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OF

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GRANITE REEF WASH

FLOOD DELINEATION STUDY

ESTIMATION OF MANNING'S N VALUE

FCD CONTRACT NO. 95-<sup>29</sup>~~05~~

FEBRUARY 19~~05~~

Revised Nov

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## 4.2 Parameter Estimation

### 4.2.1 Manning's n Value

#### 4.2.1.1 Introduction

The Granite Reef Wash study consists of approximately 2 miles of floodplain to be delineated under this project. The wash was divided into eight reaches of similar hydraulic characteristics and Manning's n values assigned to the reaches based on their typical characteristics. Reach 5 was further subdivided into Reaches 5A and 5B to account for some differences on the right bank. Likewise, Reach 8 was also subdivided into Reaches 8A and 8B. Each reach was identified with four-character identifier. The first three characters represent the name of the wash, and the fourth is the reach number. For example, GRF2 denotes Granite Reef Wash, Reach 2. The reach numbers start with "1" at the downstream end and increases in the upstream direction.

The limits, location of photographs and n values for each reach are shown on Exhibit 1 entitled, "Manning's n Value Map". In calculating the n Value, the following factors were considered:

Bed material particle size

Degree of irregularity of the bank slopes

Effect of obstruction

Degree of meandering

Vegetation

The obstruction of structures was ignored in calculation of n-values because the cross-sections excluded the structures from the flow area.

The density and type of vegetation have significant impact on the roughness coefficient (n value). The vegetation within the floodplain was identified to include the following:

Lawns

Desert landscaping

#### 4.2.1.2 Methodology

Each reach was identified with the aid of 1" = 100' aerial photographs. The discerning characteristics were channel size, vegetation density, bed materials and development encroachment. Each reach was photographed during the field reconnaissance at a representative and accessible location. The photography locations are summarized on Exhibit 1.

Manning's roughness coefficients were determined in accordance with the methodology described in *Estimated Manning's Roughness Coefficient for Streams Channels and Floodplains in Maricopa County, Arizona* (USGS, Water Resources Division, April 1991). The method described in this publication selects a base value for the roughness coefficient based exclusively on bed material. This base value is then adjusted to account for vegetation, irregularities, obstructions and cross-section variations. In addition, a multiplier can be applied to the adjusted n-value if meandering of the reach is significant.

The base roughness coefficient in this study was selected based on the average particle size observed in the field. The typical bed materials in the study area range from smooth concrete to coarse gravel, and typical values of the roughness coefficients range from 0.018 for paved streets to 0.035 for riprap lined channels.

#### **4.2.1.3 n Value Determination**

The base values, adjustments and the adjusted values for Manning's roughness coefficient are shown in the following tables.

## DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

**Project:** Granite Reef Flood Plain Delineation  
**Stream:** Granite Reef Reach 1  
**Location:** New improved channel  
**Photo No:**

Channel Conditions		Manning's n Adjustment		Left Overbank (East)	Channel	Right Overbank (West)
Channel Material	Concrete	n,	.012 - .018		0.018	
	Firm Soil		.025 - .032	0.025		
	Coarse Sand		.026 - .035			0.028
	Gravel		.028 - .035			
	Cobble		.030 - .050			
	Boulder		.040 - .070			
Degree of Irregularity	Smooth	n,	0			
	Minor		.001 - .005			
	Moderate		.006 - .010			
	Severe		.011 - .020			
Effects of Obstruction	Negligible	n,	.000 - .004		0.002	0.002
	Minor		.005 - .015			
	Appreciable		.020 - .030			
	Severe		.040 - .060			
Vegetation	Small	n,	.002 - .010	0.003		0.005
	Medium		.010 - .025			
	Large		.025 - .050			
	Very Large		.050 - .100			
Variations in Channel Cross section	Gradual	n,	0			
	Occ. Alt.		.001 - .005			
	Freq. Alt.		.010 - .015			
				0.028	0.02	0.035
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Sever		1.3			
$n = (n_1 + n_2 + n_3 + n_4 + n_5) / m$				0.028	0.02	0.035

## DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDM METHOD

**Project:** Granite Reef Flood Plain Delineation  
**Stream:** Granite Reef Reach 2  
**Location:** Concrete lined channel south of Granite Reef Road  
**Photo No:**

Channel Conditions		Manning's n Adjustment	Left Overbank (East)	Channel	Right Overbank (West)	
Channel Material	Concrete	n,	.012 - .018	0.018		
	Firm Soil		.025 - .032			0.025
	Coarse Sand		.026 - .035			
	Gravel		.028 - .035			
	Cobble		.030 - .050			
	Boulder		.040 - .070			
Degree of Irregularity	Smooth	n,	0			
	Minor		.001 - .005			0.003
	Moderate		.006 - .010			
	Severe		.011 - .020			
Effects of Obstruction	Negligible	n,	.000 - .004	0.001	0.004	
	Minor		.005 - .015			
	Appreciable		.020 - .030			
	Severe		.040 - .060			
Vegetation	Small	n,	.002 - .010			
	Medium		.010 - .025			0.012
	Large		.025 - .050			
	Very Large		.050 - .100			
Variations in Channel Cross section	Gradual	n,	0			
	Occ. Alt.		.001 - .005			
	Freq. Alt.		.010 - .015			
			0.041	0.018	0.029	
Degree of Meandering	Minor	m	1	1	1	
	Appreciable		1.15			
	Sever		1.3			
$n = (n_1 + n_2 + n_3 + n_4 + n_5) / m$			<b>0.041</b>	<b>0.018</b>	<b>0.029</b>	

## DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

**Project:** Granite Reef Flood Plain Delineation  
**Stream:** Granite Reef Reach 3  
**Location:** Granite Reef Road  
**Photo No:**

Channel Conditions		Manning's n Adjustment		Left Overbank (East)	Channel	Right Overbank (West)
Channel Material	Concrete	n,	.012 - .018		0.018	
	Firm Soil		.025 - .032	0.025		
	Coarse Sand		.026 - .035			
	Gravel		.028 - .035			0.030
	Cobble		.030 - .050			
	Boulder		.040 - .070			
Degree of Irregularity	Smooth	n,	0			
	Minor		.001 - .005			0.001
	Moderate		.006 - .010	0.006		
	Severe		.011 - .020			
Effects of Obstruction	Negligible	n,	.000 - .004			0.004
	Minor		.005 - .015	0.015		
	Appreciable		.020 - .030			
	Severe		.040 - .060			
Vegetation	Small	n,	.002 - .010	0.01		0.01
	Medium		.010 - .025			
	Large		.025 - .050			
	Very Large		.050 - .100			
Variations in Channel Cross section	Gradual	n,	0			
	Occ. Alt.		.001 - .005	.001		.001
	Freq. Alt.		.010 - .015			
				0.057	0.018	0.046
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Sever		1.3			
n = (n,+n,+n,+n,+n,)m				0.057	0.018	0.046

## DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

**Project:** Granite Reef Flood Plain Delineation  
**Stream:** Granite Reef Reach 4  
**Location:** 84th Place  
**Photo No:**

Channel Conditions		Manning's n Adjustment	Left Overbank (East)	Channel	Right Overbank (West)		
Channel Material	Concrete	n,	.012 - .018	0.018			
	Firm Soil		.025 - .032			0.025	
	Coarse Sand		.026 - .035				
	Gravel		.028 - .035				
	Cobble		.030 - .050				
	Boulder		.040 - .070				
Degree of Irregularity	Smooth	n,	0				
	Minor		.001 - .005			0.003	
	Moderate		.006 - .010				0.003
	Severe		.011 - .020				
Effects of Obstruction	Negligible	n,	.000 - .004	0.002	0.002		
	Minor		.005 - .015				
	Appreciable		.020 - .030				
	Severe		.040 - .060				
Vegetation	Small	n,	.002 - .010	0.005	0.005		
	Medium		.010 - .025				
	Large		.025 - .050				
	Very Large		.050 - .100				
Variations in Channel Cross section	Gradual	n,	0				
	Occ. Alt.		.001 - .005				
	Freq. Alt.		.010 - .015			0.01	0.01
			0.045	0.018	0.045		
Degree of Meandering	Minor	m	1	1	1		
	Appreciable		1.15				
	Sever		1.3				
$n = (n_1 + n_2 + n_3 + n_4 + n_5) / m$			<b>0.045</b>	<b>0.018</b>	<b>0.045</b>		

## DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

**Project:** Granite Reef Flood Plain Delineation  
**Stream:** Granite Reef Reach 5A  
**Location:** Earthen cahannel between 84th Place and McDowell Road  
**Photo No:**

Channel Conditions		Manning's n Adjustment		Left Overbank (East)	Channel	Right Overbank (West)
Channel Material	Concrete	n,	.012 - .018			
	Firm Soil		.025 - .032			
	Coarse Sand		.026 - .035	0.028	0.028	0.028
	Gravel		.028 - .035			
	Cobble		.030 - .050			
	Boulder		.040 - .070			
Degree of Irregularity	Smooth	n,	0			
	Minor		.001 - .005			
	Moderate		.006 - .010			
	Severe		.011 - .020			
Effects of Obstruction	Negligible	n,	.000 - .004			
	Minor		.005 - .015	0.007		
	Appreciable		.020 - .030			
	Severe		.040 - .060			
Vegetation	Small	n,	.002 - .010	0.006		0.006
	Medium		.010 - .025		0.01	
	Large		.025 - .050			
	Very Large		.050 - .100			
Variations in Channel Cross section	Gradual	n,	0			
	Occ. Alt.		.001 - .005	.002		.002
	Freq. Alt.		.010 - .015			
				0.043	0.038	0.036
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Sever		1.3			
$n = (n_1 + n_2 + n_3 + n_4 + n_5) / m$				0.043	0.038	0.036

## DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

**Project:** Granite Reef Flood Plain Delineation  
**Stream:** Granite Reef Reach 5B  
**Location:** Earthen channel between 84th Place and McDowell Road  
**Photo No:**

Channel Conditions		Manning's n Adjustment		Left Overbank (East)	Channel	Right Overbank (West)
Channel Material	Concrete	n <sub>c</sub>	.012 - .018			
	Firm Soil		.025 - .032			
	Coarse Sand		.026 - .035	0.028	0.028	0.028
	Gravel		.028 - .035			
	Cobble		.030 - .050			
	Boulder		.040 - .070			
Degree of Irregularity	Smooth	n <sub>i</sub>	0			
	Minor		.001 - .005			
	Moderate		.006 - .010			
	Severe		.011 - .020			
Effects of Obstruction	Negligible	n <sub>o</sub>	.000 - .004			
	Minor		.005 - .015			0.015
	Appreciable		.020 - .030			
	Severe		.040 - .060			
Vegetation	Small	n <sub>v</sub>	.002 - .010	0.005		0.005
	Medium		.010 - .025		0.01	
	Large		.025 - .050			
	Very Large		.050 - .100			
Variations in Channel Cross section	Gradual	n <sub>s</sub>	0			
	Occ. Alt.		.001 - .005	.002		.002
	Freq. Alt.		.010 - .015			
				0.035	0.038	0.05
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Sever		1.3			
$n = (n_c + n_i + n_o + n_v + n_s) m$				0.035	0.038	0.05

## DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

**Project:** Granite Reef Flood Plain Delineation  
**Stream:** Granite Reef Reach 6  
**Location:** Upstream from McDowell Road  
**Photo No:**

Channel Conditions		Manning's n Adjustment		Left Overbank (East)	Channel	Right Overbank (West)
Channel Material	Concrete	n,	.012 - .018			
	Firm Soil		.025 - .032	0.028		0.028
	Coarse Sand		.026 - .035			
	Gravel		.028 - .035			
	Cobble		.030 - .050		.045	
	Boulder		.040 - .070			
Degree of Irregularity	Smooth	n,	0			
	Minor		.001 - .005	0.001		0.002
	Moderate		.006 - .010			
	Severe		.011 - .020			
Effects of Obstruction	Negligible	n,	.000 - .004			
	Minor		.005 - .015	0.005		0.007
	Appreciable		.020 - .030			
	Severe		.040 - .060			
Vegetation	Small	n,	.002 - .010	0.002		0.002
	Medium		.010 - .025			
	Large		.025 - .050			
	Very Large		.050 - .100			
Variations in Channel Cross section	Gradual	n,	0			
	Occ. Alt.		.001 - .005	0.001		0.005
	Freq. Alt.		.010 - .015			
				0.037	0.045	0.044
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Sever		1.3			
$n = (n_1 + n_2 + n_3 + n_4 + n_5) / m$				0.037	0.045	0.044

## DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

**Project:** Granite Reef Flood Plain Delineation  
**Stream:** Granite Reef Reach 7  
**Location:** Upstream from 87th Street  
**Photo No:**

Channel Conditions		Manning's n Adjustment		Left Overbank (East)	Channel	Right Overbank (West)
Channel Material	Concrete	n,	.012 - .018			
	Firm Soil		.025 - .032	0.030	0.030	0.030
	Coarse Sand		.026 - .035			
	Gravel		.028 - .035			
	Cobble		.030 - .050			
	Boulder		.040 - .070			
Degree of Irregularity	Smooth	n,	0			
	Minor		.001 - .005			
	Moderate		.006 - .010	0.008		0.008
	Severe		.011 - .020			
Effects of Obstruction	Negligible	n,	.000 - .004	0.002		0.002
	Minor		.005 - .015		0.015	
	Appreciable		.020 - .030			
	Severe		.040 - .060			
Vegetation	Small	n,	.002 - .010			
	Medium		.010 - .025			
	Large		.025 - .050			
	Very Large		.050 - .100			
Variations in Channel Cross section	Gradual	n,	0			
	Occ. Alt.		.001 - .005	0.005		0.005
	Freq. Alt.		.010 - .015			
				0.045	0.045	0.045
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Sever		1.3			
$n = (n_1 + n_2 + n_3 + n_4 + n_5) / m$				0.045	0.045	0.045

## DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

**Project:** Granite Reef Flood Plain Delineation  
**Stream:** Granite Reef Reach 8A  
**Location:** 87th Street  
**Photo No:**

Channel Conditions		Manning's n Adjustment		Left Overbank (East)	Channel	Right Overbank (West)
Channel Material	Concrete	n,	.012 - .018		0.018	
	Firm Soil		.025 - .032	0.028		0.028
	Coarse Sand		.026 - .035			
	Gravel		.028 - .035			
	Cobble		.030 - .050			
	Boulder		.040 - .070			
Degree of Irregularity	Smooth	n,	0			
	Minor		.001 - .005	0.005		0.005
	Moderate		.006 - .010			
	Severe		.011 - .020			
Effects of Obstruction	Negligible	n,	.000 - .004			
	Minor		.005 - .015	0.008		0.008
	Appreciable		.020 - .030			
	Severe		.040 - .060			
Vegetation	Small	n,	.002 - .010			
	Medium		.010 - .025	0.010		0.010
	Large		.025 - .050			
	Very Large		.050 - .100			
Variations in Channel Cross section	Gradual	n,	0			
	Occ. Alt.		.001 - .005	.004		.004
	Freq. Alt.		.010 - .015			
				0.055	0.018	0.055
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Sever		1.3			
$n = (n_1 + n_2 + n_3 + n_4 + n_5) / m$				0.055	0.018	0.055

## DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

**Project:** Granite Reef Flood Plain Delineation  
**Stream:** Granite Reef Reach 8B  
**Location:** 87th Street near Thomas Road  
**Photo No:**

Channel Conditions		Manning's n Adjustment	Left Overbank (East)	Channel	Right Overbank (West)
Channel Material	Concrete	n,	.012 - .018	0.018	
	Firm Soil		.025 - .032	0.028	0.028
	Coarse Sand		.026 - .035		
	Gravel		.028 - .035		
	Cobble		.030 - .050		
	Boulder		.040 - .070		
Degree of Irregularity	Smooth	n,	0		
	Minor		.001 - .005	0.001	0.005
	Moderate		.006 - .010		
	Severe		.011 - .020		
Effects of Obstruction	Negligible	n,	.000 - .004		
	Minor		.005 - .015		0.008
	Appreciable		.020 - .030		
	Severe		.040 - .060		
Vegetation	Small	n,	.002 - .010	0.006	
	Medium		.010 - .025		0.010
	Large		.025 - .050		
	Very Large		.050 - .100		
Variations in Channel Cross section	Gradual	n,	0		
	Occ. Alt.		.001 - .005		.004
	Freq. Alt.		.010 - .015		
			0.035	0.018	0.055
Degree of Meandering	Minor	m	1	1	1
	Appreciable		1.15		
	Sever		1.3		
n = (n,+n,+n,+n,+n,)m			0.035	0.018	0.055

# GRANITE REEF WASH GRW 1



Picture No. 2

Water well at upstream end of reach



Picture No. 1

Upstream from McKellips Road

# GRANITE REEF WASH

## GRW 2



Picture No. 4  
Storm drain outlet



Picture No. 3  
Granite Reef Channel

Picture No. 7  
Granite Reef Road



Picture No. 6  
Detention basin west of  
Granite Reef Road



**GRANITE REEF  
WASH  
GRW 3**

Picture No. 5  
Granite Reef Road



# GRANITE REEF WASH

## GRW 4

Picture No. 8



84TH Place

# GRANITE REEF WASH

## GRW 5A



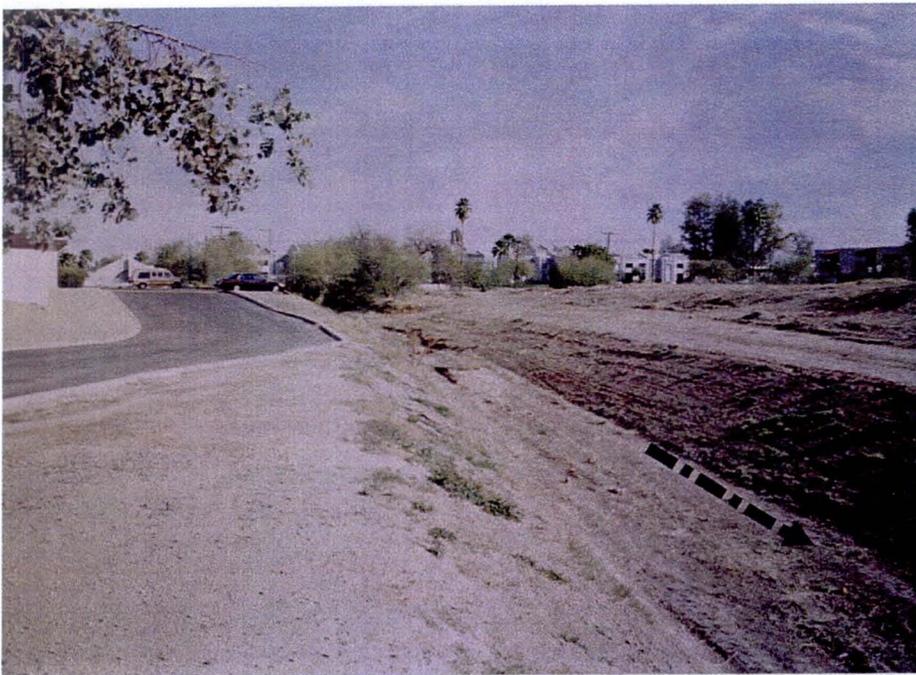
Picture No. 10  
Upstream end



Picture No. 9  
Downstream end



Picture No. 13  
Downstream from  
McDowell Road



# GRANITE REEF WASH GRW 5B

Picture No. 12  
Upstream end



Picture No. 11  
Downstream end

# GRANITE REEF WASH GRW 6



Picture No. 16  
Upstream looking south



Picture No. 15  
Downstream end

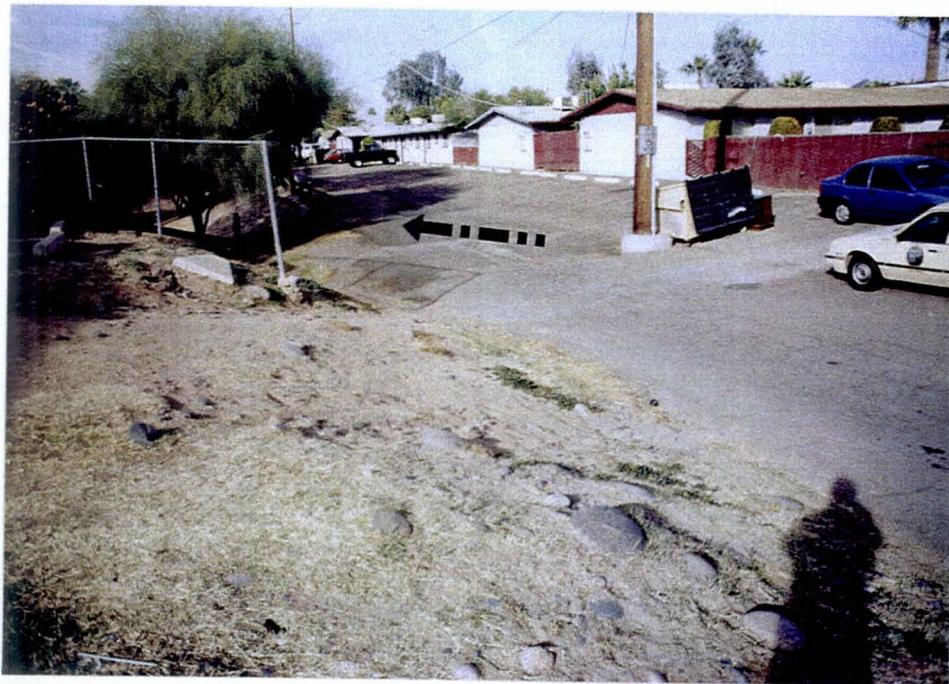
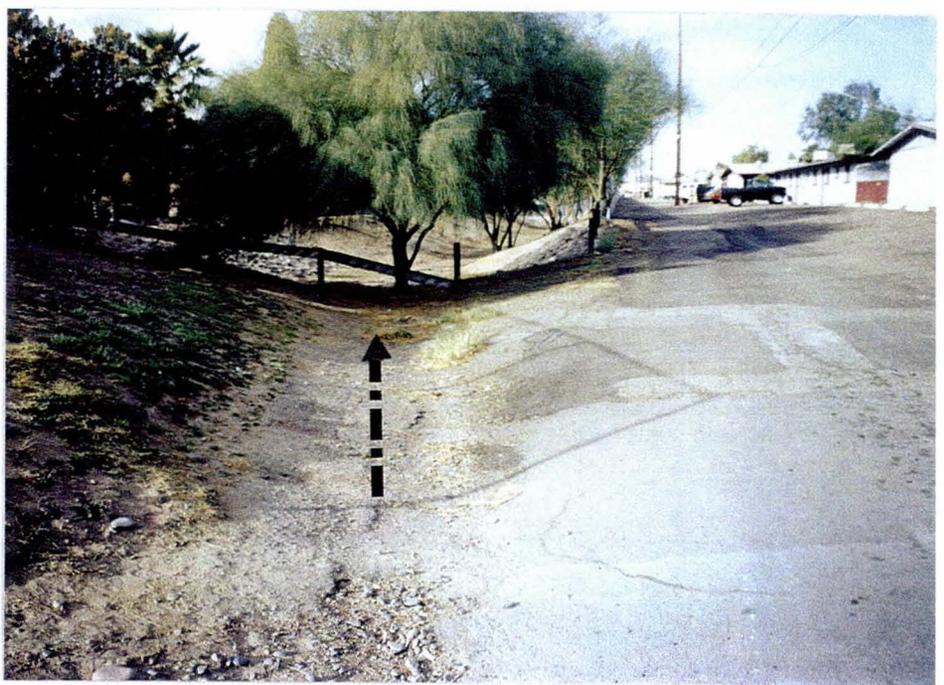


Picture No. 14  
From McDowell Road

GRANITE REEF  
WASH  
GRW 7

Picture No.19

Upstream end of channel



Picture No.18

Upstream end of channel



Picture No.17

Channel looking downstream

# GRANITE



87TH Street

south of Thomas Road

Picture No.25

87TH Street

from Edgemont Avenue looking south

Picture No.24



# REEF



# WASH GRW 8

Picture No.23

87TH Street

south of Earll Drive

# GRANITE

Picture No.22

87TH Street

north of Oak Street



# REEF

Picture No.21

87TH Street

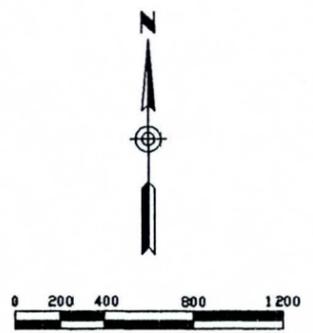
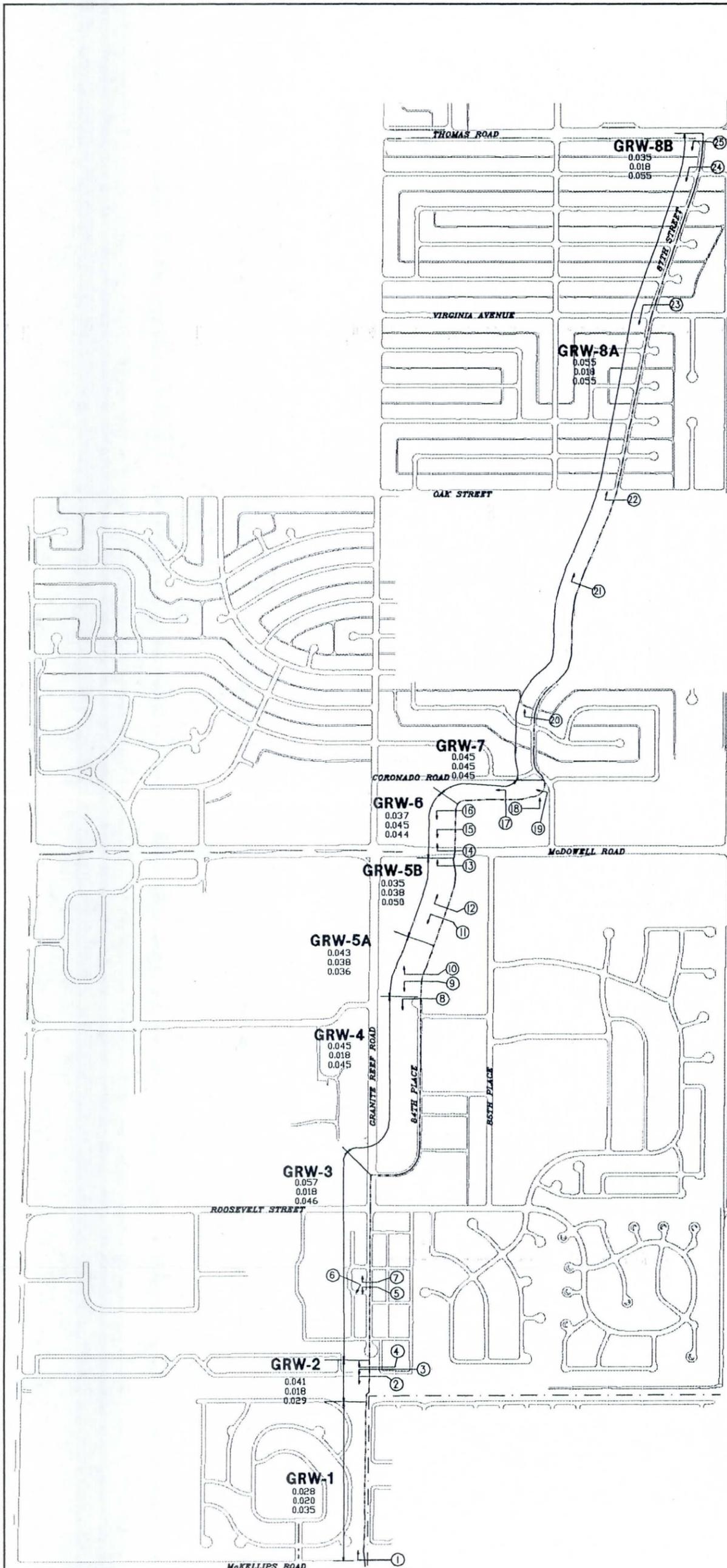
north of Holly Street

# WASH GRW 8

Picture No.20  
87TH Street

North of Coronado Road





**LEGEND**

REACH LABEL	<b>GRW3</b>
LEFT (EAST) OVERBANK n-VALUE	0.057
MAIN CHANNEL n-VALUE	0.018
RIGHT (WEST) OVERBANK n-VALUE	0.046
PHOTO LOCATION AND DIRECTION	⑤ →
HYDRAULIC BASE LINE	— — — — —

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<b>FLOOD CONTROL DISTRICT OF MARICOPA COUNTY</b>			
PROJECT TITLE <b>FLOOD DELINEATION STUDY OF GRANITE REEF WASH F.C.D. CONTRACT NO. 95-05</b>			
DESIGNED BY HAA	DRAWN BY DRP	CHECKED BY SEK	DATE 2/23/96
REVISION 11/14/96			
<b>EXHIBIT 1 MANNING'S n VALUE MAP</b>			

FILE: MANNING.dwg XREF: ROADS.dwg DATE: 11/21/96