetted Perimeter	18.31	ft
Top Width	18.25	ft
Critical Depth	0.67	ft
Critical Slope	0.018927	ft/ft
Velocity	2.59	ft/s
Velocity Head	0.10	ft
Specific Energy	0.86	ft
Froude Number	0.74	
Flow Type	Subcritical	

Channel Calculations

CHANNEL 5 – CP D7

Project Description	
Worksheet	CP D7
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Channel Slope	0.010000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	3.00	ft
Discharge	35.00	cfs

Results		
Depth	1.34	ft
Flow Area	9.4	ft²
Wetted Perimeter	11.48	ft
Top Width	11.04	ft
Critical Depth	1.13	ft
Critical Slope	0.020760	ft/ft
Velocity	3.72	ft/s
Velocity Head	0.21	ft
Specific Energy	1.56	ft
Froude Number	0.71	
Flow Type	Subcritical	

Channel Calculations

CHANNEL 6 – CP D11

Project Description	
Worksheet	D11
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.010000	ft/ft
Left Side Slope	12.00	H : V
Right Side Slope	12.00	H : V
Discharge	13.00	cfs

Results		
Depth	0.67	ft
Flow Area	5.4	ft²
Wetted Perimeter	16.22	ft
Top Width	16.16	ft
Critical Depth	0.59	ft
Critical Slope	0.019767	ft/ft
Velocity	2.39	ft/s
Velocity Head	0.09	ft
Specific Energy	0.76	ft
Froude Number	0.73	
Flow Type	Subcritical	

Channel Calculations

CHANNEL 7 – CP OS-5

Project Description	
Worksheet	CP OS-5
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.005000	ft/ft
Left Side Slope	12.00	H : V
Right Side Slope	12.00	H : V
Discharge	1.00	cfs

Results		
Depth	0.29	ft
Flow Area	1.0	ft²
Wetted Perimeter	7.06	ft
Top Width	7.03	ft
Critical Depth	0.21	ft
Critical Slope	0.027806	ft/ft
Velocity	0.97	ft/s
Velocity Head	0.01	ft
Specific Energy	0.31	ft
Froude Number	0.45	
Flow Type	Subcritical	

Channel Calculations

CHANNEL 8 – CP D13

Project Description	
Worksheet	CP D13
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Channel Slope	0.010000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	3.00	ft
Discharge	26.00	cfs

Results		
Depth	1.16	ft
Flow Area	7.6	ft^2
Wetted Perimeter	10.36	ft
Top Width	9.98	ft
Critical Depth	0.97	ft
Critical Slope	0.021619	ft/ft
Velocity	3.44	ft/s
Velocity Head	0.18	ft
Specific Energy	1.35	ft
Froude Number	0.70	
Flow Type	Subcritical	

Channel Calculations

CHANNEL 9 – CP D16

Project Description	
Worksheet	CP D16
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Channel Slope	0.010000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	3.00	ft
Discharge	39.00	cfs

Results		
Depth	1.41	ft
Flow Area	10.2	ft²
Wetted Perimeter	11.92	ft
Top Width	11.46	ft
Critical Depth	1.19	ft
Critical Slope	0.020458	ft/ft
Velocity	3.83	ft/s
Velocity Head	0.23	ft
Specific Energy	1.64	ft
Froude Number	0.72	
Flow Type	Subcritical	

Channel Calculations

CHANNEL 10 – CP D17

Project Description	
Worksheet	CP D17
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Channel Slope	0.010000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	3.00	ft
Discharge	18.00	cfs

Results		
Depth	0.97	ft
Flow Area	5.8	ft^2
Wetted Perimeter	9.16	ft
Top Width	8.84	ft
Critical Depth	0.79	ft
Critical Slope	0.022746	ft/ft
Velocity	3.12	ft/s
Velocity Head	0.15	ft
Specific Energy	1.13	ft
Froude Number	0.68	
Flow Type	Subcritical	

Channel Calculations

CHANNEL 11 – CP D21

Project Description	
Worksheet	D21
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.010000	ft/ft
Left Side Slope	12.00	H : V
Right Side Slope	12.00	H : V
Discharge	29.00	cfs

Results		
Depth	0.91	ft
Flow Area	9.9	ft²
Wetted Perimeter	21.90	ft
Top Width	21.83	ft
Critical Depth	0.82	ft
Critical Slope	0.017760	ft/ft
Velocity	2.92	ft/s
Velocity Head	0.13	ft
Specific Energy	1.04	ft
Froude Number	0.76	
Flow Type	Subcritical	

Channel Calculations

CHANNEL 12 – CP D8

Project Description	
Worksheet	CP D8
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.003900	ft/ft
Left Side Slope	8.00	H : V
Right Side Slope	8.00	H : V
Bottom Width	80.00	ft
Discharge	1,101.00	cfs

Results		
Depth	2.32	ft
Flow Area	228.4	ft²
Wetted Perimeter	117.37	ft
Top Width	117.08	ft
Critical Depth	1.70	ft
Critical Slope	0.011519	ft/ft
Velocity	4.82	ft/s
Velocity Head	0.36	ft
Specific Energy	2.68	ft
Froude Number	0.61	
Flow Type	Subcritical	

Channel Calculations

CHANNEL 12 – CP D18

Project Description	
Worksheet	CP D18
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.003900	ft/ft
Left Side Slope	8.00	H : V
Right Side Slope	8.00	H : V
Bottom Width	80.00	ft
Discharge	1,101.00	cfs

Results		
Depth	2.32	ft
Flow Area	228.4	ft²
Wetted Perimeter	117.37	ft
Top Width	117.08	ft
Critical Depth	1.70	ft
Critical Slope	0.011519	ft/ft
Velocity	4.82	ft/s
Velocity Head	0.36	ft
Specific Energy	2.68	ft
Froude Number	0.61	
Flow Type	Subcritical	

Channel Calculations

CHANNEL 12 – CP D22

Project Description	
Worksheet	CP D22
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.003900	ft/ft
Left Side Slope	8.00	H : V
Right Side Slope	8.00	H : V
Bottom Width	80.00	ft
Discharge	1,101.00	cfs

Results		
Depth	2.32	ft
Flow Area	228.4	ft²
Wetted Perimeter	117.37	ft
Top Width	117.08	ft
Critical Depth	1.70	ft
Critical Slope	0.011519	ft/ft
Velocity	4.82	ft/s
Velocity Head	0.36	ft
Specific Energy	2.68	ft
Froude Number	0.61	
Flow Type	Subcritical	

MMLA
McGovern MacVittie Lodge & Associates, Inc.

Project Name: Pines II
Project Number # : 05082-78 Made by CBR Date 11/30/05
Reference: SMDDFPM Checked By _____ Date _____

Calculation of Channel Parameters

General Equations:

1) Minimum Channel Freeboard

$$FB = 1/6\left[Y + \frac{V^2}{2g}\right] \qquad \text{Eq 8.4}$$

Where
FB = Freeboard (ft)
Y = Depth of Flow (ft)
V = average velocity of flow, (fps)
g = Acceleration due to gravity = 32.2 ft/sec2

2) Minimum Channel Radius

$$R_c = 3T \qquad \text{Froude Number } <0.86$$

Where
R_c = Minimum Radius of Curvature Centerline (ft)
T = Channel Topwidth at Watersurface (ft)

$$R_c = \frac{4V^2T}{gY} \qquad \text{Froude Number } >0.86 \qquad \text{Eq 8.12}$$

Where
R_c = Minimum Radius of Curvature Centerline (ft)
T = Channel Topwidth at Watersurface (ft)
V = average velocity of flow, (fps)
Y = Hydraulic Depth of Flow (ft)

Channel	C.P	Y (ft)	V (fps)	**FB (ft)**	Froude Number	T (ft)	**Rc (ft)**
1	OS-1	1.75	3.05	**0.32**	0.52	13.49	**40.47**
2	3	0.29	0.97	**0.05**	0.45	7.03	**21.09**
3	2	1.61	4.25	**0.32**	0.83	19.31	**57.93**
4	5	0.76	2.59	**0.14**	0.74	18.25	**54.75**
5	7	1.34	3.72	**0.26**	0.71	11.04	**33.12**
6	11	0.67	2.39	**0.13**	0.73	16.16	**48.48**
7	OS-5	0.29	0.97	**0.05**	0.45	7.03	**21.1**
8	13	1.16	3.44	**0.22**	0.70	9.98	**29.9**
9	16	1.41	3.83	**0.27**	0.72	11.46	**34.4**
10	17	0.97	3.12	**0.19**	0.68	8.84	**26.5**
11	21	0.91	2.92	**0.17**	0.76	21.83	**65.5**
12	D8, D18, D22	2.32	4.82	**0.45**	0.61	117.08	**351.2**

CULVERT DESIGN

Calculations for Culvert at CP D5

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

November 27, 2005

PROGRAM INPUT DATA

DESCRIPTION	VALUE
Culvert Diameter (ft)	2.0
FHWA Chart Number	1
FHWA Scale Number (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.013
Entrance Loss Coefficient of Culvert Opening	0.1
Culvert Length (ft)	65.0
Invert Elevation at Downstream end of Culvert (ft)	100.0
Invert Elevation at Upstream end of Culvert (ft)	100.65
Culvert Slope (ft/ft)	0.01
Starting Flow Rate (cfs)	18.0
Incremental Flow Rate (cfs)	1.0
Ending Flow Rate (cfs)	18.0
Starting Tailwater Depth (ft)	1.53
Incremental Tailwater Depth (ft)	1.0
Ending Tailwater Depth (ft)	1.53

COMPUTATION RESULTS

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
18.0	1.53	2.64	0.0	1.35	1.53	1.35	7.99

Calculations for Culvert at CP D8

BOX CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

November 27, 2005

PROGRAM INPUT DATA

DESCRIPTION	VALUE
Culvert Span (ft)	10.0
Culvert Rise (ft)	4.0
FHWA Chart Number	9
FHWA Scale Number (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n value)	0.013
Entrance Loss Coefficient of Culvert Opening	0.2
Culvert Length (ft)	55.0
Invert Elevation at Downstream end of Culvert (ft)	100.0
Invert Elevation at Upstream end of Culvert (ft)	100.39
Culvert Slope (ft/ft)	0.0071
Starting Flow Rate (cfs)	202.0
Incremental Flow Rate (cfs)	1.0
Ending Flow Rate (cfs)	202.0
Starting Tailwater Depth (ft)	2.33
Incremental Tailwater Depth (ft)	1.0
Ending Tailwater Depth (ft)	2.33

COMPUTATION RESULTS

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
202.0	2.33	3.78	0.0	1.76	2.33	1.76	11.48

Calculations for Culvert at CP D19

BOX CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

November 27, 2005

PROGRAM INPUT DATA

DESCRIPTION	VALUE
Culvert Span (ft)	10.0
Culvert Rise (ft)	4.0
FHWA Chart Number	9
FHWA Scale Number (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.013
Entrance Loss Coefficient of Culvert Opening	0.2
Culvert Length (ft)	55.0
Invert Elevation at Downstream end of Culvert (ft)	100.0
Invert Elevation at Upstream end of Culvert (ft)	100.39
Culvert Slope (ft/ft)	0.0071
Starting Flow Rate (cfs)	202.0
Incremental Flow Rate (cfs)	1.0
Ending Flow Rate (cfs)	202.0
Starting Tailwater Depth (ft)	2.33
Incremental Tailwater Depth (ft)	1.0
Ending Tailwater Depth (ft)	2.33

COMPUTATION RESULTS

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
202.0	2.33	3.78	0.0	1.76	2.33	1.76	11.48

SPLASH PAD CALCULATIONS

Splash Pad Design for CP D1 36" RCP

DISCHARGE	CULVERT DIAM	TAILWATER DEPTH	DURATION
44.00CFS	3.00FT	1.50FT	5.00MIN

MAX SCOUR LGT	MAX SCOUR DEPTH	MAX SCOUR WIDTH	SCOUR VOLUME
31.4FT	3.8FT	14.2FT	243.9FT3

MAX DEPTH OCCURS 12.6 FT DOWNSTREAM OF THE CULVERT OUTLET

SCOUR PROFILE		SCOUR X-SECT AT LOC MAX DEPTH	
LENGTH	DEPTH	DIST FROM CL	DEPTH
0.0	0.00	0.0	3.85
3.1	1.23	0.7	3.73
6.3	2.89	1.4	3.50
9.4	3.62	2.1	3.00
12.6	3.85	2.8	1.96
15.7	3.69	3.6	0.89
18.9	3.31	4.3	0.35
22.0	2.69	5.0	0.15
25.1	1.92	5.7	0.08
28.3	1.00	6.4	0.04
31.4	0.00	7.1	0.00

STONE DIAM(D50) REQUIRED TO PREVENT SCOUR UNDER ALL TAILWATER CONDITION
==> 5.72 INCHES ON A HORIZONTAL BLANKET 2D50 THICK.

LENGTH OF HORIZONTAL STONE PROTECTION BLANKET REQUIRED TO PREVENT SCOUR
UNDER ALL TAILWATER CONDITIONS = 25.4FT

THE RIPRAP BLANKET SHOULD BE 3 CULVERT DIAMETERS WID E AT THE CULVERT AND
SHOULD BE FLARED 1(NORMAL TO THE CULVE RT CL) ON 2(PARALLEL TO THE CULVERT
CENTERLINE AND HAVE A THICKNESS EQUAL TO 2D50.

IF THE COMPUTED STONE SIZE (D50) IS NOT REALISTIC, IT CAN BE REDUCED
BY 38 AND 59 PERCENT IF PREFORMED SCOUR HOLES 0.5 OR 1.0 CULVERT DIAMETER
DEEP, RESPECTIVELY, ARE USED. THE BOTTOM OF THE SCOUR HOLE SHOULD BE
3 CULVERT DIAMETER LONG AND 2 CULVERT DIAMETERS WIDE AND SHOULD
BEGIN 1.5 AND 3.0 CULVERT DIAMETERS DOWNSTREAM FROM THE CULVERT EXIT
PORTAL FOR SCOUR HOLE DEPTH OF 0.5 AND 1.0 CULVERT DIAMETERS, RESPECTIVELY.
IT SHOULD HAVE 1V TO 3H SIDE SLOPES IN ALL DIRECTIONS AND HAVE A RIP
RAP THICKNESS EQUAL TO 2D50.

Splash Pad Design for CP D1 15' Scupper

DISCHARGE	CULVERT WIDTH	HEIGHT	TAILWATER DEPTH	DURATION
34.00CFS	15.00FT	0.50FT	0.25FT	5.00MIN

MAX SCOUR LGT	MAX SCOUR DEPTH	MAX SCOUR WIDTH	SCOUR VOLUME
9.4FT	0.9FT	5.0FT	5.8FT3

MAX DEPTH OCCURS 3.8 FT DOWNSTREAM OF THE CULVERT OUTLET

SCOUR PROFILE		SCOUR X-SECT AT LOC MAX DEPTH	
LENGTH	DEPTH	DIST FROM CL	DEPTH
0.0	0.00	0.0	0.87
0.9	0.28	0.3	0.85
1.9	0.65	0.5	0.79
2.8	0.82	0.8	0.68
3.8	0.87	1.0	0.44
4.7	0.84	1.3	0.20
5.6	0.75	1.5	0.08
6.6	0.61	1.8	0.03
7.5	0.44	2.0	0.02
8.4	0.23	2.3	0.01
9.4	0.00	2.5	0.00

STONE DIAM(D50) REQUIRED TO PREVENT SCOUR UNDER ALL TAILWATER CONDITION
==> 2.84 INCHES ON A HORIZONTAL BLANKET 2D50 THICK.

LENGTH OF HORIZONTAL STONE PROTECTION BLANKET REQUIRED TO PREVENT SCOUR
UNDER ALL TAILWATER CONDITIONS = 9.6FT

THE RIPRAP BLANKET SHOULD BE 3 CULVERT DIAMETERS WID E AT THE CULVERT AND
SHOULD BE FLARED 1(NORMAL TO THE CULVE RT CL) ON 2(PARALLEL TO THE CULVERT
CENTERLINE AND HAVE A THICKNESS EQUAL TO 2D50.

IF THE COMPUTED STONE SIZE (D50) IS NOT REALISTIC, IT CAN BE REDUCED
BY 38 AND 59 PERCENT IF PREFORMED SCOUR HOLES 0.5 OR 1.0 CULVERT DIAMETER
DEEP, RESPECTIVELY, ARE USED. THE BOTTOM OF THE SCOUR HOLE SHOULD BE
3 CULVERT DIAMETER LONG AND 2 CULVERT DIAMETERS WIDE AND SHOULD
BEGIN 1.5 AND 3.0 CULVERT DIAMETERS DOWNSTREAM FROM THE CULVERT EXIT
PORTAL FOR SCOUR HOLE DEPTH OF 0.5 AND 1.0 CULVERT DIAMETERS, RESPECTIVELY.
IT SHOULD HAVE 1V TO 3H SIDE SLOPES IN ALL DIRECTIONS AND HAVE A RIP
RAP THICKNESS EQUAL TO 2D50.

Splash Pad Design for CP D2 21' Channel

DISCHARGE	CULVERT WIDTH	HEIGHT	TAILWATER DEPTH	DURATION
66.00CFS	21.00FT	1.75FT	1.75FT	5.00MIN

MAX SCOUR LGT	MAX SCOUR DEPTH	MAX SCOUR WIDTH	SCOUR VOLUME
10.9FT	1.7FT	4.2FT	11.2FT3

MAX DEPTH OCCURS 4.4 FT DOWNSTREAM OF THE CULVERT OUTLET

SCOUR PROFILE		SCOUR X-SECT AT LOC MAX DEPTH	
LENGTH	DEPTH	DIST FROM CL	DEPTH
0.0	0.00	0.0	1.71
1.1	0.55	0.2	1.65
2.2	1.28	0.4	1.55
3.3	1.60	0.6	1.33
4.4	1.71	0.8	0.87
5.5	1.64	1.1	0.39
6.5	1.47	1.3	0.15
7.6	1.19	1.5	0.07
8.7	0.85	1.7	0.03
9.8	0.44	1.9	0.02
10.9	0.00	2.1	0.00

STONE DIAM(D50) REQUIRED TO PREVENT SCOUR UNDER ALL TAILWATER CONDITION
==> 0.63 INCHES ON A HORIZONTAL BLANKET 2D50 THICK.

LENGTH OF HORIZONTAL STONE PROTECTION BLANKET REQUIRED TO PREVENT SCOUR UNDER ALL TAILWATER CONDITIONS = 7.1FT

THE RIPRAP BLANKET SHOULD BE 3 CULVERT DIAMETERS WID E AT THE CULVERT AND SHOULD BE FLARED 1(NORMAL TO THE CULVE RT CL) ON 2(PARALLEL TO THE CULVERT CENTERLINE AND HAVE A THICKNESS EQUAL TO 2D50.

IF THE COMPUTED STONE SIZE (D50) IS NOT REALISTIC, IT CAN BE REDUCED BY 38 AND 59 PERCENT IF PREFORMED SCOUR HOLES 0.5 OR 1.0 CULVERT DIAMETER DEEP, RESPECTIVELY, ARE USED. THE BOTTOM OF THE SCOUR HOLE SHOULD BE 3 CULVERT DIAMETER LONG AND 2 CULVERT DIAMETERS WIDE AND SHOULD BEGIN 1.5 AND 3.0 CULVERT DIAMETERS DOWNSTREAM FROM THE CULVERT EXIT PORTAL FOR SCOUR HOLE DEPTH OF 0.5 AND 1.0 CULVERT DIAMETERS, RESPECTIVELY. IT SHOULD HAVE 1V TO 3H SIDE SLOPES IN ALL DIRECTIONS AND HAVE A RIP RAP THICKNESS EQUAL TO 2D50.

Splash Pad Design for CP D4 9' Scupper

DISCHARGE	CULVERT WIDTH	HEIGHT	TAILWATER DEPTH	DURATION
20.00CFS	9.00FT	0.50FT	0.25FT	5.00MIN

MAX SCOUR LGT	MAX SCOUR DEPTH	MAX SCOUR WIDTH	SCOUR VOLUME
9.2FT	0.9FT	4.9FT	5.6FT3

MAX DEPTH OCCURS 3.7 FT DOWNSTREAM OF THE CULVERT OUTLET

SCOUR PROFILE		SCOUR X-SECT AT LOC MAX DEPTH	
LENGTH	DEPTH	DIST FROM CL	DEPTH
0.0	0.00	0.0	0.87
0.9	0.28	0.2	0.84
1.8	0.65	0.5	0.79
2.8	0.81	0.7	0.68
3.7	0.87	1.0	0.44
4.6	0.83	1.2	0.20
5.5	0.74	1.5	0.08
6.5	0.61	1.7	0.03
7.4	0.43	2.0	0.02
8.3	0.23	2.2	0.01
9.2	0.00	2.5	0.00

STONE DIAM(D50) REQUIRED TO PREVENT SCOUR UNDER ALL TAILWATER CONDITION
==> 2.77 INCHES ON A HORIZONTAL BLANKET 2D50 THICK.

LENGTH OF HORIZONTAL STONE PROTECTION BLANKET REQUIRED TO PREVENT SCOUR
UNDER ALL TAILWATER CONDITIONS = 9.4FT

THE RIPRAP BLANKET SHOULD BE 3 CULVERT DIAMETERS WID E AT THE CULVERT AND
SHOULD BE FLARED 1(NORMAL TO THE CULVE RT CL) ON 2(PARALLEL TO THE CULVERT
CENTERLINE AND HAVE A THICKNESS EQUAL TO 2D50.

IF THE COMPUTED STONE SIZE (D50) IS NOT REALISTIC, IT CAN BE REDUCED
BY 38 AND 59 PERCENT IF PREFORMED SCOUR HOLES 0.5 OR 1.0 CULVERT DIAMETER
DEEP, RESPECTIVELY, ARE USED. THE BOTTOM OF THE SCOUR HOLE SHOULD BE
3 CULVERT DIAMETER LONG AND 2 CULVERT DIAMETERS WIDE AND SHOULD
BEGIN 1.5 AND 3.0 CULVERT DIAMETERS DOWNSTREAM FROM THE CULVERT EXIT
PORTAL FOR SCOUR HOLE DEPTH OF 0.5 AND 1.0 CULVERT DIAMETERS, RESPECTIVELY.
IT SHOULD HAVE 1V TO 3H SIDE SLOPES IN ALL DIRECTIONS AND HAVE A RIP
RAP THICKNESS EQUAL TO 2D50.

Splash Pad Design for CP D7 11' Channel

DISCHARGE	CULVERT WIDTH	HEIGHT	TAILWATER DEPTH	DURATION
35.00CFS	11.00FT	1.34FT	1.34FT	5.00MIN

MAX SCOUR LGT	MAX SCOUR DEPTH	MAX SCOUR WIDTH	SCOUR VOLUME
11.2FT	1.5FT	4.7FT	11.5FT3

MAX DEPTH OCCURS 4.5 FT DOWNSTREAM OF THE CULVERT OUTLET

SCOUR PROFILE		SCOUR X-SECT AT LOC MAX DEPTH	
LENGTH	DEPTH	DIST FROM CL	DEPTH
0.0	0.00	0.0	1.52
1.1	0.49	0.2	1.48
2.2	1.14	0.5	1.39
3.4	1.43	0.7	1.19
4.5	1.52	0.9	0.78
5.6	1.46	1.2	0.35
6.7	1.31	1.4	0.14
7.8	1.07	1.7	0.06
9.0	0.76	1.9	0.03
10.1	0.40	2.1	0.02
11.2	0.00	2.4	0.00

STONE DIAM(D50) REQUIRED TO PREVENT SCOUR UNDER ALL TAILWATER CONDITION
==> 0.84 INCHES ON A HORIZONTAL BLANKET 2D50 THICK.

LENGTH OF HORIZONTAL STONE PROTECTION BLANKET REQUIRED TO PREVENT SCOUR UNDER ALL TAILWATER CONDITIONS = 8.2FT

THE RIPRAP BLANKET SHOULD BE 3 CULVERT DIAMETERS WID E AT THE CULVERT AND SHOULD BE FLARED 1(NORMAL TO THE CULVE RT CL) ON 2(PARALLEL TO THE CULVERT CENTERLINE AND HAVE A THICKNESS EQUAL TO 2D50.

IF THE COMPUTED STONE SIZE (D50) IS NOT REALISTIC, IT CAN BE REDUCED BY 38 AND 59 PERCENT IF PREFORMED SCOUR HOLES 0.5 OR 1.0 CULVERT DIAMETER DEEP, RESPECTIVELY, ARE USED. THE BOTTOM OF THE SCOUR HOLE SHOULD BE 3 CULVERT DIAMETER LONG AND 2 CULVERT DIAMETERS WIDE AND SHOULD BEGIN 1.5 AND 3.0 CULVERT DIAMETERS DOWNSTREAM FROM THE CULVERT EXIT PORTAL FOR SCOUR HOLE DEPTH OF 0.5 AND 1.0 CULVERT DIAMETERS, RESPECTIVELY. IT SHOULD HAVE 1V TO 3H SIDE SLOPES IN ALL DIRECTIONS AND HAVE A RIP RAP THICKNESS EQUAL TO 2D50.

Splash Pad Design for CP D8 5-4x10 RCBC

DISCHARGE	CULVERT WIDTH	HEIGHT	TAILWATER DEPTH	DURATION
220.00CFS	10.00FT	4.00FT	2.00FT	5.00MIN

MAX SCOUR LGT	MAX SCOUR DEPTH	MAX SCOUR WIDTH	SCOUR VOLUME
41.1FT	5.1FT	18.5FT	548.7FT3

MAX DEPTH OCCURS 16.5 FT DOWNSTREAM OF THE CULVERT OUTLET

SCOUR PROFILE		SCOUR X-SECT AT LOC MAX DEPTH	
LENGTH	DEPTH	DIST FROM CL	DEPTH
0.0	0.00	0.0	5.08
4.1	1.63	0.9	4.93
8.2	3.81	1.9	4.62
12.3	4.78	2.8	3.96
16.5	5.08	3.7	2.59
20.6	4.88	4.6	1.17
24.7	4.37	5.6	0.46
28.8	3.56	6.5	0.20
32.9	2.54	7.4	0.10
37.0	1.32	8.3	0.05
41.1	0.00	9.3	0.00

STONE DIAM(D50) REQUIRED TO PREVENT SCOUR UNDER ALL TAILWATER CONDITION
==> 7.37 INCHES ON A HORIZONTAL BLANKET 2D50 THICK.

LENGTH OF HORIZONTAL STONE PROTECTION BLANKET REQUIRED TO PREVENT SCOUR
UNDER ALL TAILWATER CONDITIONS = 33.0FT

THE RIPRAP BLANKET SHOULD BE 3 CULVERT DIAMETERS WID E AT THE CULVERT AND
SHOULD BE FLARED 1(NORMAL TO THE CULVE RT CL) ON 2(PARALLEL TO THE CULVERT
CENTERLINE AND HAVE A THICKNESS EQUAL TO 2D50.

IF THE COMPUTED STONE SIZE (D50) IS NOT REALISTIC, IT CAN BE REDUCED
BY 38 AND 59 PERCENT IF PREFORMED SCOUR HOLES 0.5 OR 1.0 CULVERT DIAMETER
DEEP, RESPECTIVELY, ARE USED. THE BOTTOM OF THE SCOUR HOLE SHOULD BE
3 CULVERT DIAMETER LONG AND 2 CULVERT DIAMETERS WIDE AND SHOULD
BEGIN 1.5 AND 3.0 CULVERT DIAMETERS DOWNSTREAM FROM THE CULVERT EXIT
PORTAL FOR SCOUR HOLE DEPTH OF 0.5 AND 1.0 CULVERT DIAMETERS, RESPECTIVELY.
IT SHOULD HAVE 1V TO 3H SIDE SLOPES IN ALL DIRECTIONS AND HAVE A RIP
RAP THICKNESS EQUAL TO 2D50.

** Note: Discharge of 220 cfs x 5 Cells = 1100 cfs total discharge.

Splash Pad Design for CP D10 13' Scupper

DISCHARGE	CULVERT WIDTH	HEIGHT	TAILWATER DEPTH	DURATION
13.00CFS	13.00FT	0.50FT	0.25FT	5.00MIN

MAX SCOUR LGT	MAX SCOUR DEPTH	MAX SCOUR WIDTH	SCOUR VOLUME
5.2FT	0.6FT	2.4FT	1.1FT3

MAX DEPTH OCCURS 2.1 FT DOWNSTREAM OF THE CULVERT OUTLET

SCOUR PROFILE		SCOUR X-SECT AT LOC MAX DEPTH	
LENGTH	DEPTH	DIST FROM CL	DEPTH
0.0	0.00	0.0	0.64
0.5	0.21	0.1	0.62
1.0	0.48	0.2	0.58
1.6	0.60	0.4	0.50
2.1	0.64	0.5	0.33
2.6	0.62	0.6	0.15
3.1	0.55	0.7	0.06
3.7	0.45	0.8	0.03
4.2	0.32	0.9	0.01
4.7	0.17	1.1	0.01
5.2	0.00	1.2	0.00

STONE DIAM(D50) REQUIRED TO PREVENT SCOUR UNDER ALL TAILWATER CONDITION
==> 0.96 INCHES ON A HORIZONTAL BLANKET 2D50 THICK.

LENGTH OF HORIZONTAL STONE PROTECTION BLANKET REQUIRED TO PREVENT SCOUR
UNDER ALL TAILWATER CONDITIONS = 4.2FT

THE RIPRAP BLANKET SHOULD BE 3 CULVERT DIAMETERS WID E AT THE CULVERT AND
SHOULD BE FLARED 1(NORMAL TO THE CULVE RT CL) ON 2(PARALLEL TO THE CULVERT
CENTERLINE AND HAVE A THICKNESS EQUAL TO 2D50.

IF THE COMPUTED STONE SIZE (D50) IS NOT REALISTIC, IT CAN BE REDUCED
BY 38 AND 59 PERCENT IF PREFORMED SCOUR HOLES 0.5 OR 1.0 CULVERT DIAMETER
DEEP, RESPECTIVELY, ARE USED. THE BOTTOM OF THE SCOUR HOLE SHOULD BE
3 CULVERT DIAMETER LONG AND 2 CULVERT DIAMETERS WIDE AND SHOULD
BEGIN 1.5 AND 3.0 CULVERT DIAMETERS DOWNSTREAM FROM THE CULVERT EXIT
PORTAL FOR SCOUR HOLE DEPTH OF 0.5 AND 1.0 CULVERT DIAMETERS, RESPECTIVELY.
IT SHOULD HAVE 1V TO 3H SIDE SLOPES IN ALL DIRECTIONS AND HAVE A RIP
RAP THICKNESS EQUAL TO 2D50.

CUL.OUT

Splash Pad Design for CP D13 12' Channel

DISCHARGE	CULVERT WIDTH	HEIGHT	TAILWATER DEPTH	DURATION
26.00CFS	12.00FT	1.50FT	1.50FT	5.00MIN

MAX SCOUR LGT	MAX SCOUR DEPTH	MAX SCOUR WIDTH	SCOUR VOLUME
8.5FT	1.4FT	3.2FT	5.3FT3

MAX DEPTH OCCURS 3.4 FT DOWNSTREAM OF THE CULVERT OUTLET

SCOUR PROFILE		SCOUR X-SECT AT LOC MAX DEPTH	
LENGTH	DEPTH	DIST FROM CL	DEPTH
0.0	0.00	0.0	1.39
0.8	0.44	0.2	1.35
1.7	1.04	0.3	1.26
2.5	1.30	0.5	1.08
3.4	1.39	0.6	0.71
4.2	1.33	0.8	0.32
5.1	1.19	1.0	0.12
5.9	0.97	1.1	0.06
6.8	0.69	1.3	0.03
7.6	0.36	1.4	0.01
8.5	0.00	1.6	0.00

STONE DIAM(D50) REQUIRED TO PREVENT SCOUR UNDER ALL TAILWATER CONDITION
==> 0.45 INCHES ON A HORIZONTAL BLANKET 2D50 THICK.

LENGTH OF HORIZONTAL STONE PROTECTION BLANKET REQUIRED TO PREVENT SCOUR UNDER ALL TAILWATER CONDITIONS = 5.3FT

THE RIPRAP BLANKET SHOULD BE 3 CULVERT DIAMETERS WID E AT THE CULVERT AND SHOULD BE FLARED 1(NORMAL TO THE CULVE RT CL) ON 2(PARALLEL TO THE CULVERT CENTERLINE AND HAVE A THICKNESS EQUAL TO 2D50.

IF THE COMPUTED STONE SIZE (D50) IS NOT REALISTIC, IT CAN BE REDUCED BY 38 AND 59 PERCENT IF PREFORMED SCOUR HOLES 0.5 OR 1.0 CULVERT DIAMETER DEEP, RESPECTIVELY, ARE USED. THE BOTTOM OF THE SCOUR HOLE SHOULD BE 3 CULVERT DIAMETER LONG AND 2 CULVERT DIAMETERS WIDE AND SHOULD BEGIN 1.5 AND 3.0 CULVERT DIAMETERS DOWNSTREAM FROM THE CULVERT EXIT PORTAL FOR SCOUR HOLE DEPTH OF 0.5 AND 1.0 CULVERT DIAMETERS, RESPECTIVELY. IT SHOULD HAVE 1V TO 3H SIDE SLOPES IN ALL DIRECTIONS AND HAVE A RIP RAP THICKNESS EQUAL TO 2D50.

Splash Pad Design for CP D16 13.5' Channel

DISCHARGE	CULVERT WIDTH	HEIGHT	TAILWATER DEPTH	DURATION
39.00CFS	13.50FT	1.75FT	1.75FT	5.00MIN

MAX SCOUR LGT	MAX SCOUR DEPTH	MAX SCOUR WIDTH	SCOUR VOLUME
10.3FT	1.7FT	3.9FT	9.5FT3

MAX DEPTH OCCURS 4.1 FT DOWNSTREAM OF THE CULVERT OUTLET

SCOUR PROFILE		SCOUR X-SECT AT LOC MAX DEPTH	
LENGTH	DEPTH	DIST FROM CL	DEPTH
0.0	0.00	0.0	1.65
1.0	0.53	0.2	1.60
2.1	1.24	0.4	1.50
3.1	1.55	0.6	1.29
4.1	1.65	0.8	0.84
5.1	1.59	1.0	0.38
6.2	1.42	1.2	0.15
7.2	1.16	1.4	0.07
8.2	0.83	1.6	0.03
9.2	0.43	1.8	0.02
10.3	0.00	2.0	0.00

STONE DIAM(D50) REQUIRED TO PREVENT SCOUR UNDER ALL TAILWATER CONDITION
==> 0.56 INCHES ON A HORIZONTAL BLANKET 2D50 THICK.

LENGTH OF HORIZONTAL STONE PROTECTION BLANKET REQUIRED TO PREVENT SCOUR UNDER ALL TAILWATER CONDITIONS = 6.6FT

THE RIPRAP BLANKET SHOULD BE 3 CULVERT DIAMETERS WID E AT THE CULVERT AND SHOULD BE FLARED 1(NORMAL TO THE CULVE RT CL) ON 2(PARALLEL TO THE CULVERT CENTERLINE AND HAVE A THICKNESS EQUAL TO 2D50.

IF THE COMPUTED STONE SIZE (D50) IS NOT REALISTIC, IT CAN BE REDUCED BY 38 AND 59 PERCENT IF PREFORMED SCOUR HOLES 0.5 OR 1.0 CULVERT DIAMETER DEEP, RESPECTIVELY, ARE USED. THE BOTTOM OF THE SCOUR HOLE SHOULD BE 3 CULVERT DIAMETER LONG AND 2 CULVERT DIAMETERS WIDE AND SHOULD BEGIN 1.5 AND 3.0 CULVERT DIAMETERS DOWNSTREAM FROM THE CULVERT EXIT PORTAL FOR SCOUR HOLE DEPTH OF 0.5 AND 1.0 CULVERT DIAMETERS, RESPECTIVELY. IT SHOULD HAVE 1V TO 3H SIDE SLOPES IN ALL DIRECTIONS AND HAVE A RIP RAP THICKNESS EQUAL TO 2D50.

Splash Pad Design for CP D17 18' Scupper

DISCHARGE	CULVERT WIDTH	HEIGHT	TAILWATER DEPTH	DURATION
18.00CFS	18.00FT	0.50FT	0.25FT	5.00MIN

MAX SCOUR LGT	MAX SCOUR DEPTH	MAX SCOUR WIDTH	SCOUR VOLUME
5.2FT	0.6FT	2.4FT	1.1FT3

MAX DEPTH OCCURS 2.1 FT DOWNSTREAM OF THE CULVERT OUTLET

SCOUR PROFILE		SCOUR X-SECT AT LOC MAX DEPTH	
LENGTH	DEPTH	DIST FROM CL	DEPTH
0.0	0.00	0.0	0.64
0.5	0.21	0.1	0.62
1.0	0.48	0.2	0.58
1.6	0.60	0.4	0.50
2.1	0.64	0.5	0.33
2.6	0.62	0.6	0.15
3.1	0.55	0.7	0.06
3.7	0.45	0.8	0.03
4.2	0.32	0.9	0.01
4.7	0.17	1.1	0.01
5.2	0.00	1.2	0.00

STONE DIAM(D50) REQUIRED TO PREVENT SCOUR UNDER ALL TAILWATER CONDITION
==> 0.96 INCHES ON A HORIZONTAL BLANKET 2D50 THICK.

LENGTH OF HORIZONTAL STONE PROTECTION BLANKET REQUIRED TO PREVENT SCOUR
UNDER ALL TAILWATER CONDITIONS = 4.2FT

THE RIPRAP BLANKET SHOULD BE 3 CULVERT DIAMETERS WID E AT THE CULVERT AND
SHOULD BE FLARED 1(NORMAL TO THE CULVE RT CL) ON 2(PARALLEL TO THE CULVERT
CENTERLINE AND HAVE A THICKNESS EQUAL TO 2D50.

IF THE COMPUTED STONE SIZE (D50) IS NOT REALISTIC, IT CAN BE REDUCED BY 38 AND 59 PERCENT IF PREFORMED SCOUR HOLES 0.5 OR 1.0 CULVERT DIAMETER
DEEP, RESPECTIVELY, ARE USED. THE BOTTOM OF THE SCOUR HOLE SHOULD BE 3 CULVERT DIAMETER LONG AND 2 CULVERT DIAMETERS WIDE AND SHOULD BEGIN 1.5 AND 3.0 CULVERT DIAMETERS DOWNSTREAM FROM THE CULVERT EXIT PORTAL FOR SCOUR HOLE DEPTH OF 0.5 AND 1.0 CULVERT DIAMETERS, RESPECTIVELY.
IT SHOULD HAVE 1V TO 3H SIDE SLOPES IN ALL DIRECTIONS AND HAVE A RIP RAP THICKNESS EQUAL TO 2D50.

Splash Pad Design for CP D18 5-4x10 RCBC

DISCHARGE	CULVERT WIDTH	HEIGHT	TAILWATER DEPTH	DURATION
220.00CFS	10.00FT	4.00FT	2.00FT	5.00MIN

MAX SCOUR LGT	MAX SCOUR DEPTH	MAX SCOUR WIDTH	SCOUR VOLUME
41.1FT	5.1FT	18.5FT	548.7FT3

MAX DEPTH OCCURS 16.5 FT DOWNSTREAM OF THE CULVERT OUTLET

SCOUR PROFILE		SCOUR X-SECT AT LOC MAX DEPTH	
LENGTH	DEPTH	DIST FROM CL	DEPTH
0.0	0.00	0.0	5.08
4.1	1.63	0.9	4.93
8.2	3.81	1.9	4.62
12.3	4.78	2.8	3.96
16.5	5.08	3.7	2.59
20.6	4.88	4.6	1.17
24.7	4.37	5.6	0.46
28.8	3.56	6.5	0.20
32.9	2.54	7.4	0.10
37.0	1.32	8.3	0.05
41.1	0.00	9.3	0.00

STONE DIAM(D50) REQUIRED TO PREVENT SCOUR UNDER ALL TAILWATER CONDITION
==> 7.37 INCHES ON A HORIZONTAL BLANKET 2D50 THICK.

LENGTH OF HORIZONTAL STONE PROTECTION BLANKET REQUIRED TO PREVENT SCOUR
UNDER ALL TAILWATER CONDITIONS = 33.0FT

THE RIPRAP BLANKET SHOULD BE 3 CULVERT DIAMETERS WID E AT THE CULVERT AND
SHOULD BE FLARED 1(NORMAL TO THE CULVE RT CL) ON 2(PARALLEL TO THE CULVERT
CENTERLINE AND HAVE A THICKNESS EQUAL TO 2D50.

IF THE COMPUTED STONE SIZE (D50) IS NOT REALISTIC, IT CAN BE REDUCED
BY 38 AND 59 PERCENT IF PREFORMED SCOUR HOLES 0.5 OR 1.0 CULVERT DIAMETER
DEEP, RESPECTIVELY, ARE USED. THE BOTTOM OF THE SCOUR HOLE SHOULD BE
3 CULVERT DIAMETER LONG AND 2 CULVERT DIAMETERS WIDE AND SHOULD
BEGIN 1.5 AND 3.0 CULVERT DIAMETERS DOWNSTREAM FROM THE CULVERT EXIT
PORTAL FOR SCOUR HOLE DEPTH OF 0.5 AND 1.0 CULVERT DIAMETERS, RESPECTIVELY.
IT SHOULD HAVE 1V TO 3H SIDE SLOPES IN ALL DIRECTIONS AND HAVE A RIP
RAP THICKNESS EQUAL TO 2D50.

** Note: Discharge of 220 cfs x 5 Cells = 1100 cfs total discharge.

Splash Pad Design for CP D19 17' Scupper

DISCHARGE	CULVERT WIDTH	HEIGHT	TAILWATER DEPTH	DURATION
17.00CFS	17.00FT	0.50FT	0.25FT	5.00MIN

MAX SCOUR LGT	MAX SCOUR DEPTH	MAX SCOUR WIDTH	SCOUR VOLUME
5.2FT	0.6FT	2.4FT	1.1FT3

MAX DEPTH OCCURS 2.1 FT DOWNSTREAM OF THE CULVERT OUTLET

SCOUR PROFILE		SCOUR X-SECT AT LOC MAX DEPTH	
LENGTH	DEPTH	DIST FROM CL	DEPTH
0.0	0.00	0.0	0.64
0.5	0.21	0.1	0.62
1.0	0.48	0.2	0.58
1.6	0.60	0.4	0.50
2.1	0.64	0.5	0.33
2.6	0.62	0.6	0.15
3.1	0.55	0.7	0.06
3.7	0.45	0.8	0.03
4.2	0.32	0.9	0.01
4.7	0.17	1.1	0.01
5.2	0.00	1.2	0.00

STONE DIAM(D50) REQUIRED TO PREVENT SCOUR UNDER ALL TAILWATER CONDITION
==> 0.96 INCHES ON A HORIZONTAL BLANKET 2D50 THICK.

LENGTH OF HORIZONTAL STONE PROTECTION BLANKET REQUIRED TO PREVENT SCOUR
UNDER ALL TAILWATER CONDITIONS = 4.2FT

THE RIPRAP BLANKET SHOULD BE 3 CULVERT DIAMETERS WID E AT THE CULVERT AND
SHOULD BE FLARED 1(NORMAL TO THE CULVE RT CL) ON 2(PARALLEL TO THE CULVERT
CENTERLINE AND HAVE A THICKNESS EQUAL TO 2D50.

IF THE COMPUTED STONE SIZE (D50) IS NOT REALISTIC, IT CAN BE REDUCED
BY 38 AND 59 PERCENT IF PREFORMED SCOUR HOLES 0.5 OR 1.0 CULVERT DIAMETER
DEEP, RESPECTIVELY, ARE USED. THE BOTTOM OF THE SCOUR HOLE SHOULD BE
3 CULVERT DIAMETER LONG AND 2 CULVERT DIAMETERS WIDE AND SHOULD
BEGIN 1.5 AND 3.0 CULVERT DIAMETERS DOWNSTREAM FROM THE CULVERT EXIT
PORTAL FOR SCOUR HOLE DEPTH OF 0.5 AND 1.0 CULVERT DIAMETERS, RESPECTIVELY.
IT SHOULD HAVE 1V TO 3H SIDE SLOPES IN ALL DIRECTIONS AND HAVE A RIP
RAP THICKNESS EQUAL TO 2D50.

Splash Pad Design for CP D20 28' Scupper

DISCHARGE	CULVERT WIDTH	HEIGHT	TAILWATER DEPTH	DURATION
28.00CFS	28.00FT	0.50FT	0.25FT	5.00MIN

MAX SCOUR LGT	MAX SCOUR DEPTH	MAX SCOUR WIDTH	SCOUR VOLUME
5.2FT	0.6FT	2.4FT	1.1FT3

MAX DEPTH OCCURS 2.1 FT DOWNSTREAM OF THE CULVERT OUTLET

SCOUR PROFILE		SCOUR X-SECT AT LOC MAX DEPTH	
LENGTH	DEPTH	DIST FROM CL	DEPTH
0.0	0.00	0.0	0.64
0.5	0.21	0.1	0.62
1.0	0.48	0.2	0.58
1.6	0.60	0.4	0.50
2.1	0.64	0.5	0.33
2.6	0.62	0.6	0.15
3.1	0.55	0.7	0.06
3.7	0.45	0.8	0.03
4.2	0.32	0.9	0.01
4.7	0.17	1.1	0.01
5.2	0.00	1.2	0.00

STONE DIAM(D50) REQUIRED TO PREVENT SCOUR UNDER ALL TAILWATER CONDITION
==> 0.96 INCHES ON A HORIZONTAL BLANKET 2D50 THICK.

LENGTH OF HORIZONTAL STONE PROTECTION BLANKET REQUIRED TO PREVENT SCOUR
UNDER ALL TAILWATER CONDITIONS = 4.2FT

THE RIPRAP BLANKET SHOULD BE 3 CULVERT DIAMETERS WID E AT THE CULVERT AND
SHOULD BE FLARED 1(NORMAL TO THE CULVE RT CL) ON 2(PARALLEL TO THE CULVERT
CENTERLINE AND HAVE A THICKNESS EQUAL TO 2D50.

IF THE COMPUTED STONE SIZE (D50) IS NOT REALISTIC, IT CAN BE REDUCED
BY 38 AND 59 PERCENT IF PREFORMED SCOUR HOLES 0.5 OR 1.0 CULVERT DIAMETER
DEEP, RESPECTIVELY, ARE USED. THE BOTTOM OF THE SCOUR HOLE SHOULD BE
3 CULVERT DIAMETER LONG AND 2 CULVERT DIAMETERS WIDE AND SHOULD
BEGIN 1.5 AND 3.0 CULVERT DIAMETERS DOWNSTREAM FROM THE CULVERT EXIT
PORTAL FOR SCOUR HOLE DEPTH OF 0.5 AND 1.0 CULVERT DIAMETERS, RESPECTIVELY.
IT SHOULD HAVE 1V TO 3H SIDE SLOPES IN ALL DIRECTIONS AND HAVE A RIP
RAP THICKNESS EQUAL TO 2D50.

Splash Pad Design for CP D22 125' Channel

DISCHARGE	CULVERT WIDTH	HEIGHT	TAILWATER DEPTH	DURATION
1101.00CFS	125.00FT	2.32FT	1.16FT	5.00MIN

MAX SCOUR LGT	MAX SCOUR DEPTH	MAX SCOUR WIDTH	SCOUR VOLUME
22.2FT	2.8FT	9.8FT	88.0FT3

MAX DEPTH OCCURS 8.9 FT DOWNSTREAM OF THE CULVERT OUTLET

SCOUR PROFILE		SCOUR X-SECT AT LOC MAX DEPTH	
LENGTH	DEPTH	DIST FROM CL	DEPTH
0.0	0.00	0.0	2.84
2.2	0.91	0.5	2.76
4.4	2.13	1.0	2.58
6.7	2.67	1.5	2.22
8.9	2.84	2.0	1.45
11.1	2.73	2.5	0.65
13.3	2.44	2.9	0.26
15.6	1.99	3.4	0.11
17.8	1.42	3.9	0.06
20.0	0.74	4.4	0.03
22.2	0.00	4.9	0.00

STONE DIAM(D50) REQUIRED TO PREVENT SCOUR UNDER ALL TAILWATER CONDITION
==> 3.75 INCHES ON A HORIZONTAL BLANKET 2D50 THICK.

LENGTH OF HORIZONTAL STONE PROTECTION BLANKET REQUIRED TO PREVENT SCOUR
UNDER ALL TAILWATER CONDITIONS = 17.3FT

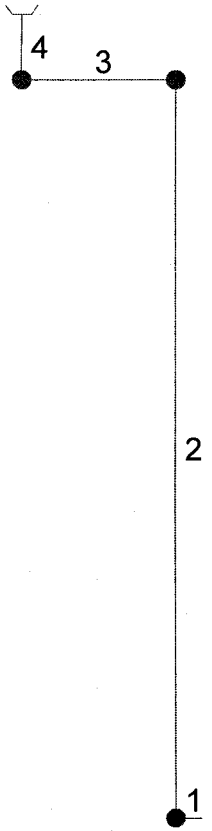
THE RIPRAP BLANKET SHOULD BE 3 CULVERT DIAMETERS WID E AT THE CULVERT AND
SHOULD BE FLARED 1(NORMAL TO THE CULVE RT CL) ON 2(PARALLEL TO THE CULVERT
CENTERLINE AND HAVE A THICKNESS EQUAL TO 2D50.

IF THE COMPUTED STONE SIZE (D50) IS NOT REALISTIC, IT CAN BE REDUCED
BY 38 AND 59 PERCENT IF PREFORMED SCOUR HOLES 0.5 OR 1.0 CULVERT DIAMETER
DEEP, RESPECTIVELY, ARE USED. THE BOTTOM OF THE SCOUR HOLE SHOULD BE
3 CULVERT DIAMETER LONG AND 2 CULVERT DIAMETERS WIDE AND SHOULD
BEGIN 1.5 AND 3.0 CULVERT DIAMETERS DOWNSTREAM FROM THE CULVERT EXIT
PORTAL FOR SCOUR HOLE DEPTH OF 0.5 AND 1.0 CULVERT DIAMETERS, RESPECTIVELY.
IT SHOULD HAVE 1V TO 3H SIDE SLOPES IN ALL DIRECTIONS AND HAVE A RIP
RAP THICKNESS EQUAL TO 2D50.

PRELIMINARY
STORM DRAIN CALCULATIONS

SYSTEM 1

Hydraflow Plan View



Project file: System 1 - D1 OS-1.stm	IDF file: New.IDF.IDF	No. Lines: 4	11-28-2005

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	CP D1	44.00	36 c	15.0	100.00	100.08	0.533	103.00	103.06	0.51	End
2	MH 1- MH 2	44.00	36 c	305.0	100.38	101.91	0.502	103.58	104.81	0.52	1
3	MH2 - MH 3	44.00	36 c	89.0	102.21	102.65	0.494	105.33*	105.72*	0.51	2
4	MH4-OS-1	44.00	36 c	27.0	102.95	103.09	0.519	106.23*	106.35*	0.51	3

Project File: System 1 - D1 OS-1.stm I-D-F File: New.IDF.IDF | Total No. Lines: 4 | Run Date: 11-28-2005

NOTES: c = circular; e = elliptical; b = box; Return period = 100 Yrs.; * Indicates surcharge condition.

Hydraflow Hydraulic Grade Line Computations

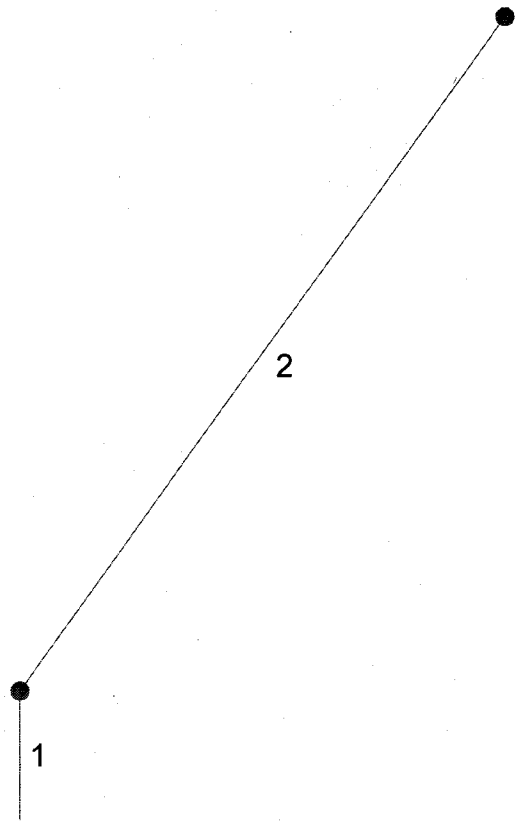
Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
1	36	44.00	100.00	103.00	3.00	7.07	6.23	0.60	103.60	0.435	15.0	100.08	103.06	2.98	7.06	6.23	0.60	103.67	0.408	0.422	0.063	0.85	0.51
2	36	44.00	100.38	103.58	3.00	7.07	6.23	0.60	104.18	0.435	305	101.91	104.81	2.90	7.00	6.29	0.62	105.42	0.381	0.408	1.246	0.85	0.52
3	36	44.00	102.21	105.33	3.00	7.07	6.23	0.60	105.93	0.435	89.0	102.65	105.72	3.00	7.07	6.22	0.60	106.32	0.435	0.435	0.387	0.85	0.51
4	36	44.00	102.95	106.23	3.00	7.07	6.23	0.60	106.83	0.435	27.0	103.09	106.35	3.00	7.07	6.22	0.60	106.95	0.435	0.435	0.118	0.85	0.51

Project File: System 1 - D1 OS-1.stm | I-D-F File: New.IDF.IDF | Total number of lines: 4 | Run Date: 11-28-2005

NOTES: Initial tailwater elevation = 103 (ft) , * Crown depth assumed., ** Critical depth assumed.

SYSTEM 2

Hydraflow Plan View



Project file: New.stm	IDF file: New.IDF.IDF	No. Lines: 2	11-28-2005

Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
	(in)	(cfs)									(ft)											(K)	(ft)
1	24	13.00	100.00	102.00	2.00	3.14	4.14	0.27	102.27	0.331	15.0	100.08	102.05	1.97	3.13	4.15	0.27	102.31	0.298	0.314	0.047	0.85	0.23
2	24	13.00	100.28	102.28	2.00*	3.14	4.14	0.27	102.55	0.331	110	100.83	102.59	1.76	2.92	4.45	0.31	102.89	0.298	0.314	0.346	1.00	0.31

Project File: New.stm | I-D-F File: New.IDF.IDF | Total number of lines: 2 | Run Date: 11-28-2005

NOTES: Initial tailwater elevation = 102 (ft) , * Crown depth assumed., ** Critical depth assumed.

Hydraflow Summary Report

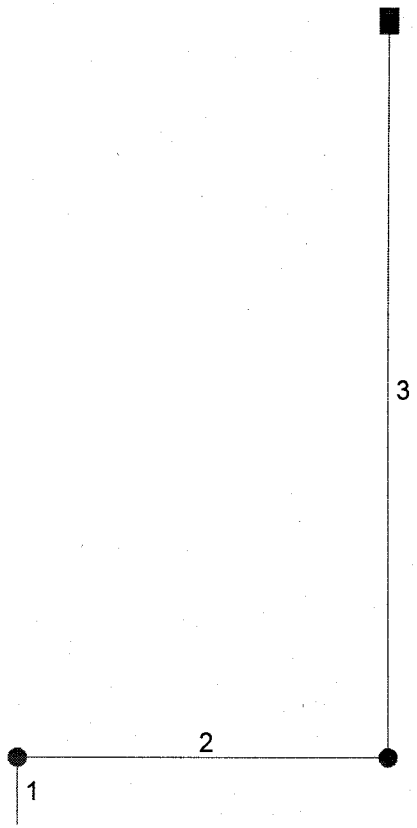
Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	D13 - MH4	13.00	24 c	15.0	100.00	100.08	0.533	102.00	102.05	0.23	End
2	MH4 - D11	13.00	24 c	110.0	100.28	100.83	0.500	102.28	102.59	0.31	1

Project File: New.stm	I-D-F File: New.IDF.IDF	Total No. Lines: 2	Run Date: 11-28-2005

NOTES: c = circular; e = elliptical; b = box; Return period = 100 Yrs.; * Indicates surcharge condition.

SYSTEM 3

Hydraflow Plan View



Project file: System 3 - D16 D14.stm	IDF file: New.IDF.IDF	No. Lines: 3	11-28-2005

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	D16- D14	17.00	24 c	34.0	100.00	100.17	0.500	102.00	102.17	0.39	End
2	MH4- MH5	17.00	24 c	261.0	100.47	101.78	0.502	102.56*	104.03*	0.46	1
3	MH5-D14	17.00	24 c	372.0	102.08	103.94	0.500	104.49*	106.59*	0.39	2

Project File: New.stm	I-D-F File: New.IDF.IDF	Total No. Lines: 3	Run Date: 11-28-2005

NOTES: c = circular; e = elliptical; b = box; Return period = 100 Yrs.; * Indicates surcharge condition.

Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
1	24	17.00	100.00	102.00	2.00	3.14	5.41	0.46	102.46	0.565	34.0	100.17	102.17	2.00	3.14	5.41	0.46	102.62	0.555	0.560	0.190	0.85	0.39
2	24	17.00	100.47	102.56	2.00	3.14	5.41	0.46	103.01	0.565	261	101.78	104.03	2.00	3.14	5.41	0.46	104.49	0.565	0.565	1.475	1.00	0.46
3	24	17.00	102.08	104.49	2.00	3.14	5.41	0.46	104.94	0.565	372	103.94	106.59	2.00	3.14	5.41	0.46	107.04	0.565	0.565	2.102	0.85	0.39

Project File: New.stm	I-D-F File: New.IDF.IDF	Total number of lines: 3	Run Date: 11-28-2005

NOTES: Initial tailwater elevation = 102 (ft) , * Crown depth assumed., ** Critical depth assumed.

HYDRAULIC STRUCTURES
(EXISTING CONDITIONS)

TABLE 3 (cont.)

Existing Culvert Description and Split Flow Conditions for Q100

Basin/Structure	Station	Description		Existing Conditions (Q100 cfs) Q100 (cfs)	WSE (ft)	Structure	Break Out*	Over-flow**	Hydraulic Capacity***	Recurrence Interval
Cortaro Rd.	4915+25	Roadway Interchange		1430	2158.35	—	404	1430	—	2 yr
NR5	4905+00	SPRR	1 - 9' X 2' "	4105	2157.0	190	2565	1350	150	0 yr
		WBFR	3 -5.5' X 3.5' "	1540	2155.45	355	715	715	300	2 yr
		I-10	—	1474	—	—	1474	—	—	—
NR4	4892+30	SPRR	2 - 8' X 2' "	4065	2148.38	450	3362	253	400	0 yr
		WBFR	1 - 6' X 4' "	1418	2147.54	156	959	303	140	0yr
		I-10	—	1933	—	—	1933	—	—	—
NR3	4880+82	SPRR	2 - 14' X 4' "	4862	2144.44	1090	3387	385	1000	2 yr
		WBFR	2 - 4' X 2' "	2434	2143.37	145	796	1493	100	0 yr
		I-10	2 - 6' x 3' "	3571	2142.64	400	2470	701	300	0 yr
NR2	4875+20	SPRR	2 - 13' X 4' CBC	4887	2141.92	1246	2548	1093	1000	2 yr
		WBFR	—	3135	2140.42	—	1847	1288	—	—
		I-10	—	3758	—	—	3758	—	—	—
NR1	4868+72	SPRR	2 - 14' X 2' "	4048	2138.91	670	2905	473	600	0 yr
		WBFR	3 - 6' X 3' "	2990	2137.88	545	1078	1367	400	0 yr
		I-10	2 - 8' X 3' "	5670	2139.02	555	3014	2101	400	0 yr
CAÑADA AGUA										
CA8	4848+12	SPRR	1 - 9' X 4' "	10738	2132.88	482	5123	5135	380	0 yr
		WBFR	3 - 6' X 3' "	6695	2129.79	605	1195	3333	450	0 yr
		I-10	2 - 8' X 3' "	4357	2129.81	565	1952	1840	450	0 yr
CA7	4833+00	SPRR	2 - 8' X 3' "	3830	2125.26	580	1220	2030	520	0 yr
		WBFR	3 - 8' X 4' "	3510	2123.40	880	548	2082	570	0 yr
		I-10	3 - 9' X 4' "	3072	2123.44	760	1752	560	650	0 yr
CA6	4813+00	SPRR	2 - 13' x 3' "	3338	2115.61	865	2398	75	800	2 yr
		WBFR	2 - 8' x 3' "	1488	2112.66	432	250	806	350	2 yr
		I-10	2 - 8' x 4' "	1530	2111.44	545	812	173	400	2 yr

701 + 400 = 1101 cfs

2101 + 555 = 2656 cfs

RESULTS
==========
Entrance Type: SQUARE HEADWALL (RCP)
Discharge is 26.00 cfs
1 X 24 " RCP X 50 FT. LONG
Manning's 'n' 0.012
Inlet Control HW/D 2.02
Inlet Control HW 4.04
Ke 0.50
H 2.16
Critical Depth 1.79
Dc+D/2 1.89
Tailwater 1.25
H0 1.89
L*S0 0.15
Outlet HW 3.90

INLET CONTROL GOVERNS HW= 4.04
Outlet Velocity 8.28 fps

Assume 26 cfs
Enters from existing
24" RCP at NR 4.

RESULTS
==========
Entrance Type: SQUARE HEADWALL (RCP)
Discharge is 26.00 cfs
1 X 24 " RCP X 50 FT. LONG
Manning's 'n' 0.012
Inlet Control HW/D 2.02
Inlet Control HW 4.04
Ke 0.50
H 2.16
Critical Depth 1.79
Dc+D/2 1.89
Tailwater 1.25
H0 1.89
L*S0 0.15
Outlet HW 3.90

INLET CONTROL GOVERNS HW= 4.04
Outlet Velocity 8.28 fps