Iona Wash Flood Insurance Study

Field Reconnaissance Report

Prepared for

Flood Control District
of
Maricopa County

Prepared by

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Contents

Introduction

This report summarizes the results of field reconnaissance for the Iona Wash Flood Insurance Study (FIS). The purpose of the report is to:

- Document field conditions relevant to floodplain modeling
- Demonstrate the procedures used to estimate Manning's "n" values

This report is the deliverable for Tasks 6.6.1 and 6.6.2 of Flood Control District of Maricopa County (FCDMC) contract number FCD 92-07.

Field Reconnaissance

The Iona Wash study area extends approximately 12 river miles from the confluence with Trilby Wash in T.4N., R3W., Section 25 to State Route 89 (Grand Avenue) in T.6N., R.3W., Section 29 as shown in Figure 1. Iona Wash includes reaches of channelized and distributary flow, as well as portions of unconfined sheet flow.

CH2M HILL project staff conducted field reconnaissance visits to the study area on October 14, 1992 and December 10, 1992. The overall goal of field reconnaissance was to become familiar with the study area prior to floodplain modeling. Specific goals of field reconnaissance were to:

- Observe channel conditions to support Manning's "n" value estimatation
- Obtain photographic documentation of field conditions
- Determine channel bank stations
- Observe potential overflow and breakover areas
- Identify levees and other flood control structures
- Measure bridges and other hydraulic structures

Reach Definition. Within the study area, Iona Wash can be divided into six reaches of distinct geomorphic and hydraulic characteristics (Figure 2). These six reaches are described in Table 1. An additional reach, which conveys breakover flow from Iona Wash to Trilby Wash, will be used for floodplain modeling. The six reaches include three basic channel types: (1) reaches with wide, well-defined channels, and limited riparian vegetation near the banks (reaches 2, 4, and 6), (2) braided reaches with narrow, less well defined channels and extensive riparian zones (reaches 1 and 5), and (3) poorly defined sheet flow areas with minor channel conveyance (reach 3 and the breakover reach).

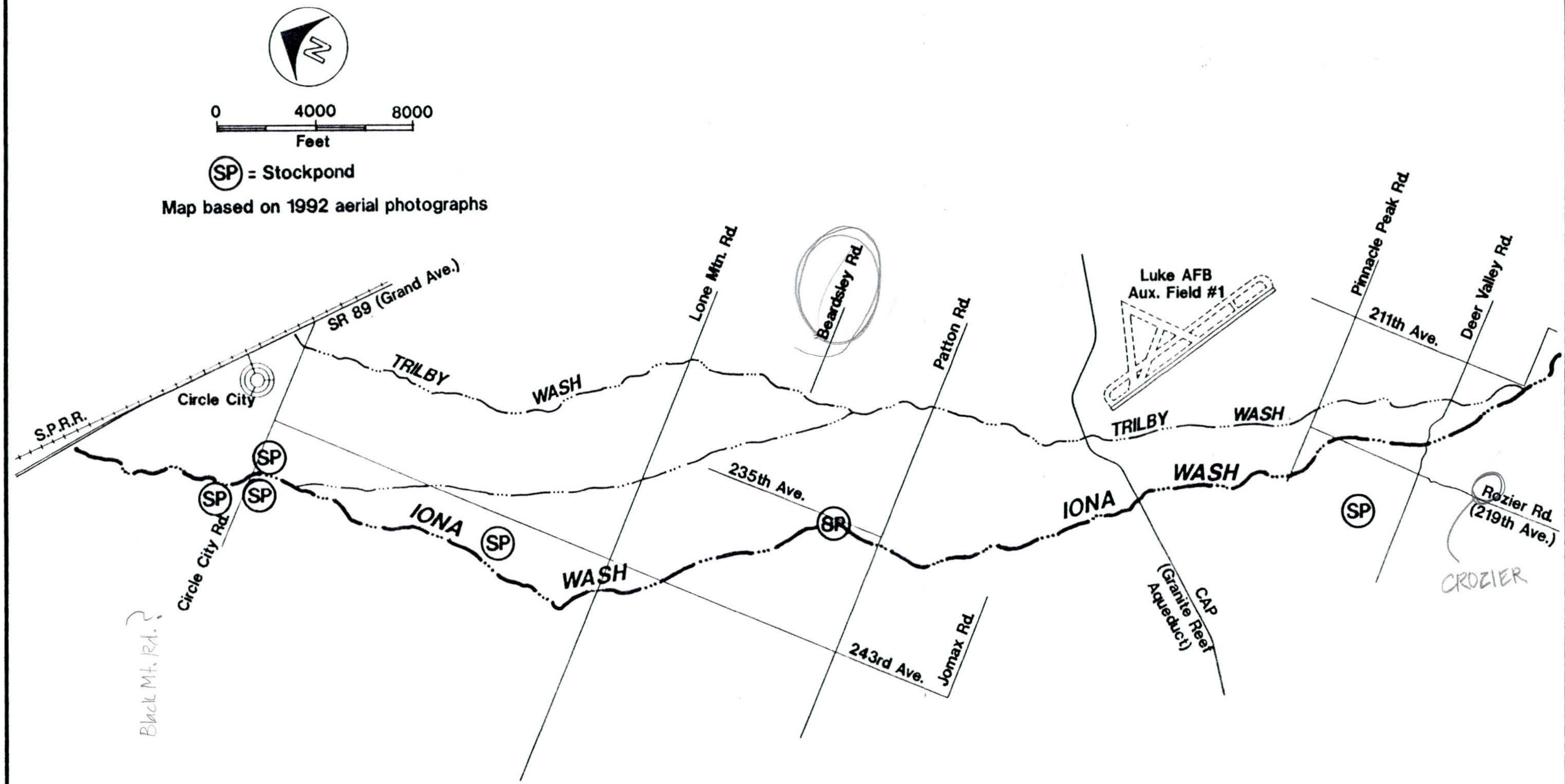

FIGURE 1
LOCATION MAP

Maricopa County, Arizona
June, 1993 CH2M HILL
Iona Wash FIS PHX34747.A0

CH2M HILL

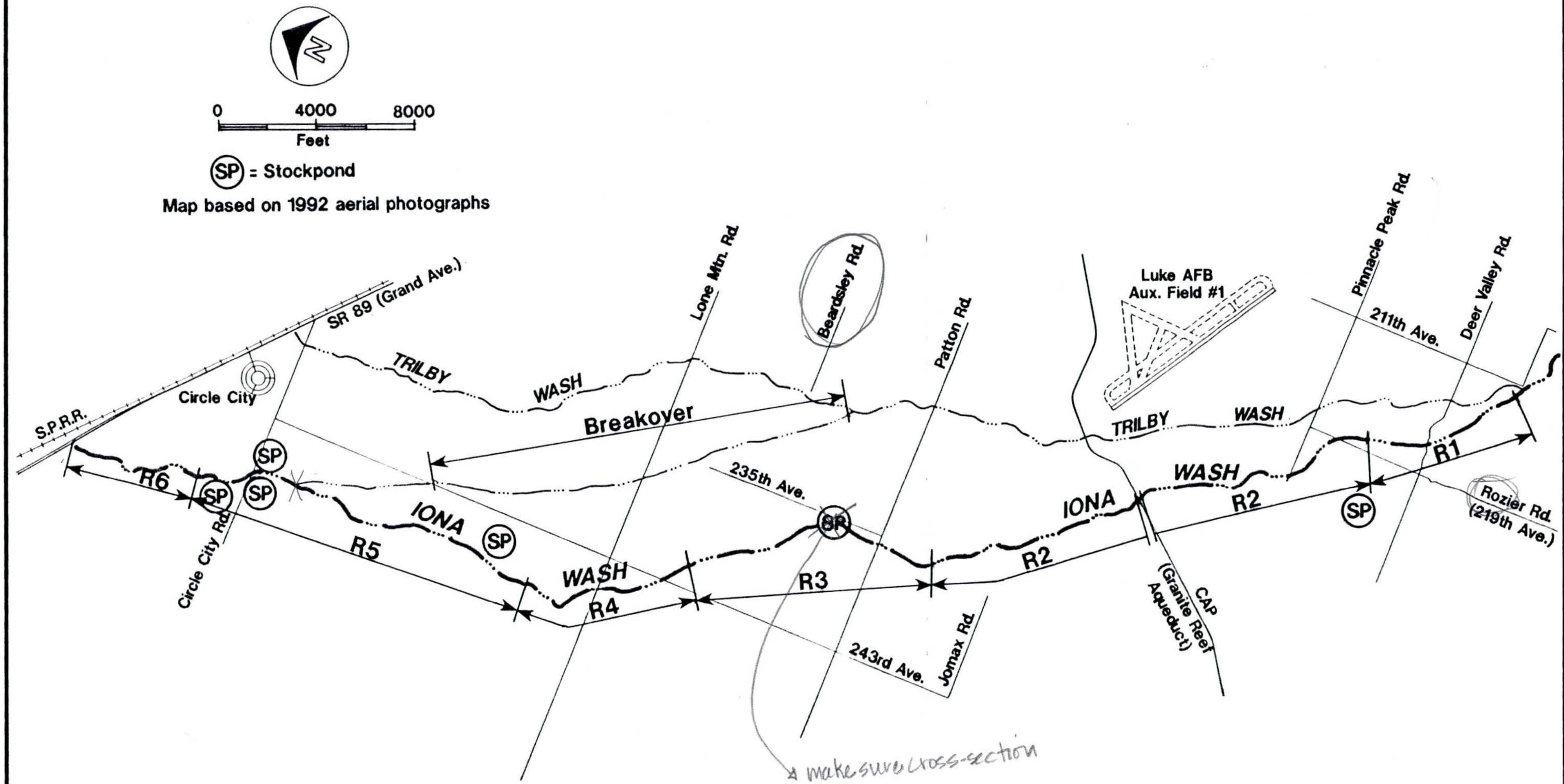

FIGURE 2
REACH DESIGNATIONS

Maricopa County, Arizona
June, 1993 CH2M HILL
Iona Wash FIS PHX34747.A0

CH2M HILL

Table 1. Iona Wash Reach Definition.		
Reach	Reach Limits	Description
1	Trilby Wash to Crozier Rd.	Braided w/ Dense Riparian Veg'n
2	Reach 1 to 237th Ave.	Channelized w/ Riparian Veg'n
3	Reach 2 to Beardley Rd.	Sheet Flow, Unconfined
4	Reach 3 to 1/2 mi. N of Lone Mtn Rd	Channelized w/ Riparian Veg'n
5	Reach 4 to 1 mi. S of Rt. 89	Braided, Very Poorly Defined
6	Reach 5 to Rt. 89	Channelized, wide channels
Breakover	Iona Wash to Trilby Wash	Sheet Flow to Braided

Channel Conditions. For this report, two definitions of "channels" will be used, as illustrated in Figure 3. For well-defined reaches the standard definition of a channel, the wash bottom and bank slope, applies. For braided and sheet flow reaches, the term "channel" includes the wash bottom and the surrounding riparian zone. This broader definition will be used for several reasons. First, a single flow path cannot be easily identified in the field or on phototopography due to the presence of multiple channels, the a tree canopy which hides channels, and the inaccessibility of most of the wash. Including riparian zone makes identifying the channels using aerial photography possible. Second, the channel and riparian zone are better characterized by a single composite "n" value. Third, this broader definition will facilitate floodway mapping.

The degree of channel definition varies considerably within the study area. Near State Route 89 in reach 6, Iona Wash has a well defined channel with sand and gravel beds, and cut banks or mature riparian vegetation. The defined channel transitions first to a braided pattern, then to sheet flow in reach 5. Some of this sheet flow breaks over into Trilby Wash. Sheet flow is collected into a well defined channel in reach 4 where a major tributary joins Iona Wash. This defined channel also becomes braided and transitions to sheet flow in reach 3, before becoming re-channelized upstream of the Central Arizona Project Granite Reef Aqueduct (CAP) in reach 2. Channel definition is lost again near the confluence of Iona Wash and another unnamed tributary with Trilby Wash.

Channel sediment and vegetation also varies throughout the study area. Sediment in defined channels varies from course gravel and angular cobbles in reach 6 to coarse sands in reach 2. Reaches with braided and unconfined flow typically have sand beds. Riparian vegetation also varies with channel type. Braided channel and sheet flow

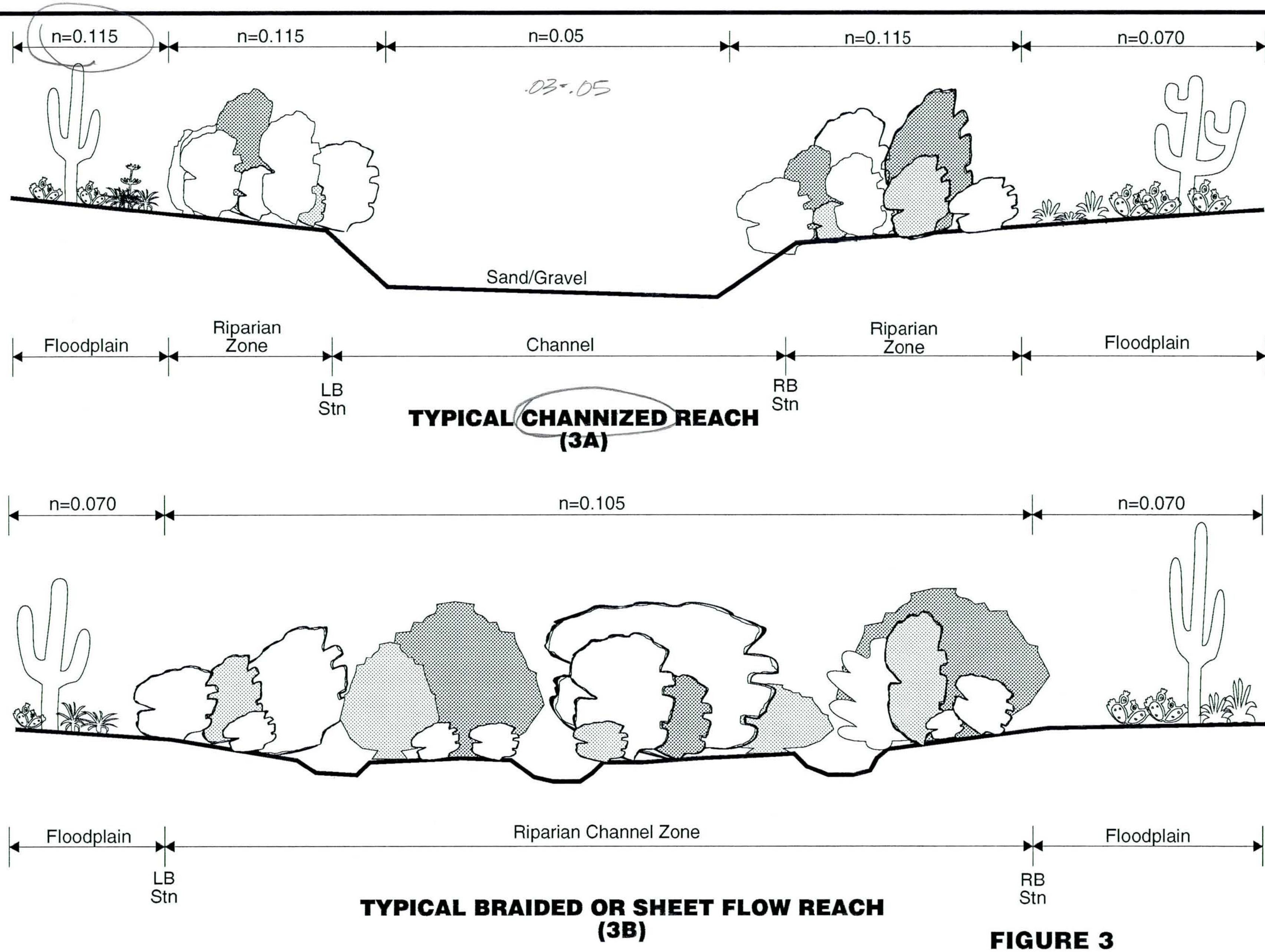

FIGURE 3
CHANNEL BANK AND "N" VALUE DESIGNATION

Maricopa County, Arizona
June, 1993 CH2M HILL
Iona Wash FIS PHX34747.A0

CH2M HILL

areas typically have denser vegetation and wider riparian zones than do channelized reaches. Vegetative density is easily estimated from aerial photography.

Channel Bank Stations. Channel bank stations for hydraulic modeling will be defined in two ways[1]. First, for wide, well-defined channelized reaches, bank stations will defined at top of the bank slope adjacent to the margins of the sandy channel bottom. Using this first definition, separate "n" values can be selected for the channel characteristics, the riparian zone, the floodplain. For braided and sheet flow areas with limited conveyance in channels, the channel bank stations will defined at the margins of the riparian zone. A composite "n" value will be used to estimate roughness in the braided channel area.

Overbank Floodplain Conditions. Floodplain areas are very similar throughout the study reach. Topographically lower floodplain areas are extremely flat and are characterized by creosote-bursage vegetative communities and sandy silt soils. These lower floodplain areas have essentially no drainage network despite relatively large areal extent. Topographically higher floodplain areas typically have some desert pavement surfaces and some cacti species in addition the creosote-bursage vegetation. The lower and higher floodplain surface can probably be modeled using the same manning's "n" value.

Given the limited size of channel in most reaches in the study area and the 100-year discharge rates, it is likely that significant overbank flow will occur along Iona Wash. Signs of recent overbank flooding, including ripple marks in silty soils in reach 5, were observed during the October field visit. These data confirm overbank and breakover flow characteristics indicated by the drainage patterns visible in aerial photographs.

Breakover Reaches. Breakover from Iona Wash to Trilby Wash is possible in reach 5. This breakover reach will be modeled separately from the rest of the Iona Wash floodplain. Breakover flow is predicted on the basis of topographic, geomorphic, and field evidence. Contours on the USGS topographic maps indicate a drainage divide (grade break) in reach 5 at the point where breakover is predicted. Flow crossing this divide would not return to Iona Wash. Vegetative and channel patterns also indicate that flow crosses the divide in the breakover area. Several minor flow paths directly connect Iona and Trilby Washes. Field evidence of recent sheet flow along the predicted breakover zone was observed during the October field visit.

Distributary Flow. There are no natural distributary flow areas in the study area, as defined in the proposed ADWR state standard for development in sheet flow areas. Several man-made diversions to stockponds look like distributary flow bifurcations, but are not active channels downstream of the stockponds. The multiple channels in reaches 1, 3, and 5 are braided washes, rather than distributary. Braided channels

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[1] Actual bank stations cannot be defined for individual cross sections until cross section alignments are approved.

along Iona Wash can be modeled as a single channel with a composite "n" value, particularly at high flow rates such as the 100-year flood.

note: need to run HEC-2 w/cross section at stockpond to see effects. May have to run w/rating curve depending. Then before encroachment run – take out cross-section, can't send to FEMA with – but we need for management purposes.

Levees and Stockponds. There several abandoned stockponds and levees in the study area (Figure 1). All but one of the stockponds are off-channel features, not directly connected to the main channel of Iona Wash. The single in-channel stockpond is located in reach 3, which is a sheet flow area. The off-channel stockponds are generally located along tributary channels upstream of the tributary confluence with Iona Wash. Man-made diversions may direct runoff from Iona Wash into the ponds. Levees were constructed in conjunction with the stockpond diversions in reaches 2 and 6. It is unlikely that these levees or the stockponds will meet FEMA criteria.

Most of the stockponds and all of the levees identified during field reconnaissance are in disrepair. Only the stockponds in reaches 3 and 5 still pond water. The other stockponds have partially silted in. The east banks of the stockpond in Reach 6 are severely eroded. Both diversion levees are breached in places.

The CAP levee is the only levee in the study area in good condition and likely to have been designed by a licensed engineer. The hydrologic analysis completed for the Wittmann ADMS indicates that the CAP levee overtops in the 100-year flood. Field conditions indicate that significant ponding of runoff and sedimentation occurs upstream of the CAP overchute.

Hydraulic Structures. There are three hydraulic structures within the study area. A reinforced concrete box culvert conveys flow under State Route 89 at the upstream limit of the study area. Four 42-inch reinforced concrete pipes are located at the Patton Road crossing of Iona Wash in reach 3. A concrete overchute conveys Iona Wash over the CAP canal in reach 2. As-built plans for these structures are provided under separate cover, in the Iona Wash FIS Data Collection Report.

Manning's N Values

Methodology. Manning's roughness coefficients, or "n" values, were determined using procedures adopted by the FCDMC[2]. In addition, the following materials were used to support the analysis:

- Aerial Photographs. 1992 1:12,000 contact prints by Kenney Aerial photographs to be used for base mapping of study area.

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[2] Thomsen, B.W., and Hjalmarson, H.W., 1991, *Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona*, Report by the USGS to the FCDMC, April.

- Ground Photographs. Color photographs taken during field reconnaissance trips.

- Field Data. Hydraulic information and geomorphic data gathered during field reconnaissance trips.

The FCDMC procedure consists of selection of a base "n" value and addition of several adjustment factors to determine a composite roughness coefficient for hydraulic modeling. The base "n" value accounts for roughness due to the bed material. Adjustments to the base "n" value include factors for the degree of channel irregularity, obstructions, vegetation, variations in cross section geometry, and degree of meandering. Tables from the FCDMC manual which describe each of the adjustment factors are attached in Appendix A.

For the Iona Wash FIS, base "n" values were estimated using field estimates of bed sediment characteristics, and Table 1 of the FCDMC manual. N value adjustment factors were estimated by comparison of values in Table 2 of the FCDMC manual and field conditions observed during field reconnaissance. Photographs which document field conditions at the time of the field visits are attached in Appendix B.

General Approach. There are three general types of channels in the study area: defined channels, braided channels, and sheet flow, as discussed in the field reconnaissance section above. Channel "n" values for braided and sheet flow areas will be composites of the channel and riparian zone, as defined by denser vegetation visible on aerial photographs. In defined channels, "n" values represent just the bed of the defined channel. N values for riparian zones adjacent to defined channels will be assigned a separate "n" value. NH records will be required to model roughness coefficients along defined channels in the study area.

Floodplain areas will be assigned a single Manning's "n" value of 0.070 for the entire study area. As illustrated in the photographs attached in Appendix B, floodplain characteristics are similar for the entire study reach. Riparian zones, except composite zones in braided and sheet flow areas, are also hydraulically similar throughout the study area. Riparian zones will be assigned "n" values of 0.115. N values for floodplain and riparian zones are based on the information and procedures presented in the FCDMC manual and engineering judgement.

Sample N Value Procedure. To illustrate use of the FCDMC methodology, "n" value estimates for reaches 5 and 6 and the floodplain are described in detail.

Table 3 of the FCDMC manual (See Appendix A) lists values of Manning's "n" for floodplains. None of the categories are identical to field conditions in the Iona Wash floodplain. However, field conditions are most similar to light brush and trees in summer (n = 0.040-0.080). Iona wash floodplains have somewhat coarser floodplain sediments than were assumed for the FCDMC table 3. Therefore, a composite value of 0.070 was selected, which is higher than the average value for the light brush category.

Reach 5 has braided and sheet flow areas. Where channels exist, they are typically sand bedded. Floodplain soils and sheet flow areas are also typically composed of sandy soil material. Therefore, a base "n" value of 0.022 was selected by interpolating between values given in the last column in Table 1 of the FCDMC manual (See Appendix A). Channel irregularity and cross section variation are typically minor in braided and sheet flow areas, therefore adjustment factors of 0.003 and 0.005 were added (Table 2 of FCDMC manual, Appendix A). However, channel obstructions and vegetative influence are usually significant, so adjustment factors of 0.025 and 0.040 were added. Finally, meandering along Iona Wash is minor, so no meandering adjustment was needed (Meander factor = 1.0, Table 2 of FCDMC manual, Appendix A). Adding these adjustment factors to the base "n" value results in a composite "n" value of 0.095.

should use either channel obstr. or veg adj. factor. See Table 2, n-value report.

Reach 6 has a well-defined channel with a riparian zone of varying width. The channel sediments consist of sands, gravels and small cobbles. A base "n" value of 0.028 was selected (Table 1 of FCDMC manual, Appendix A). The well defined channel is relatively free of obstructions, vegetation, and drastic geometry changes, so adjustment factors of 0.005, 0.002, and 0.002 were used. However, an adjustment factor of 0.009 was needed to account for the cutbanks and other channel irregularities. Since meandering is limited, the resulting composite "n" value was estimated as 0.046.

Manning's N Values. Photographs of channels in each reach and floodplains are attached in Appendix B. Composite channel "n" values are shown in Table 2 for each reach, and for overbank and riparian zones. Overbanks and riparian zones are similar throughout the study area and were each given similar "n" values.

Table 2. Iona Wash FIS, Manning's N Estimates							
Reach	Base N	Irregularity Adjustment	Obstruction Adjustment	Vegetation Adjustment	Variation Adjustment	Meandering Adjustment	Composite N
1	0.022	0.003	0.025	0.050	0.005	1.0	0.105
2	0.026	0.007	0.010	0.002	0.001	1.0	0.046
3	0.022	0.003	0.025	0.050	0.005	1.0	0.105
4	0.028	0.008	0.010	0.005	0.001	1.0	0.052
5	0.022	0.003	0.025	0.040	0.005	1.0	0.095
6	0.028	0.009	0.005	0.002	0.002	1.0	0.046
Break out	0.022	0.003	0.025	0.050	0.005	1.0	0.105
Floodplain: Light brush and small trees with summer grass							0.070
Riparian Zones: Mesquite & Palo Verde with dense catclaw, grass and brush understory							0.115

Summary

Field reconnaissance of the Iona Wash study area was conducted to support the floodplain delineation. Field tasks included collection of data to assist in "n" value estimation, identification and observation of significant channel features and floodplain characteristics. Manning's "n" values were estimated for six channel reaches, as well as overbank floodplain areas using FCDMC procedures. Photographic documentation of channel conditions was provided to support the field reconnaissance report and "n" value estimates.

Appendix A

A common method of selecting the roughness coefficient, *n*, is to first select a base value of *n* for the bed material (table 1). The base values of *n* are for a straight uniform channel of a given bed material. Cross-section irregularities, channel alignment, obstructions, vegetation, and other factors that increase roughness are accounted for by adding increments of roughness to the base value of *n*. Ranges of adjustments for the factors that may add to channel roughness are shown in table 2.

Many alluvial channels in Maricopa County have bed material that moves during floodflow. In addition to the changing channel geometry of these channels, the roughness coefficient may change during floodflow because of the changing form of the channel bed in parts of the channel cross section (Davidian, 1984). Bedforms, such as dunes, antidunes, and plane bed have been observed during large floods. Within a few minutes, dunes can appear, disappear, and reappear at different locations across a large stream channel. The Manning roughness coefficient can double or triple when the bedform changes from plane to dunes. A method of defining reliable values of Manning's *n* for unstable alluvial channels is not available. A plane bedform is common during large floods, and for this report, plane-bed conditions are assumed where the roughness coefficient is related to the size of the channel material and not the form of the channel bed. Plane-bed conditions were assumed for nearly all indirect measurements of peak discharge where the slope-area method was used.

Table 1.--*Base values of Manning's n for stable channels*

[Modified from Aldridge and Garrett, 1973, table 1]

Channel material	Size of bed material		Base *n* values	
	Millimeters	Inches	Benson and Dalrymple (1967)[1]	Chow (1959)[2]
Concrete..............	-------	--------	0.012-0.018	0.011
Rock cut..............	-------	--------	-----------	.025
Firm soil.............	-------	--------	.025- .032	.020
Coarse sand...........	1-2	--------	.026- .035	-----
Fine gravel...........	-------	--------	-----------	.024
Gravel................	2-64	0.08-2.5	.028- .035	-----
Coarse gravel.........	-------	--------	-----------	.028
Cobble................	64-256	2.5-10.0	.030- .050	-----
Boulder...............	>256	>10.0	.040- .070	-----

[1]Straight uniform channel.
[2]Smoothest channel attainable in indicated material.

Table 2.--*Adjustment factors for the determination of overall Manning's n values*

[Modified from Chow, 1959]

Channel conditions	Manning's n adjustment[1]	Example
Degree of irregularity:		
Smooth	0.000	Smoothest channel attainable in given bed material.
Minor	.001- .005	Channels with slightly eroded or scoured side slopes.
Moderate	.006- .010	Channels with moderately sloughed or eroded side slopes.
Severe	.011- .020	Channels with badly sloughed banks; unshaped, jagged, and irregular surfaces of channels in rock.
Effects of obstruction[2]:		
Negligible	.000- .004	A few scattered obstructions, which include debris deposits, stumps, exposed roots, logs, piers, or isolated boulders, that occupy less than 5 percent of the cross-sectional area.
Minor	.005- .015	Obstructions occupy 5 to 15 percent of the cross-sectional area and the spacing between obstructions is such that the sphere of influence around one obstruction does not extend to the sphere of influence around another obstruction. Smaller adjustments are used for curved smooth-surfaced objects than are used for sharp-edged angular objects.
Appreciable	.020- .030	Obstructions occupy from 15 to 50 percent of the cross-sectional area or the space between obstructions is small enough to cause the effects of several obstructions to be additive, thereby blocking an equivalent part of a cross section.
Severe	.040- .060	Obstructions occupy more than 50 percent of the cross-sectional area or the space between obstructions is small enough to cause turbulence across most of the cross section.
Vegetation:		
Small	.002- .010	Dense growths of flexible turf grass, such as Bermuda, or weeds where the average depth of flow is at least two times the height of the vegetation; supple tree seedlings such as willow, cottonwood, arrow weed, or saltcedar where the average depth of flow is at least three times the height of the vegetation.
Medium	.010- .025	Grass or weeds where the average depth of flow is from one to two times the height of the vegetation; moderately dense stemmy grass, weeds, or tree seedlings where the average depth of flow is from two to three times the height of the vegetation; moderately dense brush, similar to 1- to 2-year-old saltcedar in the dormant season, along the banks and no significant vegetation along the channel bottoms where the hydraulic radius exceeds 2 feet.
Large	.025- .050	Turf grass or weeds where the average depth to flow is about equal to the height of vegetation; small trees intergrown with some weeds and brush where the hydraulic radius exceeds 2 feet.

See footnotes at end of table.

Table 2.--*Adjustment factors for the determination of overall Manning's n values*--Continued

Channel conditions	Manning's n adjustment[1]	Example
Vegetation—Continued:		
Very large	.050- .100	Turf grass or weeds where the average depth of flow is less than half the height of vegetation; small bushy trees intergrown with weeds along side slopes of dense cattails growing along channel bottom; trees intergrown with weeds and brush.
Variations in channel cross section:		
Gradual	.000	Size and shape of cross sections change gradually.
Alternating	.001- .005	Large and small cross sections alternate occasionally, or the main flow occasionally shifts from side to side owing to changes in cross-sectional shape.
Alternating	.010- .015	Large and small cross sections alternate frequently, or the main flow frequently shifts from side to side owing to changes in cross-sectional shape.
Degree of meadering[3]:		
Minor	1.00	Ratio of the meander length to the straight length of the channel reach is 1.0 to 1.2.
Appreciable	1.15	Ratio of the meader length to the straight length of channel is 1.2 to 1.5.
Severe	1.30	Ratio of the meander length to the straight length of channel is greater than 1.5.

[1]Adjustments for degree of irregularity, variations in cross section, effect of obstructions, and vegetation are added to the base n value (table 1) before multiplying by the adjustment for meander.

[2]Conditions considered in other steps must not be reevaluated or duplicated in this section.

[3]Adjustment values apply to flow confined in the channel and do not apply where downvalley flow crosses meanders. The adjustment is a multiplier.

For floodflows in sand channels with moveable beds, roughness mainly is a function of the size of the bed material as shown in the following table (Benson and Dalrymple, 1967, p. 22).

Median grain size, in millimeters	Manning's *n*	Median grain size, in millimeters	Manning's *n*
0.2	0.012	0.6	.023
.3	.017	.8	.025
.4	.020	1.0	.026
.5	.022		

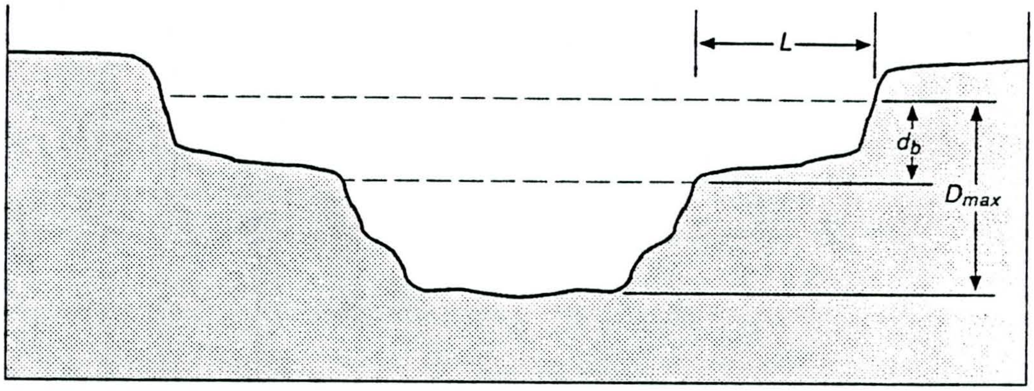


Figure 2.--Subdivision criteria commonly used for streams in Maricopa County, Arizona.

Table 3.--*Values of Manning's n for flood plains*

[Modified from Chow, 1959]

Description	Minimum	Normal	Maximum
Pasture, no brush:			
Short grass.....	0.025	0.030	0.035
High grass..	.030	.035	.050
Cultivated areas:			
No crop...	.020	.030	.040
Mature row crops................................	.025	.035	.045
Mature field crops..............................	.030	.040	.050
Brush:			
Scattered brush, heavy weeds....................	.035	.050	.070
Light brush and trees, in winter................	.035	.050	.060
Light brush and trees, in summer................	.040	.060	.080
Medium to dense brush, in winter................	.045	.070	.110
Medium to dense brush, in summer................	.070	.100	.160
Trees:			
Dense willows, summer, straight.................	.110	.150	.200
Cleared land with tree stumps, no sprouts.......	.030	.040	.050
Same as above, but heavy growth off sprouts.....	.050	.060	.080
Heavy stand of timber, a few down trees, little undergrowth, flood stage below branches.......	.080	.100	.120
Same as above, but with flood stage reaching branches.............................	.100	.120	.160

Iona Wash FIS

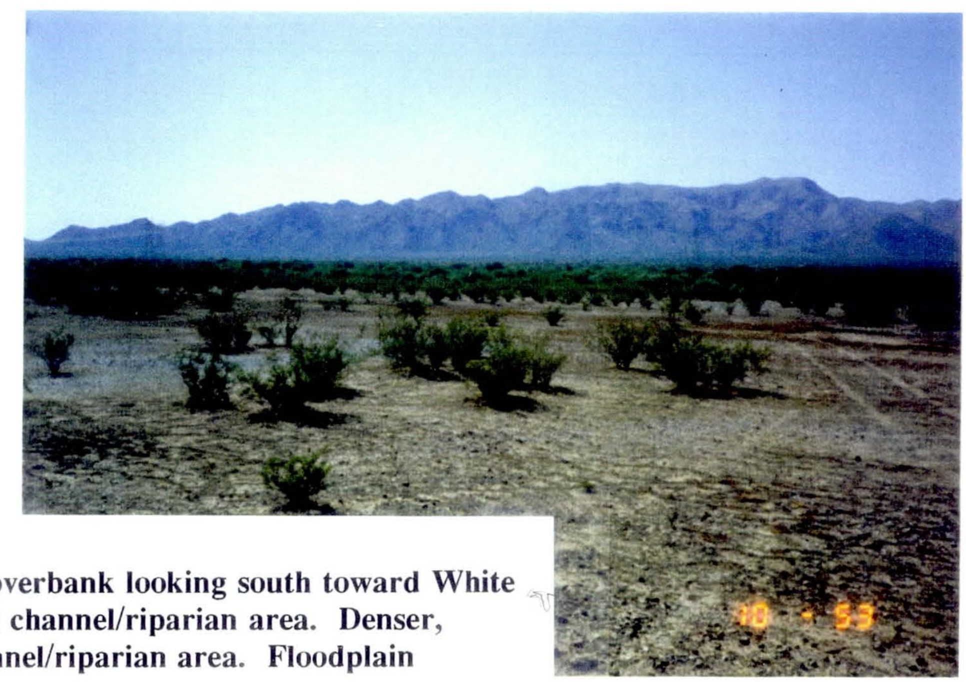
Manning's N Estimates

Reach	Channel Segment	Base N	Irregularity Adjustment	Obstruction Adjustment	Vegetation Adjustment	XN Variation Adjustment	Meandering Adjustment	Composite N
1	CHL	0.022	0.003	0.025	0.050	0.005	1.0	0.105
2	CHL	0.026	0.007	0.010	0.002	0.001	1.0	0.046
3	CHL	0.022	0.003	0.025	0.050	0.005	1.0	0.105
4	CHL	0.028	0.008	0.010	0.005	0.001	1.0	0.052
5	CHL	0.022	0.003	0.025	0.040	0.005	1.0	0.095
6	CHL	0.028	0.009	0.005	0.002	0.002	1.0	0.046
Breakout	CHL	0.022	0.003	0.025	0.050	0.005	1.0	0.105
Floodplain		Light brush and small trees with summer grass						0.070
Riparian Zones		Mesquite & Palo Verde with dense catclaw, grass and brush understory						0.115

Appendix B

Reach 1. Typical channel braid downstream of Crozier Road. Base n value = 0.022; Composite n including riparian vegetation = 0.105.

* Would like to see channel n = & overbank n = on these pictures. Base n & composite are confusing.



high

channel n =
overbank n =

Reach 1. View of left overbank looking south toward White Tank Mountains across channel/riparian area. Denser, taller vegetation is channel/riparian area. Floodplain n value = 0.070. seems a little high based on this picture.

Reach 2. Looking upstream at typical channel in Reach 2. Base n value = .026. N value for riparian zone adjacent to channel = 0.115.

Reach 3. View of typical channel in braided flow area in Reach 3. Channel shown is one of many upstream of Patton Road. Base n value = 0.022. Composite n value includes riparian vegetation. .105

.07

Reach 3. Right overbank in heavily grazed part of Reach 3. Dense vegetation lines channel.

? channel n =
overbank n = } ?

Reach 4. Looking upstream at defined channel in Reach 4. Base n value = 0.028. N value for riparian zone adjacent to channel = 0.115. View from Lone Mountain Road.

depending on depth of flow

Reach 5. Looking north from stockpond embankment across braided flow area in Reach 5. Base n value = 0.022; composite n value including riparian vegetation = 0.095. Truck is parked between several active flow paths. Hieroglyphic Mountains in distance.

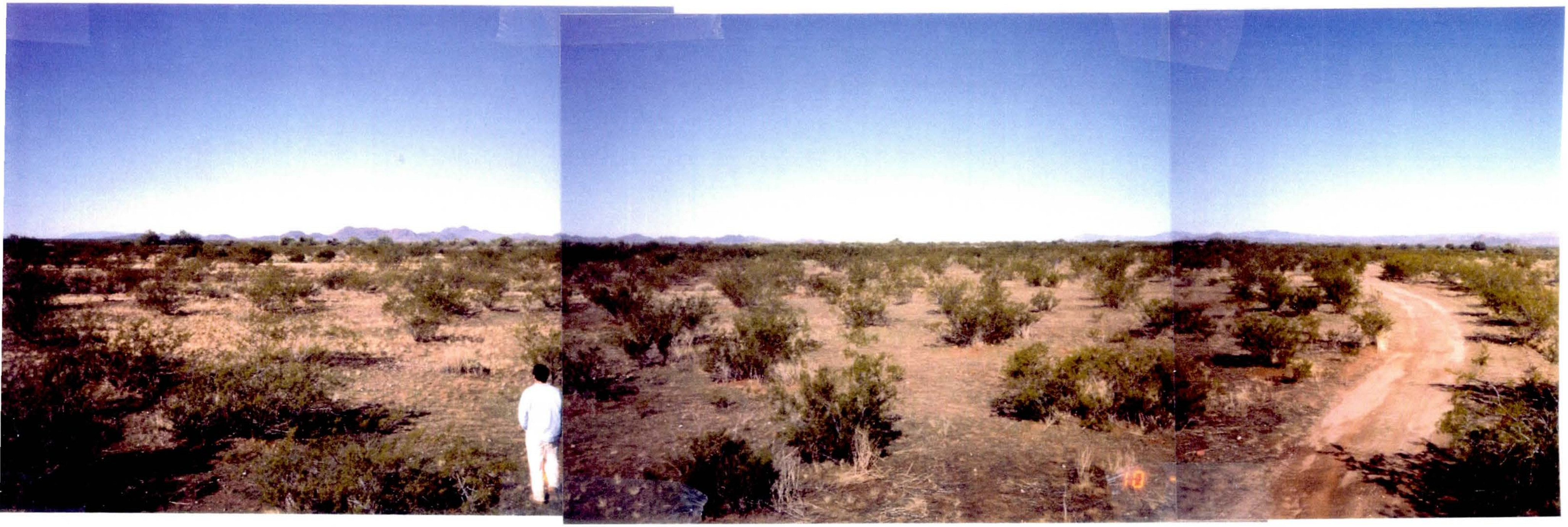
just from this picture – it would seem this reach should have a higher vegetation adjustment? than reaches 1 & 3.??

Reach 6. **View looking upstream in Reach 6 just above stockpond diversion channel. Base n value = 0.028.**

channel n =
overbank n =

Typical floodplain with creosote bursage vegetative community with a heavily grazed low grass understory. Floodplain n value of 0.070 applies to all overbank areas in study area except riparian zones. View looking north from CAP levee in left overbank in Reach 2.

this picture → .030 – .050 ??



Typical floodplain with creosote bursage vegetative community and heavily grazed low grass. Floodplain n value of 0.070 applies to all overbank areas in study areas except riparian zones. View looking south toward White Tank Mountains in right overbank in Reach 5.

depending on depth of flow — !!
could also be .04-.05.