BELL ROAD PROJECT DRAINAGE STUDY

CALCULATIONS

DRAINAGE AREAS 4 and 5

A530.802

Total area = 7.79 mi²

Greiner Engineering

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Tucson 602 327-3413
Phoenix 602 275-5400

Job: BELL ROAD PROJECT DRAINAGE STUDY

Description:

E123061 J0501

Calculated by: R.H Date: 8/12/86 Sheet No. ____

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Property of
Flood Control District of MC Library
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Phoenix, AZ 85009

Drainage Area Designation Q4-010

Area .081 square miles .069 (15% reduced for future)

Upstream Elevation 1380 Hydraulic Length >300 feet

Downstream Elevation 1368 Slope .0052 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
		City of Phx.					
	80%		P.C.	UNDEV	B	82	
	5%		P.C.	UNDEV	D	90	
	7%		C-2	UNDEV	D	95	
	8%		C-2	UNDEV	B	92	

Weighted CN= $\frac{82 \times 80 + 90 \times 5}{85} = 82.5$ ⇒ 83 (Future)

Existing = 79

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/S^0.5)^0.38	Lag = L^0.8 (1000/CN - 9)^0.7/1900 S^½
N= ____ L= ____ m; Lc ____ m;	L= >300 ft CN= 79
S= ____ ft/m;	S= 10.52 % Lag= .902 hours
Lag= ____ hours	

Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-002

Area .251 square miles

Upstream Elevation 1378 Hydraulic Length 4400 feet

Downstream Elevation 1355 Slope .0052 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	55%	City of Phx.	P.C.	UNDEV	D	~~92~~ 90	~~5060~~
	45%		P.C.	UNDEV	B	~~87~~ 82	~~3915~~
							~~8975~~

Weighted CN= ~~90~~ 86 Existing CN = 79

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N= ____ L= ____ m; Lc ____ m;	L= 4400 ft CN= 79
S= ____ ft/m;	S= 0.52 % Lag= 1.501 hours
Lag= ____ hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-003

Area .067 square miles

Upstream Elevation 1362 Hydraulic Length 1680 feet

Downstream Elevation 1354 Slope .0045 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	15%	City of Phx.	P.C.	UNDEV	D	9290	
	85%		P.C.	UNDEV	B	~~8782~~	

Weighted CN= ~~88~~ 83 (Future) Existing = 79

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N= L= m; Lc m;	L= 1680 ft CN= 79
S= ft/m;	S= 0.450 % Lag= 0.740 hours
Lag= hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-004

Area: .073 square miles

Upstream Elevation: 1359 Hydraulic Length: >>80 feet

Downstream Elevation: 1348 Slope: .0050 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	50%	City of Phx.	P.C.	UNDEV	B	~~87~~82	
	50%		P.C.	UNDEV	D	~~92~~90	

Weighted CN= ~~90~~ 86 (Future) Existing = 79

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N= ____ L= ____ m; Lc ____ m;	L= >>80 ft CN= 79
S= ____ ft/m;	S= 0.500 % Lag= 0.896 hours
Lag= ____ hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-005

Area: .055 square miles .044 (20% reduced for future)

Upstream Elevation: 1357 Hydraulic Length: 2500 feet

Downstream Elevation: 1346 Slope: .0048 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
		City of Phx.					
	2%		R1-8	DEV	D	90	180
	78%		R1-8	DEV	B	82	6396
	20%		P.S.C.	UNDEV	B	95	1900
							8476

Weighted CN= ~~85~~ 82 (Future) Existing = $\frac{180+6396+20\times79}{100} = 81.6 \Rightarrow 82$

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	
	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-006

Area .056 square miles

Upstream Elevation 1354 Hydraulic Length 2380 feet

Downstream Elevation 1342 Slope .0050 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
		city of phx.					
	50%		R1-8	DEV	B	82	
	50%		R1-8	DEV	D	90	

Weighted CN= 86

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-007

Area: .064 square miles .051 (20% reduced for future)

Upstream Elevation: 1350 Hydraulic Length: 2200 feet

Downstream Elevation: 1338 Slope: .0055 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	60%	City of phx.	R1-8	DEV	B	82	
	20%		P.A.D.12	UNDEV	B	~~85~~ 82	
	20%		C-1	UNDEV	B	92	

Weighted CN= ~~85~~ 82

Existing = $\frac{80 \times 82 + 20 \times 79}{100} = 81.4$
$\Rightarrow 81$

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N= ____ L= ____ mi Lc ____ mi	L= 2200 ft CN= 81
S= ____ ft/mi	S= 0.550 % Lag= .780 hours
Lag= ____ hours	Adjust Lag:
	30% Impervious Area
	Lag Factor = 0.82
	Lag = 0.780 × 0.82 = 0.640 #

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-008

Area: .066 square miles

Upstream Elevation: 1349 Hydraulic Length: >700 feet

Downstream Elevation: 1335 Slope: .0055 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
		City of phx.					
	50%		RE-43	UNDEV	D	86	
	40%		RE-43	UNDEV	B	79 ~~77~~	
	10%		R1-8	DEV	B	82	

Weighted CN= ~~82~~ 83 (Future) Existing = $\frac{820 + 90 \times 79}{100} = 79.3 \Rightarrow 79$

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N= ____ L= ____ m; Lc ____ m;	L= >700 ft CN= 79
S= ____ ft/m;	S= .55 % Lag= .978 hours
Lag= ____ hours	Adjust Lag:
	10% improved chan. ⇒ .94
	10% imperviour area ⇒ .94
	.978 X .94 X .94 = .864

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-009

Area: .051 square miles

Upstream Elevation: 1342 Hydraulic Length: 2200 feet

Downstream Elevation: 1320 Slope: .0060 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
		City of Phx.					
	25%		P.A.D.-12	DEV	B	85	
	75%		RE-43	UNDEV	B	~~77~~ 79	

Weighted CN= ~~79~~ 81 (Future) Exist. = 79

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{1/2}$
N= ____ L= ____ mi Lc ____ mi	L= 2200 ft CN= 79
S= ____ ft/mi	S= 0.600 % Lag= 0.795 hours
Lag= ____ hours	Adjust Lag:
	>5% hydraulically improved
	Lag factor = 0.848
	>5% impervious areas
	Lag factor = 0.856

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-010

Area: .064 square miles

Upstream Elevation: 1342 Hydraulic Length: 2200 feet

Downstream Elevation: 1330 Slope: .0055 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
		City of Phx.					
	8%		RI-8	UNDEV	B	82	
	12%		RE-43	UNDEV	D	86	
	80%		RE-43	UNDEV 50%	B	~~77~~ 79	

Weighted CN= ~~78~~ 80 (Future)

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N= ____ L= ____ mi Lc ____ mi	L= 2200 ft CN= 79
S= ____ ft/mi	S= 0.550 % Lag= .830 hours
Lag= ____ hours	Adjust Lag: 30% impervious Lag factor = 0.827
	Lag= 0.830 × 0.827 = 0.689 hrs

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-011

Area .142 square miles

Upstream Elevation 1334 Hydraulic Length 3240 feet

Downstream Elevation 1319 Slope .00445 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Phx.	RE-43	90% UNDEV	B	~~77~~ 79	

Weighted CN= ~~77~~ 79

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=_____ L=_____m; Lc_____m;	L= 3240 ft CN= 79
S=_____ft/m;	S= 0.450 % Lag= 1.251 hours
Lag=_____hours	Adjust Lag:
	10% impervious areas
	Lag factor = 0.938
	Lag = 1.251 X 0.938 = 1.174 hrs

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-012

Area: .090 square miles

Upstream Elevation: 1318 Hydraulic Length: 2250 feet

Downstream Elevation: 1308 Slope: .0045 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
		City of Phx.					
	50%		R1-8	UNDEV	B	82	
	30%		RE-43	UNDEV	B	~~77~~ 79	
	20%		R-2	UNDEV	B	84	

Weighted CN= ~~81~~ 82 Existing = 79

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N= ____ L= ____ mi Lc ____ mi	L= 2250 ft CN= 79
S= ____ ft/mi	S= .45 % Lag= 0.935 hours
Lag= ____ hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-013

Area: .040 square miles

Upstream Elevation: 1313 Hydraulic Length: 2640 feet

Downstream Elevation: 1300 Slope: .0050 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Phx.	RE-43	UNDEV	B	77 79	

Weighted CN= 77 79

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N= ____ L= ____ mi Lc ____ mi	L= 2640 ft CN= 79
S= ____ ft/mi	S= 0.500% Lag= 1.008 hours
Lag= ____ hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-014

Area .043 square miles

Upstream Elevation 1368 Hydraulic Length 1560 feet

Downstream Elevation 1362 Slope .0038 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	city of phx.	P.C.	UNDEV	B	~~87~~ 82	

Weighted CN= ~~87~~ 82 (Future) Existing = 79

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=_____ L=_____m; Lc_____m;	L= 1560 ft CN= 79
S=_____ft/m;	S= .38 % Lag= .759 hours (Exist.)
Lag=_____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-015

Area .033 square miles

Upstream Elevation 1263 Hydraulic Length 1680 feet

Downstream Elevation 1256 Slope .0042 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	2%	City of Phx.	C-3	UNDEV	D	95	
	5%		R1-6	DEV	B	84	420
	93%		R1-6	DEV	D	90	8370

Weighted CN= $\frac{420+8370}{98} = 89.7 \Rightarrow 90$

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-016

Area: .0066 square miles

Upstream Elevation: 1367 Hydraulic Length: 2450 feet

Downstream Elevation: 1356 Slope: .0045 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
		City of Phx.					
	20%		R1-8	DEV	D	90	1800
	80%		R1-8	DEV	B	82	6560
							8360

Weighted CN= 84

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-017

Area: .063 square miles

Upstream Elevation: 1362 Hydraulic Length: 2530 feet

Downstream Elevation: 1352 Slope: .0040 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	55%	City of Phx.	R1-6	DEV	D	90	4950
	45%		R1-6	DEV	B	84	3780
							8730

Weighted CN= 87

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: 04-018

Area: .064 square miles

Upstream Elevation: 1361 Hydraulic Length: 2480 feet

Downstream Elevation: 1351 Slope: .0040 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	45%	City of Phx.	R1-8	DEV	D	90	4050
	55%		R1-8	DEV	B	82	4510
							8560

Weighted CN= 86

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-019

Area .061 square miles

Upstream Elevation 1356 Hydraulic Length 1380 feet

Downstream Elevation 1347 Slope .0065 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	25%	City of Phx.	R1-8	DEV	D	90	2250
	75%		R1-8	DEV	B	82	6150
							8400

Weighted CN= 84

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{1/2}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-020

Area .064 square miles

Upstream Elevation 1354 Hydraulic Length 3200 feet

Downstream Elevation 1345 Slope .0028 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	30%	City of Phx.	R1-8	DEV	D	90	2700
	70%		R1-8	DEV	B	82	5740
							8440

Weighted CN= 84

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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Job BELL ROAD PROJECT DRAINAGE STUDY

Description

E123061 J0501

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-021

Area .065 square miles

Upstream Elevation 1350 Hydraulic Length 2580 feet

Downstream Elevation 1339 Slope .0043 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	35%	City of Phx.	R1-8	DEV	D	90	3150
	65%		R1-8	DEV	B	82	5330
							8480

Weighted CN= 85

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-022

Area: .054 square miles

Upstream Elevation: 1348 Hydraulic Length: 2260 feet

Downstream Elevation: 1338 Slope: .0044 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	20%	City of Phx.	R1-8	DEV	D	90	1800
	80%		R1-8	DEV	B	82	6560
							8360

Weighted CN= 84

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-023

Area .071 square miles

Upstream Elevation 1342 Hydraulic Length 2520 feet

Downstream Elevation 1332 Slope .0040 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	20%	City of Phx.	R1-8	DEV	D	90	1800
	20%		R-2	DEV	D	91	1820
	10%		R-3A	DEV	D	93	930
	10%		R-3A	DEV	B	88	880
	30%		P.S.C	DEV	B	85	2550
	10%		R1-8	DEV	B	82	820
							8800

Weighted CN= 88

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-024

Area .063 square miles

Upstream Elevation 1342 Hydraulic Length 2580 feet

Downstream Elevation 1331 Slope .0043 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	30%	City of Phx.	RE-43	DEV	D	86	2580
	70%		RE-43	DEV	B	~~77~~ 79	~~5390~~ ~~7970~~

Weighted CN= ~~80~~ 81

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N= L= m; Lc m;	L= ft CN=
S= ft/m;	S= % Lag= hours
Lag= hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-025

Area: .066 square miles

Upstream Elevation: 1338 Hydraulic Length: 2580 feet

Downstream Elevation: 1327 Slope: .0043 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	5%	City of Phx.	C-2	DEV	B	92	460
	15%		RE-43	DEV	D	86	1290
	80%		RE-43	DEV	B	79 ~~77~~	~~6160~~
							~~7910~~

Weighted CN= 81 ~~79~~

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-026

Area .062 square miles

Upstream Elevation 1337 Hydraulic Length 2580 feet

Downstream Elevation 1326 Slope .0050 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	20%	City of Phx.	RE-43	DEV	D	86	~~1720~~
	80%		RE-43	DEV	B	~~77~~ 79	~~6160~~
							~~7880~~

Weighted CN= ~~79~~ 80

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-027

Area .063 square miles

Upstream Elevation 1331 Hydraulic Length 2580 feet

Downstream Elevation 1319 Slope .0047 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	5%	City of Phx.	RE-43	DEV	D	86	430
	95%		RE-43	DEV	B	~~77~~ 79	~~1315~~
							~~1745~~

Weighted CN= ~~77~~ 79

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-028

Area .063 square miles

Upstream Elevation 1229 Hydraulic Length 2580 feet

Downstream Elevation 1218 Slope .0043 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Phx.	RE-43	DEV	B	~~77~~ 79	

Weighted CN= ~~77~~ 79

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-029

Area: .064 square miles

Upstream Elevation: 1324 Hydraulic Length: 2580 feet

Downstream Elevation: 1314 Slope: .0039 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Phx.	RE-43	DEV	B	~~77~~ 79	

Weighted CN= ~~77~~ 79

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N= ____ L= ____ m; Lc ____ m;	L= ____ ft CN= ____
S= ____ ft/m;	S= ____ % Lag= ____ hours
Lag= ____ hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-030

Area .063 square miles

Upstream Elevation 1324 Hydraulic Length 2580 feet

Downstream Elevation 1315 Slope .0035 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Phx.	RE-43	DEV	B	~~77~~ 79	

Weighted CN= ~~77~~ 79

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-031

Area: .065 square miles

Upstream Elevation: 1318 Hydraulic Length: >500 feet

Downstream Elevation: 1311 Slope: .0028 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100% Built	City of Phx.	RE-43	DEV (NEW)	B	~~77~~ 79	

Weighted CN= ~~77~~ 79

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-032

Area .095 square miles .081 (15% reduced for future)

Upstream Elevation 1318 Hydraulic Length 3520 feet

Downstream Elevation 1310 Slope .0023 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
		City of Phx					
	30%		R1-8	DEV	B	82	2460
	55%		P.A.D.-8	DEV	B	85	4675
	15%		P.S.C	UNDEV	B	95	

Weighted CN= $\frac{2460+4675}{85} = 83.9 \Rightarrow 84$ Exist. = $\frac{2460+4675+15\times 79}{100} = 83.20 \Rightarrow 83$

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-033

Area: .121 square miles

Upstream Elevation: 1319 Hydraulic Length: 3840 feet

Downstream Elevation: 1306 Slope: .0034 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Phx.	R1-8	DEV	B	82	

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-034

Area .072 square miles

Upstream Elevation 1312 Hydraulic Length 2200 feet

Downstream Elevation 1299 Slope .0059 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of phx.	R1-8	DEV	B	82	

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/mi	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-035

Area .063 square miles

Upstream Elevation 1306 Hydraulic Length 2120 feet

Downstream Elevation 1295 Slope .0052 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Phx.	R1-8	DEV	B	82	

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-036

Area: .090 square miles

Upstream Elevation: 1300 Hydraulic Length: 2400 feet

Downstream Elevation: 1292 Slope: .0033 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Phx.	RE-43	UNDEV	B	~~82~~ 79	

Weighted CN= ~~82~~ 77 79

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N= ____ L= ____ m; Lc ____ m;	L= 2400 ft CN= 79
S= ____ ft/m;	S= .33 % Lag= 1.149 hours (Existing)
Lag= ____ hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-037

Area: .057 square miles

Upstream Elevation: 1300 Hydraulic Length: 2200 feet

Downstream Elevation: 1289 Slope: .0050 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Phx.	R1-8	DEV	B	82	

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-038

Area: .031 square miles .016 (50% reduced for future)

Upstream Elevation: 1356 Hydraulic Length: 1440 feet

Downstream Elevation: 1351 Slope: .0035 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
		city of phx.					
	25%		R-4A	DEV	B	87	2175
	25%		R-4A	DEV	D	92	2300
	25%		C-1	UNDEV	B	92	
	25%		C-1	UNDEV	D	95	—

Weighted CN= $\frac{2175+2300}{50} = 89.5 \Rightarrow 90$ (Future)

Existing $= \frac{2175+2300+50\times79}{100} = 84$

Large or Elongated Watersheds

Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$

N=_____ L=_____m; Lc_____m;

S=_____ft/m;

Lag=_____hours

Small, Uniform Watersheds

Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$

L= 1440 ft CN= 84 Exist.

S= .35 % Lag= .631 hours

Adjust Lag:

15% channel improved factor=0.952

15% impervious areas factor=0.95

Lag = 0.631 × 0.952 × 0.95 = 0.571

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-039

Area .031 square miles

Upstream Elevation 1352 Hydraulic Length 1900 feet

Downstream Elevation 1345 Slope 0.0041 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	2%	City of Phx.	IND. PK.	DEV	D	93	186
	48%		IND. PK.	DEV	B	88	4224
	50%		R-4A	UNDEV	B	87	4350

Weighted CN= Future 88

Existing = $\frac{186+4224+50\times79}{100} = 89.60 \Rightarrow 84$

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=____ L=____ mi Lc____ mi	L=____ ft CN=____
S=____ ft/mi	S=____ % Lag=____ hours
Lag=____ hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-040

Area .057 square miles

Upstream Elevation 1356 Hydraulic Length 2560 feet

Downstream Elevation 1347 Slope .0035 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	40%	City of Phx.	R1-8	DEV	B	82	3280
	50%		R1-8	DEV	D	90	4500
	10%		R-3A	DEV	D	91	910
							8690

Weighted CN= 87

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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Job: BELL ROAD PROJECT DRAINAGE STUDY

Description: E123061 J0501

Calculated by: R.H Date: 8/15/86 Sheet No. ____

Checked by: BGR Date: 8/28/86 of ____

BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-041

Area: .057 square miles

Upstream Elevation: 1351 Hydraulic Length: 2080 feet

Downstream Elevation: 1342 Slope: .0043 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	65%	City of Phx.	R1-6	DEV	D	90	5850
	35%		R1-6	DEV	B	84	2940
							8790

Weighted CN= 88

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/S^0.5)^0.38	Lag = L^0.8 (1000/CN - 9)^0.7/1900 S^½
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Description:
E123061 J0501
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-042

Area: .072 square miles

Upstream Elevation: 1353 Hydraulic Length: 2440 feet

Downstream Elevation: 1340 Slope: .0053 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	15%	City of Phx.	RI-8	DEV	D	90	1350
	35%		RI-6	DEV	D	90	3150
	50%		RI-6	DEV	B	85	4250
							8750

Weighted CN= 88

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Description: E123061 J0501

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-043

Area: .069 square miles

Upstream Elevation: 1347 Hydraulic Length: 2420 feet

Downstream Elevation: 1338 Slope: .0037 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	55%	City of Phx.	R1-6	DEV	D	90	4950
	45%		R1-6	DEV	B	84	3780
							8730

Weighted CN= 87

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Description: E123061 J0501
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-044

Area: .064 square miles

Upstream Elevation: 1345 Hydraulic Length: 2500 feet

Downstream Elevation: 1334 Slope: .0044 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	50%	City of Phx.	R1-6	DEV	D	90	
	50%		R1-6	DEV	B	84	

Weighted CN= 87

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-045

Area .064 square miles

Upstream Elevation 1340 Hydraulic Length 2500 feet

Downstream Elevation 1328 Slope .0048 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	60%	City of Phx.	R1-6	DEV	D	90	5400
	40%		R1-6	DEV	B	84	3360
							8760

Weighted CN= 88

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Description: E123061 J0501

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-046

Area: .065 square miles .042 (35% reduced for future)

Upstream Elevation: 1338 Hydraulic Length: 2560 feet

Downstream Elevation: 1332 Slope: .0023 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
		City of Phx.					
	30%		P.S.C	UNDEV	B	95	
	5%		P.S.C	UNDEV	D	95	
	3%		R1-6	DEV	D	90	270
	62%		R1-6	DEV	B	84	5208

Weighted CN= $\frac{2700+5208}{65} = 84.3$ (future)

Existing = $\frac{2700+5208+35 \times 79}{100} = 82.43 \Rightarrow 82$

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	

Adjust Lag:

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Description: E123061 J0501
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-047

Area: .065 square miles

Upstream Elevation: _____ Hydraulic Length: >>00 feet

Downstream Elevation: _____ Slope: .0040 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
		City of Phx.					
	25%		R1-6	DEV	D	90	2250
	75%		R1-6	DEV	B	84	6300
							8550

Weighted CN= 86

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-048

Area: .084 square miles

Upstream Elevation: 1332 Hydraulic Length: 2600 feet

Downstream Elevation: 1320 Slope: .0046 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	3%	City of phx.	P.S.C.	DEV	D	95	285
	7%		P.S.C.	DEV	B	95	665
	7%		R-2	DEV	D	90	630
	8%		R-2	DEV	B	86	688
	40%		R1-8	DEV	D	90	3600
	35%		R1-8	DEV	B	82	2870
							8738

Weighted CN= 87

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N= ____ L= ____ m; Lc ____ m;	L= ____ ft CN= ____
S= ____ ft/m;	S= ____ % Lag= ____ hours
Lag= ____ hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-049

Area: .066 square miles

Upstream Elevation: 1328 Hydraulic Length: 2900 feet

Downstream Elevation: 1318 Slope: .0026 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	5%	City of Phx.	R1-6	DEV	D	90	450
	35%		R1-6	DEV	B	84	2940
	66%		R1-8	DEV	B	82	4920
							8310

Weighted CN= 83

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-050

Area .049 square miles

Upstream Elevation 1323 Hydraulic Length 2200 feet

Downstream Elevation 1316 Slope .0032 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	50%	City of Phx.	R1-8	DEV	D	90	
	50%		R1-8	DEV	B	82	

Weighted CN= 86

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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Description

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-051

Area .060 square miles

Upstream Elevation 1322 Hydraulic Length 2520 feet

Downstream Elevation 1311 Slope .00444 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	30%	City of PHX.	R1-6	DEV	D	90	2700
	70%		R1-6	DEV	B	84	5880
							8580

Weighted CN= 86

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-052

Area .069 square miles

Upstream Elevation 1319 Hydraulic Length >910 feet

Downstream Elevation 1310 Slope .0031 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	5%	City of Phx.	R1-8	DEV	D	90	450
	95%		R1-8	DEV	B	82	7790
							8240

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Description

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-053

Area .070 square miles

Upstream Elevation 1315 Hydraulic Length >580 feet

Downstream Elevation 1304 Slope .0043 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	40%	city of phx.	R1-8	DEV	D	90	3600
	60%		R1-8	DEV	B	82	4920
							8520

Weighted CN= 85

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Job: BELL ROAD PROJECT DRAINAGE STUDY

Description: E123061 J0501

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-054

Area: .055 square miles

Upstream Elevation: 1313 Hydraulic Length: 2340 feet

Downstream Elevation: 1304 Slope: .0038 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of PhX.	R1-8	20% UNDEV	B	82	

Weighted CN= 82 (Future)

Existing $= \frac{82 \times 80 + 79 \times 20}{100} = 81.40 \Rightarrow 81$

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Description

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-055

Area .058 square miles

Upstream Elevation 1310 Hydraulic Length 2140 feet

Downstream Elevation 1298 Slope .0056 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	10%	City of Phx.	R1-8	DEV	D	90	900
	90%		R1-8	DEV	B	82	7380
							8280

Weighted CN= 83

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-056

Area: .141 square miles

Upstream Elevation: 1311 Hydraulic Length: 4000 feet

Downstream Elevation: 1293 Slope: 0.0045 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	30%	City of phx.	P.A.D.-9	DEV	D	90	2700
	55~~70~~%		P.A.D.-9	DEV	B	84	4620
	15%		Golf Course	DEV	B	61	915
							8235

Weighted CN= ~~86~~ 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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Description
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-057

Area .113 square miles

Upstream Elevation 1305 Hydraulic Length 3740 feet

Downstream Elevation 1290 Slope 0.0042 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	5%	City of Phx.	P.A.D.-9	DEV	D	90	450
	80 ~~95~~%		P.A.D.-9	DEV	B	84	6720 ~~7980~~
	15%		Golf Course	DEV	B	61	915
							8085

Weighted CN= ~~84~~ 81

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Job: BELL ROAD PROJECT DRAINAGE STUDY
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-058

Area: .069 square miles

Upstream Elevation: 1298 Hydraulic Length: 2900 feet

Downstream Elevation: 1289 Slope: 0.0031 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Phx.	R1-8	DEV	B	82	

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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Job BELL ROAD PROJECT DRAINAGE STUDY

Description

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-059

Area .078 square miles

Upstream Elevation 1295 Hydraulic Length 2840 feet

Downstream Elevation 1284 Slope 0.0039 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Phx.	R1-8	DEV	B	82	

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Job BELL ROAD PROJECT DRAINAGE STUDY

Description

E123061 J0501

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-060

Area .050 square miles

Upstream Elevation 1293 Hydraulic Length 1860 feet

Downstream Elevation 1285 Slope 0.0043 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Phx.	R1-8	UNDEV	B	82	

Weighted CN= 82 (Future)

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N= L= m; Lc m;	L= 1860 ft CN= 79 (Exist.)
S= ft/m;	S= .43 % Lag= 0.821 hours
Lag= hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-061

Area: .046 square miles

Upstream Elevation: 1289 Hydraulic Length: 2200 feet

Downstream Elevation: 1279 Slope: 0.0045 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Phx.	R1-8	DEV	B	82	

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Job BELL ROAD PROJECT DRAINAGE STUDY
Description
E123061 J0501
Calculated by R.H Date 8/19/86 Sheet No.
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-062

Area .161 square miles .145 sq. mi. (10% reduced for future)

Upstream Elevation 1347 Hydraulic Length 3240 feet

Downstream Elevation 1328 Slope .0059 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	35%	City of Phx.	C-2	UNDEV	B	92	3220
	65%		IND. PK.	[redacted] UNDEV 55%	B	88	5720
							8940

Weighted CN= 89 (Future) Existing = 79

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{1/2}$
N= L= m; Lc m;	L= 3240 ft CN= 79 (Exist.)
S= ft/m;	S= .59 % Lag= 1.093 hours
Lag= hours	Adjust Lag:
	10% improved chan. ⇒ Factor = .94
	10% impervious area ⇒ Factor = .94
	1.093 x .94 x .94 = 0.966 hour

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Job: BELL ROAD PROJECT DRAINAGE STUDY

Description: E123061 J0501

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-063

Area: .042 square miles

Upstream Elevation: 1341 Hydraulic Length: 1780 feet

Downstream Elevation: 1332 Slope: .0051 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	70%	City of Phx.	R1-8	DEV	D	90	6300
	30%		R1-8	DEV	B	82	2460
							8760

Weighted CN= 88

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Description:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-064

Area: .061 square miles

Upstream Elevation: 1336 Hydraulic Length: 2500 feet

Downstream Elevation: 1324 Slope: .0048 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Phx.	R1-8	DEV	B	82	

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-065

Area .026 square miles

Upstream Elevation 1334 Hydraulic Length 1660 feet

Downstream Elevation 1329 Slope .0030 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	60%	City of Phx.	R1-6	UNDEV	D	90	5400
	40%		R1-6	DEV	B	84	3360
							8760

Weighted CN= 88 (Future)

Existing = $\frac{3360+60\times 82}{100} = 82.80$
$\Rightarrow 83$

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Description: E123061 J0501
Calculated by: R.H Date: 8/19/86 Sheet No. ____
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-D66

Area: .065 square miles

Upstream Elevation: 1331 Hydraulic Length: 2500 feet

Downstream Elevation: 1322 Slope: .0036 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	10%	City of Phx.	R1-6	DEV	D	90	900
	15%		R1-8	DEV	B	82	1230
	75%		R1-6	DEV	B	84	6300
							8430

Weighted CN= 84

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-067

Area .047 square miles

Upstream Elevation 1327 Hydraulic Length 1960 feet

Downstream Elevation 1318 Slope .0046 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
		City of Phx.					
	70%		R-3A	DEV	D	91	6370
	12%		R-3A	DEV	B	86	1032
	8%		C-1	DEV	B	88	704
	10%		R1-8	DEV	B	82	820
							8926

Weighted CN= 89

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-068

Area .095 square miles

Upstream Elevation 1332 Hydraulic Length 4060 feet

Downstream Elevation 1318 Slope .0034 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	40%	City of Phx.	R1-6	DEV	D	90	3600
	60%		R1-6	DEV	B	84	5040
							8640

Weighted CN= 86

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=_____ L=_____mi Lc_____mi	L=_____ft CN=_____
S=_____ft/mi	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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Description

E123061 J0501

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-069

Area .065 square miles

Upstream Elevation 1323 Hydraulic Length 2200 feet

Downstream Elevation 1314 Slope .0041 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	15%	City of Phx.	P.A.D.14	DEV	D	89	1335
	45%		P.A.D.14	DEV	B	86	3870
	40%		P.S.C.	DEV	B	95	3800
							9005

Weighted CN= 90

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-071

Area .081 square miles

Upstream Elevation 1317 Hydraulic Length 2840 feet

Downstream Elevation 1309 Slope .0028 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	20%	City of Phx.	P.S.C.	DEV	B	95	1900
	80%		R1-8	DEV	B	82	6560
							8460

Weighted CN= 85

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-072

Area: .060 square miles

Upstream Elevation: 1318 Hydraulic Length: 2200 feet

Downstream Elevation: 1305 Slope: .0059 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	20%	City of Phx.	R1-8	DEV	D	90	1800
	80%		R1-8	DEV	B	82	6560
							8360

Weighted CN= 84

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Description: E123061 J0501

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-073

Area: .069 square miles

Upstream Elevation: 1312 Hydraulic Length: 2600 feet

Downstream Elevation: 1303 Slope: .0035 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Phx.	R1-8	DEV	B	~~90~~ 82	

Weighted CN= ~~90~~ 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-074

Area: .063 square miles

Upstream Elevation: 1311 Hydraulic Length: 2200 feet

Downstream Elevation: 1298 Slope: .0059 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	5%	City of Phx.	R1-8	DEV	D	90	450
	95%		R1-8	DEV	B	82	7790
							8240

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Description:

E123061 J0501

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-075

Area: .063 square miles

Upstream Elevation: 1306 Hydraulic Length: 2200 feet

Downstream Elevation: 1297 Slope: .0041 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Phx.	R1-8	DEV	B	82	

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{1/2}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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Description:
E123068 J0501
Calculated by: R.H Date: 8/19/86 Sheet No. ____
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-076

Area: .070 square miles

Upstream Elevation: 1303 Hydraulic Length: 2760 feet

Downstream Elevation: 1293 Slope: .0036 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	10%	City of Phx.	R1-8	DEV	D	90	900
	90%		R1-8	DEV	B	82	7380
							8280

Weighted CN= 83

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Description

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-077

Area .028 square miles

Upstream Elevation 1298 Hydraulic Length 1660 feet

Downstream Elevation 1292 Slope .0036 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Phx.	R1-8	DEV	B	82	

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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Description

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-078

Area .026 square miles

Upstream Elevation 1298 Hydraulic Length 1180 feet

Downstream Elevation 1294 Slope .0034 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Phx.	R1-8	DEV	B	82	

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____ mi Lc____ mi	L=____ ft CN=____
S=____ ft/mi	S=____ % Lag=____ hours
Lag=____ hours	Adjust Lag:

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Description: E123061 J0501

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-079

Area: .028 square miles .017 (40% reduced for future)

Upstream Elevation: 1295 Hydraulic Length: 1200 feet

Downstream Elevation: 1288 Slope: .0058 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	40%	City of Phx.	P.S.C.	UNDEV	B	95	3800
	60%		R1-8	50% UNDEV	B	82	4920
							8720

Weighted CN: ~~87~~ Future 82

Exist. = $\frac{10 \times 82 + 90 \times 79}{100}$ = 79.3 ⇒ 79

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N= ____ L= ____ m; Lc ____ m;	L= 1200 ft CN= 79
S= ____ ft/m;	S= .58 % Lag= .498 hours
Lag= ____ hours	

Adjust Lag:

10% improved ⇒ Lag factor = .95

10% impervious area ⇒ Lag factor = .96

Exist. Lag = .498 X .95 X .96 = .454

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Description

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-080

Area .089 square miles

Upstream Elevation 1296 Hydraulic Length 2750 feet

Downstream Elevation 1287 Slope 0.0033 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	65% ~~100%~~	City of Phx.	P.A.D.-9		84		
	35%		Golf Course		61		

.014
.0164
.029 → 80

Weighted CN= ~~84~~ 76

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	

Adjust Lag:

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Job BELL ROAD PROJECT DRAINAGE STUDY

Description

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-081

Area .087 square miles

Upstream Elevation 1294 Hydraulic Length 2690 feet

Downstream Elevation 1286 Slope .0030 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	35%	City of Phx.	P.S.C.	DEV	B	95	3325
	65%		P.A.D.-9	DEV	B	84	5460
							8785

Weighted CN= 88

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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Job: BELL ROAD PROJECT DRAINAGE STUDY

Description: E123061 J0501

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-082

Area: .102 square miles

Upstream Elevation: 1293 Hydraulic Length: 3140 feet

Downstream Elevation: 1280 Slope: 0.004 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	80 ~~100~~%	City of Phx.	P.A.D.-9	DEV	B	84	
	20%		Golf Course	DEV	B	61	

Weighted CN= ~~84~~ 79

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{1/2}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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Job BELL ROAD PROJECT DRAINAGE STUDY

Description

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-083

Area .074 square miles

Upstream Elevation 1286 Hydraulic Length 3140 feet

Downstream Elevation 1272 Slope 0.0045 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Phx.	P.A.D.-9	DEV	B	84	

Weighted CN= 84

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-084

Area: .075 square miles

Upstream Elevation: 1287 Hydraulic Length: 3630 feet

Downstream Elevation: 1272 Slope: 0.004 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	75 ~~100~~%	City of Phx.	P.A.D.-9	DEV	B	84	
	>5%		Golf Course	DEV	B	61	

Weighted CN= ~~84~~ 78

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-085

Area: .070 square miles

Upstream Elevation: 1287 Hydraulic Length: 3000 feet

Downstream Elevation: 1276 Slope: .0037 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Phx.	P.A.D.-9	DEV	B	84	

Weighted CN= 84

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-086

Area .056 square miles .034 (40% reduced for future)

Upstream Elevation 1279 Hydraulic Length >300 feet

Downstream Elevation 1270 Slope .0039 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	40%	City of Phx.	P.S.C.	UNDEV	B	95	3800
	60%		P.A.D.-9	DEV	B	84	5040
							8840

Weighted CN= 88 (Future) Existing = $\frac{5040+40\times79}{100}=82$

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-087

Area .09 square miles

Upstream Elevation 1288 Hydraulic Length >150 feet

Downstream Elevation 1278 Slope .0067 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
		City of Glendale					
	100%		R1-6	DEV	B	84	

Weighted CN= 84

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-088

Area .03 square miles

Upstream Elevation 1283 Hydraulic Length 1560 feet

Downstream Elevation 1276 Slope .0045 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Glendale	R1-6	UNDEV	B	84	

Weighted CN= 84 (Future)
79 (Existing)

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N= L= m; Lc m;	L= 1560 ft CN= 79
S= ft/m;	S= .45 % Lag= .697 hours (Exist.)
Lag= hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-089

Area .06 square miles

Upstream Elevation 1285 Hydraulic Length 2040 feet

Downstream Elevation 1275 Slope .0049 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
		City of Glendale					
	95%		R1-6	50% UNDEV	B	84	7980
	5%		R1-6	UNDEV	D	90	450
							8430

Weighted CN= 84 (Future) Existing= $\frac{50 \times 79 + 50 \times 84}{100}$ = 81.50 Use 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N= L= m; Lc m;	L= 2040 ft CN= 82
S= ft/m;	S= .49 % Lag= .753 (Exist.) hours
Lag= hours	Adjust Lag:
	40% improved channel ⇒ factor = .82
	50% impervious area ⇒ factor = .77
	Exist. Lag = .753 × .82 × .77 = .476

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-090

Area: .06 square miles

Upstream Elevation: 1280 Hydraulic Length: 2000 feet

Downstream Elevation: 1271 Slope: .0045 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	90%	City of Glendale	R1-6	UNDEV	B	84	7560
	10%		R1-6	UNDEV	D	90	900
							8460

Weighted CN= 85 (Future) Existing = 79 (B.G.)

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N= ____ L= ____ m; Lc ____ m;	L= 2000 ft CN= 79 (Exist.)
S= ____ ft/m;	S= .45 % Lag= .851 hours
Lag= ____ hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-091

Area .12 square miles

Upstream Elevation 1279 Hydraulic Length 3100 feet

Downstream Elevation 1265 Slope .0045 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Glendale	M-P	UNDEV	B	88	

Weighted CN= 88 (Future) Existing = 79

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/S$^{0.5}$)$^{0.38}$	Lag = L$^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 S$^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L= 3100 ft CN= 79
S=____ft/m;	S= .45 % Lag= 1.208 hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-092

Area .16 square miles

Upstream Elevation 1273 Hydraulic Length 3360 feet

Downstream Elevation 1260 Slope .0039 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	95%	City of Glendale	M-P		B	88	8360
	5%		M-P		D	93	465
							8825

Weighted CN= ~~8825~~ 88 (Future) Existing = 79

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L= 3360 ft CN= 79
S=____ft/m;	S= .39 % Lag= 1.384 hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-093

Area .08 square miles

Upstream Elevation 1280 Hydraulic Length 2620 feet

Downstream Elevation 1269 Slope .0042 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Glendale	R1-6		B	84	

Weighted CN= 84

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-094

Area .06 square miles

Upstream Elevation 1275 Hydraulic Length 1780 feet

Downstream Elevation 1267 Slope .0045 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	40%	City of Glendale	R1-6	DEV	D	90	3600
	60%		R1-6	DEV	B	84	5040
							8640

Weighted CN= 86

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-095

Area .04 square miles

Upstream Elevation 1271 Hydraulic Length 1600 feet

Downstream Elevation 1263 Slope .0050 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
		City of Glendale					
	25%		R1-6	DEV	D	90	2250
	75%		R1-6	DEV	B	84	6300
							8550

Weighted CN= 86

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-096

Area: .08 square miles .048 (40% reduced for future)

Upstream Elevation: 1265 Hydraulic Length: >500 feet

Downstream Elevation: 1255 Slope: .0040 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
		City of Glendale					
	15%		R1-6	DEV	D	90	1350
	45%		R1-6	DEV	B	84	3780
	(40%		M-P	UNDEV	B	88)	

Weighted CN= $\frac{1350+3780}{60} = 86$ (Future) Existing = $\frac{1350+3780+40\times 79}{100} = 82.90 \Rightarrow 83$

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-097

Area: .06 square miles .036 (40% reduced for future)

Upstream Elevation: 1273 Hydraulic Length: 2220 feet

Downstream Elevation: 1264 Slope: .0041 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
		city of Glendale					
	(40%		C-1	UNDEV	B	92)	
	60%		R1-6	DEV	B	84	5040

Weighted CN= 84 (Future) Existing = $\frac{5040+40\times 79}{100} = 82$

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	
	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-098

Area: .06 square miles

Upstream Elevation: 1269 Hydraulic Length: 1960 feet

Downstream Elevation: 1263 Slope: .0031 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%		R1-6		B	84	

Weighted CN= 84

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-099

Area: .08 square miles

Upstream Elevation: 1267 Hydraulic Length: >640 feet

Downstream Elevation: 1258 Slope: .0036 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
		City of Glendale					
	5%		R-2		B	87	435
	10%		R-3		B	85	850
	85%		R1-6		B	84	7140
							8425

Weighted CN= 84

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-100

Area .07 square miles

Upstream Elevation 1262 Hydraulic Length 1800 feet

Downstream Elevation 1253 Slope .0050 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	30%	City of Glendale	C-2	UNDEV	D	95	2850
	70%		C-2	UNDEV	B	92	6440
							9290

Weighted CN= 93 (Future)

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/S$^{0.5}$)$^{0.38}$	Lag = L$^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 S$^{1/2}$
N= L= m; Lc m;	L= 1800 ft CN= 79 (Exist.)
S= ft/m;	S= .50 % Lag= .742 hours
Lag= hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-101

Area: .26 square miles

Upstream Elevation: 1267 Hydraulic Length: 4200 feet

Downstream Elevation: 1240 Slope: .0066 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	100%	City of Glendale	R1-6	70% UNDEV	B	84	

Weighted CN= 84 (Future)

Exist. = $\frac{84 \times 30 + 79 \times 70}{100}$
= 80.5 ⇒ 81

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N= ____ L= ____ m; Lc ____ m;	L= 4200 ft CN= 81
S= ____ ft/m;	S= .66 % Lag= 1.213 hours
Lag= ____ hours	

Adjust Lag:

30% improved chan. ⇒ factor = .832

30% impervious area ⇒ factor = .832

Exist. Lag = 1.213 X .832 X .832 = .840

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-102

Area .12 square miles

Upstream Elevation 1263 Hydraulic Length 3720 feet

Downstream Elevation 1246 Slope .0046 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
		City of Glendale					
	100%		R1-6	DEV	B	84	

Weighted CN= 84

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q4-103

Area .09 square miles

Upstream Elevation 1247 Hydraulic Length 2160 feet

Downstream Elevation 1230 Slope .0079 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
		City of Glendale					
	100%		R1-6	70% UNDEV	B	84	

Weighted CN= 84 (Future)

Exist. $= \frac{84 \times 30 + 79 \times 70}{100} = 80.50 \Rightarrow 81$

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L= 2160 ft CN= 81
S=____ft/m;	S= .79 % Lag= .641 hours
Lag=____hours	

Adjust Lag:

30% improved chan. ⇒ factor = .83

Exist. Lag = .641 X .83 = .532

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Description:

E123068 J0501

Calculated by: R.H Date: 8/20/86 Sheet No. ____

Checked by: BGB Date: 8/26/86 of ____

BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-104

Area: .17 square miles .145 (15% reduced for future)

Upstream Elevation: 1258 Hydraulic Length: 3240 feet

Downstream Elevation: 1243 Slope: .0046 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	30%		R1-6	DEV	B	84	2520
	25%		A-1	DEV	B	74	1850
	15%		C-O	UNDEV	B	88	1320
	30%		P.A.D.	UNDEV	B	84	2520
							8210

Weighted CN= 82 (Future) 79 (Exist.)

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L= 3240 ft CN= 79
S=____ft/m;	S= .46 % Lag= 1.238 hours
Lag=____hours	Adjust Lag:
	40% improved ⇒ factor = .76
	40% impervious ⇒ factor = .76
	Exist. Lag = 1.238 x .76 x .76 = 0.715

Greiner Engineering

Greiner Engineering Sciences, Inc.

Tucson 602 327-3413
Phoenix 602 275-5400

Job: BELL ROAD PROJECT DRAINAGE STUDY

Description: E123061 J0501

Calculated by: R.H Date: 8/20/86 Sheet No. ____

Checked by: BGR Date: 8/26/86 of ____

BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4-105

Area: ~~.16~~ .111 square miles .083 (>5% reduced for future)

Upstream Elevation: 1246 Hydraulic Length: >400 feet

Downstream Elevation: 1233 Slope: .0054 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	15%		R1-6	DEV	B	84	1260
	50%		A-1	>0% UNDEV	B	74	3700
	>25%		C-1	UNDEV	B	92	>2300
	10%		C-0	DEV	B	88	880
							8140

Weighted CN= 81 (Future) Exist = 79

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N= ____ L= ____ m; Lc ____ m;	L= >400 ft CN= 79
S= ____ ft/m;	S= .54 % Lag= .898 hours
Lag= ____ hours	

Adjust Lag:

50% improved ⇒ factor = .71

50% impervious ⇒ factor = .70

Exist. Lag = .898 × .71 × .70 = .446

Greiner Engineering

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Tucson 602 327-3413
Phoenix 602 275-5400

Job: BELL ROAD PROJECT DRAINAGE STUDY

Description: E123068 J0501

Calculated by: R.H Date: 8/20/86 Sheet No. ____

Checked by: BAS Date: 8/26/86 of ____

BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q4106

Area: .049 square miles

0=100
~~Bt.~~ >0'

Upstream Elevation: 1237

Hydraulic Length: 1960 feet

Downstream Elevation: 1232

Slope: .0026 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.049	100%		R1-6		B	84	

Weighted CN= 84

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1~3 for Drainage Area 4

DESIGNER: BSB

DATE: 11/12/86

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on 35th Ave. from Bell Rd. to ACDC

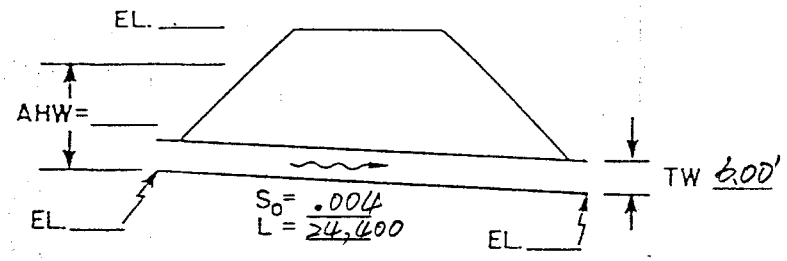
Q_1 = 2010 cfs TW_1 = 6.00'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



MEAN STREAM VELOCITY = _____

48.8 MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
6-8'x6' RCB	335	8'x6'	.98	5.88	0.5	1.90/93%			6.00	6.00	97.6	1.12	5.88			Chart 1 Scale 2 for Inlet Control

SUMMARY & RECOMMENDATIONS: Use 6-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1~3 for Drainage Area 4

DESIGNER: BGB

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on 35th Ave. from Campo Bello Dr. to Bell Rd.

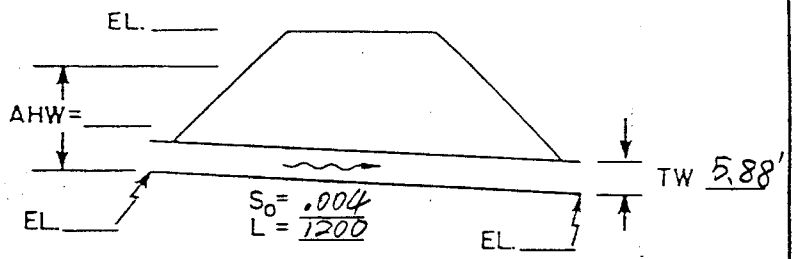
Q_1 = 820 TW_1 = 5.88'

Q_2 = TW_2 =

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION :



2.40 MEAN STREAM VELOCITY =
MAX. STREAM VELOCITY =

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
2-8'x6' RCB	410	8'x6'	1.25	7.50	0.5	2.90/6.96			5.88	5.88	4.80	8.04	8.04			

SUMMARY & RECOMMENDATIONS: Use 2-8'x6' RCB

Figure 7

PROJECT: E1>3061 Bell Rd. Project Drainage Study
Alternate No. 1~3 for Drainage Area 4

DESIGNER: BGS

DATE: 11/12/86

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 35th Ave. from Grovers Ave. to Campo Bello Dr.

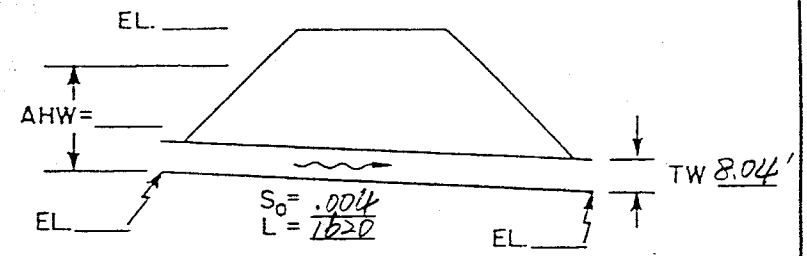
Q_1 = 690 cfs TW_1 = 8.04'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



3.24

MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
2-8'x5' RCB	345	8'x5'	1.38	6.90	0.5	3.10/10.04			8.04	8.04	6.48	11.60	11.60			NG
2-8'x6' RCB	345	8'x6'	1.02	6.12	0.5	2.00/6.48			8.04	8.04	6.48	8.04	8.04			

SUMMARY & RECOMMENDATIONS: Use 2-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1~3 for Drainage Area 4

DESIGNER: BGS

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. from 32nd Ln. to 35th Ave.

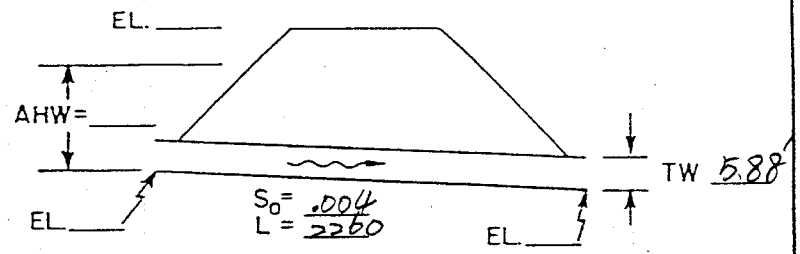
Q_1 = 1110 cfs TW_1 = 5.88'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



4.52 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
3-8'x6' RCB	370	8'x6'	1.16	6.96	0.5	0.35/10.62			5.88	5.88	9.04	7.46	7.46			

SUMMARY & RECOMMENDATIONS: Use 3-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1~3 for Drainage Area 4

DESIGNER: BGS

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. from 31st Ave. to 32nd Ln.

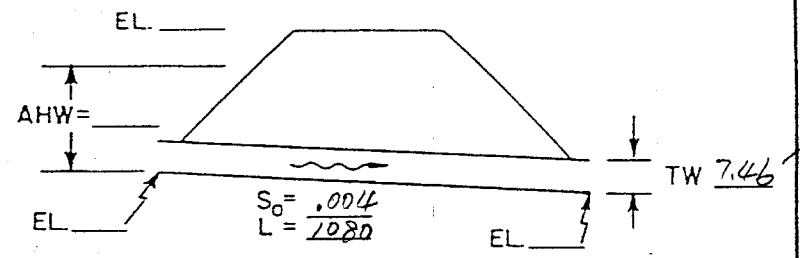
Q_1 = 960 cfs TW_1 = 7.46

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



2.16 MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
3-8'x5' RCB	320	8'x5'	1.28	6.40	0.5	2.6/5.62			7.46	7.46	4.32	8.76	8.76			

SUMMARY & RECOMMENDATIONS: Use 3-8'x5' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1~3 Drainage Area 4

DESIGNER: BGS

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. from I-17 HWY East to 31st Ave.

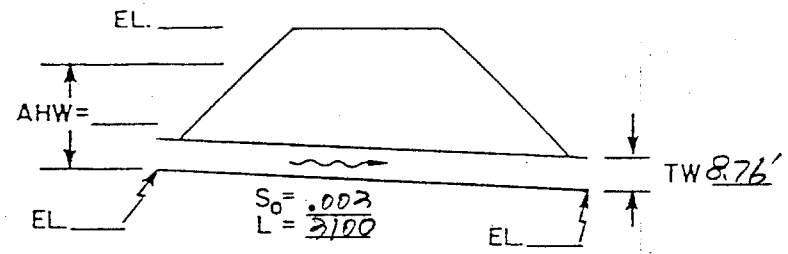
Q_1 = 730 cfs TW_1 = 8.76'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



6.50 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT.		OUTLET CONTROL HW=H + h_o − LS_o								CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW				
2-8'x5' RCB	365	8'x5'	1.43	7.15	0.5	3.18/19.71			8.76	8.76	9.30	19.17	19.17			N.G.
3-8'x5' RCB	243	8'x5'	1.05	5.25	0.5	1.55/9.61			8.76	8.76	9.30	9.07	9.07			

SUMMARY & RECOMMENDATIONS: Use 3-8'x5' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1 & 2 for Drainage Area 4

DESIGNER: BGB

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on 43rd Ave. from Bell Rd. to ACDC

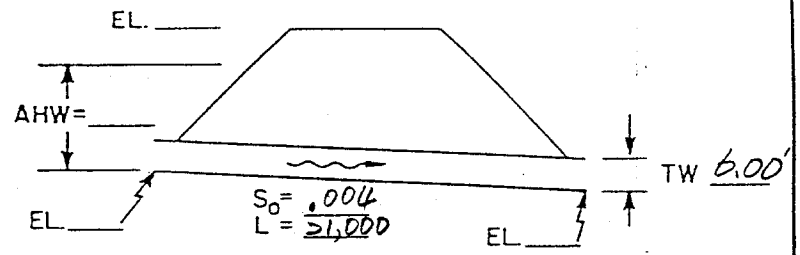
Q_1 = 1540 cfs TW_1 = 6.00'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



42.00

MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT.		OUTLET CONTROL HW=H + h_o − LS_o								CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW				
5-8'x6' RCB	308	8'x6'	1.03	6.18	0.5	1.65/69.3			6.00	6.00	84.00	-8.70	6.18			
6-8'x5' RCB	257	8'x5'	1.08	5.40	0.5	1.70/71.4			6.00	6.00	84.00	-6.60	5.40			
6-6'x6' RCB	257	6'x6'	1.01	6.06	0.5	2.20/92.4			6.00	6.00	84.00	14.40	14.40			NG

SUMMARY & RECOMMENDATIONS: Use 5-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1 & 2 for Drainage Area 4

DESIGNER: BGS

DATE: 11/12/86

HYDROLOGIC AND CHANNEL INFORMATION

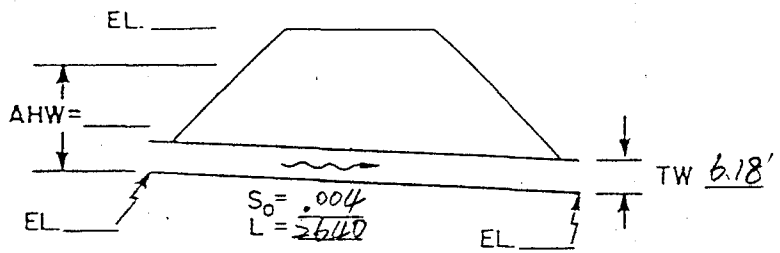
Structure on 43rd Ave. from Grovers Ave. to Bell Rd.

Q_1 = 680 cfs TW_1 = 6.18'
Q_2 = _____ TW_2 = " _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



5.28 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW = H + h_o - LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
2-8'x6' RCB	340	8'x6'	1.09	6.54	0.5	2.09/10.56			6.18	6.18	10.56	6.18	6.54			
2-6'x6' RCB	340	6'x6'	1.37	8.22	0.5	2.80/5.06			6.18	6.18	10.56	15.68	15.68			NG
2-8'x5' RCB	340	8'x5'	1.35	6.75	0.5	2.95/15.58			6.18	6.18	10.56	11.20	11.20			NG

SUMMARY & RECOMMENDATIONS: Use 2-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1 & 2 for Drainage Area 4

DESIGNER: BGR

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. from 41st Ave. to 43rd Ave.

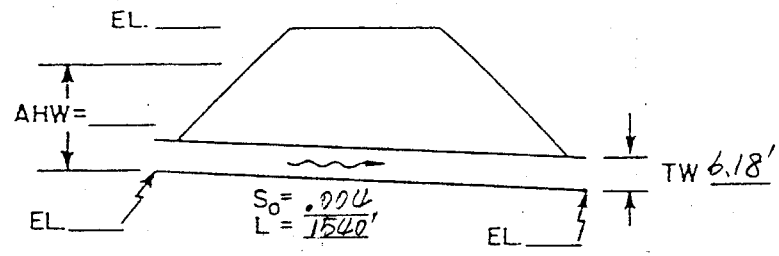
Q_1 = 840 cfs TW_1 = 6.18'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

7.08

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h_o−LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
2-8'x6' RCB	420	8'x6'	1.28	7.68	0.5	7.10/9.55			6.18	6.18	6.16	9.57	9.57			
3-6'x6' RCB	280	6'x6'	1.18	7.08	0.5	7.58/7.95			6.18	6.18	6.16	7.97	7.97			

SUMMARY & RECOMMENDATIONS: Use 3-6'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1 & 2 for Drainage Area 4

DESIGNER: BGB

DATE: 11/12/86

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. from 39th Ave. to 41st Ave.

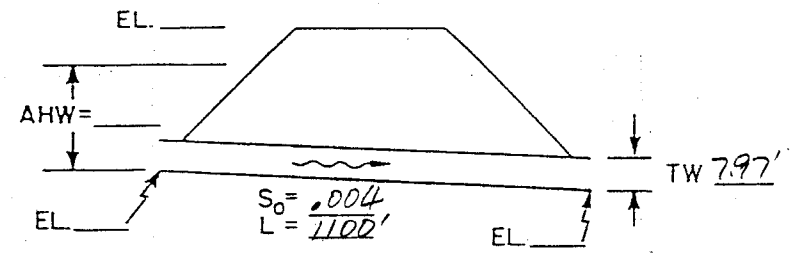
Q_1 = 450 cfs TW_1 = 7.97'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



2.20 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
2-6'x6' RCB	225	6'x6'	1.00	6.00	0.5	1.70/3.74			7.97	7.97	4.40	7.31	7.31			
1-10'x6' RCB	450	10'x6'	1.14	6.84	0.5	2.05/4.51			7.97	7.97	4.40	8.08	8.08			

SUMMARY & RECOMMENDATIONS: Use 1-10'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1 & 2 for Drainage Area 4

DESIGNER: BGB

DATE: 11/12/86

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on 51st Ave. from Bell Rd. to ACDC

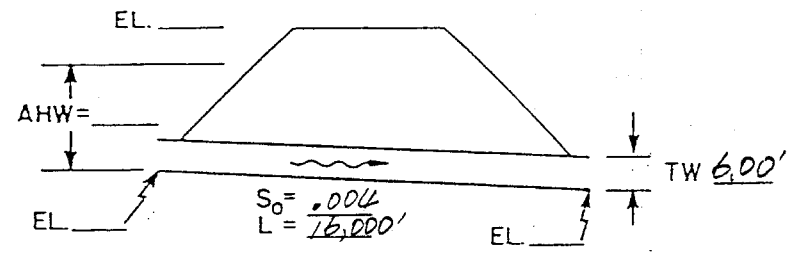
Q_1 = 660 cfs TW_1 = 6.00'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



32.00

MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
2-8'x6' RCB	330	8'x6'	1.08	6.48	0.5	1.85/59.2			6.00	6.00	64.00	1.20	6.48			

SUMMARY & RECOMMENDATIONS: Use 2-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1 & 2 for Drainage Area 4

DESIGNER: BGS

DATE: 11/12/86

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on 51st Ave. from Grovers Ave. to Bell Rd.

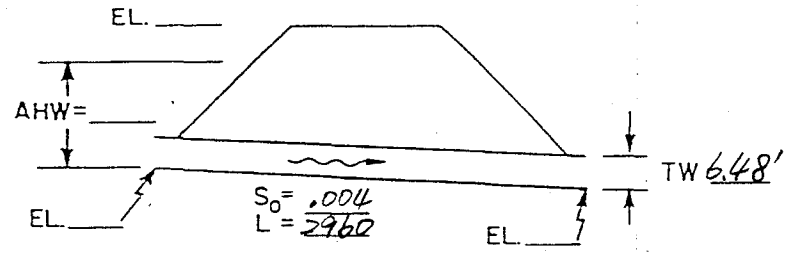
Q_1 = 380 cfs TW_1 = 6.48'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



5.92 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-10'x5' RCB	380	10'x5'	1.24	6.20	0.5	2.22 / 13.14			6.48	6.48	11.84	7.78				

SUMMARY & RECOMMENDATIONS: Use 1-10'x5' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1 & 2 for Drainage Area 4

DESIGNER: BGS

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. from 47th Ave. to 51st Ave.

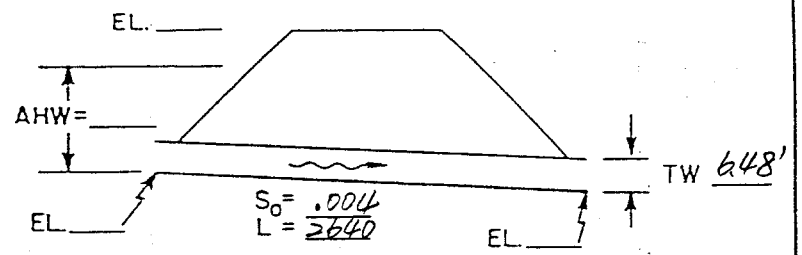
Q_1 = 230 cfs TW_1 = 6.48'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



5.28 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-8'x5' RCB	230	8'x5'	1.02	5.10	0.5	1.35/7.13			6.48	6.48	10.56	7.05	5.10			
1-6'x5' RCB	230	6'x5'	1.24	6.20	0.5	2.7/14.26			6.48	6.48	10.56	10.18	10.18			
1-6'x6' RCB	230	6'x6'	1.03	6.18	0.5	1.76/9.29			6.48	6.48	10.56	5.21	6.18			
1-8'x4' RCB	230	8'x4'	1.29	5.16	0.5	2.25/11.88			6.48	6.48	10.56	7.80	7.80		12.08	
1 RCP	230	72"	2.6	15.6											7150	N.G.

SUMMARY & RECOMMENDATIONS: Use 1-8'x4' RCB

5-18

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1 for Drainage Area 4

DESIGNER: BGB

DATE: 11/12/86

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on 59th Ave. from Bell Rd. to ACDC

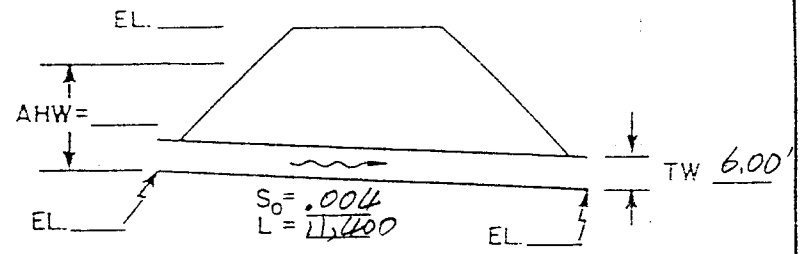
Q_1 = 750 cfs TW_1 = 6.00'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



22.80

MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h_o−LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
2-8'x6' RCB	375	8'x6'	1.17	7.02	0.5	2.45 / 55.88			6.00	6.00	45.60	16.26	16.26			
3-6'x6' RCB	250	6'x6'	1.10	6.60	0.5	2.05 / 46.74			6.00	6.00	45.60	7.14	7.14			

SUMMARY & RECOMMENDATIONS: Use 3-6'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1 for Drainage Area 4

DESIGNER: BGB

DATE: 11/12/86

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 59th Ave. from Grovers Ave. to Bell Rd.

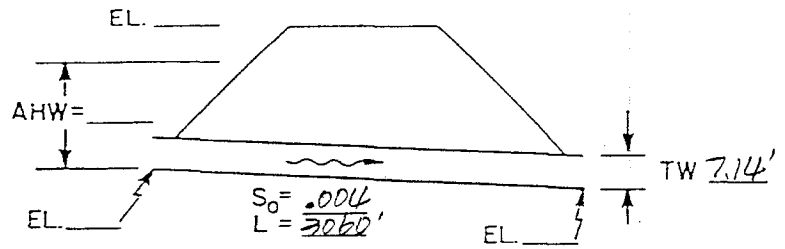
Q_1 = 300 cfs TW_1 = 7.14'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



6.12 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h_o−LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-8'x5' RCB	300	8'x5'	1.22	6.10	0.5	2.3/1408			7.14	7.14	12.24	8.98	8.98			
1-6'x6' RCB	300	6'x6'	1.23	7.38	0.5	3.00/1836			7.14	7.14	12.24	13.26	13.26			NG

SUMMARY & RECOMMENDATIONS: Use 1-8'x5' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1 for Drainage Area 4

DESIGNER: BGS

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. from 55th Ave. to 59th Ave.

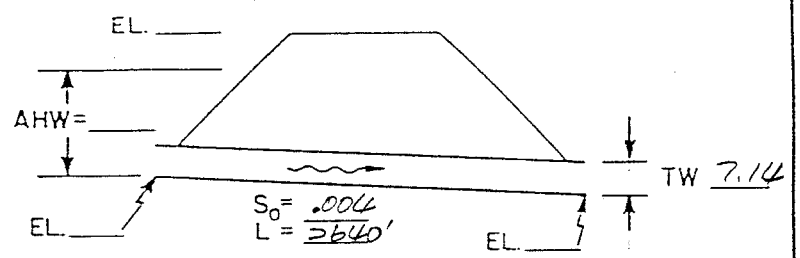
Q_1 = 450 cfs TW_1 = 7.14

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



5.28 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
2-6'x6' RCB	225	6'x6'	1.00	6.00	0.5	1.7 / 8.98			7.14	7.14	10.56	5.56	6.00			
2-8'x4' RCB	225	8'x4'	1.26	5.04	0.5	2.2 / 11.62			7.14	7.14	10.56	8.20	8.20			
2-6'x5' RCB	225	6'x5'	1.22	6.10	0.5	2.5 / 13.20			7.14	7.14	10.56	9.78	9.78			

SUMMARY & RECOMMENDATIONS: Use 2-6'x5' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1 for Drainage Area 4

DESIGNER: BGS

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on 67th Ave. from Bell Rd. to ACDC

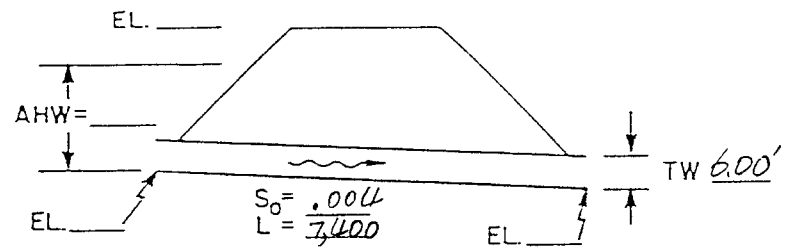
Q_1 = 350 cfs TW_1 = 6.00'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



14.80

MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-8'x5' RCB	350	8'x5'	1.39	6.95	0.5	3.1/45.88			6.00	6.00	>9.60	>>>8	>>>8			NG
1-10'x6' RCB	350	10'x6'	0.96	5.76	0.5	1.25/18.5			6.00	6.00	>9.60	-5.10	5.76			
1-8'x6' RCB	350	8'x6'	1.12	6.72	0.5	2.1/31.08			6.00	6.00	>9.60	7.48	7.48			

SUMMARY & RECOMMENDATIONS: Use 1 - 8'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1 for Drainage Area 4

DESIGNER: BGS

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. from 63rd Ave. to 67th Ave.

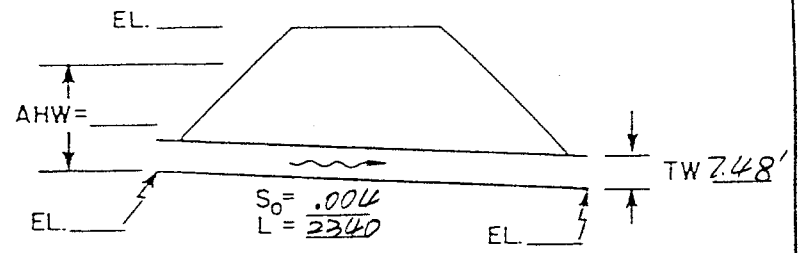
Q_1 = 240 TW_1 = 7.48'

Q_2 = TW_2 =

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION :



4.68 MEAN STREAM VELOCITY = ____
MAX. STREAM VELOCITY = ____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-8'x4' RCB	240	8'x4'	1.32	5.28	0.5	2.4/11.23			7.48	7.48	9.36	9.35	9.35			

SUMMARY & RECOMMENDATIONS: Use 1-8'x4' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
On-site Drainage along Bell Rd.

DESIGNER: BGR

DATE: 11/14/86

HYDROLOGIC AND CHANNEL INFORMATION

Pipe on Bell Rd. from 35th Ave. to 39th Ave.

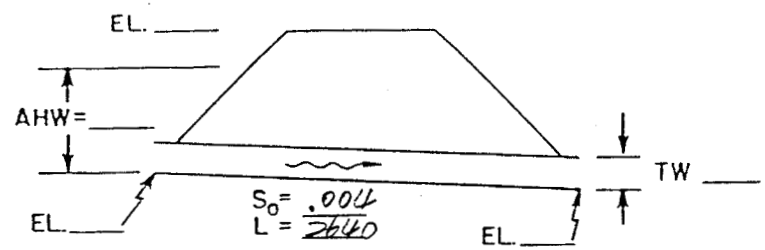
Q_1 = 19 cfs TW_1 = 8.08

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



5.28 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
24" RCP	19	24"	1.42	2.84	0.2	3.5/18.48			8.08	8.08	10.56	16.00	16.00			NG
30" RCP	19	30"	0.90	2.25	0.2	1.17/5.91			8.08	8.08	10.56	3.43	3.43			Alt. No. 1
30" RCP	19	30"	0.90	2.25	0.2	5.91			8.08	8.08	10.56	3.43	3.43			Alt. No. 2
30" RCP	19	30"	0.90	2.25	0.2	5.91			8.14	8.14	10.56	3.49	3.49			Alt. No. 3

SUMMARY & RECOMMENDATIONS: Use 30" RCP

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 2 for Drainage Area 4

DESIGNER: BGS

DATE: 11/13/86

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. from 67th Ave. to Skunk Creek

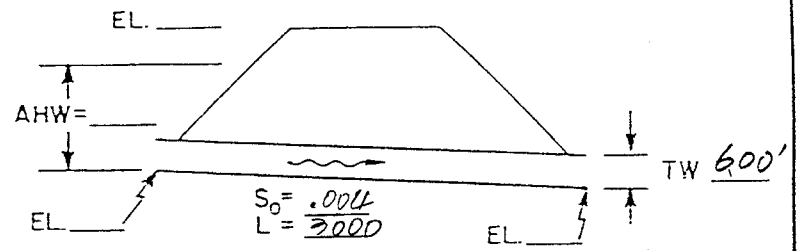
Q_1 = 980 cfs TW_1 = 6.00'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



6.00

MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
3-8'x6' RCB	327	8'x6'	1.07	6.42	0.5	1.8/10.8			6.00	6.00	12.00	4.80	6.42			

SUMMARY & RECOMMENDATIONS: Use 3-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 2 for Drainage Area 4

DESIGNER: BGR

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. from 63rd Ave. to 67th Ave.

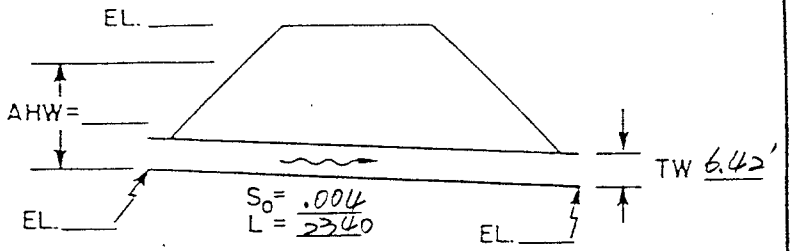
Q_1 = 900 cfs TW_1 = 6.42'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



4.68 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
3-8'x5' RCB	300	8'x5'	1.22	6.10	0.5	2.25/10.58			6.42	6.42	9.36	7.59	7.59			

SUMMARY & RECOMMENDATIONS: Use 3-8'x5' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 2 for Drainage Area 4

DESIGNER: BGS

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. from 59th Ave. to 63rd Ave.

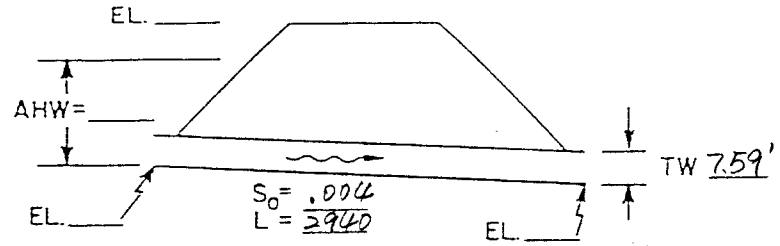
Q_1 = 820 cfs TW_1 = 7.59'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



5.88 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
3-6'x5' RCB	273	6'x5'	1.45	7.25	0.5	9.8/55.74			7.59	7.59	11.76	18.17	18.17			NG
3-8'x5' RCB	273	8'x5'	1.14	5.70	0.5	1.95/11.47			7.59	7.59	11.76	7.30	7.30			

SUMMARY & RECOMMENDATIONS: Use 3-8'x5' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 2 for Drainage Area 4

DESIGNER: BGS

DATE: 11/13/86

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on 59th Ave. from Grovers Ave. to Bell Rd.

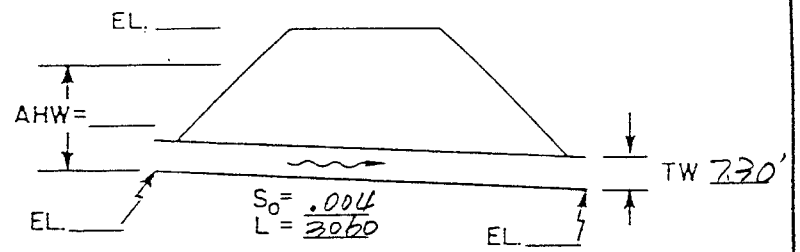
Q_1 = 300 cfs TW_1 = 7.30'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



6.12 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW = H + h_o - LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-8'X5' RCB	300	8'X5'	1.22	6.10	0.5	2.3/1.408			7.30	7.30	12.24	9.14	9.14			

SUMMARY & RECOMMENDATIONS: Use 1 - 8'X5' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 2 for Drainage Area 4

DESIGNER: BGB

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. from 55th Ave. to 59th Ave.

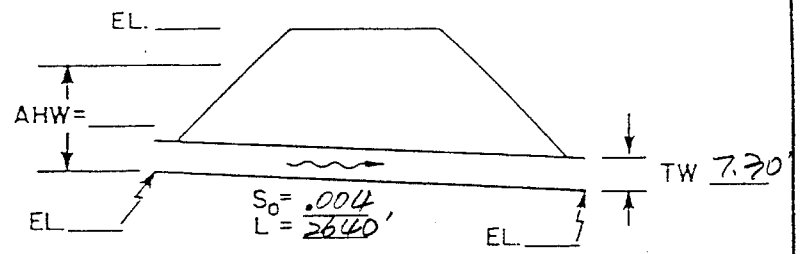
Q_1 = 450 cfs TW_1 = 7.30'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



5.28

MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h_o−LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
2-6'x5' RCB	225	6'x5'	1.22	6.10	0.5	2.5/1.20			7.30	7.30	10.56	9.94	9.94			

SUMMARY & RECOMMENDATIONS: Use 2-6'x5' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 3 for Drainage Area 4

DESIGNER: BGB

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. from 67th Ave. to Skunk Creek

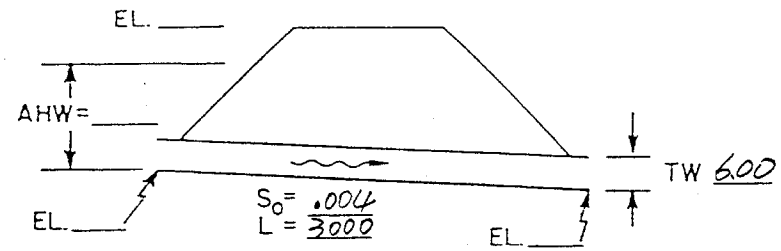
Q_1 = 3030 cfs TW_1 = 6.00

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



6.00

MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW.	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
6-10'x5' RCB	505	10'x5'	1.58	7.90	0.5	2.9/23.4			6.00	6.00	12.00	17.40	17.40			
6-10'x6' RCB	505	10'x6'	1.24	7.44	0.5	2.6/15.6			6.00	6.00	12.00	9.60	9.60			
6-10'x7' RCB	505	10'x7'	1.05	7.35	0.5	1.8/10.8			6.00	6.00	12.00	4.80	7.35			

SUMMARY & RECOMMENDATIONS: Use 6-10'x7' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 3 for Drainage Area 4

DESIGNER: BGB

DATE: 11/13/86

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. from 63rd Ave. to 67th Ave.

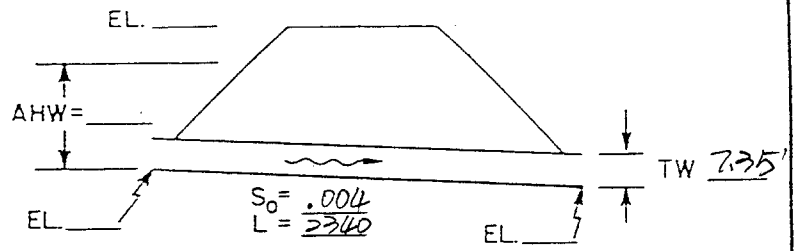
Q_1 = 2990 cfs TW_1 = 7.35'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



4.68 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
6-10'x7' RCB	498	10'x7'	1.03	7.21	0.5	1.73/8.05			7.35	7.35	9.36	6.04	7.21			

SUMMARY & RECOMMENDATIONS: Use 6-10'x7' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 3 for Drainage Area 4

DESIGNER: BGR

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. from 59th Ave. to 63rd Ave.

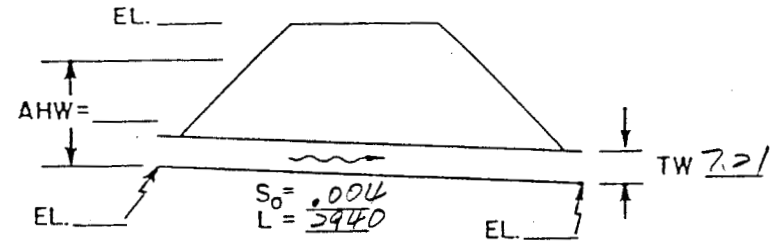
Q_1 = 2890 cfs TW_1 = 7.21'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



5.88 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
6-10'x6' RCB	482	10'x6'	1.21	7.26	0.5	2.4/14.11			7.21	7.21	11.76	9.56	9.56			
6-10'x7' RCB	482	10'x7'	1.03	7.21	0.5	1.7/10.00			7.21	7.21	11.76	5.45	7.21			

SUMMARY & RECOMMENDATIONS: Use 6-10'x7' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 3 for Drainage Area 4

DESIGNER: BGS

DATE: 11/13/86

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on 59th Ave. from Grovers Ave. to Bell Rd.

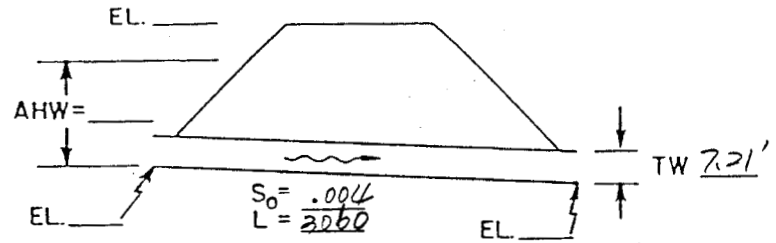
Q_1 = 300 cfs TW_1 = 7.21'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



6.12 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-8'x5' RCB	300	8'x5'	1.22	6.10	0.5	2.3/1408			7.21	7.21	12.24	9.05	9.05			

SUMMARY & RECOMMENDATIONS: Use 1-8'x5' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 3 for Drainage Area 4

DESIGNER: BGS

DATE: 11/13/86

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. from 55th Ave. to 59th Ave.

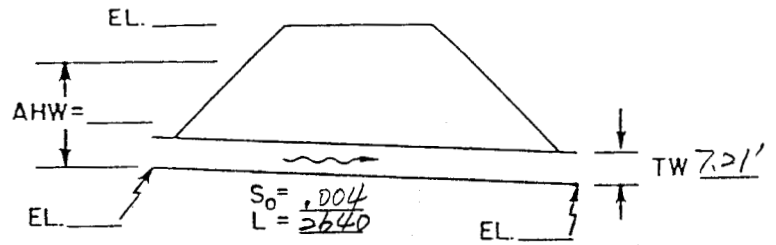
Q_1 = 2750 cfs TW_1 = 7.21'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



5.28 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h_o−LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
6-10'x6' RCB	458	10'x6'	1.16	6.96	0.5	2.1/11.09			7.21	7.21	10.56	7.74	7.74			

SUMMARY & RECOMMENDATIONS: Use 6-10'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 3 for Drainage Area 4

DESIGNER: BGS

DATE: 11/13/86

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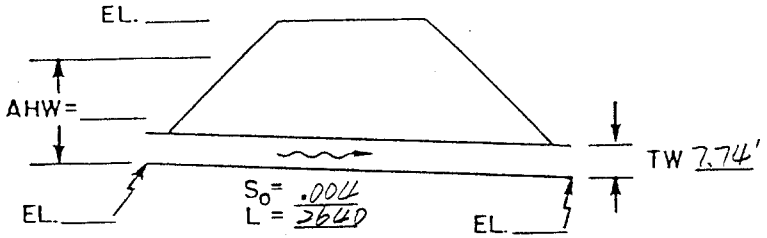
HYDROLOGIC AND CHANNEL INFORMATION
Structure on Bell Rd. from 51st Ave. to 55th Ave.

Q_1 = 2100 CFS TW_1 = 7.74'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



5.28 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
6-8'x6' RCB	350	8'x6'	1.12	6.72	0.5	2.1/11.09			7.74	7.74	10.56	8.27	8.27			

SUMMARY & RECOMMENDATIONS: Use 6-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study

DESIGNER: BGB

DATE: 11/13/86

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on 51st Ave. from Grovers Ave. to Bell Rd.

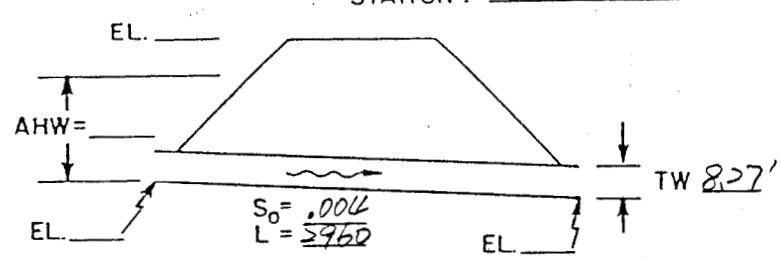
Q_1 = 380 cfs TW_1 = 8.27'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



MEAN STREAM VELOCITY = _____

5.92 MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT.		OUTLET CONTROL HW=H + h_o − LS_o								CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			HW/D	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				
1-10'x5' RCB	380	10'x5'	1.24	6.20	0.5	2.22 / 13.14			8.27	8.27	11.84	9.57	9.57			

SUMMARY & RECOMMENDATIONS: Use 1-10'x5' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 3 for Drainage Area 4

DESIGNER: BSB

DATE: 11/13/86

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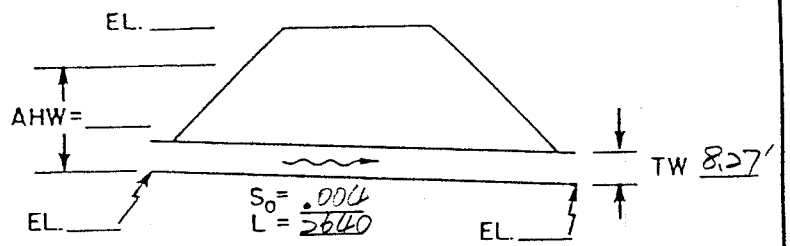
HYDROLOGIC AND CHANNEL INFORMATION
Structure on Bell Rd. from 47th Ave. to 51st Ave.

Q_1 = 1690 cfs TW_1 = 8.27'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



5.28 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
5-8'x6' RCB	338	8'x6'	1.08	6.48	0.5	1.95/10.3			8.27	8.27	10.56	8.01	8.01			

SUMMARY & RECOMMENDATIONS: Use 5-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 3 for Drainage Area 4

DESIGNER: BGS

DATE: 11/13/86

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. from 43rd Ave. to 47th Ave.

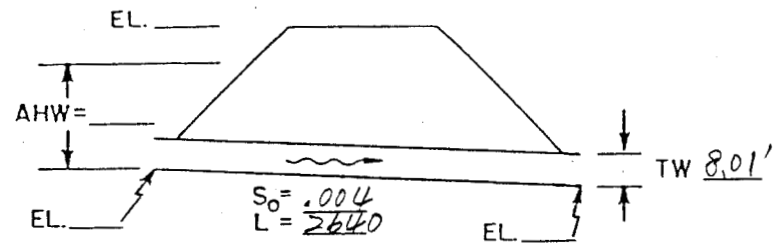
Q_1 = 1540 cfs TW_1 = 8.01'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



5.28 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
5-8'x6' RCB	308	8'x6'	1.04	6.24	0.5	1.65/8.71			8.01	8.01	10.56	6.16	6.24			
5-8'x5' RCB	308	8'x5'	1.25	6.25	0.5	2.4/12.67			8.01	8.01	10.56	10.12	10.12			NG
6-6'x6' RCB	257	6'x6'	1.10	6.60	0.5	2.1/11.08			8.01	8.01	10.56	8.54	8.54			

SUMMARY & RECOMMENDATIONS: Use 5-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 3 for Drainage Area 4

DESIGNER: BGS

DATE: 11/13/86

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on 43rd Ave. from Grovers Ave. to Bell Rd.

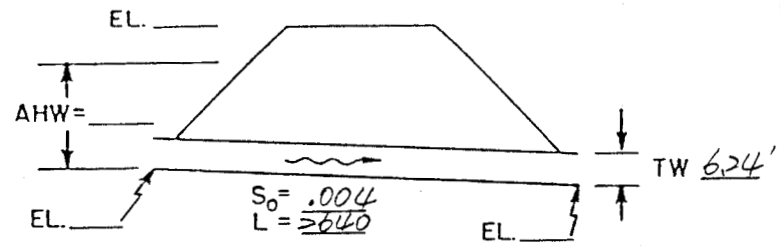
Q_1 = 680 cfs TW_1 = 6.24'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



5.28 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h_o−LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
2-8'x6' RCB	340	8'x6'	1.09	6.54	0.5	2.0/10.56			6.24	6.24	10.56	6.54	6.54			

SUMMARY & RECOMMENDATIONS: Use 2-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 3 for Drainage Area 4

DESIGNER: BGB

DATE: 11/13/86

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. from 41st Ave. to 43rd Ave.

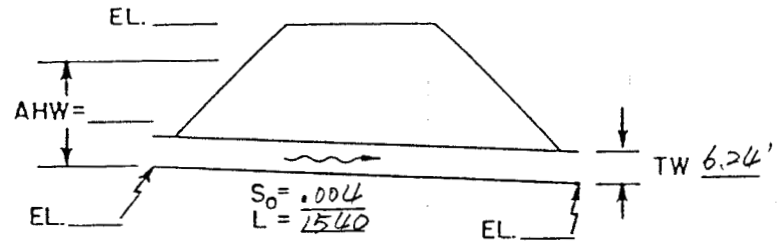
Q_1 = 840 cfs TW_1 = 6.24'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



3.08 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
3-6'x6' RCB	280	6'x6'	1.18	7.08	0.5	0.58/7.95			6.24	6.24	6.16	8.03	8.03			

SUMMARY & RECOMMENDATIONS: Use 3-6'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 3 for Drainage Area 4

DESIGNER: BGS

DATE: 11/13/86

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HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. from 39th Ave. to 41st Ave.

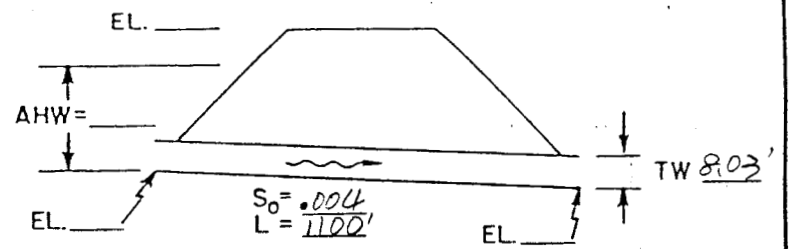
Q_1 = 450 cfs TW_1 = 8.03'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



MEAN STREAM VELOCITY = _____

2.2 MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-10'x6' RCB	450	10'x6'	1.14	6.84	0.5	2.05/4.5			8.03	8.03	4.40	8.14	8.14			

SUMMARY & RECOMMENDATIONS: Use 1-10'x6' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 & 2 for D.A. 4 for Q_{10}

DESIGNER: BGS

DATE: 11-26-86

Sheet No. 1/18

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 35th Ave. from Bell to ACDC

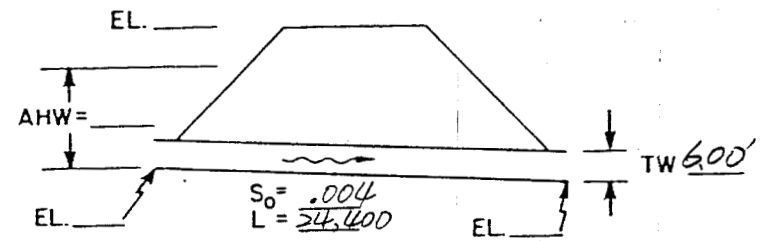
Q_1 = 890 cfs : TW_1 = 6.00'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25} ; Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



48.8 MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING H.W.	OUTLET VELOCITY	COST	COMMENTS
3-6'x6' RCB	>97	6'x6'	1.22	7.32	0.5	2.85 / 139.08			6.00	6.00	97.6	47.48	47.48			NG
3-8'x6' RCB	>97	8'x6'	0.99	5.94	0.5	1.55 / 75.64			6.00	6.00	97.6	-15.96	5.94			
3-8'x5' RCB	>97	8'x5'	1.20	6.00	0.5	2.20 / 107.36			6.00	6.00	97.6	15.76	15.76			NG

SUMMARY & RECOMMENDATIONS: Use 3-8'x6' RCB

Inlet Control
Use Scale 2

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 & 2 for D.A. 4 for Q_{10}

DESIGNER: BGS R.H. 12/9/87

DATE: 11-26-86

Sheet No. 2/18

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 35th Ave. from Campo Bello Dr. to Bell Rd.

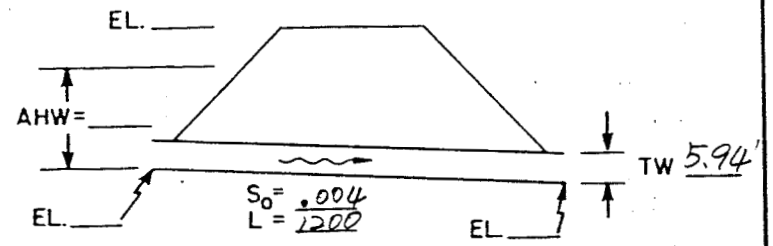
Q_1 = 400 cfs : TW_1 = 5.94'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25} ; Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



MEAN STREAM VELOCITY = _____

>.40 MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-10'x6' RCB	400	10'x6'	1.05	6.30	0.5	1.60/2.84			5.94	5.94	4.80	4.98	6.30			
1-8'x6' RCB	400	8'x6'	1.22	7.32	0.5	2.80/6.72			5.94	5.94	4.80	7.86	7.86			
1-6'x6' RCB	400	6'x6'	1.60	9.60	"	5.2/12.4			"	"	"	13.62	13.62			N.G.

SUMMARY & RECOMMENDATIONS: Use 1-8'x6' RCB

Figure 7

PROJECT: E1220061 Bell Road Project Drainage Study
Alt. No. 1 & 2 for D.A. 4 for Q_{10}

DESIGNER: BGB R.H 12/9/86

DATE: 11-26-86

Sheet No. 3/18

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 35th Ave. from Grovers Ave. to Campo Bello Dr.

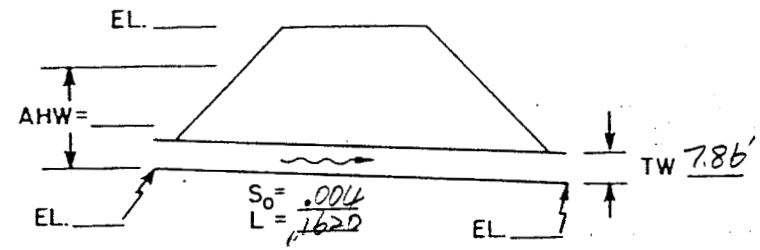
Q_1 = 320 cfs : TW_1 = 7.86'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25} ; Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



3.24 MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW = H + h_o - LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-8'x6' RCB	320	8'x6'	1.05	6.30	0.5	1.75/5.67			7.86	7.86	6.48	7.05	7.05			
1-6'x6' RCB	320	6'x6'	1.28	7.68	0.5	2.35/10.85			7.86	7.86	6.48	12.23	12.23			N.G.

SUMMARY & RECOMMENDATIONS: Use 1-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 & 2 for D.A. 4 for Q_{10}

DESIGNER: BGR R.H. 12/1/86

DATE: 11-26-86

Sheet No. 4/18

HYDROLOGIC AND CHANNEL INFORMATION

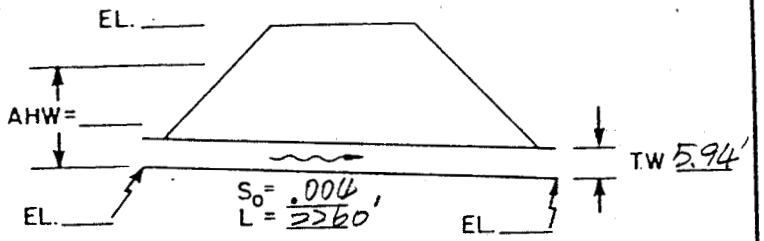
Structure on Bell Rd. from 32nd Ln. to 35th Ave.

Q_1 = 450 cfs : TW_1 = 5.94'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



MEAN STREAM VELOCITY = _____
4.52 MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING H.W.	OUTLET VELOCITY	COST	COMMENTS
1-8'x6' RCB	450	8'x6'	1.35	8.10	0.5	3.4/15.37			5.94	5.94	9.04	12.27	12.27			NG
1-10'x6' RCB	450	10'x6'	1.13	6.78	0.5	2.10/9.49			5.94	5.94	9.04	6.39	6.78			

SUMMARY & RECOMMENDATIONS: Use 1-10'x6' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 & 2 for D.A. 4 for Q_{10}

DESIGNER: BGS

DATE: 11-26-86

Sheet No. 5/18

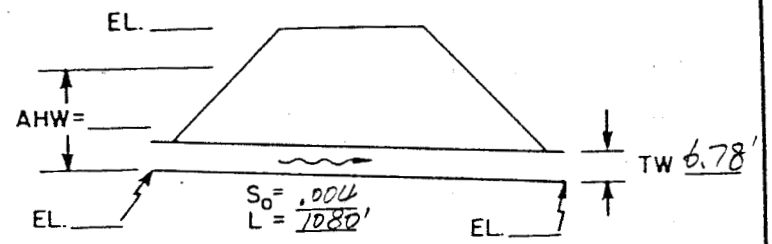
HYDROLOGIC AND CHANNEL INFORMATION
Structure on Bell Road from 31st. Ave. to 32nd Ln.

Q_1 = 370 cfs : TW_1 = 6.78'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____
2.16

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-8'x6' RCB	370	8'x6'	1.16	6.96	0.5	2.35/5.08			6.78	6.78	4.32	7.54	7.54			

SUMMARY & RECOMMENDATIONS: Use 1-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 & 2 for D.A. 4 for Q_{10}

DESIGNER: BGS R.H. 12/1/86

DATE: 11-26-86

Sheet No. 6/18

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Road from I-17 HWY East to 31st Ave.

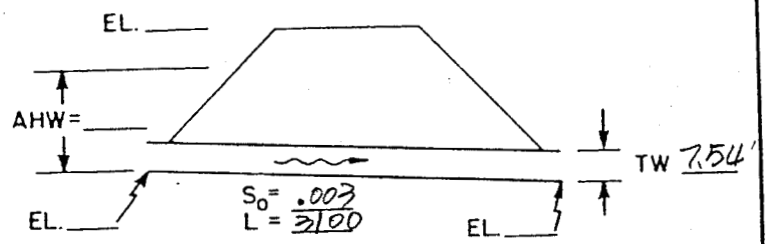
Q_1 = >50 cfs : TW_1 = 7.54'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



MEAN STREAM VELOCITY = _____

6.20 MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-8'x5' RCB	>50	8'x5'	1.08	5.40	0.5	1.60/9.97			7.54	7.54	9.30	8.16	8.16			

SUMMARY & RECOMMENDATIONS: Use 1-8'x5' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 for D.A. 4 for Q_{10}

DESIGNER: BGS
DATE: 11-26-86 R.H. 12/2/86

Sheet No. 7/18

HYDROLOGIC AND CHANNEL INFORMATION
Structure on 43rd Ave. from Bell Rd. to ACDC

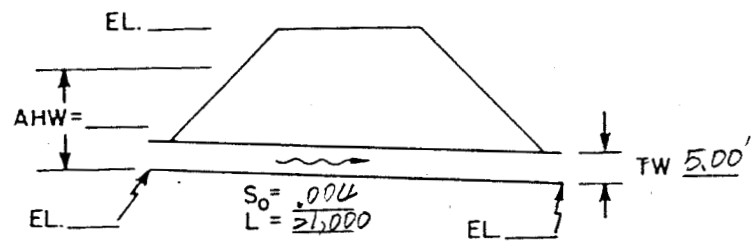
Q_1 = 560 cfs
Q_2 = _____

TW_1 = 5.00'
TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



42.00 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
2-8'x5' RCB	>80	8'x5'	1.16	5.80	0.5	2.0/84.00			5.00	5.00	84.00	5.00	5.80			
2-6'x6' RCB	>80	6'x6'	1.18	7.08	0.5	2.6/109.2			5.00	5.00	84.00	30.2	30.2			N.G.

SUMMARY & RECOMMENDATIONS: Use 2-8'x5' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 for D.A. 4 for Q_{10}

DESIGNER: BGS
DATE: 11-26-86
R.11 12/9/8

Sheet No. 8/18

HYDROLOGIC AND CHANNEL INFORMATION

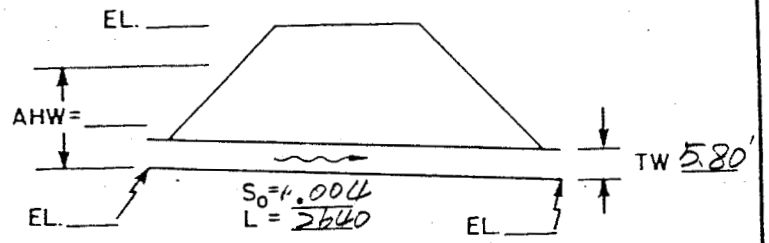
Structure on 43rd Ave. from Grovers Ave. to Bell Rd.

Q_1 = 220 cfs : TW_1 = 5.80'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



5.28 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-6'x5' RCB	220	6'x5'	1.20	6.00	0.5	2.45/12.94			5.80	5.80	10.56	8.18	8.18			

SUMMARY & RECOMMENDATIONS: Use 1-6'x5' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 for D.A. 4 for Q_{10}

DESIGNER: BGS

DATE: 12-01-86 12/1/86

Sheet No. 9/18

HYDROLOGIC AND CHANNEL INFORMATION

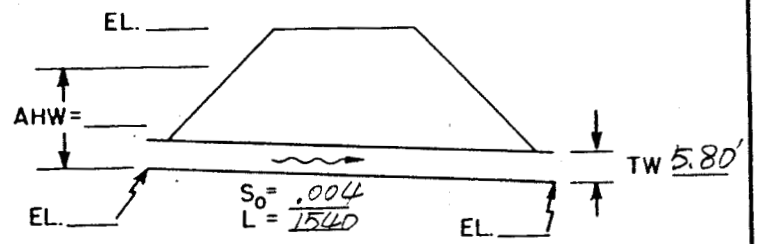
Structure on Bell Road from 41st Ave. to 43rd Ave.

Q_1 = 340 cfs TW_1 = 5.80'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



3.08 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-8'x5' RCB	340	8'x5'	1.35	6.75	0.5	3.00/9.24			5.80	5.80	6.16	8.88	8.88			

SUMMARY & RECOMMENDATIONS: Use 1-8'x5' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 for D.A. 4 for Q_{10}

DESIGNER: BGS

DATE: 12-01-86

Sheet No. 10/18

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Road from 39th Ave. to 41st Ave.

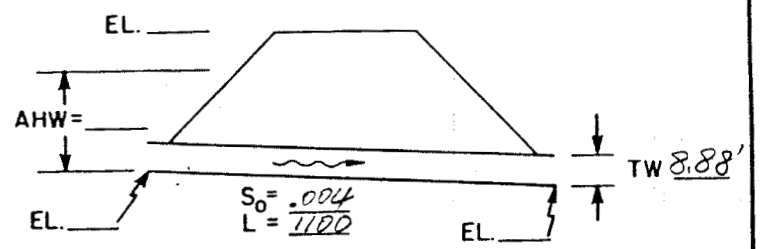
Q_1 = 190 cfs TW_1 = 8.88'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}; Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

2.30

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-6'x5' RCB	190	6'x5'	1.08	5.40	0.5	1.80/3.96			8.88	8.88	4.40	8.44	8.44			
1-6'x4' RCB	190	6'x4'	1.40	5.60	0.5	3.10/6.82			8.88	8.88	4.40	11.30	11.30			N.G.

SUMMARY & RECOMMENDATIONS: Use 1-6'x5' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 for D.A. 4 for Q_{10}

DESIGNER: BGR

DATE: 12-01-86 R.11 12/9/86

Sheet No. 11/18

HYDROLOGIC AND CHANNEL INFORMATION

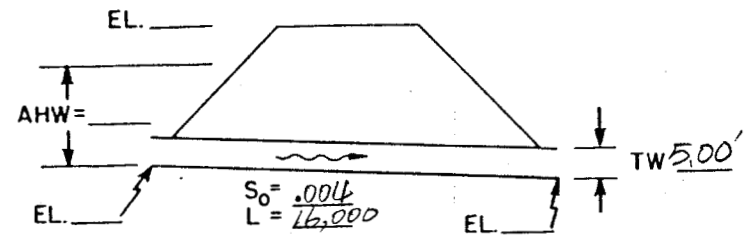
Structure on 51st Ave. from Bell Rd. to ACDC

Q_1 = 270 cfs TW_1 = 5.00'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



32.00

MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o - LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-8'x5' RCB	270	8'x5'	1.13	5.65	0.5	1.70/54.40			5.00	5.00	64.00	-4.60	5.65			
1-6'x6' RCB	270	6'x6'	1.14	6.84	0.5	2.10/67.20	2.10/16.8		5.00	5.00	64.00	8.20	~~8.20~~	17.8		N.G.

SUMMARY & RECOMMENDATIONS: Use 1-6'x6' RCB
Use 1-8'x5' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 for D.A. 4 for Q_{10}

DESIGNER: BGS

DATE: 12-08-86 R.11 12/9/7

Sheet No. 13/18

HYDROLOGIC AND CHANNEL INFORMATION

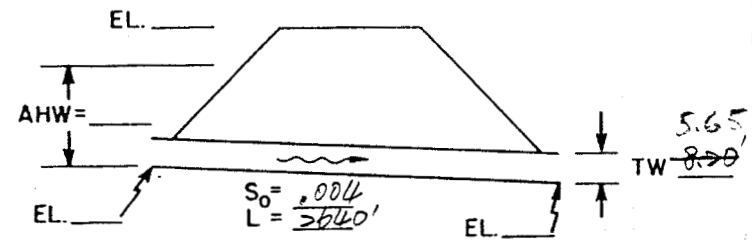
Structure on Bell Road from 47th Ave. to 51st. Ave.

Q_1 = 120 cfs TW_1 = 8.20'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



5.28 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-54" RCP	120	54"	1.20	~~6.00~~	.20	~~2.80~~ 1.478			5.65 ~~8.20~~	8.20	10.56	7.41 ~~12.62~~	7.87 ~~12.62~~			~~HS~~ o.k
1-60" RCP	120	60"	.97	4.85	.20	1.58' ~~8.34~~			~~8.20~~	8.20	10.56	3.47 ~~5.98~~	3.47 ~~5.98~~			o.k

SUMMARY & RECOMMENDATIONS: ~~Use 1-60" RCP~~
Use 1-54" RCP

5-18

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 for D.A. 4 for Q_{10}

DESIGNER: BGB

DATE: 12-01-86 R.H. 12/9/86

Sheet No. 12/18

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 51st Ave. from Grovers Ave. to Bell Rd.

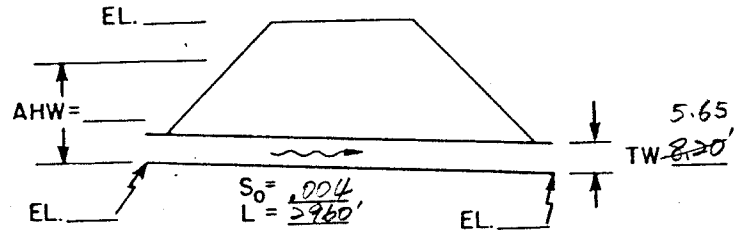
Q_1 = 140 cfs TW_1 = ~~8.20'~~ 5.65

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



5.92 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h_o−LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-72" RCP	140	72"	.80	4.80	.20	0.93 / 5.51			5.65 ~~8.20~~	.65 8.20	11.84	-0.58 ~~1.87~~	4.80			
1-60" RCP	140	60"	1.10	5.50	.20	2.15 / 12.73			" 8.20	" 8.20	11.84	6.54 ~~9.09~~	6.54 ~~9.09~~			

SUMMARY & RECOMMENDATIONS: Use 1-60" RCP o.k.

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 for D.A. 4 for Q_{10}

DESIGNER: BGB

DATE: 12-08-86 R.11 12/9/87

Sheet No. 13/18

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Road from 47th Ave. to 51st. Ave.

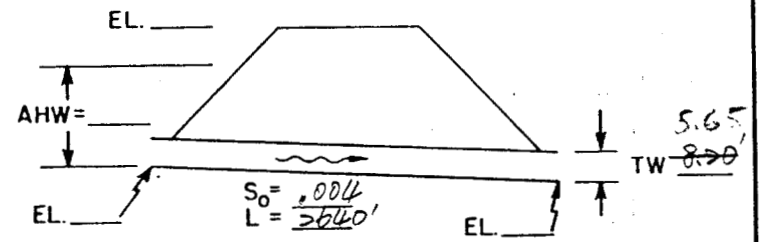
Q_1 = 120 cfs TW_1 = 8.20'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



5.28 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-54" RCP	120	54"	1.20	~~6.00~~ 5.1	.20	~~2.80~~ 1.478			~~8.20~~ 5.65	~~8.20~~ 5.65	10.56	~~12.2~~ 7.47	~~12.2~~ 7.47			~~NG~~ O.K
1-60" RCP	120	60"	.97	4.85	.20	~~1.58~~ 1.34			~~8.20~~ "	~~8.20~~ "	10.56	~~5.98~~ 3.43	~~5.98~~ 3.43			O.K

SUMMARY & RECOMMENDATIONS: ~~Use 1-60" RCP~~
Use 1-54" RCP

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 for D.A. 4 for Q_{10}

DESIGNER: BGB

DATE: 12-08-86

Sheet No. 14/18

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 59th Ave. from Bell Rd. to ACDC.

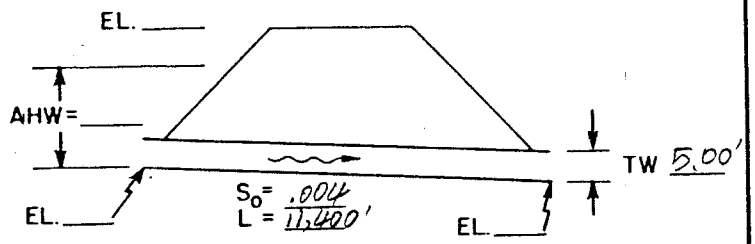
Q_1 = >60 cfs TW_1 = 5.00'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



MEAN STREAM VELOCITY = _____

22.80 MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-8'x5' RCB	>60	8'x5'	1.10	5.50	0.5	1.75/39.90			5.00	5.00	45.60	-0.70	5.50			
1-6'x5' RCB	>60	6'x5'	1.37	6.85	0.5	2.5/49.80			5.00	5.00	45.60	39.20	39.20			N.G.

SUMMARY & RECOMMENDATIONS: Use 1-8'x5' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 for D.A. 4 for Q_{10}

DESIGNER: BGS

DATE: 12-08-86

Sheet No. 15/18

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 59th Ave. from Grovers Ave. to Bell Rd.

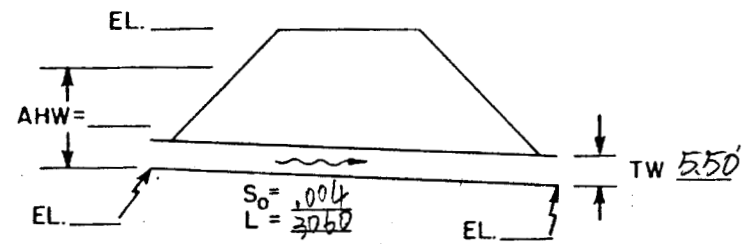
Q_1 = 110 cfs TW_1 = 5.50'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



6.12 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-60" RCP	110	60"	.92	4.60	.20	1.37/2.02			5.50	5.50	12.24	1.34	4.60			
1-54" RCP	110	54"	1.12	5.04	.20	2.35/1.38			5.50	5.50	12.24	7.64	7.64			

SUMMARY & RECOMMENDATIONS: Use 1-54" RCP

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 for D.A. 4 for Q_{10}

DESIGNER: BGS

DATE: 12-09-86

Sheet No. 16/18

HYDROLOGIC AND CHANNEL INFORMATION

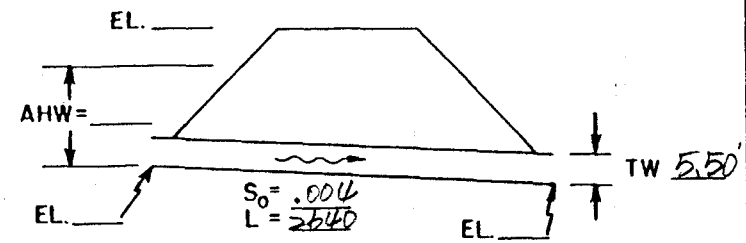
Structure on Bell Road from 55th Ave. to 59th Ave.

Q_1 = 120 cfs TW_1 = 5.50'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



5.28 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-54" RCP	120	54"	1.20	6.00	.20	2.80 / 14.78			5.50	5.50	10.56	9.72	9.72			

SUMMARY & RECOMMENDATIONS: Use 1-54" RCP

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 for D.A. 4 for Q_{10}

DESIGNER: BGS

DATE: 12-08-86

Sheet No. 17/18

HYDROLOGIC AND CHANNEL INFORMATION

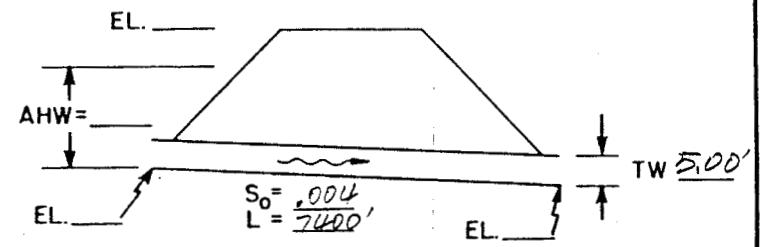
Structure on 67th Ave. from Bell Rd. to ACDC

Q_1 = 160 cfs TW_1 = 5.00'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



14.80 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-60" RCP	160	60"	1.22	6.10	.20	2.80/4.44			5.00	5.00	>9.60	16.84	16.84			N.G.
1-72" RCP	160	72"	.87	5.22	.20	1.22/18.06			6.00	6.00	>9.60	-5.54	5.22			
1-66" RCP	160	66"	1.02	5.61	.20	1.88/27.87			5.50	5.50	>9.60	3.72	5.61			

SUMMARY & RECOMMENDATIONS: Use 1-66" RCP

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 for D.A. 4 for Q_{10}

DESIGNER: BGB

DATE: 12-08-86

Sheet No. 18/18

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Road from 63rd. Ave. to 67th Ave.

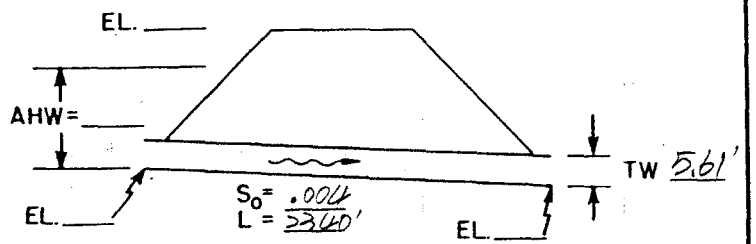
Q_1 = 120 cfs TW_1 = 5.61'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



4.68 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-60" RCP	120	60"	.97	4.85	.20	1.58/2.33			5.61	5.61	9.36	3.64	4.85			
1-54" RCP	120	54"	1.20	6.00	.20	2.80/3.10			5.61	5.61	9.36	9.35	9.35			

SUMMARY & RECOMMENDATIONS: Use 1-54" RCP

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
On-Site Drainage for D.A. 4

DESIGNER: BGB

DATE: 12-09-86

HYDROLOGIC AND CHANNEL INFORMATION

Q_1 = 12 cfs

Q_2 = _____

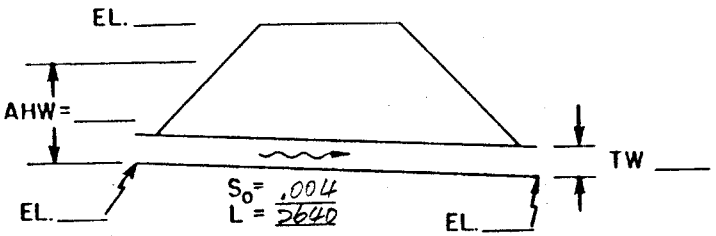
TW_1 = _____

TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



5.28 MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-24" RCP	12	24"	.90	1.80	.20	1.45/7.66					10.56					
1-18" RCP	12	18"	1.92	2.88	.20	8.75										N.G.

SUMMARY & RECOMMENDATIONS: Use 1-24" RCP

Figure 7

Sheet No. 3/12

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 2 for D.A. 4 for Q_{10}

DESIGNER: BGS

DATE: 12-08-86 R.H 12/9/86

HYDROLOGIC AND CHANNEL INFORMATION

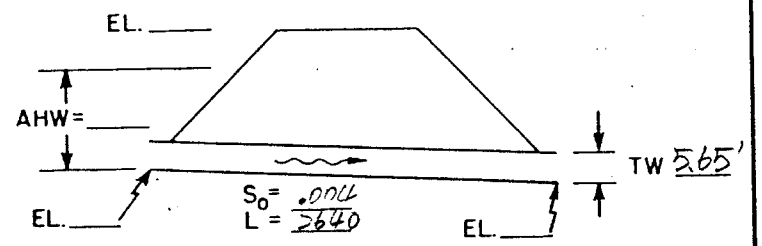
Structure on Bell Road from 47th Ave. to 51st Ave.

Q_1 = 630 cfs TW_1 = 5.65'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



5.28 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
2-8'x5' RCB	315	8'x5'	1.27	6.35	0.5	2.5/13.20			5.65	5.65	10.56	8.29	8.29			
3-6'x5' RCB	210	6'x5'	1.16	5.80	0.5	2.27/11.99			5.65	5.65	10.56	7.08	7.08			
2-10'x5' RCB	315	10'x5'	1.05	5.25	0.5	1.5/7.92			5.65	5.65	10.56	7.01	5.25			

SUMMARY & RECOMMENDATIONS: Use ~~3-6'x5' RCB~~
2-10'x5' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 2 for D.A. 4 for Q_{10}

DESIGNER: BGS
R.H. 12/9/86
DATE: 12-08-86

Sheet No. 4/2

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. from 43rd Ave. to 47th Ave.

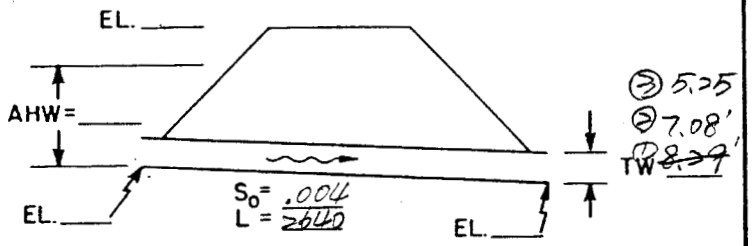
Q_1 = 570 cfs
Q_2 = _____

TW_1 = ③ 5.25 ② 7.08' ① ~~8.29~~
TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



5.28 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

	CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
①	2-8'x5' RCB	285	8'x5'	1.18	5.90	0.5	2.05/10.82			8.29	8.29	10.56	8.55	8.55			
②	2-8'x5' RCB	285	8'x5'	1.18	5.90	0.5	2.05/10.82			7.08	7.08	10.56	7.34	7.34			
③	2-8'x5' RCB	285	8'x5	1.18	5.90	0.5	2.05/10.82			5.25	5.25	10.56	5.51	5.90			Used

SUMMARY & RECOMMENDATIONS: Use 2-8'x5' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 2 for D.A. 4 for Q_{10}

DESIGNER: BGS

DATE: 12-08-86 R.11 12/9/86

Sheet No. 5/12

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 43rd Ave. from Grovers Ave. to Bell Rd.

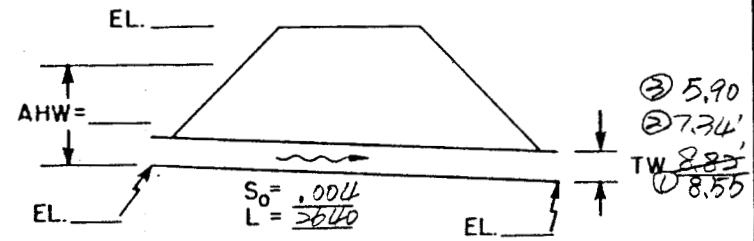
Q_1 = 230 cfs
Q_2 = _____

TW_1 = ① ~~8.82~~ 8.55' ② 7.34' ③ 5.90
TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



5.28 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

	CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h_o−LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
①	1-6'x5' RCB	230	6'x5'	1.25	6.25	0.5	2.70/14.26			~~8.82~~ 8.55	~~8.82~~ 8.55	10.56	~~12.52~~ 12.25	~~12.52~~ 12.25			N.G.
②	1-6'x5' RCB	230	6'x5'	1.25	6.25	0.5	2.70/14.26			7.34	7.34	10.56	11.04	11.04			N.G.
②	1-8'x5' RCB	230	8'x5'	1.00	5.00	0.5	1.33/7.02			7.34	7.34	10.56	7.80	5.00			
③	1-6'x5' RCB	230	6'x5'	1.25	6.25	0.5	2.70/14.26			5.90	5.90	10.56	9.60	9.60			used

SUMMARY & RECOMMENDATIONS: Use 1-6'x5' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 2 for D.A. 4 for Q_{10}

DESIGNER: BGS

DATE: 12-08-86 R.H 12/9/86

Sheet No. 6/12

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Road from 41st Ave. to 43rd Ave.

Q_1 = 340 cfs

Q_2 = _____

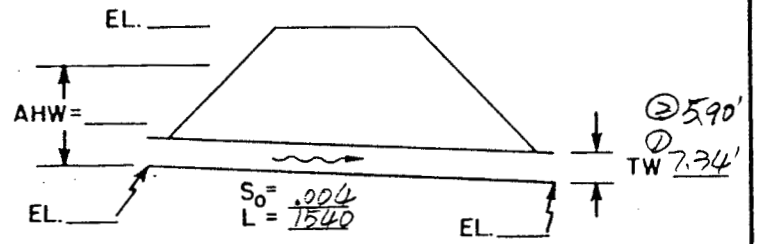
TW_1 = ② 5.90' ① 7.34'

TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = 7.08

	CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
①	1-8'x5' RCB	340	8'x5'	1.35	6.75	0.5	2.95/9.09			7.34	7.34	6.16	10.27	10.27			N.G.
①	1-10'x5' RCB	340	10'x5'	1.14	5.70	0.5	1.85/5.70			7.34	7.34	6.16	6.88	6.88			
②	1-8'x5' RCB	340	8'x5'	1.35	6.75	0.5	2.95/9.09			5.90	5.90	6.16	8.83	8.83			Used

SUMMARY & RECOMMENDATIONS: Use 1- 8'x5' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 2 for D.A. 4 for Q_{10}

DESIGNER: BGS
R.H. 12/9/86

DATE: 12-08-86

Sheet No. 7/12

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. from 39th Ave. to 41st. Ave.

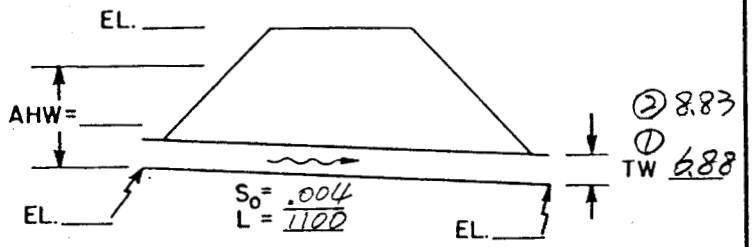
Q_1 = 190 cfs
Q_2 = _____

TW_1 = ① 6.88' ② 8.83'
TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



2.20 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

	CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
①	1-6'x5' RCB	190	6'x5'	1.08	5.40	0.5	1.80/3.96			6.88	6.88	4.40	6.44	6.44			
②	1-6'x5' RCB	190	6'x5'	1.08	5.40	0.5	1.8/3.96			8.83	8.83	4.40	8.39	8.39			

SUMMARY & RECOMMENDATIONS: Use 1-6'x5' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 2 for D.A. 4 for Q_{10}

DESIGNER: BGS

DATE: 12-08-86 R.H 12/9/86

Sheet No. 8/12

HYDROLOGIC AND CHANNEL INFORMATION

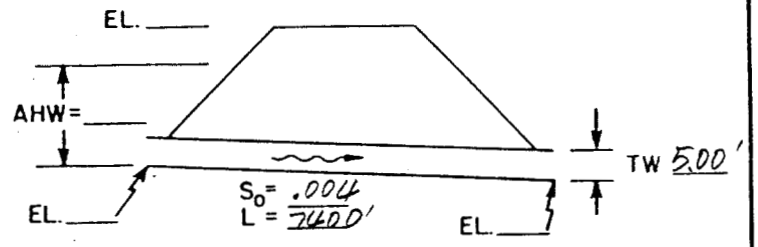
Structure on 67th Ave. from Bell Rd. to ACDC

Q_1 = 370 cfs TW_1 = 5.00'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



14.80 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-8'x5' RCB	370	8'x5'	1.45	7.25	0.5	3.4/50%			5.00	5.00	>9.60	>5.72	>5.72			N.G.
1-8'x6' RCB	370	8'x6'	1.17	7.02	0.5	2.3/34%			6.00	6.00	>9.60	10.44	10.44			NG
1-10'x5' RCB	370	10'x5'	1.22	6.10	0.5	2.05/30%			5.00	5.00	>9.60	5.76	6.10			

SUMMARY & RECOMMENDATIONS: Use 1-10'x5' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 2 for D.A. 4 for Q_{10}

DESIGNER: BGS R.H. 12/9/86

DATE: 12-08-86

Sheet No. 9/12

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Road from 63rd Ave. to 67th Ave.

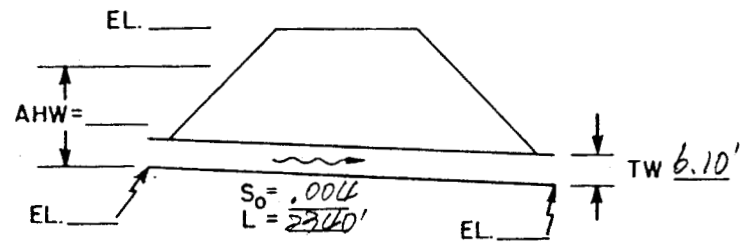
Q_1 = 340 cfs TW_1 = 6.10'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



4.68 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h_o−LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-8'x5' RCB	340	8'x5'	1.35	6.75	0.5	2.95/12.81			6.10	6.10	9.36	10.55	10.55			N.G.
1-10'x5' RCB	340	10'x5'	1.15	5.75	0.5	1.75/8.19			6.10	6.10	9.36	4.93	5.75			

SUMMARY & RECOMMENDATIONS: Use 1-10'x5' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 2 for D.A. 4 for Q_{10}

DESIGNER: BGB
DATE: 12-08-86 R.H 12/9/86

Sheet No. 10/12

HYDROLOGIC AND CHANNEL INFORMATION

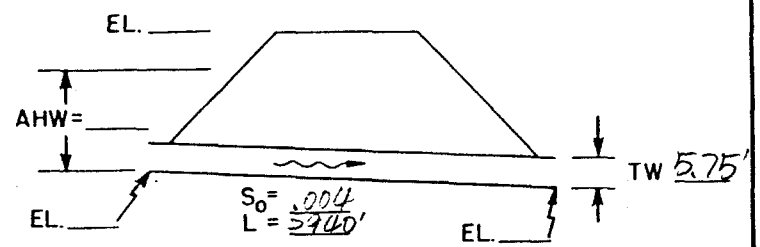
Structure on Bell Road from 59th Ave. to 63rd Ave.

Q_1 = 260 cfs TW_1 = 5.75'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



5.88 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-8'x5' RCB	260	8'x5'	1.10	5.50	0.5	1.75/10.29			5.75	5.75	11.76	4.28	5.50			
1-6'x5' RCB	260	6'x5'	1.38	6.90	0.5	7.4/19.98			5.75	5.75	11.76	13.98	13.98			N.G.

SUMMARY & RECOMMENDATIONS: Use 1-8'x5' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 2 for D.A. 4 for Q_{10}

DESIGNER: BGN
DATE: 12-08-86 R.H 12/9/86

Sheet No. 10/12

HYDROLOGIC AND CHANNEL INFORMATION

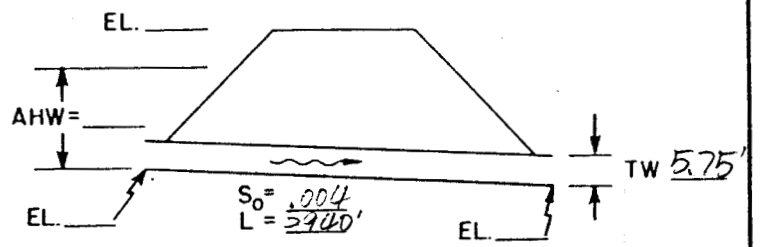
Structure on Bell Road from 59th Ave. to 63rd Ave.

Q_1 = 260 cfs TW_1 = 5.75'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



5.88 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-8'x5' RCB	260	8'x5'	1.10	5.50	0.5	1.75/10.29			5.75	5.75	11.76	4.28	5.50			
1-6'x5' RCB	260	6'x5'	1.38	6.90	0.5	7.4/19.9			5.75	5.75	11.76	13.98	13.98			N.G.

SUMMARY & RECOMMENDATIONS: Use 1-8'x5' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 2 for D.A. 4 for Q_{10}

DESIGNER: BGR R.H. 12/9/86

DATE: 12-08-86

Sheet No. 11/12

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 59th Ave. from Grovers Ave. to Bell Rd.

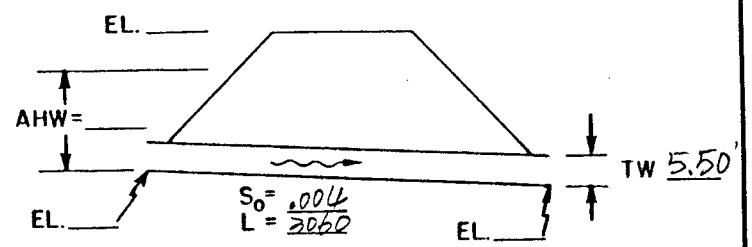
Q_1 = ~~110~~ 120 cfs TW_1 = 5.50'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

6.12

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o - LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
~~1-60" RCP~~	~~110~~	~~60"~~	~~.92~~	~~4.60~~	~~.20~~	~~1.37/8.08~~	—	—	~~5.50~~	~~5.50~~	~~12.24~~	~~7.34~~	~~4.60~~	—		
1-54" RCP	120	54"	1.20	5.40	.20	2.77/16.65			5.50	5.50	12.24	9.91	9.91			

SUMMARY & RECOMMENDATIONS: Use 1-54" RCP

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 2 for D.A. 4 for Q_{10}

DESIGNER: BGS

DATE: 12-09-86 R.H. 12/9/86

Sheet No. 12/12

HYDROLOGIC AND CHANNEL INFORMATION

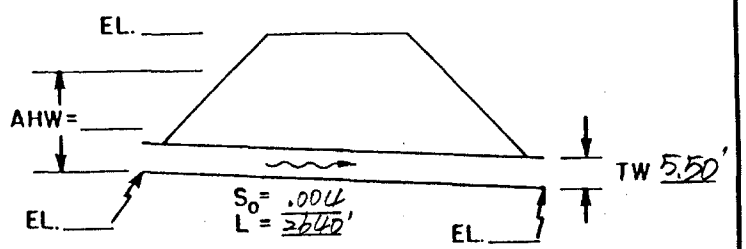
Structure on Bell Rd. from 55th Ave. to 59th Ave.

Q_1 = 120 cfs TW_1 = 5.50'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



5.28 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-54" RCP	120	54"	1.20	5.40	.20	2.72/1.436			5.50	5.50	10.56	9.30	9.30			

SUMMARY & RECOMMENDATIONS: Use 1-54" RCP

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 3 for D.A. 4 for Q_{10}

DESIGNER: BGB

DATE: 12-09-86 12/9/86

Sheet No. 1/17

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Road from 67th Ave. to Skunk Creek

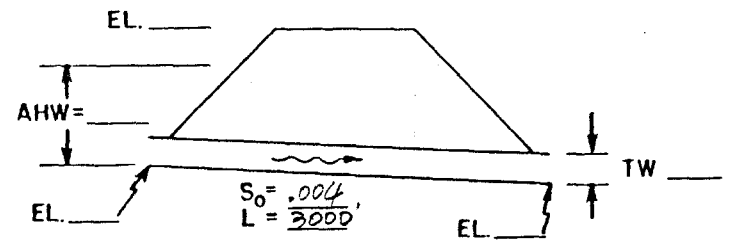
Q_1 = 1810 cfs TW_1 = 6.00'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



MEAN STREAM VELOCITY = _____

6.00 MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
6-8'x6' RCB	302	8'x6'	1.00	6.00	0.5	1.50/9.30			6.00	6.00	12.00	3.30	6.00			

SUMMARY & RECOMMENDATIONS: Use 6-8'x6' RCB

Figure 7

Sheet No. 2/17

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 3 for Drainage Area 4 for Q_{10}

DESIGNER: BGS
RH 12/9/86
DATE: 12-09-86

HYDROLOGIC AND CHANNEL INFORMATION

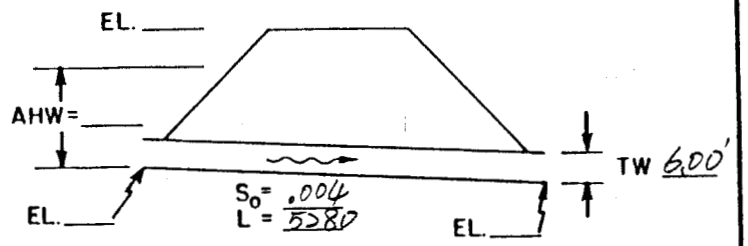
Structure on Bell Road from 59th Ave. to 67th Ave.

Q_1 = 1810 cfs TW_1 = 6.00
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



MEAN STREAM VELOCITY = _____
10.56 MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
6-8'x6' RCB	302	8'x6'	1.00	6.00	0.5	~~1.55~~ 1.63			6.00	6.00	>1.12	1.25	6.00			

SUMMARY & RECOMMENDATIONS: Use 6- 8'x6' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 3 for Drainage Area 4 for Q_{10}

DESIGNER: BGB

DATE: 12-09-86 K.H 12/9/86

Sheet No. 3/17

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 59th Ave. from Grovers Ave. to Bell Rd.

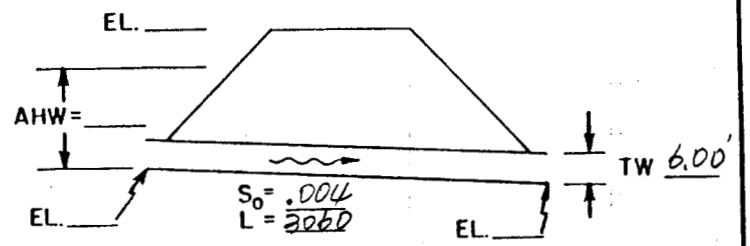
Q_1 = 110 cfs TW_1 = 6.00'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



6.12 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o - LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-54" RCP	110	54"	1.12	5.04	.20	2.35/1.438			6.00	6.00	12.24	8.14	8.14			

SUMMARY & RECOMMENDATIONS: Use 1-54" RCP

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 3 for D.A. 4 for Q_{10}

DESIGNER: BGS R.H. 12/9/86

DATE: 12-09-86

Sheet No. 4/17

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Road from 51st Ave. to 59th Ave.

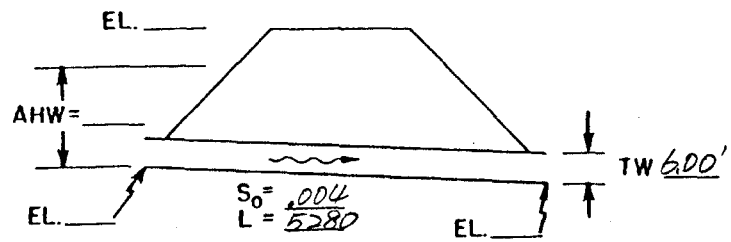
Q_1 = 1600 cfs TW_1 = 6.00'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



10.56 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
5-8'x6' RCB	320	8'x6'	1.05	6.30	0.5	1.72/18.16			6.00	6.00	1.12	7.04	6.30			

SUMMARY & RECOMMENDATIONS: Use 5-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 3 for D.A. 4 for Q_{10}

DESIGNER: BGS RTI 12/9/86

DATE: 12-09-86

Sheet No. 5/17

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 51st Ave. from Groveys Ave. to Bell Road

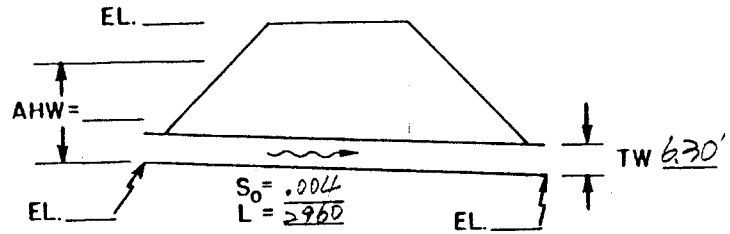
Q_1 = 140 cfs TW_1 = 6.30'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



5.92 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-60" RCP	140	60"	1.10	5.50	.20	2.15/12.75			6.30	6.30	11.84	7.19	7.19			

SUMMARY & RECOMMENDATIONS: Use 1-60" RCP

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 3 for D.A. 4 for Q_{10}

DESIGNER: BSB

DATE: 12-09-86 12/9/86

Sheet No. 6/17

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Road from 47th Ave. to 51st Ave.

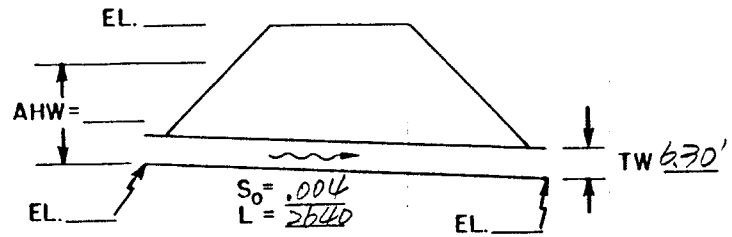
Q_1 = 1440 cfs TW_1 = 6.30'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



5.28

MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT.		OUTLET CONTROL HW=H + h_o − LS_o								CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				
4-8'x6' RCB	360	8'x6'	1.14	6.84	0.5	2.4/12.67			6.30	6.30	10.56	8.41	8.41			

SUMMARY & RECOMMENDATIONS: Use 4-8'x6' RCB

Figure 7

Sheet No. 7/7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 3 for D.A. 4 for Q_{10}

DESIGNER: BGS

DATE: 12-09-86 R.H. 12/9/86

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Road from 43rd Ave. to 47th Ave.

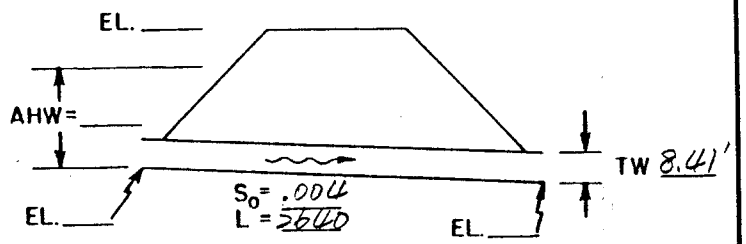
Q_1 = 1390 cfs TW_1 = 8.41'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



5.28 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o - LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
4-8'x6' RCB	348	8'x6'	1.11	6.66	0.5	2.05 / 10.87			8.41	8.41	10.56	8.67	8.67			

SUMMARY & RECOMMENDATIONS: Use 4-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 3 for D.A. 4 for Q_{10}

DESIGNER: BGB

DATE: 12-09-86 R.H 12/9/86

Sheet No. 8/17

HYDROLOGIC AND CHANNEL INFORMATION

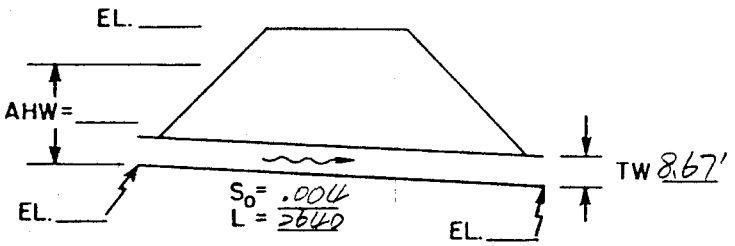
Structure on 43rd Ave. from Grovers Ave. to Bell Rd.

Q_1 = >30 cfs TW_1 = 8.67'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



5>8 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-6'x6' RCB	>30	6'x6'	1.03	6.18	0.5	1.7 / 8.98			8.67	8.67	10.56	7.09				
1-6'x5' RCB	>30	6'x5'	1.23	6.15	0.5	2.65 / 10.33			8.67	8.67	10.56	12.10				N.G.

SUMMARY & RECOMMENDATIONS: Use 1-6'x6' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 3 for D.A. 4 for Q_{10}

DESIGNER: BGB
DATE: 12-09-86 R.H 12/9/86

Sheet No. 9/17

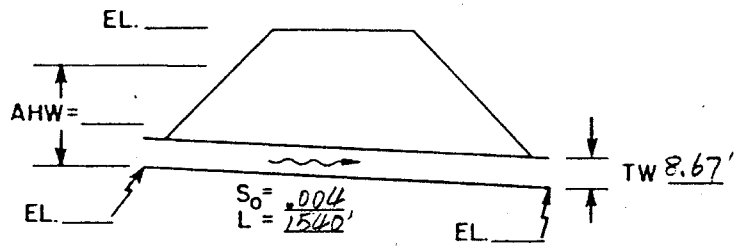
HYDROLOGIC AND CHANNEL INFORMATION
Structure on Bell Road from 41st Ave. to 43rd Ave.

Q_1 = 1170 cfs TW_1 = 8.67'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



3.08 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
4-8'x6' RCB	>93	8'x6'	.97	5.82	0.5	1.45/4.47			8.67	8.67	6.16	6.98				

SUMMARY & RECOMMENDATIONS: Use 4- 8'x6' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 3 for D.A. 4 for Q_{10}

DESIGNER: BBR R.H 12/9/86

DATE: 12-09-86

Sheet No. 10/17

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Road from 39th Ave. to 41st. Ave.

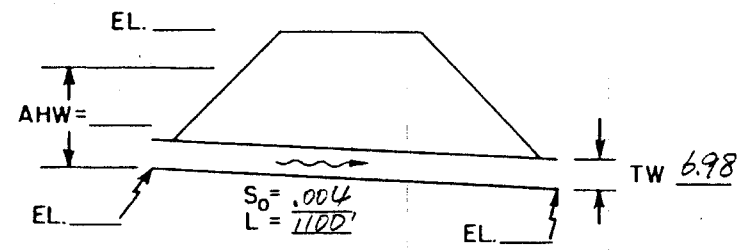
Q_1 = 1050 cfs TW_1 = 6.98'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



>.20 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
4-8'x6' RCB	>63	8'x6'	.92	5.52	0.5	1.18/2.60			6.98	6.98	4.40	5.18	5.52			

SUMMARY & RECOMMENDATIONS: Use 4-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 3 for D.A. 4 for Q_{10}

DESIGNER: BGS

DATE: 12-09-86 R.H 12/9/86

Sheet No. 11/17

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Road from 37th Ave. to 39th Ave.

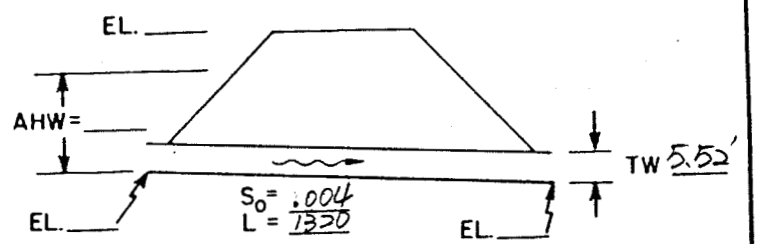
Q_1 = 950 cfs TW_1 = 5.52'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



2.64 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
3-8'x6' RCB	317	8'x6'	1.05	6.30	0.5	1.7/4.49			5.52	5.52	5.28	4.73	6.30			

SUMMARY & RECOMMENDATIONS: Use 3-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 3 for D.A. 4 for Q_{10}

DESIGNER: BGB

DATE: 12-09-86 R.H 12/9/86

Sheet No. 12/17

HYDROLOGIC AND CHANNEL INFORMATION

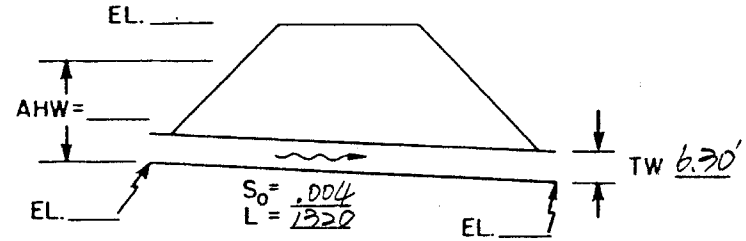
Structure on Bell Road from 35th Ave. to 37th Ave.

Q_1 = 890 cfs TW_1 = 6.30'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
3-8'x6' RCB	>97	8'x6'	.99	5.94	0.5	1.55/4.09			6.30	6.30	5.28	5.11	5.94			

SUMMARY & RECOMMENDATIONS: Use 3-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 3 for D.A. 4 for Q_{10}

DESIGNER: BGS

DATE: 12-09-86 R.H 12/9/86

Sheet No. 13/17

HYDROLOGIC AND CHANNEL INFORMATION

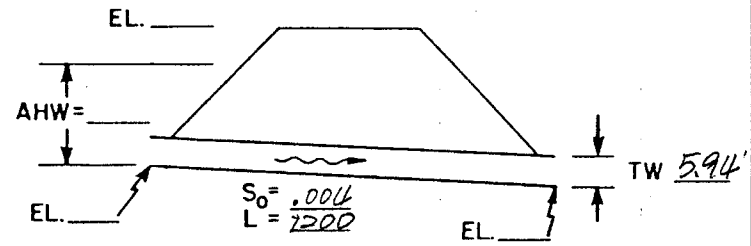
Structure on 35th Ave. from Campo Bello Dr. to Bell Rd.

Q_1 = 400 cfs TW_1 = 5.94'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



2.40 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT.		OUTLET CONTROL $HW=H+h_o-LS_o$								CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			HW/D	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				
1-8'x6' RCB	400	8'x6'	1.22	7.32	0.5	2.80/6.72			5.94	5.94	4.80	7.86	7.86			

SUMMARY & RECOMMENDATIONS: Use 1-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 3 for D.A. 4 for Q_{10}

DESIGNER: BGB

DATE: 12-09-86 R.H 12/9/86

Sheet No. 14/17

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 35th Ave. from Grovers Ave. to Campo Bello Dr.

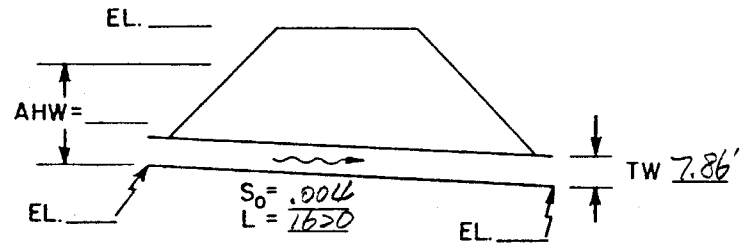
Q_1 = 320 cfs TW_1 = 7.86'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



3.24 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT.		OUTLET CONTROL $HW = H + h_o - LS_o$								CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				
1-8'x6' RCB	320	8'x6'	1.05	6.30	0.5	1.75/5.67			7.86	7.86	6.48	7.05	7.05			

SUMMARY & RECOMMENDATIONS: Use 1-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 3 for D.A. 4 for Q_{10}

DESIGNER: BGB

DATE: 12-09-86 R.H 12/9/86

Sheet No. 15/17

HYDROLOGIC AND CHANNEL INFORMATION

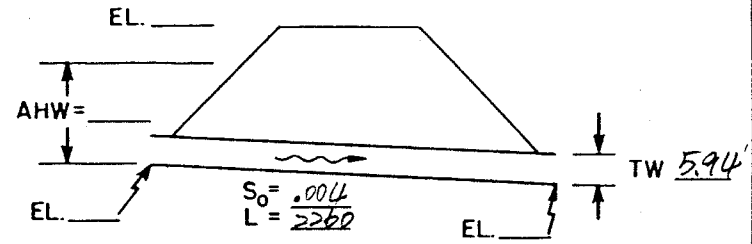
Structure on Bell Rd. from 32nd Ln. to 35th Ave.

Q_1 = 450 cfs TW_1 = 5.94'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



MEAN STREAM VELOCITY = _____
4.52 MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-10'x6'RCB	450	10'x6'	1.13	6.78	0.5	2.10/9.49			5.94	5.94	9.04	6.39	6.78			

SUMMARY & RECOMMENDATIONS: Use 1-10'x6' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 3 for D. A. 4 for Q_{10}

DESIGNER: BGS

DATE: 12-09-86 R.H. 12/9/86

Sheet No. 16/17

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Road from 31st Ave. to 32nd Ln.

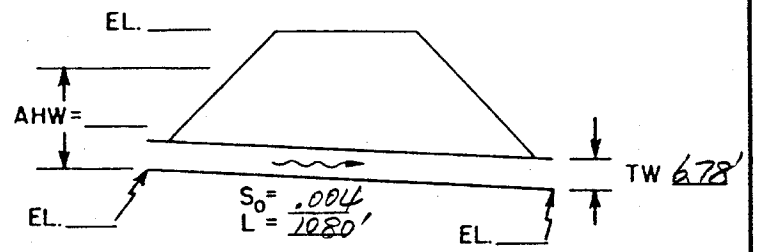
Q_1 = 370 cfs TW_1 = 6.78'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



MEAN STREAM VELOCITY = _____

2.16 MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1- 8'x6' RCB	370	8'x6'	1.16	6.96	0.5	2.35/5.08			6.78	6.78	4.32	7.54	7.54			

SUMMARY & RECOMMENDATIONS: Use 1- 8'x6' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 3 for D.A. 4 for Q_{10}

DESIGNER: BGB

DATE: 12-09-86 R.H 12/9/86

Sheet No. 17/17

HYDROLOGIC AND CHANNEL INFORMATION

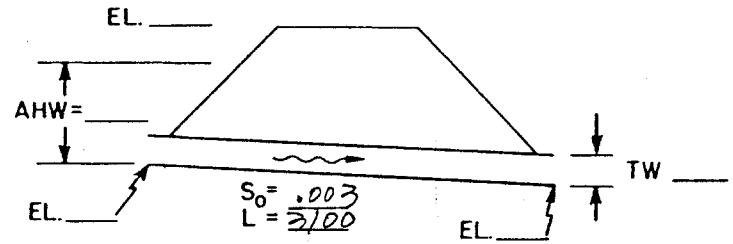
Structure on Bell Road from I-17 HWY East to 31st. Ave.

Q_1 = 250cfs TW_1 = 7.54'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



6.>0 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT.		OUTLET CONTROL HW=H + h_o − LS_o								CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			HW/D	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				
1-8'x5' RCB	250	8'x5'	1.08	5.40	0.5	1.60/9.92			7.54	7.54	9.30	8.16	8.16			

SUMMARY & RECOMMENDATIONS: Use 1- 8'x 5' RCB
"

Figure 7

Greiner Engineering

Greiner Engineering Sciences, Inc.

Tucson 602 327-3413
Phoenix 602 275-5400

Job: Bell Road Project Drainage Study
Description: Cost Estimate for D.A. 4 for Q_{10}
Calculated by: BGR Date: 12/09/86 Sheet No. 1
Checked by: R.H Date: 12/10/86 of

Cost Estimate for Drainage Area 4 for Q_{10}, Alt. No. 1 (21 miles)

City of Phoenix, Off-Site

LOCATION	STRUCTURE	QUANTITY	UNIT COST	TOTAL COST
Bell Rd. (I-17 HWY East to 31st Ave.)	1-8'x5' RCB	3,100 ft	$ 222/ft	$ 688,200
Bell Rd. (31st Ave. to 32nd Ln.)	1-8'x6' RCB	1,080 ft	$ 243/ft	$ 262,500
Bell Rd. (32nd Ln. to 35th Ave.)	1-10'x6' RCB	2,260 ft	$ 306/ft	$ 691,600
35th Ave. (Grovers Ave. to Bell Rd.)	1-8'x6' RCB	2,820 ft	$ 243/ft	$ 685,300
35th Ave. (Bell Rd. to ACDC)	3-8'x6' RCB	24,400 ft	$ 625/ft	$ 15,250,000
Bell Rd. (39th Ave. to 41st Ave.)	1-6'x5' RCB	1,100 ft	$ 180/ft	$ 198,000
Bell Rd. (41st. Ave. to 43rd Ave.)	1-8'x5' RCB	1,540 ft	$ 222/ft	$ 341,900
43rd Ave. (Grovers Ave. to Bell Rd.)	1-6'x5' RCB	2,640 ft	$ 180/ft	$ 475,200
43rd Ave. (Bell Rd. to ACDC)	2-8'x5' RCB	21,000 ft	$ 409/ft	$ 8,589,000
Bell Rd. (47th Ave. to 51st Ave.)	54" RCP	2,640 ft	$ 124/ft	$ 327,400
51st Ave. (Grovers Ave. to Bell Rd.)	60" RCP	2,960 ft	$ 140/ft	$ 414,400

Greiner Engineering

Greiner Engineering Sciences, Inc.

Tucson 602 327-3413
Phoenix 602 275-5400

Job: Bell Road Project Drainage Study
Description: Cost Estimate for D.A. 4 for Q10
Calculated by: BGS Date: 12/09/86 Sheet No. 2
Checked by: RH Date: 12/10/86 of

Cost Estimate for Drainage Area 4 for Q10, Alt. No. 1 (Cont'd)

City of Phoenix, Off-Site

LOCATION	STRUCTURE	QUANTITY	UNIT COST	TOTAL COST
51st Ave. (Bell Rd. to ACDC)	1-8'x5' RCB	16,000 ft	$222/ft	$ 3,552,000
			Total	$ 31,475,500

City of Phoenix $31,476,000 for Off-Site Drainage

City of Phoenix, On-Site

LOCATION	STRUCTURE	QUANTITY	UNIT COST	TOTAL COST
from 35th Ave. to 39th Ave.	24" RCP	2,640 ft	$39/ft	$ 103,000
from 43rd Ave. to 47th Ave.	24" RCP	2,640 ft	$39/ft	$ 103,000
			Total	$ 206,000

City of Phoenix $206,000 for On-Site Drainage

Greiner Engineering

Greiner Engineering Sciences, Inc.
Tucson 602 327-3413
Phoenix 602 275-5400

Job: Bell Road Project Drainage Study
Description: Cost Estimate for D.A. 4 for Q10
Calculated by: BGS Date: 12/09/86 Sheet No. 3
Checked by: _____ Date: _____ of _____

Cost Estimate for Drainage Area 4 for Q10, Alt. No. 1 (Cont'd)

City of Glendale, Off-Site

LOCATION	STRUCTURE	QUANTITY	UNIT COST	TOTAL COST
Bell Rd. (55th Ave. to 59th Ave.)	54" RCP	2,640 ft	$124/ft	$ 327,400
59th Ave. (Grovers Ave. to Bell Rd.)	54" RCP	3,060 ft	$124/ft	$ 379,500
59th Ave. (Bell Rd. to ACDC	1-8'x5' RCB	11,400 ft	$222/ft	$ 2,530,800
Bell Rd. (63rd Ave. to 67th Ave.)	54" RCP	2,340 ft	$124/ft	$ 290,200
67th Ave. (Bell Rd. to ACDC)	66" RCP	7,400 ft	$145/ft	$ 1,073,000
			Total	$ 4,600,900

City of Glendale $4,600,900 for Off-Site Drainage

City of Glendale, On-Site

LOCATION	STRUCTURE	QUANTITY	UNIT COST	TOTAL COST
from 51st Ave. to 55th Ave.	24" RCP	2,640 ft	$39/ft	$ 103,000
from 59th Ave. to 63rd Ave.	24" RCP	2,940 ft	$39/ft	$ 114,700
			Total	$ 217,700

City of Glendale $ 218,000 for On-Site Drainage.

Greiner Engineering

Greiner Engineering Sciences, Inc.
Tucson 602 327-3413
Phoenix 602 275-5400

Job [illegible]
Description Cost Estimate for D.A. 4 for Q_{10}
Calculated by BGB Date 12/09/86 Sheet No. 1
Checked by R.H Date 12/10/86 of

Cost Estimate for Drainage Area 4 for Q_{10}, Alt. No. 2 (16 miles)

City of Phoenix, Off-Site

LOCATION	STRUCTURE	QUANTITY	UNIT COST	TOTAL COST
Bell Rd. (I-17 HWY East to 31st Ave.)	1-8'x5' RCB	3,100 ft	$ 222/ft	$ 688,200
Bell Rd. (31st Ave. to 32nd Ln.)	1-8'x6' RCB	1,080 ft	$ 243/ft	$ 262,500
Bell Rd. (32nd Ln. to 35th Ave.)	1-10'x6' RCB	2,260 ft	$ 306/ft	$ 691,600
35th Ave. (Grovers Ave. to Bell Rd.)	1-8'x6' RCB	2,820 ft	$ 243/ft	$ 685,300
35th Ave. (Bell Rd. to ACDC)	3-8'x6' RCB	24,400 ft	$ 625/ft	$ 15,250,000
Bell Rd. (39th Ave. to 41st Ave.)	1-6'x5' RCB	1,100 ft	$ 180/ft	$ 198,000
Bell Rd. (41st. Ave. to 43rd Ave.)	1-8'x5' RCB	1,540 ft	$ 222/ft	$ 341,900
43rd Ave. (Grovers Ave. to Bell Rd.)	1-6'x5' RCB	2,640 ft	$ 180/ft	$ 475,200
Bell Rd. (43rd Ave. to 47th Ave.)	2-8'x5' RCB	2,640 ft	$ 409/ft	$ 1,079,800
Bell Rd. (47th Ave. to 51st Ave.)	2-10'x5' RCB	2,640 ft	$ 546/ft	$ 1,441,500
51st Ave. (Grovers Ave. to Bell Rd.)	60" RCP	2,960 ft	$ 140/ft	$ 414,400

Greiner Engineering

Greiner Engineering Sciences, Inc.
Tucson 602 327-3413
Phoenix 602 275-5400

Job: Bell Road Project Drainage Study
Description: Cost Estimate for D.A. 4 for Q10
Calculated by: BGS Date: 12/09/86 Sheet No. 2
Checked by: R.H Date: 12/10/86 of

Cost Estimate for Drainage Area 4 for Q10, Alt. No. 2 (Cont'd)

City of Phoenix, Off-Site

LOCATION	STRUCTURE	QUANTITY	UNIT COST	TOTAL COST
51st Ave. (Bell Rd. to ACDC)	3-8'x5' RCB	16,000 ft	$614/ft	$9,824,000

Total $31,352,400

City of Phoenix $31,353,000 for Off-Site Drainage.

City of Phoenix, On-Site

LOCATION	STRUCTURE	QUANTITY	UNIT COST	TOTAL COST
from 35th Ave. to 39th Ave.	24" RCP	2,640 ft	$39/ft	$103,000

City of Phoenix $103,000 for On-Site Drainage

Greiner Engineering

Greiner Engineering Sciences, Inc.

Tucson 602 327-3413
Phoenix 602 275-5400

Job: Bell Road Project Drainage Study
Description: Cost Estimate for D.A. 4 for Q_{10}
Calculated by: BGR Date: 12/09/86 Sheet No. 3
Checked by: R.H Date: 12/10/86 of

Cost Estimate for Drainage Area 4 for Q_{10}, Alt. No. 2 (Cont'd)

City of Glendale, Off-Site

LOCATION	STRUCTURE	QUANTITY	UNIT COST	TOTAL COST
Bell Rd. (55th Ave. to 59th Ave.)	54" RCP	2,640 ft	$124/ft	$ 327,400
59th Ave. (Grovers Ave. to Bell Rd.)	54" RCP	3,060 ft	$124/ft	$ 379,500
Bell Rd. (59th Ave. to 63rd Ave.)	1-8'x5' RCB	2,940 ft	$222/ft	$ 652,700
Bell Rd. (63rd Ave. to 67th Ave.)	1-10'x5' RCB	2,340 ft	$284/ft	$ 664,600
67th Ave. (Bell Rd. to ACDC)	1-10'x5' RCB	7,400 ft	$284/ft	$ 2,101,600
			Total	$ 4,125,800

City of Glendale $4,125,800 for Off-Site Drainage

City of Glendale, On-Site

LOCATION	STRUCTURE	QUANTITY	UNIT COST	TOTAL COST
from 51st Ave. to 55th Ave.	24" RCP	2,640 ft	$39/ft	$103,000

City of Glendale $103,000 for On-Site Drainage.

Greiner Engineering

Greiner Engineering Sciences, Inc.

Tucson 602 327-3413
Phoenix 602 275-5400

Job: Bell Road Project & Drainage Study
Description: Cost Estimate for D.A. 4 for Q_{10}
Calculated by: BGR Date: 12/09/86 Sheet No. 1
Checked by: R.H Date: 12/10/86 of

Cost Estimate for Drainage Area 4 for Q_{10}, Alt. No. 3 (7.5 miles)

City of Phoenix, Off-Site

LOCATION	STRUCTURE	QUANTITY	UNIT COST	TOTAL COST
Bell Rd. (I-17 HWY East to 31st Ave.)	1-8'x5' RCB	3,100 ft	$ 222/ft	$ 688,200
Bell Rd. (31st Ave. to 32nd Ln.)	1-8'x6' RCB	1,080 ft	$ 243/ft	$ 262,500
Bell Rd. (32nd Ln. to 35th Ave.)	1-10'x6' RCB	2,260 ft	$ 306/ft	$ 691,600
35th Ave. (Grovers Ave. to Bell Rd.)	1-8'x6' RCB	2,820 ft	$ 243/ft	$ 685,300
Bell Rd. (35th Ave. to 39th Ave.)	3-8'x6' RCB	2,640 ft	$ 625/ft	$ 1,650,000
Bell Rd. (39th Ave. to 51st Ave.)	4-8'x6' RCB	3,960 ft	$ 813/ft	$ 3,219,500
43rd Ave. (Grovers Ave. to Bell Rd.)	1-6'x6' RCB	2,640 ft	$ 198/ft	$ 522,800
51st Ave. (Grovers Ave. to Bell Rd.)	60" RCP	2,960 ft	$ 140/ft	$ 414,400
				$ 8,134,300

City of Phoenix $ 8,135,000 for Off-Site Drainage

No On-Site facilities needed.

Greiner Engineering

Greiner Engineering Sciences, Inc.
Tucson 602 327-3413
Phoenix 602 275-5400

Job: Bell Road Project Drainage Study
Description: Cost Estimate for D.A. 4 for Q_{10}
Calculated by: BGB Date: 12/10/86 Sheet No. 2
Checked by: R.H Date: 12/10/86 of

Cost Estimate for Drainage Area 4 for Q_{10}, Alt. No. 3 (Cont'd)

City of Glendale, Off-Site

LOCATION	STRUCTURE	QUANTITY	UNIT COST	TOTAL COST
Bell Rd. (51st Ave. to 59th Ave.)	5-8'x6' RCB	5,280 ft	$1016/ft	$5,364,500
59th Ave. (Grovers Ave. to Bell Rd.)	54" RCP	3,060 ft	$124/ft	$ 379,500
Bell Rd. (59th Ave. to Skunk Creek)	6-8'x6' RCB	8,280 ft	$1250/ft	$10,350,000
			Total	$16,094,000

City of Glendale $16,094,000 for Off-Site Drainage

No On-Site facilities required.

Greiner Engineering

Greiner Engineering Sciences, Inc.

Tucson 602 327-3413
Phoenix 602 275-5400

Q100 Alternate No. 1 for Drainage Area 4

Alternate No. 1 is comprised of five (5) separate systems of reinforced concrete box culverts that convey off-site drainage to The Arizona Canal Diversion Channel (ACDC). In general, the design of box culvert systems was restricted to east and/or north of outfalls along Bell Road, a distance of one-half just mile. These outfalls were at 35th Avenue, 43rd Avenue, 51st Avenue, 59th Avenue and 67th Avenue.
The assumption was made to Union Hills Drive, which was designed to handle the peak flows of Greiner's hydrology for the 50-year, 24-hour storm events. The exceeded flows were diverted and routed to the systems at one-mile streets along Bell Road. These systems also pick up the flows from the area of I-17 HWY east whatever reaches to the systems.

The system with outfall at 35th Avenue consists of box culvert crossing I-17 HWY and box culverts along frontage road and Bell Road. A future detention basin recommended by the Glendale Storm Water Management Plan was consided to retain the 10-year stormwater. There is no need to provide drainage structure for north of Bell Road at 67th Avenue.

The on-site drainage was provided by utilizing 30-inch RCP along Bell Road where is needed. The off-site drainage system was then utilized for conveyance of on-site storm runoff.

The total cost of proposed box culverts is $ 75,960,000.

Alt. 1 Area 4

The 3-8'x5' RCBC along Bell Rd. from Black Canyon to 35th Ave. is in conflict with 12" ACP water line and 12" VCP sewer line, gas & electric lines along Bell Rd. It is also in conflict with the followings: 2-8" VCP sewer-line crossing Bell Rd. along 31st Ave., 1-8" VCP crossing Bell Rd. along 31st Dr., gas line crossing Bell Rd. along 29th ave. & 35th Ave.
The 6-8'x6' RCBC along 35th Ave. and south of Bell Rd. are in conflict with 12" ACP water, and 12" VCP sewer line,
The 5-8'x6' RCBC along 43rd Ave. from Bell Rd. to the South is in conflict with 8" ACP water line, 21" VCP sewerline, and gas line.
The 2-8'x6' RCBC along 51st Ave. from Bell Rd. to the South is in conflict with 8" ACP water and 15" VCP sewerline and gas line.
No conflict of utilities in the city of Glendale for this alternate.

Greiner Engineering

Greiner Engineering Sciences, Inc.
Tucson 602 327-3413
Phoenix 602 275-5400

Job: BELL Rd E123061
Description: COST EST. D.A. 4
Alternate No. 1
Calculated by: TMO Date: 11/13/86 Sheet No. X 3
Checked by: BGS Date: 11/14/86 of 34

Alternate No. 1 Q100

	LOCATION	STRUCTURE	QUANTITY (FT.)	UNIT $	TOTAL $
COP	35th AVE FROM BELL Rd to ACDC	6-8'x6' RCBC	24,400	$1,220/L.F.	$29,768,000
COP	35th AVE FROM GROVERS to BELL Rd	2-8'x6 RCBC	2,820	432/L.F.	1,218,200
COP	BELL Rd FROM 32nd to 35th AVE	3-8'x6' RCBC	2,260	625/L.F.	1,412,500
COP	BELL Rd FROM I-17 HWY to 32nd	3-8'x5' RCBC	4,180	614/L.F.	2,566,500
COP	43rd AVE FROM BELL Rd to ACDC	5-8'x6' RCBC	21,000	1,016/L.F.	21,336,000
COP	43rd FROM GROVER AVE to BELL Rd	2-8'x6' RCBC	2,640	432/L.F.	1,140,500
COP	BELL Rd FROM 41st to 43rd AVE	3-6'x6' RCBC	1,540	489/L.F.	753,100
COP	BELL Rd FROM 39th to 41st	1-10'x6' RCBC	1,100	306/L.F.	336,600
COP	51st AVE FROM BELL to ACDC	2-8'x6' RCBC	16,000	432/L.F.	6,912,000
COP	51st AVE FROM GROVERS to BELL Rd	1-10'x5' RCBC	2,960	284/L.F.	840,600

Greiner Engineering

Greiner Engineering Sciences, Inc.

Tucson 602 327-3413
Phoenix 602 275-5400

Job: BELL Rd

Description: CONCEPT 1

Calculated by: TMO Date: 11/13/86 Sheet No. 2

Checked by: BGS Date: 11/14/86 of 4

Q100

	LOCATION	STRUCTURE	QUANTITY (FT)	UNIT $	TOTAL $
	BELL Rd FROM 47th to 51ST AVE	1-8'x4' RCBC	2640	$208/L.F.	$549,100
COG	59th AVE FROM BELL to ACDC	3-6'x6' RCBC	11,400	489/L.F.	$5,574,600
COG	59th FROM GROVERS to BELL	1-8'x5' RCBC	3,060	222/L.F.	679,300
COG	BELL FROM 55th to 59th AVE	2-6'x5' RCBC	2,640	307/L.F.	810,500
COG	67th AVE FROM BELL to ACDC	1-8'x6' RCBC	7,400	213/L.F.	1,576,200
COG	BELL Rd FROM 63rd to 67th AVE	1-8'x4' RCBC	2340	208/L.F.	486,700
				TOTAL: $	75,960,400

City of Phoenix	$ 66,833,100
City of Glendale	$ 9,127,300
Total	$ 75,960,400

Greiner Engineering

Greiner Engineering Sciences, Inc.
Tucson 602 327-3413
Phoenix 602 275-5400

Alternate No. 2 for Drainage Area 4 Q_{100}

Alternate No. 2 is the same as Alternate No. 1 except the area west of 51st Avenue. From 51st Avenue to Skunk Creek drainage is to be conveyed west along Bell Road into Skunk Creek.

Again, the off-site drainage system was utilized for conveyance of on-site storm runoff. A 30-inch RCP was used if necessary to convey on-site drainage.

The total cost of these systems is $ 73,440,000. (Per Sht. 4 of 4)

Greiner Engineering

Greiner Engineering Sciences, Inc.

Tucson 602 327-3413
Phoenix 602 275-5400

Job Bell Rd. Project Drainage Study
Description Utilities conflicts Q100

Calculated by R.H Date 11/13/86 Sheet No. 2
Checked by _____ Date _____ of 4

Alt2. Area 4

Same conflicts of utilities which applies to alternate 1. also applies to alternate 2. There are no conflicts of utilities in the city of Glendale for this alternate.

Greiner Engineering

Greiner Engineering Sciences, Inc.
Tucson 602-327-3413
Phoenix 602 275-5400

Job BELL RD R1C0001
Description COST EST. D.A. 4 CONCEPT 2
Calculated by TMO Date 11/13/86 Sheet No. 2 of 4
Checked by _____ Date _____

Q100

LOCATION	STRUCTURE	QUANTITY (FT.)	UNIT $	TOTAL $
35th AVE FROM BELL Rd to ACDC	6-8'x6' RCBC	24,400	$1,220/L.F.	$29,768,000
35th AVE FROM GROVERS to BELL Rd	2-8'x6 RCBC	2,820	432/L.F.	1,218,200
BELL Rd FROM 32nd to 35th AVE	3-8'x6' RCBC	2,260	625/L.F.	1,412,500
BELL Rd FROM I-17 HWY to 32nd	3-8'x5' RCBC	4,180	614/L.F.	2,566,500
43rd AVE FROM BELL Rd to ACDC	5-8'x6' RCBC	21,000	1,016/L.F.	21,336,000
43rd FROM GROVER AVE to BELL Rd	2-8'x6' RCBC	2,640	432/L.F.	1,140,500
BELL Rd FROM 41st to 43rd AVE	3-6'x6' RCBC	1,540	489/L.F.	753,100
BELL Rd FROM 39th to 41st	1-10'x6' RCBC	1,100	306/L.F.	336,600
51st AVE FROM BELL to ACDC	2-8'x6' RCBC	16,000	432/L.F.	6,912,000
51st AVE. FROM GROVERS to BELL Rd	1-10'x5' RCBC	2,960	284/L.F.	840,600

Greiner Engineering

Greiner Engineering Sciences, Inc.

Tucson 602 327-3413
Phoenix 602 275-5400

Job: BELL RD - E123061
Description: COST EST., DA 4
CONCEPT 2
Calculated by: YMO Date: 11/13/86 Sheet No. 4
Checked by: _____ Date: _____ of 4

Q100

	LOCATION	STRUCTURE	QUANTITY	UNIT $	TOTAL $
	BELL Rd FROM 47th to 51st AVE	1-8'x4' RCBC	2,640	208/L.F.	549,100
COG	BELL Rd FROM 67th to SKUNK CREEK	3-8'x6' RCBC	3,000	625/L.F.	1,875,000
COG	BELL FROM 59th to 67th AVE	3-8'x5' RCBC	5,280	614/L.F.	3,241,900
COG	59th FROM GROVERS to BELL	1-8'x5' RCBC	3,060	222/L.F.	679,300
COG	BELL Rd FROM 55th to 59th AVE	2-6'x5' RCBC	2,640	307/L.F.	810,500
				Total	$ 73,439,800

City of Phoenix	$ 66,833,100
City of Glendale	$ 6,606,700
Total	$ 73,439,800

Greiner Engineering

Greiner Engineering Sciences, Inc.

Tucson 602 327-3413
Phoenix 602 275-5400

Job: Bell Rd. Project Drainage Study

Description: Summary for Concept Alternates Drainage Area 4

Calculated by: BGB Date: 11/14/86 Sheet No. 1

Checked by: _____ Date: _____ of 4

Alternate No. 3 for Drainage Area 4 Q100

Alternate No. 3 is comprised of two (2) separate systems with outlets to ACDC and Skunk Creek. The system with outlet to ACDC is identical to Alternate No. 1 with outfall at 35th Avenue along Bell Road. The drainage of the area west of 35th Avenue is conveyed along Bell Road to the west into Skunk Creek.

The on-site drainage was provided between 35th Avenue and 37th Avenue by ultilizing 30" RCP.

The total cost of proposed drainage structures is $ 65,119,000.

(per sht. 4 of 4)

Greiner Engineering

Greiner Engineering Sciences, Inc.
Tucson 602 327-3413
Phoenix 602 275-5400

Job Bell Rd. Project Drainage Study
Description Utilities Conflicts Q100

Calculated by R.H Date 11/13/86 Sheet No. 2
Checked by _____ Date _____ of 4

Alt. 3 Area 4

Utilities conflicts in alt. 1 also apply to this alternate. In addition The following utilities in City of Glendale are possible conflicts: 5-8'x6' RCBC along Bell Rd. from 43rd Ave. to 51st Ave. in conflict with Water and Sewer line along Bell Rd and those crossing Bell Rd. 6-8'x6' RCBC along Bell Rd. from 51st Ave. to 55th Ave. in conflict with utilities along Bell Rd. 6-10'x6' RCBC along Bell Rd. from 55th Ave. to 59th Ave. and the 6-10'x7' RCBC from 59th Ave. to Skunk Creek are all in conflict with utilities along Bell Rd and those crossing Bell Rd.

Greiner Engineering

Greiner Engineering Sciences, Inc.

Tucson 602 327-3413
Phoenix 602 275-5400

Job BELL RD E125061
Description COST EST. D.A. 4 CONCEPT 3
Calculated by TMO Date 11/13/86 Sheet No. 2 of 4
Checked by _____ Date _____

Q100

	LOCATION	STRUCTURE	QUANTITY (FT.)	UNIT $	TOTAL $
	35th AVE FROM BELL Rd to ACDC	6-8'x6' RCBC	24,400	1,220/L.F.	29,768,000
	35th AVE FROM GROVERS to BELL Rd	2-8'x6 RCBC	2,820	432/L.F.	1,218,200
	BELL Rd FROM 32nd to 35th AVE	3-8'x6' RCBC	2,260	625/L.F.	1,412,500
	BELL Rd FROM I-17 HWY to 32nd	3-8'x5' RCBC	4,180	614/L.F.	2,566,500
COG	BELL Rd FROM 59th to SKUNK CREEK	6-10'x7' RCBC	8,280	1,645/L.F.	13,620,600
COG	59th FROM GROVERS to BELL Rd	1-8'x5' RCBC	3,060	222/L.F.	679,300
COG	BELL Rd FROM 55th to 59th AVE	6-10'x6' RCBC	2,640	1,590/L.F.	4,197,600
COG	BELL Rd FROM 51st to 55th AVE	6-8'x6' RCBC	2,640	1,220/L.F.	3,220,800
	51st AVE FROM GROVERS to BELL Rd	1-10'x5' RCBC	2,960	284/L.F.	840,600
	BELL Rd FROM 43rd to 51st AVE	5-8'x6' RCBC	5,280	1016/L.F.	5,364,500

Greiner Engineering

Greiner Engineering Sciences, Inc.

Tucson 602 327-3413
Phoenix 602 275-5400

Job: BELL Rd

Description: CONCEPT 3

Calculated by: YMO Date: 11/13/86 Sheet No. 4

Checked by: _____ Date: _____ of 4

Q100

LOCATION	STRUCTURE	QUANTITY	UNIT $	TOTAL $
43rd AVE FROM GROVERS to BELL Rd	2-8'x6' RCBC	2,640	432/L.F.	1,140,500
BELL FROM 41st to 43rd AVE	3-6'x6' RCBC	1,540	489/L.F.	753,100
BELL FROM 39th to 41st	1-10'x6' RCBC	1,100	306/L.F.	336,600
			Total	$ 65,118,800

City of Phoenix	$ 43,400,500
City of Glendale	$ 21,718,300
Total	$ 65,118,800

Greiner Engineering

Greiner Engineering Sciences, Inc.

Tucson 602 327-3413
Phoenix 602 275-5400

Job: Bell Rd. Project Drainage Study
Description: Revise Hydrologic Modeling For Drainage Area 5
Calculated by: BGR Date: 10/30/86 Sheet No. 1
Checked by: _____ Date: _____ of _____

Revision To Future Conditions

The hydrologic modeling for the 100-year storm, future conditions in Drainage Area 5 has been revised as per review comments and PRC's "I-17 Drainage Design Study".

The modifications to the HEC-1 model have been performed and these are:

1. An average value of 0.17 is used as an overland flow roughness coefficient on the UK cards using the Kinematic Wave method.

2. Drainage Area 5 is divided into two (2) parts, east half and west half. Area east of 19th Avenue is considered to be east half.

3. Storages in the depressed intersections at Union Hills Drive and Bell Road are calculated using the 100 scale contour maps.

4. New culvert proposed by the PRC Engineering will increase the capacity from 25 cfs to 440 cfs. This culvert will be located approximately at Utopia Drive and I-17 Highway.

5. Culvert capacities at I-17 Highway are adopted the PRC's values as indicated in their Initial Design Report.

In regard to the new hydrologic model for the 100-year, 24-hour storm, the following conclusions are made:

1. Due to the new structure at Utopia Draive and I-17 HWY, peak inflow at Union Hills Drive depressed intersection is changed from 783 cfs to 328 cfs.

2. Peak inflow at Bell Road intersection is reduced from 901 cfs to 821 cfs due to using the roughness coefficient of 0.17 for

Revision To Future Conditions (Cont'd)

overland flows.

3. No breakout will occur at these two depressed intersections.

4. No storage has been considered for the Digital's detention basin except the on-site detention. The reason for this is that there is no control of future development in that property.

Revision To Existing Conditions

The hydrologic modeling for existing conditions in Drainage Area 5 has been re-analyzed for the 100-year, 24-hour storm event.

The differences in the modification between future conditions and existing conditions are listed below:

1. Due to the capacities of the existing catch basins on 19th Avenue at Grovers Avenue and at Bell Road, the divert flows at Grovers Ave. and at Bell Road are 11 cfs and 15 cfs, respectively.

2. An assumption has been made for the existing Digital's detention basin just north of Union Hills Drive. The detention basin is assumed to retain flow exceeded the culvert capacities at I-17 HWY. Also this basin is assumed to be full. Therefore, no flows will be diverted from 19th Ave. or from Bell Road.

3. The storage-discharge routing has been re-evaluated at two depressed sections at I-17 HWY.

Revision To Existing Conditions (Cont'd)

The following conclusions are made for the HEC-1 results of existing conditions:

1. Peak inflow at Union Hills Drive is changed from >850 cfs to 1208 cfs. The main reason is that flow exceeded box culvert's capacity (480 cfs) is assumed to be retained in the Digital's detention facility. The total flow of 1208 cfs is discharging into this basin and the box culvert at I-17 HWY and north of Union Hills drains 480 cfs to west of I-17 HWY.

   Breakout will occur at this depressed section. The ponded water will begin to flow the south-west into south of Bell Road. The outflow will not flow to the west on Bell Road. Also, floodwater along the frontage road on the east side of I-17 HWY will drain into the west of I-17 HWY.

   With time interval of 10 minutes, the peak outflow (1138 cfs) exceeds the peak inflow (1136 cfs). This phenomenon contradicts the equation of continuity and this model has been re-evaluated by using 3-minute time interval.

   Results are compared between 3-minute and 10-minute time intervals. Although the peak flows for the 10-min interval run are approximately 6% lower than the 3-min interval run, volumes for the 3-min interval run are approximately 16% lower than the 10-min interval run. Both results are presented with the printout of the routed hydrographs at this depressed section.

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Revision To Existing Conditions (Cont'd)

2. There is virtually no outflow at the Bell Road depressed section. The peak inflow is changed from 1024 cfs to 1000 cfs. The maximum storage is increased from 40 ac-ft to 90 ac-ft.

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: 95-001

Area: ~~.042~~ .054 square miles

Upstream Elevation: 1392 Hydraulic Length: 1700 feet

Downstream Elevation: 1380 Slope: .0071 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
~~.042~~ .054		City of Phx.					
	10%		C-2	UNDEV	D	95	950 8370
	90%		IND. PK.	UNDEV	D	~~95~~ 93	~~8550~~ ~~9500~~ 9320

Weighted CN= ~~95~~ 93 (Future) ← Eliminated Dirt (Existing) CN=79

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N= ____ L= ____ m; Lc ____ m;	L= 1700 ft CN= 79
S= ____ ft/m;	S= .71 % Lag= .595 hours
Lag= ____ hours	Adjust Lag:

Total DA 5
Exist. = 9.314 mi²
Future = 4.194 mi²

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q5-002

Area .009 square miles

Upstream Elevation 1384 Hydraulic Length 1000 feet

Downstream Elevation 1381 Slope .003 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.009		City of Phx.				92	
	60%		IND. PK.	DEV	D	93	5580
	40%		IND. PK.	DEV	B	88	3520
							9100

Weighted CN= 91

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q5_003

Area: .058 square miles .046 (20% reduced for D.B.)

Upstream Elevation: ~~1384~~ 1382 Hydraulic Length: ~~3100~~ 1660 feet (Exist. & Future)

Downstream Elevation: ~~1369~~ 1372 Slope: .0060 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.058		City of Phx.					
	40%		IND.PK.	DEV	B	88	3520
	60%		IND.PK.	DEV	D	93	5580
							9100

Weighted CN= 91

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____mi Lc____mi	L=____ft CN=____
S=____ft/mi	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Job: BELL ROAD PROJECT DRAINAGE STUDY
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q5-004

Area .151 square miles .136 (10% reduced for future)

Upstream Elevation 1399 Hydraulic Length >500 feet

Downstream Elevation 1384 Slope .0060 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.151		City of Phx.					
	40%		R1-8	UNDEV	D	90	>600
	30%		R1-8	DEV	B	82	>460
	10%		C-2	UNDEV	B	92	920
	5%		R-3A	UNDEV	B	85	425
	5%		R-3A	UNDEV	D	90	450
	10%		IND.PK	DEV	B	88	880

Weighted CN= /100 87 (Future)

Existing = $\frac{>460+880+60\times 82}{100}$ (Park) = 82.6 ⇒ 83

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N= ____ L= ____ mi Lc ____ mi	L= >500 ft CN= 83
S= ____ ft/mi	S= .60 % Lag= .775 hours
Lag= ____ hours	

Adjust Lag:

40% improved chan. ⇒ .785

40% impervious area ⇒ .78

Lag = .775 X .785 X .78 = .475

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: 95-005

Area: .098 square miles

Upstream Elevation: 1395 Hydraulic Length: 3100 feet

Downstream Elevation: 1378 Slope: .0055 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.098		City of Phx.					
	20%		P.A.D.-14	DEV	B	86	1720
	20%		P.A.D.-14	DEV	D	91	1820
	40%		RI-8	DEV	D	90	3600
	20%		RL8	DEV	B	82	1640
							8780

Weighted CN= 88

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: 95-006

Area: ~~.022~~* .150 square miles .075 (50% reduced for D.B.)

Upstream Elevation: ~~1376~~ 1370 Hydraulic Length: ~~3100~~ 1200 feet (Exist. and Future)

Downstream Elevation: ~~1357~~ 1363 Slope: ~~.0061~~ .0058 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
~~.022~~		City of Phx.					
~~.147~~ .150	40%		IND.PK.	DEV	B	88	3520
	60%		IND.PK.	DEV	D	93	5580
							9100

Weighted CN= 91

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=_____ L=_____mi Lc_____mi	L=_____ft CN=_____
S=_____ft/mi	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q5-007

Area .003 square miles .001 (70% reduced for future)

Upstream Elevation 1366 Hydraulic Length 1600 feet

Downstream Elevation 1358 Slope .0050 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.003		City of Phx.					
	10%		R-3	DEV	D	90	900
	50%		C-O	UNDEV	B	88	4400
	20%		C-1	UNDEV	B	92	1840
	20%		P.A.D. 8	DEV	B	83	1660
							8800

Weighted CN= 81 (Existing) Future = $\frac{900+1660}{30} = 85.33 \Rightarrow 85$

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=_____ L=_____mi Lc_____mi	L=_____ft CN=_____
S=_____ft/mi	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation 95-008

Area .114 square miles

Upstream Elevation 1389 Hydraulic Length 3660 feet

Downstream Elevation 1370 Slope .0052 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.114		City of Phx.					
	5%		R1-8	DEV	D	90	450
	95%		R1-8	DEV	B	82	7790
							8240

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____ mi Lc____ mi	L=____ ft CN=____
S=____ ft/mi	S=____ % Lag=____ hours
Lag=____ hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q5-009

Area .024 square miles

Upstream Elevation 1384 Hydraulic Length 1420 feet

Downstream Elevation 1378 Slope .0042 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.024	100%	City of Phx.	R1-8	DEV	B	82	

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q5-010

Area: .065 square miles

Upstream Elevation: 1378 Hydraulic Length: >800 feet

Downstream Elevation: 1365 Slope: .0046 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.065		City of Phx.				82	
	100%		R1-8	DEV	B	82	

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____mi Lc____mi	L=____ft CN=____
S=____ft/mi	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q5-011

Area .051 square miles .036 (30% reduced for future)

Upstream Elevation 1383 Hydraulic Length 2080 feet

Downstream Elevation 1373 Slope .0048 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.051		city of Phx.					
	55%		R1-8	DEV	B	82	4510
	15%		P.A.D.-14	UNDEV	B	86	1290
	15%		C-O	UNDEV	B	88	
	15%		P.S.C	UNDEV	B	95	

Weighted CN= $\frac{4510+1290}{70} = 82.9 \Rightarrow 83$ (Future) Existing = $\frac{4510+45\times79}{100} = 80.65 \Rightarrow 81$

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q5-012

Area: .031 square miles

Upstream Elevation: 1373 Hydraulic Length: 3160 feet

Downstream Elevation: 1361 Slope: .0038 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.031		City of Phx.					
	80%		R-3	DEV	B	85	6800
	10%		C-1	"	B	8892	~~880~~920
	10%		P.A.D.-14	"	B	86	860
							~~8540~~ 8580

Weighted CN= 85

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q5-013

Area ~~.024~~* ~~.039~~ .079 square miles

Upstream Elevation 1362 Hydraulic Length 2960 feet

Downstream Elevation 1350 Slope .0041 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
~~.024~~ ~~.039~~ .079		City of phx.					
	5%		C-O	DEV	D	93	465
	50%		C-O	DEV	B	88	4400
	45%		IND. PK.	DEV	B	88	3960
							8825

Weighted CN= 88

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/mi	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q5-014

Area .107 square miles

Upstream Elevation 1366 Hydraulic Length 3100 feet

Downstream Elevation 1353 Slope .0042 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.107		city of phx.					
	100%		R1-8	DEV	B	82	

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q5-015

Area .134 square miles

Upstream Elevation 1370 Hydraulic Length 2980 feet

Downstream Elevation 1355 Slope .0050 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.134		City of phx.					
	97%		R1-8	DEV	B	82	7954
	3%		C-1	DEV	B	92	276
							8230

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=_____ L=_____mi Lc_____mi	L=_____ft CN=_____
S=_____ft/mi	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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Description: E123061 J0501

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q5.016

Area ~~.01~~ .040 square miles

Upstream Elevation 1375 Hydraulic Length 1300 feet

Downstream Elevation 1369 Slope .0046 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
~~.01~~ .040		City of Phx.					
	(80%		C-2	DEV	B	92	7367
	20%		R-5	DEV	B	86	1723
							9080

Weighted CN= 91

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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Job: BELL ROAD PROJECT DRAINAGE STUDY
Description:
E123061 J0501
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q5-017

Area ~~.037*~~ .086 square miles

Upstream Elevation 1352 Hydraulic Length 2820 feet

Downstream Elevation 1341 Slope .0039 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
~~.037~~ .086	100%	City of Phx.	IND.PK.		B	88	

Weighted CN= 88

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q5-018

Area: .168 square miles

Upstream Elevation: 1356 Hydraulic Length: 3700 feet

Downstream Elevation: 1341 Slope: .0041 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.168		City of Phx.					
	40%		R1-8	DEV	D	90	3600
	60%		R1-8	DEV	B	82	4920
							8520

Weighted CN= 85

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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Job: BELL ROAD PROJECT DRAINAGE STUDY

Description: E123061 J0501

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q5-019

Area .08 square miles

Upstream Elevation 1347 Hydraulic Length 2620 feet

Downstream Elevation 1337 Slope .0038 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.08		City of Phx.				88	
	35%		C-2	DEV	B	92	3220
	10%		C-2	DEV	D	95	950
	10%		C-3	DEV	B	92	920
	30%		R-5	DEV	B	86	2580
	15%		R-5	DEV	D	91	1365
							9035

Weighted CN= 90

Large or Elongated Watersheds

Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$

N=____ L=____ mi Lc____ mi

S=____ ft/mi

Lag=____ hours

Small, Uniform Watersheds

Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$

L=____ ft CN=____

S=____ % Lag=____ hours

Adjust Lag:

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Description:
E123061 J0501
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q5-020

Area: ~~.116*~~ .174 square miles .139 (20% reduced for future)

Upstream Elevation: 1364 Hydraulic Length: 3820 feet

Downstream Elevation: 1342 Slope: .0058 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
~~.116~~ .174		city of phx.					
	5%		C-2	DEV	D	95	475
	15%		C-2	UNDEV	B	92	
	5%		R-3	DEV	B	85	425
	70%		R-5	DEV	B	86	6020
	5%		C-3	UNDEV	B	92	

Weighted CN= $\frac{425+6020}{75} = 85.93$ ⇒ 86 (Future)

Existing = $\frac{475+425+6020+20\times 79}{100} = 86$

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	

Adjust Lag:

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Description: E123061 J0501

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q5-021

Area: .108 square miles

Upstream Elevation: 1412 Hydraulic Length: >980 feet

Downstream Elevation: 1395 Slope: .0057 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.108		City of Phx.					
	100%		R1-6	DEV	B	84	

Weighted CN= 84

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Description:
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: QS-022

Area: .016 square miles

Upstream Elevation: 1403 Hydraulic Length: 800 feet

Downstream Elevation: 1399 Slope: .0050 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.016		city of Phx.					
	100%		R1-6	90% UNDEV		84	

Weighted CN= 84 (Future)

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N= L= m; Lc m;	L= 800 ft CN= 79 (Existing)
S= ft/m;	S= .45 % Lag= .409 hours
Lag= hours	Adjust Lag:
	10% impervious area ⇒ factor = .94
	Lag = .409X.94 = .384 (Existing)

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q5-023

Area: .062 square miles

Upstream Elevation: 1407 Hydraulic Length: 3100 feet

Downstream Elevation: 1390 Slope: .0055 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.062		City of Phx.					
	100%		R1-6	DEV	B	84	

Weighted CN= 84

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Description:
E123061 J0501
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q5-024

Area .066 square miles

Upstream Elevation 1405 Hydraulic Length 2140 feet

Downstream Elevation 1395 Slope .0047 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.066		City of Phx.					
	50%		R1-6	DEV	B	84	4200
	50%		R1-8	DEV	B	82	4100
							8300

Weighted CN= 83

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q5-025

Area ~~.089*~~ .107 square miles .080 (>5% reduced for future)

Upstream Elevation 1395 Hydraulic Length 3880 feet

Downstream Elevation 1375 Slope .0052 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
~~.089~~ .107		city of phx.					
	50%		R1-8	DEV	B	82	
	25%		R-4	DEV	B	86	
	(25%		P.S.C	UNDEV	B	95)	

Weighted CN= 83 Future = 83.3

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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Description:
E123061 J0501
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q5-026

Area .115 square miles

Upstream Elevation 1397 Hydraulic Length 3460 feet

Downstream Elevation 1379 Slope .0052 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.115		city of Phx.					
	100%		R1-8	DEV	B	82	

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q5-027

Area: ~~.090*~~ .132 square miles

Upstream Elevation: 1427 Hydraulic Length: 3100 feet

Downstream Elevation: 1408 Slope: .0061 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
~~.090~~ .132		City of Phx.					
	20%		R1-8	UNDEV	B	82	1640
	25%		IND.PK.	DEV	B	88	2200
	5%		C-O	DEV	B	88	440
	~~55~~ 50%		R-3	UNDEV	B	85	4250

Weighted CN= 85 (Future) Existing $\frac{30 \times 88 + 70 \times 79}{100} = 81.70$ Use 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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Description:

E123061 J0501

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q5-028

Area: .024 square miles

Upstream Elevation: 1411 Hydraulic Length: 1780 feet

Downstream Elevation: 1403 Slope: .0045 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.024		City of Phx.					
	100%		R1-8	DEV	B	82	

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q5-029

Area: .040 square miles

Upstream Elevation: 1408 Hydraulic Length: 1900 feet

Downstream Elevation: 1400 Slope: .0045 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.040		City of Phx.					
	100%		R1-8		B	82	

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Checked by: BGS Date: 8/28/86 of ____

BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q5-030

Area: .072 square miles

Upstream Elevation: 1419 Hydraulic Length: >280 feet

Downstream Elevation: 1406 Slope: .0057 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.072		city of Phx.					
	100%		R1-6	50% UNDEV	B	84	

Weighted CN= 84 (Future) Existing = $\frac{50 \times 84 + 50 \times 79}{100} = 81.50 \Rightarrow 82$

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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E123068 J0501
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q5-031

Area: .151 square miles

Upstream Elevation: 1409 Hydraulic Length: 4950 feet

Downstream Elevation: 1387 Slope: .00446 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.151		city of phx.					
	100%		R1-8		B	82	

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Description: E123061 J0501

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Ø5-032

Area: .100 square miles

Upstream Elevation: 1410 Hydraulic Length: 4900 feet

Downstream Elevation: 1388 Slope: .0045 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.100		city of Phx.					
	100%		R1-8	DEV	B	82	

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Description: E123061 J0501

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q5-033

Area: ~~.099~~ ** .138 square miles

Upstream Elevation: 1386 Hydraulic Length: 3700 feet

Downstream Elevation: 1368 Slope: .0049 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
~~.099~~		City of Phx.				–	
.138	2%		C-2	UNDEV	B	92	184
	98%		R1-8	DEV	B	82	8036
							8220

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q5-034

Area: .113 square miles

Upstream Elevation: 1379 Hydraulic Length: 3340 feet

Downstream Elevation: 1363 Slope: .0048 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.113		City of Phx.					
	98%		R1-8	DEV	B	82	8036
	2%		R3-A	DEV	B	85	170
							8206

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q5-035

Area: .108 square miles .100 (17% reduced for future)

Upstream Elevation: 1371 Hydraulic Length: 3580 feet

Downstream Elevation: 1353 Slope: .0050 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.108		City of Phx					
	40%		R-3A	DEV	B	85	3400
	2%		C-3	UNDEV	D	95	190
	5%		C-2	UNDEV	D	95	475
	23%		C-2	DEV	B	92	2116
	25%		C-1	DEV	B	92	2300
	5%		RH-8	DEV	B	82	410
							8891

Weighted CN= 89 (Existing) Future = 88

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q5-036

Area .051 square miles

Upstream Elevation 1376 Hydraulic Length 2430 feet

Downstream Elevation 1365 Slope .0045 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.051		City of Phx.					
	100%		R1-6	DEV	B	84	

Weighted CN= 84

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____mi Lc____mi	L=____ft CN=____
S=____ft/mi	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Job: BELL ROAD PROJECT DRAINAGE STUDY
Description: E123068 J0501
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation 95-037

Area .058 square miles

Upstream Elevation 1369 Hydraulic Length >>50 feet

Downstream Elevation 1358 Slope .0049 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.058		City of Phx.					
	40%		R1-6	DEV	B	84	3360
	20%		C-1	DEV	B	92	1840
	20%		R4-A	DEV	B	87	1740
	20%		P.A.D.13	DEV	B	85	1700
							8640

Weighted CN= 86 (Existing)

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=_____ L=_____mi Lc_____mi	L=_____ft CN=_____
S=_____ft/mi	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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Job: BELL ROAD PROJECT DRAINAGE STUDY
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q5-038

Area .117 square miles

Upstream Elevation 1398 Hydraulic Length 3700 feet

Downstream Elevation 1382 Slope .0043 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.117		City of Phx.					
	50%		R1-6	DEV	B	84	4200
	50%		R1-8	DEV	B	82	4100
							8300

Weighted CN= 83

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=_____ L=_____m; Lc_____m;	L=_____ft CN=_____
S=_____ft/m;	S=_____% Lag=_____hours
Lag=_____hours	Adjust Lag:

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Job: BELL ROAD PROJECT DRAINAGE STUDY

Description:

E123061 J0501

Calculated by: R.H Date: 8/12/86 Sheet No. ____

Checked by: BGS Date: 8/28/86 of ____

BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q5-039

Area: .014 square miles

Upstream Elevation: 1384 Hydraulic Length: 840 feet

Downstream Elevation: 1380 Slope: .0048 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.014		City of Phx.					
	100%		R1-8	DEV	B	82	

Weighted CN= 82

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____mi; Lc____mi	L=____ft CN=____
S=____ft/mi	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Description: E123061 J0501
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q5-040

Area: .062 square miles .059 (5% reduced for future)

Upstream Elevation: 1392 Hydraulic Length: 2700 feet

Downstream Elevation: 1379 Slope: .0048 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.062		City of Phx.					
	80%		R1-8	DEV	B	82	6560
	15%		R-2	DEV	B	85	1275
	5%		C-1	DEV	B	92	460
							8295

Weighted CN= 83

Future $CN = \frac{6560+1275}{95} = 82.47$ Use 82

Large or Elongated Watersheds	Small, Uniform Watersheds
$Lag = 24n\,(L\,Lca/S^{0.5})^{0.38}$	$Lag = L^{0.8}\,(1000/CN - 9)^{0.7}/1900\,S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	

Adjust Lag:

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Description: E123061 J0501
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: QS-041

Area: .07 square miles

Upstream Elevation: 1390 Hydraulic Length: 3120 feet

Downstream Elevation: 1375 Slope: .0048 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.07		City of Phx.					
	80%		R1-8	UNDEV	B	82	6560
	20%		R3A	UNDEV	B	86	1720
							8280

Weighted CN: 83 (Future) Existing CN=79

Large or Elongated Watersheds

$Lag = 24n\ (L\ Lca/S^{0.5})^{0.38}$

N= ____ L= ____ mi Lc ____ mi

S= ____ ft/mi

Lag= ____ hours

Small, Uniform Watersheds

$Lag = L^{0.8}\ (1000/CN - 9)^{0.7}/1900\ S^{\frac{1}{2}}$

L= 3120 ft CN= 79

S= .50 % Lag= 1.152 hours

Adjust Lag:

20% improved chan. ⇒ .88

20% impervious area ⇒ .88

Lag = 1.152 x .88 x .88 = .892

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Job: BELL ROAD PROJECT DRAINAGE STUDY
Description: E123061 J0501
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q5-042

Area: .03 square miles

Upstream Elevation: 1382 Hydraulic Length: 1400 feet

Downstream Elevation: 1375 Slope: .0050 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.03		City of Phx.					
	100%		R1-6	DEV	B	84	

Weighted CN= 84

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Job: BELL ROAD PROJECT DRAINAGE STUDY
Description:
E123061 J0501
Calculated by: R.H Date: 8/13/86 Sheet No. ____
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q5-043

Area: .099 square miles

Upstream Elevation: 1379 Hydraulic Length: >900 feet

Downstream Elevation: 1368 Slope: .0038 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.099		City of Phx.					
	90%		R1-6	DEV	B	84	7560
	10%		R-4A	DEV	B	87	870
							8430

Weighted CN= 84

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag:

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Job: BELL ROAD PROJECT DRAINAGE STUDY
Description:
E123061 J0501
Calculated by: R.H Date: 8/13/86 Sheet No.
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: QS-044

Area: .096 square miles .091 (5% reduced for future)

Upstream Elevation: 1378 Hydraulic Length: 3390 feet

Downstream Elevation: 1363 Slope: .00045 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.096		City of Phx.					
	80%		R1-6	DEV	B	84	6720
	15%		R4-A	DEV	B	87	1305
	5%		C-2	UNDEV	B	92	460
							8485

Weighted CN= 85 (Existing) Future = $\frac{6720+1305}{95}$ = 84.47 Use 84

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N= L= m; Lc m;	L= ft CN=
S= ft/m;	S= % Lag= hours
Lag= hours	Adjust Lag:

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Description:
E123061 J0501
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q5-045

Area .249 square miles

Upstream Elevation 1437 Hydraulic Length 3960 feet

Downstream Elevation 1412 Slope .006 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.249		City of Phx.					
	85%		R1-6		B	84	7140
	13%		R1-8	UNDEV	B	82	1066
	2%		C-2	UNDEV	B	92	184
							8390

Weighted CN= 84 (Future) Existing $\frac{85 \times 84 + 15 \times 79}{100} = 83.25$ Use 83 (Existi

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=____ L=____ mi Lc____ mi	L=____ ft CN=____
S=____ ft/mi	S=____ % Lag=____ hours
Lag=____ hours	Adjust Lag:

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q5-046

Area: .195 square miles

Upstream Elevation: 1418 Hydraulic Length: 4780 feet

Downstream Elevation: 1398 Slope: .0042 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.195		city of Phx.					
	100%		R1-8	>5% UNDEV	B	82	

Weighted CN= 82 (Future)

Existing CN = $\frac{75 \times 82 + 25 \times 79}{100} = 81.25$

Use 81

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = $24n\,(L\,Lca/S^{0.5})^{0.38}$	Lag = $L^{0.8}\,(1000/CN - 9)^{0.7}/1900\,S^{\frac{1}{2}}$
N= ____ L= ____ m; Lc ____ m;	L= ____ ft CN= ____
S= ____ ft/m;	S= ____ % Lag= ____ hours
Lag= ____ hours	Adjust Lag:

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Description:
E123061 J0501
Calculated by: R.H Date: 8/13/86 Sheet No.
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation Q5_047

Area .079 square miles

Upstream Elevation 1434 Hydraulic Length 3360 feet

Downstream Elevation 1418 Slope .0048 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.079		city of Phx.					
	100%		R1-8	UNDEV	B	82	

Weighted CN= 82 (Future)

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N= L= m; Lc m;	L= 3360 ft CN= 79 (Existing)
S= ft/m;	S= .48 % Lag= ~~1.247~~ hours
Lag= hours	Adjust Lag:
	20% improved channel ⇒ factor = .885
	10% impervious area ⇒ factor = .94
	Lag = 1.247 x .885 x .94 = 1.038 (Existing)

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Description:
E123061 J0501
Calculated by: R.H Date: 8/13/86 Sheet No. ____
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: Q5-48

Area: .046 square miles

Upstream Elevation: 1400 Hydraulic Length: 2200 feet

Downstream Elevation: 1382 Slope: .0082 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
.046		City of Phx.					
	100%		R1-8	UNDEV	B	82	

Weighted CN= 82 (Future)

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____ mi Lc____ mi	L= 2200 ft CN= 79 (Existing)
S=____ ft/mi	S= .82 % Lag= .680 hours
Lag=____ hours	Adjust Lag:

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Job BELL ROAD PROJECT DRAINAGE STUDY
Description W.A. 5
E123068 J0501
Calculated by B. Gary Ruan Date 9/4/86 Sheet No. ____
Checked by ____ Date ____ of ____

BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation 5049

Area .230 square miles

Upstream Elevation 1570 Hydraulic Length 7500 feet

Downstream Elevation 1430 Slope .0187 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	5		Cemetery	DEV	B	74	
	95			UNDEV	B	80	

Weighted CN= 80 (Exist. only)

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N= .035 L= 1.42 m; Lc .66 m;	L= ____ ft CN= ____
S= 99 ft/m;	S= ____ % Lag= ____ hours
Lag= .34 hours	Adjust Lag:

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Job BELL ROAD PROJECT DRAINAGE STUDY
Description W. A. 5
E123061 J0501
Calculated by BGS Date 9/4/86 Sheet No.
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation 5050

Area 1.30 square miles

Upstream Elevation 1515 Hydraulic Length 13,500 feet

Downstream Elevation 1424 Slope .0067 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	11	COP	R1-6	DEV		86	
	5	COP	A1	DEV		88	
	12		Airport	DEV		98	
	72			UNDEV		80	

Weighted CN= 83 (Exist. only)

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N= .035 L= 2.56 mi Lc 1.23 mi	L= ft CN=
S= 35 ft/mi	S= % Lag= . hours
Lag= .58 hours	Adjust Lag:

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Description: W. A. 5
E123061 J0501
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: 5051

Area: .46 square miles

Upstream Elevation: 1580 Hydraulic Length: 12,200 feet

Downstream Elevation: 1410 Slope: .0139 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	45	COP	R1-6	DEV		86	
	12		Airport			98	
	3	COP	A-1	DEV		88	
	40			UNDEV		80	

Weighted CN= 85 (Exist. only)

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N= .026 L= 2.31 m; Lc 1.16 m;	L= ____ ft CN= ____
S= 73 ft/m;	S= ____ % Lag= ____ hours
Lag= .40 hours	Adjust Lag:

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Description: W. A. 5
E123061 J0501
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: 5052

Area: .39 square miles

Upstream Elevation: 1780 Hydraulic Length: 4900 feet

Downstream Elevation: 1520 Slope: .0531 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	82%			UDEV		80	
	18%		Rock (Q_{Tb})			98	

Weighted CN= 83 (Exist. only)

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N=____ L=____m; Lc____m;	L=____ft CN=____
S=____ft/m;	S=____% Lag=____hours
Lag=____hours	Adjust Lag: .59 hour

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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: 5053

Area: 2.26 square miles

Upstream Elevation: 1515 Hydraulic Length: 16,000 feet

Downstream Elevation: 1400 Slope: .0072 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	11	COP	R1-6	R1-6		87	
	9	COP	A-1	A-1		88	
	5			AIRPORT		98	
	75			UNDEV		80	

Weighted CN= 82 (Exist. only)

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{1/2}$
N= .031 L= 3.03 m; Lc 1.33 m;	L= ft CN=
S= 38 ft/m;	S= % Lag= hours
Lag= .63 hours	Adjust Lag:

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Description: W. A. 5
E123061 J0501
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: 5054

Area: .18 square miles

Upstream Elevation: 1425 Hydraulic Length: 5300 feet

Downstream Elevation: 1396 Slope: .0055 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	10	COP	IND PK	DEV		88	
	90		Desert			83	

Weighted CN= 84 (Exist. only)

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/$S^{0.5}$)$^{0.38}$	Lag = $L^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 $S^{\frac{1}{2}}$
N=____ L=____m; Lc____m;	L= 5300 ft CN= 84
S=____ft/m;	S= .55 % Lag= 1.45 hours
Lag=____hours	Adjust Lag:
	1.45 X 0.98 X 0.75 = 1.07 hours

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Job: BELL ROAD PROJECT DRAINAGE STUDY
Description: W. A. 5
E123061 J0501
Calculated by: BGB Date: 9/4/86 Sheet No.
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BELL ROAD MASTER DRAINAGE
DRAINAGE AREA SUMMARY SHEET

Drainage Area Designation: 5055

Area: .20 square miles

Upstream Elevation: 1425 Hydraulic Length: 5600 feet

Downstream Elevation: 1392 Slope: .0059 feet/feet

LAND USE

Subarea Square Miles	% Total Area	Jurisdiction	Zoning	Development Status	Soil Group	CN	Comment
	63					87	
	20		C-3	DEV		88	
	17					83	

Weighted CN= 87

Large or Elongated Watersheds	Small, Uniform Watersheds
Lag = 24n (L Lca/S$^{0.5}$)$^{0.38}$	Lag = L$^{0.8}$ (1000/CN - 9)$^{0.7}$/1900 S$^{1/2}$
N= L= m; Lc m;	L= 5600 ft CN= 87
S= ft/m;	S= .59 % Lag= 1.32 hours
Lag= hours	Adjust Lag:
	1.32 X 0.77 X 0.78 = 0.83 hours

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Job [illegible]
Description HYDROLOGY COMMUNITY SHELT
Freeway Conditions
Calculated by M.C. Date _____ Sheet No. _____
Checked by _____ Date _____ of _____

P8A → 5049

Area : 0.23 mi^2 U.S. Elev: 1570

Area Rock : _____ mi^2 CN: _____ d.S. Elev: 1430

Hydraulic Length: 7500 FT. slope : 0.0187 ft/ft

Land Use

% Total Area	Jurisdiction	Zoning	Development Status	Dwelling Density	Percent Impervious	CN
5		CEMETERY	LAWN			74
95		UNDEVELOPED				80

weighted CN = 80

Calculate Lag

$$Lag = L^{0.8}\left(\frac{1000}{CN} - 9\right)^{0.7} / 1900(S)^{\frac{1}{2}} = ____^{0.8}\left(\frac{1000}{80} - 9\right)^{0.7} / 1900(1.87)$$

$$= 1.16 \text{ hrs}$$

Adjusted Lag = 0.94(1.16) = 1.09 hrs

L_F 0.51 (0.66)

1027
1580

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Job
Description HYDROLOGY COMPUTATIONS SHEET
Freeway Conditions
Calculated by M.C. Date Sheet No.
Checked by Date of

P8 5050

Area : 1.30 mi^2 U.S. Elev: 1515

Area Rock : mi^2 CN: d.s. Elev: 1424

Hydraulic Length: 13,500 FT. slope : 0.0067 ft/ft

Land Use

% Total Area	Jurisdiction	Zoning	Development Status	Dwelling Density	Percent Impervious	CN
11	COP	RH6	DEV			86
5	COD	A1	DEV			88
12	PAVED	AIRPORT	AREA			98
72	UNDEVELOPED					80

weighted CN = 83

Calculate Lag

$$Lag = L^{0.8}\left(\frac{1000}{CN} - 9\right)^{0.7} / 1900(S)^{\frac{1}{2}} = 13{,}500^{0.8}\left(\frac{1000}{83} - 9\right)^{0.7} / 1900(0.67)^{\frac{1}{2}}$$

$$= 2.81 \text{ hrs}$$

Adjusted Lag = 0.89(2.81) = 2.5

0.96(2.5) = 2.4 hrs

L_F 2.~~89~~ 37 (0.66) = ~~1.94~~ 1.56

P9A → 5051

Area: 0.46 mi^2 U.S. Elev: 1580

Area Rock: mi^2 CN: d.s. Elev: 1410

Hydraulic Length: 12,200 FT. slope: 0.0139 ft/ft

Land Use

% Total Area	Jurisdiction	Zoning	Development Status	Dwelling Density	Percent Impervious	CN
45	COP	R1-6	DEV			86
12	PAVED	AIRPORT				98
3	COP	A-1	DEV			68
40			UNDEV			80

weighted CN = 85

Calculate Lag

$$Lag = L^{0.8}\left(\frac{1000}{CN} - 9\right)^{0.7} / 1900(S)^{\frac{1}{2}} = 12{,}200^{0.8}\left(\frac{1000}{85} - 9\right)^{0.7} / 1900(.139)$$

$$= 1.69 \text{ hrs}$$

Adjusted Lag = 0.8(1.69) = 1.35

0.93 (1.35) = 1.26 hrs

L_F = 0.66 (1.51) = 1

P9 → 5053

Area: 2.26 mi^2 U.S. Elev: 1515

Area Rock: mi^2 CN: d.s. Elev: 1400

Hydraulic Length: 16,000 FT. slope: 0.0072 ft/ft

Land Use:

% Total Area	Jurisdiction	Zoning	Development Status	Dwelling Density	Percent Impervious	CN
11	COP	RI-6 and Comm	DEV	D		87
9	COP	A-1	DEV			88
5	PAVED	AIRPORT				88
75	UNDEVELOPED					80

weighted CN = 82

Calculate Lag

$$Lag = L^{0.8}\left(\frac{1000}{CN} - 9\right)^{0.7} / 1900(S)^{\frac{1}{2}} = \frac{16000}{3.22}^{0.8}\left(\frac{1000}{82} - 9\right)^{0.7} / 1900(0.072)$$

$$= \cancel{2.30} \text{ hrs}$$

Adjusted Lag = 0.92 (2.3) = 2.12

0.93 (2.12) = 1.97 hrs

L_p = 0.66 (2.61)

Greiner Engineering

Greiner Engineering Sciences, Inc.
Tucson 602 327-3413
Phoenix 602 275-5400

Job: [illegible]
Description: HYDROLOGIC SUMMARY SHEET
Freeway Conditions
Calculated by: M.C. Date: Sheet No.:
Checked by: Date: of:

PIOA 5054

Area: 0.18 mi^2 U.S. Elev: 1425

Area Rock: mi^2 CN: d.s. Elev: 1396

Hydraulic Length: 5300 FT. slope: 0.0055 ft/ft

Land Use

% Total Area	Jurisdiction	Zoning	Development Status	Dwelling Density	Percent Impervious	CN
10	COP	IND PK	DEV			88
90	Graded	Desert or Abandoned		Ag		83

weighted CN = 84

Calculate Lag

$$Lag = L^{0.8}\left(\frac{1000}{CN} - 9\right)^{0.7} / 1900(S)^{\frac{1}{2}} = 5300^{0.8}\left(\frac{1000}{84} - 9\right)^{0.7} / 1900(0.55)$$

$$= 1.45 \text{ hrs}$$

Adjusted Lag = 0.98(1.45) = 1.42

0.75 (1.42) = 1.07 hrs

Greiner Engineering

Greiner Engineering Sciences, Inc.
Tucson 602 327-3413
Phoenix 602 275-5400

Job: [illegible]
Description: HYDROLOGIC SUMMARY SHEET
Freeway Conditions
Calculated by: M.C. Date: Sheet No.:
Checked by: Date: of:

P10-5055

Area: 0.20 mi² U.S. Elev: 1425

Area Rock: mi² CN: d.s. Elev: 1392

Hydraulic Length: 5600 FT. slope: 0.0059 ft/ft

Land Use

% Total Area	Jurisdiction	Zoning	Development Status	Dwelling Density	Percent Impervious	CN
63		heavy	urban			87
20		C-3	DEV			88
17		Graded ~~[illegible]~~	or Abandoned Ag			83

weighted CN = 87

Calculate Lag

$$Lag = L^{0.8}\left(\frac{1000}{CN} - 9\right)^{0.7} / 1900(S)^{\frac{1}{2}} = 5600^{0.8}\left(\frac{1000}{87} - 9\right)^{0.7} / 1900(0.59)$$

$$= 1.32 \text{ hrs}$$

Adjusted Lag = 0.77(1.32) = 1.02 hrs

0.78(1.02) = 0.83 hrs

Greiner Engineering
Greiner Engin[redacted]
Sciences, Inc.
Tucson 602 327-3413
Phoenix 602 275-5400

Job: OUTER LOOP DRAINAGE STUDY
Description: 9/3 [redacted] B
Calculated by: LPN Date: Sheet No.:
Checked by: Date: of:

5052 ?

AREA:
TOTAL: 0.39 SQ MI.
ROCK: 0.07

FLOWLINE: 4900 FT

PEAK ELEV: 1780
OUTFALL ELEV: 1520

FLOWLINE SLOPE: 0.0531 1/1

ZONING/DEVELOPMENT:

100% MC RURAL-43 UNDEV 1.0 UT/AC

Land	sq. mi.	CN	Product
Undeveloped area	0.32	80	25.60
Rock (QTb)	0.07	98	6.86
	0.39		32.46

Average Weighted CN = 32.46/0.39 = 83.23 Use 83 #

ave. vel. = 2.3 fps

PROJECT: E123061 Bell Rd. Projects Drainage Study
Alternate No. 1 for Drainage Area 5

DESIGNER: BGB

DATE: 11-07-86

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 19th Ave. between Bell Rd. and Cave Creek

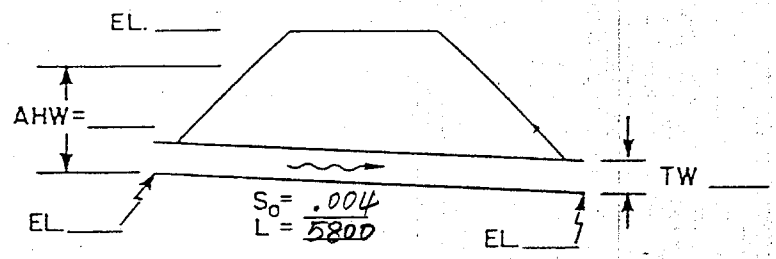
Q_1 = 2100 TW_1 = 6.00'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



11.60 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
6-8'x6' RCB	350	8'x6'	1.10	6.60	0.5	2.05/2.78			6.00	6.00	2.20	6.58	6.60			Use Chart 1 Scale 2 for inlets control.

SUMMARY & RECOMMENDATIONS: Use 6-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1

DESIGNER: BGB

DATE: 11-05-86

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 19th Ave between Grovers Ave. and Bell Rd.

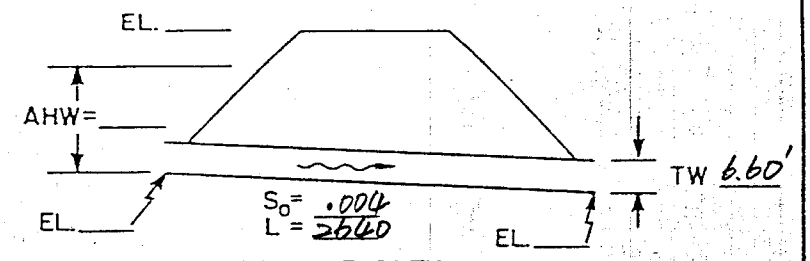
Q_1 = 1500 cfs TW_1 = _____

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



5.28

MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
5-8'x6' RCB	300	8'x6'	1.00	6.00	0.5	1.56 / 8.24			6.60	6.00	10.56	4.28	6.00			
5-7'x6' RCB	300	7'x6'	1.11	6.66	0.5	2.00 / 10.56			6.60	6.60	10.56	6.60	6.66			
4-8'x6' RCB	375	8'x6'	1.16	6.96	0.5	2.42 / 12.78			6.60	6.60	10.56	8.82	8.82			

SUMMARY & RECOMMENDATIONS: Use 5-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1

DESIGNER: BGS

DATE: 11-05-86

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 19th Ave. between Union Hills Dr. and Grovers Ave.

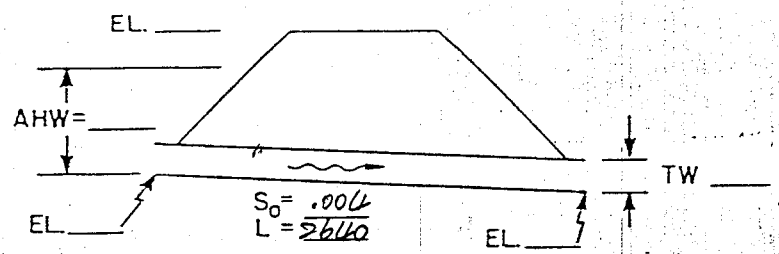
Q_1 = 1120 cfs TW_1 = ~~6.60 ft~~ 6.00

Q_2 = 1120 cfs TW_2 = 8.82 ft

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



MEAN STREAM VELOCITY = _____

5.28 MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h_o−LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
4-6'x6' RCB	280	6'x6'	1.17	7.02	0.5	2.55/13.46			6.60	6.60	10.56	9.50				
									8.82	8.82	10.56	11.72				NG
3-8'x6' RCB	373	8'x6'	1.18	7.08	0.5	2.48/13.09			6.00 ~~6.60~~	6.00 ~~6.60~~	10.56	8.53 ~~9.13~~	~~9.13~~			(Revised 11/7/86)
						13.09			8.82	8.82	10.56	11.35				NG
4-7'x6' RCB	280	7'x6'	1.06	6.36	0.5	1.75/9.24			6.60	6.60	10.56	5.28				
									8.82	8.82	10.56	7.50				

SUMMARY & RECOMMENDATIONS: Use 3-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study

DESIGNER: BGB

DATE: 11-05-86

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 19th Ave between Utopia Rd. and Union Hills Dr.

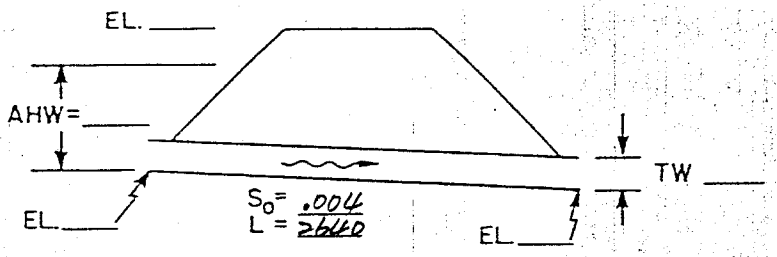
Q_1 = 585 cfs TW_1 = 9.13'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}; Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
3-6'x6' RCB	195	6'x6'	.91	5.46	0.5	1.28 / 6.75			9.13	9.13	10.56	5.33				
2-8'x6' RCB	>93	8'x6'	0.98	5.88	0.5	1.50 / 7.92			8.53 ~~9.13~~	8.53 ~~9.13~~	10.56	5.89				(Revised 11/07/86)
2-7'x6' RCB	>93	7'x6'	1.10	6.60	0.5	1.90 / 10.03			9.13	9.13	10.56	8.60	8.6			

SUMMARY & RECOMMENDATIONS: Use 2-8'x6' RCB (Revised 11-07-86)

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1

DESIGNER: BGS

DATE: 11-05-86

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Utopia Rd. between 15th Ave. and 19th Ave.

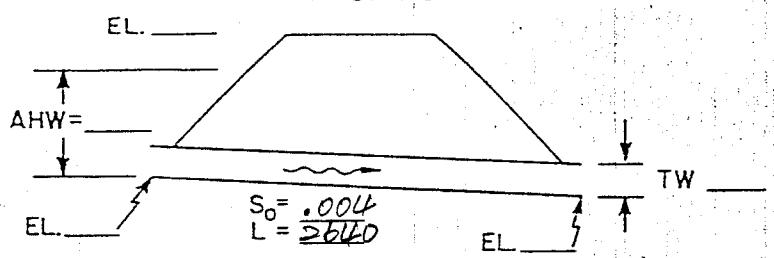
Q_1 = 500 cfs TW_1 = 8.60'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



MEAN STREAM VELOCITY = _____

5.28 MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
2-6'x6' RCB	250	6'x6'	1.10	6.60	0.5	2.10 / 11.09			5.89 / ~~8.60~~	5.89 / ~~8.60~~	10.56	6.42 / ~~9.13~~	6.60 / ~~9.13~~			(Revised 11/07/86)

SUMMARY & RECOMMENDATIONS: Use 2-6'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1

DESIGNER: BGR

DATE: 11-05-86

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. between 15th Ave. and 19th Ave.

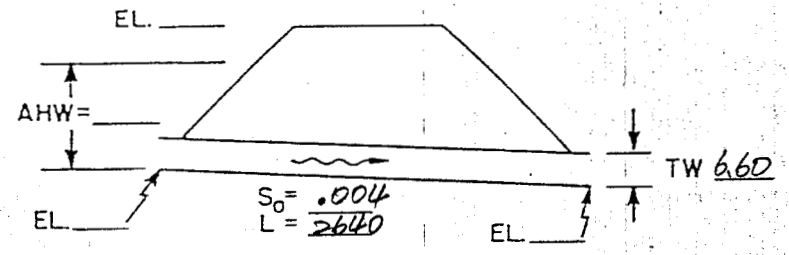
Q_1 = 480 cfs TW_1 = 6.60

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
2-8'x4' RCB	240	8'x4'	1.32	5.28	0.5	2.45 / 12.94			6.60	6.60	10.56	8.98				

SUMMARY & RECOMMENDATIONS: Use 2-8'x4' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1

DESIGNER: BGR

DATE: 11-05-86

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Union Hills Dr. between 15th Ave. and 19th Ave.

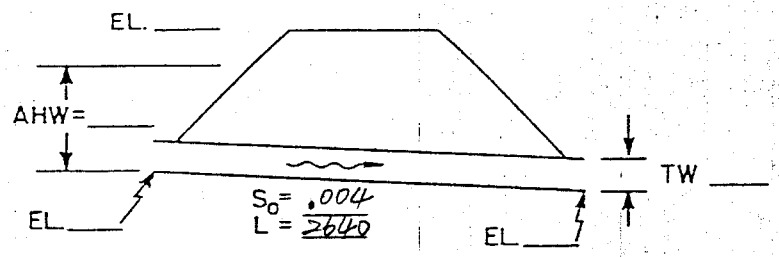
Q_1 = 430 cfs TW_1 = 9.13 ✓

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



5.28 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
2-6'x6' RCB	215	6'x6'	0.98	5.88	0.5	1.55/8.18			9.13	9.13	10.56	6.75				
2-6'x5' RCB	215	6'x5'	1.18	5.90	0.5	2.80/14.78			9.13	9.13	10.56	13.35				NG
2-8'x4' RCB	215	8'x4'	1.22	4.88	0.5	2.00/10.56			9.13	9.13	10.56	9.13				

SUMMARY & RECOMMENDATIONS: Use 2-8'x4' RCB

Figure 7

PROJECT: E123061 Bell Rd. Projects Drainage Study
Alternate No. 1 & 2 for Drainage Area 5

DESIGNER: BGB

DATE: 11/12/86

HYDROLOGIC AND CHANNEL INFORMATION

Structure along N/E quartern of I-17 Bell Rd. Intersection

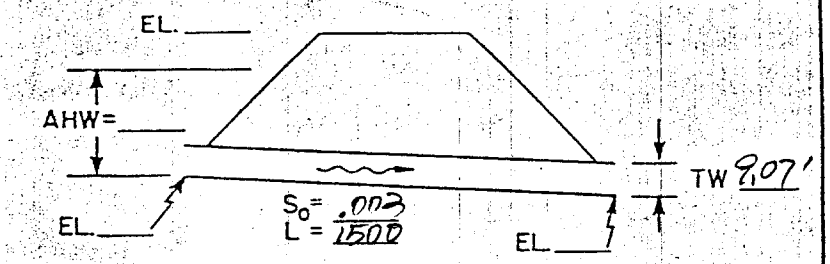
Q_1 = 500 cfs TW_1 = 9.07'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



3.00 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
2-8'x5' RCB	250	8'x5'	1.08	5.40	0.5	1.60/480			9.07	9.07	4.50	9.37	9.37			

SUMMARY & RECOMMENDATIONS: Use 2-8'x5' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 1 & 2 for Drainage Area 5

DESIGNER: BGS

DATE: 11/12/86

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. from 21st Ave. to 24th Ave.

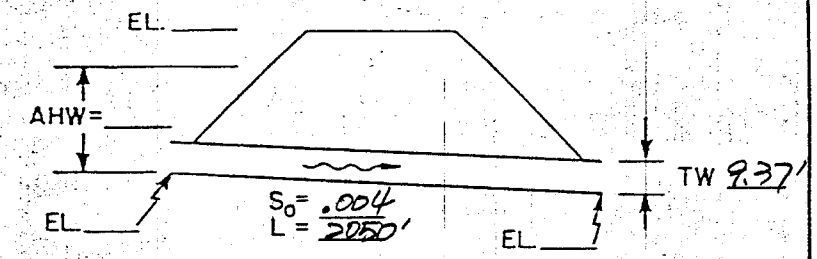
Q_1 = 380 cfs TW_1 = 9.37

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



MEAN STREAM VELOCITY = _____

4.10 MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-10'x5' RCB	380	10'x5'	1.25	6.25	0.5	>10/8.61			9.37	9.37	8.20	9.78	9.78			

SUMMARY & RECOMMENDATIONS: Use 1-10'x5' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alt. No. 1 & 2 for Drainage Area 4

DESIGNER: BSB

DATE: 11/14/86

HYDROLOGIC AND CHANNEL INFORMATION

Pipe on Bell Rd. from 19th Ave. to 21st Ave.

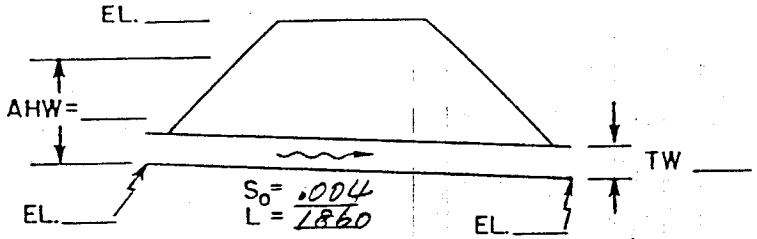
Q_1 = 14 cfs TW_1 = 9.78

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



3.72 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
24" RCP	14	2'	1.08	2.16	0.2	1.97/1.33			9.78	9.78	7.44	9.67	9.67			

SUMMARY & RECOMMENDATIONS: Use 24" RCP

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 2 for Drainage Area 5

DESIGNER: BGN

DATE: 11-07-86

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 19th Ave. between Bell Rd. and Cave Creek

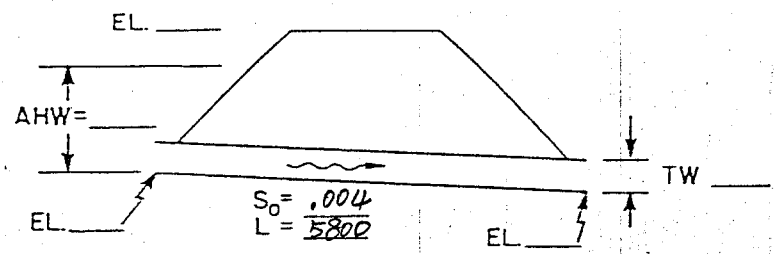
Q_1 = >110 cfs TW_1 = 6.00'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



11.60 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
6-8'x6' RCB	352	8'x6'	1.12	6.72	0.5	2.12/54.58			6.00	6.00	23.20	7.38	7.38			Use chart 1 scale 2 for inlet control

SUMMARY & RECOMMENDATIONS: Use 6-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 2

DESIGNER: BGR

DATE: 11-04-86

HYDROLOGIC AND CHANNEL INFORMATION

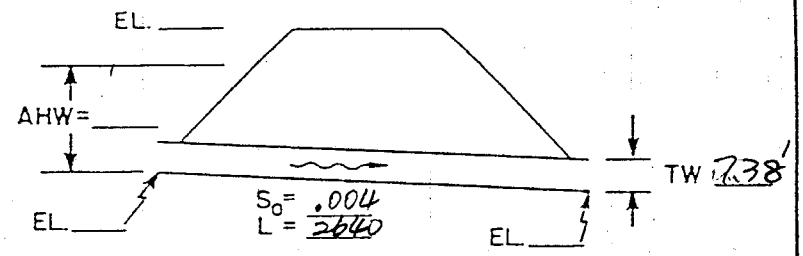
Structure on 19th Ave between Grovers Ave. and Bell Rd.

Q_1 = 1010 cfs TW_1 = 7.38'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



5.28

MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
3-8'x6' RCB	337	8'x6'	1.10	6.60	0.5	1.97/10.14			7.38	7.38	10.56	6.96	6.96			Use scale 2 for inlet control
3-7'x6' RCB	337	7'x6'	1.22	7.32	0.5	2.23/11.77			7.38	7.38	10.56	8.59	8.59			

SUMMARY & RECOMMENDATIONS: Use 3-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 2

DESIGNER: BGR

DATE: 11-04-86

HYDROLOGIC AND CHANNEL INFORMATION

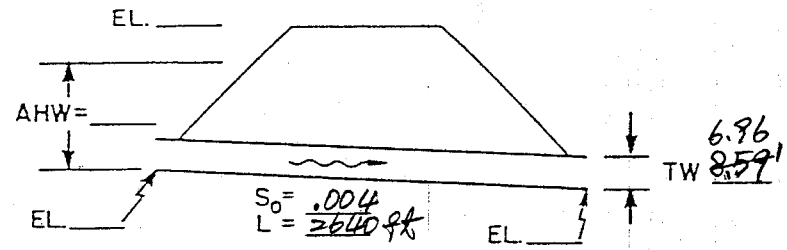
Structure on 19th Ave. between Union Hills Dr. and Grovers Ave.

Q_1 = 620 cfs TW_1 = 8.59'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

5>8

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
2-7'x6' RCB	310	7'x6'	1.12	6.72	0.5	2.17 / 11.19			6.96 / ~~8.59~~	6.96 / 8.59	10.56	9.22	9.22			
2-6'x6' RCB	310	6'x6'	1.28	7.68	0.5	3.18 / 16.79			8.59	8.59	10.56	14.82	14.82			NG
2-8'x5' RCB	310	8'x5'	1.26	6.30	0.5	2.45 / 12.94			6.96 / ~~8.59~~	6.96 / ~~8.59~~	10.56	9.34 / ~~10.97~~	9.34 / ~~10.97~~			(Revised
2-8'x6' RCB	310	8'x6'	1.05	6.30	0.5	1.68 / 8.87			6.96	6.96	10.56	5.27	6.30			11-07-86)

SUMMARY & RECOMMENDATIONS: Use 2-8'x5' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 2

DESIGNER: BGS

DATE: 11-04-86

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 19th Ave. between Utopia Rd. and Union Hills Dr.

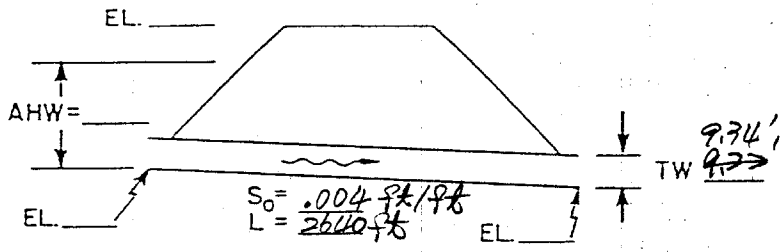
Q_1 = 370 cfs TW_1 = ~~9.22~~ 9.34'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h_o−LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
2-6'x6' RCB	185	6'x6'	.88	5.28	0.5	1.13/5.97			9.22	9.22	10.56	4.63	5.28			
1-8'x6' RCB	370	8'x6'	1.16	6.96	0.5	2.18/11.51			9.22	9.22	10.56	10.17	10.17			NG
1-7'x6' RCB	370	7'x6'	1.28	7.68	0.5	3.00/15.84			9.22	9.22	10.56	14.50	14.50			NG
1-10'x6' RCB	370	10'x6'	1.02	6.12	0.5	1.40/7.39			9.22	9.22	10.56	6.05	6.05	-		
1-10'x5' RCB	370	10'x5'	1.20	7.20	0.5	1.9/10.03			~~9.22~~ 9.34	~~9.22~~ 9.34	10.56	~~8.07~~ 8.81	~~8.07~~ 8.81			(Revised 11/07/86)

SUMMARY & RECOMMENDATIONS: Use 1-10'X5' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 2

DESIGNER: BGR

DATE: 11-04-86

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Bell Rd. between 15th Ave. and 19th Ave.

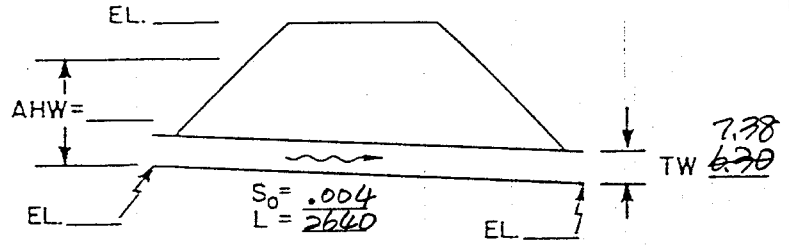
Q_1 = 970 cfs TW_1 = 7.38

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



5.28 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
3-7'x6' RCB	323	7'x6'	1.17	7.02	0.5	2.15/11.35			7.38	7.38	10.56	8.17				
3-8'x6' RCB	323	8'x6'	1.06	6.36	0.5	1.88/9.66			7.38	7.38	10.56	6.48				Revised 11/10/86

SUMMARY & RECOMMENDATIONS: Use 3-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 2

DESIGNER: BGB

DATE: 11-04-86

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 15th Ave. between Grovers Ave. and Bell Rd.

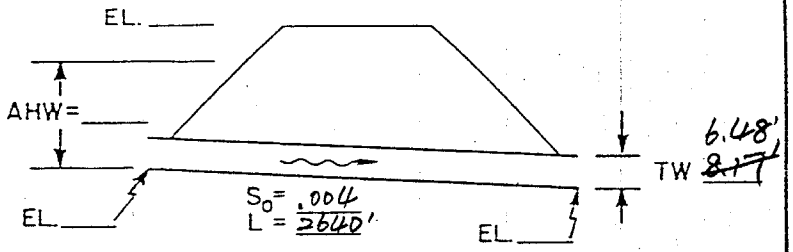
Q_1 = 710 cfs TW_1 = ~~8.17'~~ 6.48'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



5.28

MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
												$HW=H+h_o-LS_o$				
~~2-7'x6' RCB~~	~~355~~	~~7'x6'~~	~~1.26~~	~~7.56~~	~~0.5~~	~~2.8 / 14.78~~			~~7.36~~	~~7.36~~	~~10.56~~	~~11.78~~	~~11.78~~			~~NG~~
2-8'x6' RCB	355	8'x6'	1.12	6.72	0.5	2.13 / 11.25			~~8.77~~ 6.48	~~8.17~~ 6.48	10.56	~~8.86~~ 7.17	~~8.86~~ 7.17			Revised 11/10/86

SUMMARY & RECOMMENDATIONS: Use 2 - 8'x6' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 2

DESIGNER: BGB

DATE: 11-04-86

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 15th Ave. between Union Hills Dr. and Grovers Ave.

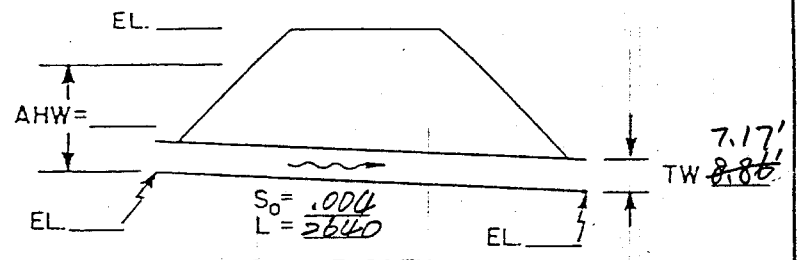
Q_1 = 620 cfs TW_1 = ~~8.86~~ 7.17'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
2-7'x6' RCB	310	7'x6'	1.12	6.72	0.5	2.12 / 11.19			7.17 ~~8.86~~	7.17 ~~8.86~~	10.56	7.80 ~~9.49~~	7.80 9.49			Revised
2-8'x5' RCB	310	8'x5'	1.25	6.25	0.5	2.42 / 12.78			7.17	7.13	10.56	9.39	9.39			11/10/86

SUMMARY & RECOMMENDATIONS: Use 2-8'x5' RCB

Figure 7

PROJECT: E123061 Bell Rd. Project Drainage Study
Alternate No. 2

DESIGNER: BGS

DATE: 11-04-86

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 15th Ave. between Utopia Rd. and Union Hills Dr.

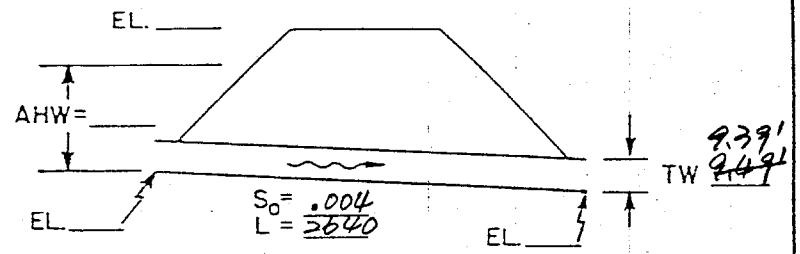
Q_1 = 240 cfs TW_1 = 9.39' ~~9.49'~~

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



5.28

MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-7'x6' RCB	240	7'x6'	0.95	5.70	0.5	1.28 / 6.76			9.39 ~~9.49~~	9.39 ~~9.49~~	10.56	5.59 ~~5.69~~	5.70			
1-6'x6' RCB	240	6'x6'	1.05	6.30	0.5	1.90 / 10.03			9.39 ~~9.49~~	9.39 ~~9.49~~	10.56	8.86 ~~8.96~~	8.86 ~~8.96~~			
1-6'x5' RCB	240	6'x5'	1.28	6.40	0.5	3.47 / 18.06			9.39 ~~9.49~~	9.39 ~~9.49~~	10.56	16.89 ~~16.99~~	16.89 ~~16.99~~			NG
1-8'x4' RCB	240	8'x4'	1.32	5.28	0.5	2.45 / 12.94			9.39 ~~9.49~~	9.39 ~~9.49~~	10.56	11.77 ~~11.87~~	11.77 ~~11.87~~			NG
1-7'x5' RCB	240	7'x5'	1.14	5.70	0.5	2.00 / 10.56			9.39 ~~9.49~~	9.39 ~~9.49~~	10.56	9.39 ~~9.49~~	9.39 ~~9.49~~			
1-8'x5' RCB	240	8'x5'	1.04	5.20	0.5	1.46 / 7.70			9.39	9.39	10.56	6.54	6.54			

Revised 11/10/86

SUMMARY & RECOMMENDATIONS: Use 1-8'x5' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 for D.A. 5 for Q_{10}

DESIGNER: BGS K.H. 12/9/86

DATE: 11-25-86

Sheet No. 1/8

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 19th Ave. from Bell Rd. to Cave Creek

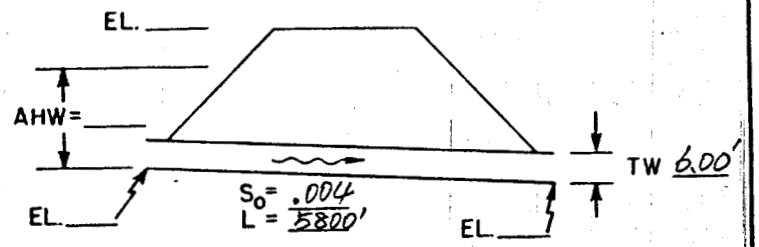
Q_1 = 970 cfs TW_1 = 6.00'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



11.60

MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT.		OUTLET CONTROL HW=H + h_o - LS_o								CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			HW/D	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				
3-8'x6' RCB	323	8'x6'	1.07	6.42	0.5	1.8/50.88			6.00	6.00	29.20	3.68	6.42			

SUMMARY & RECOMMENDATIONS: Use 3-8'x6' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 for D.A. 5 for Q_{10}

DESIGNER: BGS K.H 12/9/86

DATE: 11-25-86

Sheet No. 2/8

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 19th Ave. from Grovers Ave. to Bell Rd.

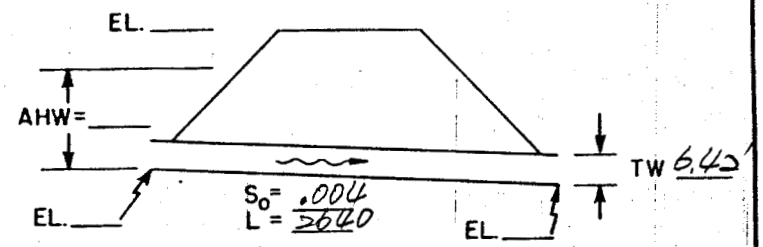
Q_1 = 750 cfs TW_1 = 6.42'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



MEAN STREAM VELOCITY = _____

5.28 MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
2-10'x6' RCB	375	10'x6'	1.00	6.00	0.5	1.45 / 2.66			6.42	6.42	10.56	7.52	6.00			
2-8'x6' RCB	375	8'x6'	1.15	6.90	0.5	2.75 / 11.88			6.42	6.42	10.56	7.74	7.74			

SUMMARY & RECOMMENDATIONS: Use 2-8'x 6' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 for D.A. 5 for Q_{10}

DESIGNER: BGB

DATE: 11-25-86 R.11 12/9/86

Sheet No. 3/8

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 19th Ave. from Union Hills Dr. to Grovers Ave.

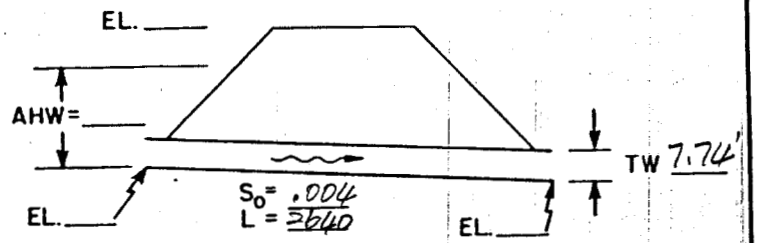
Q_1 = 570 CFS TW_1 = 7.74'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



5.28 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o - LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
2-6'x6' RCB	285	6'x6'	1.15	6.90	0.5	2.7 / 14.26			7.74	7.74	10.56	11.44	11.44			NG
2-8'x5' RCB	285	8'x5'	1.17	5.85	0.5	2.1 / 11.09			7.74	7.74	10.56	8.57	8.57			

SUMMARY & RECOMMENDATIONS: Use 2-8'x5' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 for D.A. 5 for Q_{10}

DESIGNER: BGB R.H 12/9/86

DATE: 11-26-85

Sheet No. 4/8

HYDROLOGIC AND CHANNEL INFORMATION

Structure on 19th Ave. from Utopia Rd. to Union Hills Dr.

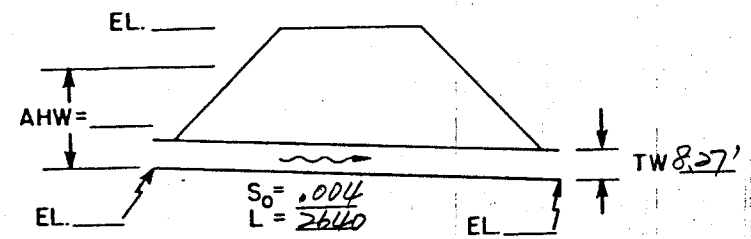
Q_1 = 280 TW_1 = 8.27'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



5.28 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H + h_o − LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-90" RCP	280	90"	.83	6.23	0.2	1.25/6.60			8.27	8.27	10.56	4.31	6.23			
1-84" RCP	280	84"	.92	6.44	0.2	1.75/9.24			8.27	8.27	10.56	6.95	6.95			
1-8'x5' RCB	280	8'x5'	1.17	5.85	0.2	2.00/10.56			8.27	8.27	10.56	8.27	8.27			

SUMMARY & RECOMMENDATIONS: Use 1-8'x5' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study

DESIGNER: BGR

DATE: 11-26-85 R.H. 12/9/85

Sheet No. 5/8

HYDROLOGIC AND CHANNEL INFORMATION

Structure on Utopia Rd. from 15th Ave. to 19th Ave.

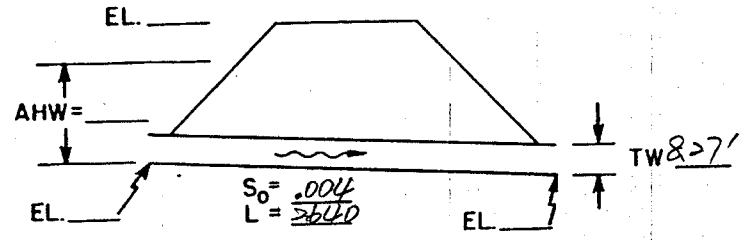
Q_1 = >60 cfs TW_1 = 8.>7'

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



5>8

MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT.		OUTLET CONTROL HW=H + h_o - LS_o								CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				
1-8'x5' RCB	>60	8'x5'	1.10	5.50	0.5	1.75/9.24			8.>7	8.>7	10.56	6.95	6.95			
1-6'x5' RCB	>60	6'x5'	1.37	6.85	0.5	2.5/18.48			8.>7	8.>7	10.56	16.19	16.19			NG

SUMMARY & RECOMMENDATIONS: Use 1-8'x5' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 for D.A. 5 for Q_{10}

DESIGNER: BGS
DATE: 11-26-86 R: 11/12/9/86

Sheet No. 6/8

HYDROLOGIC AND CHANNEL INFORMATION

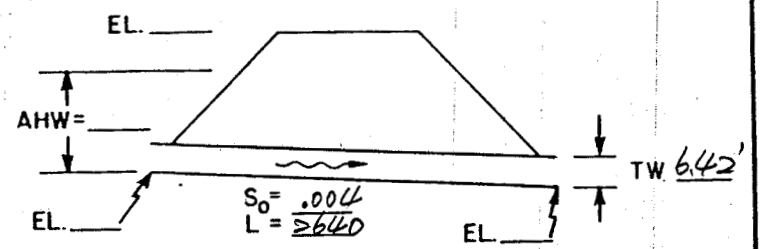
Structure on Bell Rd. from 15th Ave. to 19th Ave.

Q_1 = 170 cfs TW_1 = 6.42'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25} ; Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



5.>8

MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-6'x5' RCB	170	6'x5'	1.12	5.60	0.5	1.45/7.66			6.42	6.42	10.56	7.52	5.60			
1-6'x4' RCB	170	6'x4'	1.90	7.60	0.5	7.5/13.20			6.42	6.42	10.56	9.06	9.06			

SUMMARY & RECOMMENDATIONS: Use 1-6'x4' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 for D.A. 5 for Q_{10}

DESIGNER: BSB R.H 12/9/86

DATE: 11-26-86

Sheet No. 7/8

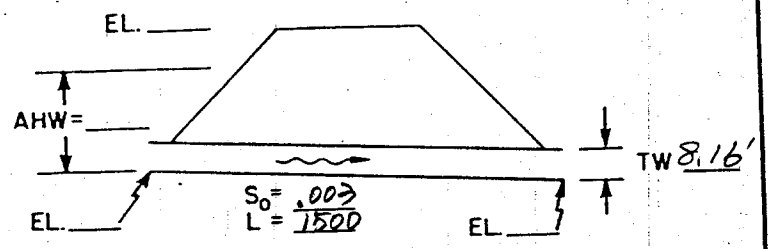
HYDROLOGIC AND CHANNEL INFORMATION
Structure along N/E frontage road at Bell Road Intersection

Q_1 = >50 cfs TW_1 = 8.16'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: _____



MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

≥00

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL HW=H+h_o−LS_o: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-8'x5' RCB	>50	8'x5'	1.08	5.40	0.5	1.6/4.80			8.16	8.16	4.50	8.46	8.46			

SUMMARY & RECOMMENDATIONS: Use 1-8'x5' RCB

Figure 7

PROJECT: E123061 Bell Road Project Drainage Study
Alt. No. 1 for D.A. 5 for Q_{10}

DESIGNER: BGB R.H 12/9/86

DATE: 11-26-86

Sheet No. 8/8

HYDROLOGIC AND CHANNEL INFORMATION

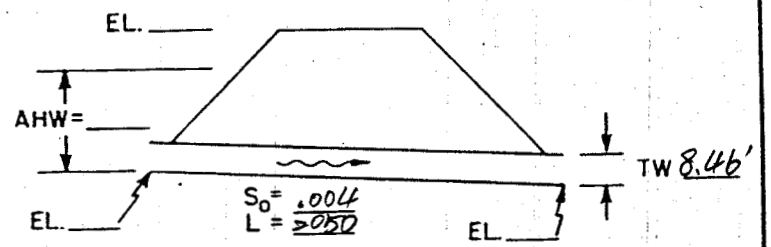
Structure on Bell Rd. from 21st Ave. to 24th Ave.

Q_1 = 190 cfs : TW_1 = 8.46'
Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____



4.1 MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
1-6'x5' RCB	190	6'x5'	1.08	5.40	0.5	1.8/7.28			8.46	8.46	8.20	7.64	7.64			
1-6'x4' RCB	190	6'x4'	1.40	5.60	0.5	3.4/12.71			8.46	8.46	8.20	12.97	12.97			N.G.

SUMMARY & RECOMMENDATIONS: Use 1-6'x5' RCB

Figure 7

Greiner Engineering

Greiner Engineering Sciences, Inc.

Tucson 602 327-3413
Phoenix 602 275-5400

Job: Bell Road Project Drainage Study E123061
Description: Cost Estimate for D.A. 5 for Q_{10}
Calculated by: BGR Date: 12/09/86 Sheet No. 2
Checked by: R.H Date: 12/10/86 of 2

Cost Estimate for Drainage Area 5 for Q_{10}, Alt. No. 1

LOCATION	STRUCTURE	QUANTITY	UNIT COST	TOTAL COST
19th Ave. (Bell Rd. to Cave Creek)	3-8'x6' RCB	5800 ft	$625/ft	$ 3,625,000
19th Ave. (Grovers Ave. to Bell Road)	2-8'x6' RCB	2640 ft	$432/ft	$ 1,140,500
19th Ave. (Union Hills to Grovers Ave.)	2-8'x5' RCB	2640 ft	$409/ft	$ 1,079,800
19th Ave. (Utopia Rd. to Union Hills Dr.)	1-8'x5' RCB	2640 ft	$222/ft	$ 586,100
Utopia Rd. (15th Ave. to 19th Ave.)	1-8'x5' RCB	2640 ft	$222/ft	$ 586,100
Bell Rd. (15th Ave. to 19th Ave.)	1-6'x4' RCB	2640 ft	$166/ft	$ 438,300
Bell Rd. (21st Ave. to 24th Ave.)	1-6'x5' RCB	2050 ft	$180/ft	$ 369,000
Bell Rd. Frontage Road	1-8'x5' RCB	1500 ft	$222/ft	$ 333,000
				$ 8,157,800

City of Phoenix $8,158,000 for Off-Site Drainage

On-Site

① from Cave Creek to 15th Ave.	24" RCP	2040 ft	$39/ft	$ 79,600
② from 19th Ave. to 21st Ave.	24" RCP	1800 ft	$39/ft	$ 70,200
				149,800

City of Phoenix $150,000 for On-Site Drainage

Greiner Engineering

Greiner Engineering Sciences, Inc.
Tucson 602 327-3413
Phoenix 602 275-5400

Q100 Alternate No. 1 for Drainage Area 5

Alternate No. 1 is comprised of two (2) separate systems that convey off-site drainage to the Arizona Canal Diversion Channel (ACDC). The drainage of the area west of 19th Avenue was conveyed west by the proposed box culverts from 21st Avenue ~~and Bell Road~~ along Bell Road and frontage road into the system of Drainage Area 4. The system along 19th Avenue is conveyed the flows east of 19th Avenue into ACDC.

A new box culvert under I-17 HWY with the capacity of 440 cfs just south of future Beardsley interchange was modeled as per PRC Engineering's recommendation. Designs were provided only for drainage structures that would be associated with Bell Road Project.

The off-site drainage system was utilized for conveyance of on-site storm runoff. A 24-inch RCP was adequate for Bell Road on-site drainage between 19th Avenue and 21st Avenue.

The total cost for this alternate is $16,860,000. (Per sht 3 of 3)

Greiner Engineering

Greiner Engineering Sciences, Inc.

Tucson 602 327-3413
Phoenix 602 275-5400

Job: Bell Rd. project Drainage Study
Description: utilities conflicts Q100

Calculated by: R.H Date: 11/13/86 Sheet No. 2 of 3
Checked by: _____ Date: _____

Alt. 1 Area 5

The 5-8x6 RCB North of Bell Rd along 19th Ave. ~~are~~ is in conflict with a 90" S.D. line, a 12" ACP water line, electric and gas lines. Also The 6-8x6' RCB South of Bell on 19th Ave. is ~~are~~ in conflict with a 12" ACP water line, gas + electric lines. Also, along Bell Rd. from 19th Ave. to 15th Ave. possible conflict of 2-8x6' RCB with 12" ACP water and 8" VCP sewer, gas and electric lines.

New 60" wate. on 19th Ave

Greiner Engineering

Greiner Engineering Sciences, Inc.
Tucson 602 327-3413
Phoenix 602 275-5400

Job Bell Rd. Project Drainage Study E123061
Description Prepare Cost Estimate (J0509) for Alternates (D.A. 5)
Calculated by BGR Date 11/07/86 Sheet No. 1 3
Checked by [illegible] Date 1/7/87 of 3 3

Cost Estimate for Drainage Area 5 Q_{100}

Alternate No. 1

Location	Structure	Length (ft)	Unit Cost ($/ft)	Subtotal Cost
19th Ave. (Bell Rd. to Cave Creek)	6-8'x6' RCB	5800	1250	$7,250,000
Bell Rd. (15th Ave. to 19th Ave.)	2-8'x4' RCB	2640	381	$1,005,800
19th Ave. (Grovers Ave to Bell Rd.)	5-8'x6' RCB	2640	1016	$2,682,900
19th Ave. (Union Hills Dr. to Grovers Ave.)	3-8'x6' RCB	2640	625	$1,650,000
Union Hills Dr. (15th Ave. to 19th Ave.)	2-8'x4' RCB	2640	381	$1,005,800
19th Ave. (Utopia Rd. to Union Hills Dr.)	2-8'x6' RCB	2640	432	$1,140,500
Utopia Rd. (15th Ave. to 19th Ave.)	2-6'x6' RCB	2640	326	$860,600
Bell Rd. (21st Ave. to 23rd Ave.)	2-8'x5' RCB	2050	409	$838,500
Bell Rd. Interchange (N/E along Frontage Rd.)	1-10'x5' RCB	1500	284	$426,000
			Total	$16,859,400

Greiner Engineering

Greiner Engineering Sciences, Inc.

Tucson 602 327-3413
Phoenix 602 275-5400

Job: Bell Road Project Drainage Study
Description: Summary of Concept Alternates Drainage Area 5
Calculated by: BGS Date: 11/14/86 Sheet No. 1 of 3
Checked by: _____ Date: _____

Q100 Alternate No. 2 for Drainage Area 5

Alternate No. 2 has the same outfalls as Alternate No. 1 with modification of parallel systems along 15th Avenue and 19th Avenue at north of Bell Road. These systems were combined at the intersection of 19th Avenue and Bell Road.

The total cost of this alternate is $ 16,450,000.
(Per Sht. 3 of 3)

Greiner Engineering

Greiner Engineering Sciences, Inc.
Tucson 602 327-3413
Phoenix 602 275-5400

Job Bell Rd. project Drainage Study
Description Utilities conflict Q100

Calculated by R.H Date 11/13/86 Sheet No. 2
Checked by _____ Date _____ of 3

Alt. 2 Area 5

In addition to conflicts described in alt. 1, The following conflicts apply to alt. 2; 2-8'x6' RCB from Bell Rd. to the North along 15th Ave. is in conflict with 8" vcp sewer line for a distance of 450', starting from 380' North of The ℄ of Bell Rd.

Greiner Engineering

Greiner Engineering Sciences, Inc.
Tucson 602 327-3413
Phoenix 602 275-5400

Job Bell Rd. Project Drainage Study (E123061)
Description Cost Estimate for Alternates
Drainage Area 5
Calculated by BGS Date 11/07/86 Sheet No. 2 of 3
Checked by _____ Date _____

Cost Estimate for Drainage Area 5 Q100

Alternate No. 2

Location	Structure	Length (ft)	Unit Cost ($/ft)	Total Cost
19th Ave. (Bell Rd. to Cave Creek)	6-8'x6' RCB	5800	1250	$7,250,000
19th Ave. (Grovers Ave. to Bell Rd.)	3-8'x6' RCB	2640	625	$1,650,000
19th Ave. (Union Hills Dr. to Grovers Ave.)	2-8'x5' RCB	2640	409	$1,079,800
19th Ave. (Utopia Rd. to Union Hills Dr.)	1-10'x5' RCB	2640	284	$ 749,800
Bell Rd. (15th Ave. to 19th Ave)	3-8'x6' RCB	2640	625	$1,650,000
15th Ave. (Grovers Ave. to Bell Rd.)	2-8'x6' RCB	2640	432	$1,140,400
15th Ave. (Union Hills Dr. to Grovers Ave.)	2-8'x5' RCB	2640	409	$1,079,800
15th Ave. (Utopia Rd. to Union Hills Dr.)	1-8'x5' RCB	2640	222	$586,100
Bell Rd. (21st Ave. to 23rd	2-8'x5' RCB	2050	409	$ 838,500
Bell Rd. Interchange (N/E along Frontage Rd.)	1-10'x5' RCB	1500	284	$ 426,000
			Total	$ 16,450,400