FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
PHOENIX, ARIZONA

RIO VERDE SOUTH FLOODPLAIN DELINEATION STUDY

FCD 93-07

TECHNICAL DATA NOTEBOOK HYDRAULICS Existing Condition

Book 1 of 2

McLaughlin Kmetty Engineers, Ltd.

Phoenix, Arizona

SEPTEMBER 1995

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PREFACE

The Rio Verde South Floodplain Delineation Study (Contract No. FCD 93-07) was performed for:

Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009
(602)506-1501 FAX (602)506-4601

Floodplain Management Branch
Branch Manager: Mr. Pedro Calza
Project Manager: Mr. Hasan Mushtaq

Watershed Management Branch
Branch Manager: Mr. Amir Motamedi
Project Manager: Ms. Sandy Story

By:
McLaughlin Kmetty Engineers, Ltd.
3501 N. 16th Street, Suite A
Phoenix, Arizona 85016
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FAX (602)248-7851

Project Manager: Mr. Geza E. Kmetty, PE
Project Engineer: Mr. Frank Edward Brown, PE

and,

George V. Sabol Consulting Engineers, Inc.
7950 E. Acoma Dr, Suite 211
Scottsdale, Arizona 85260-6962
(602)483-3368
FAX (602)483-3990

Project Co-Manager: George V. Sabol, PhD, PE
Project Engineer: Mr. Thomas R. Loomis, PE, RLS

STUDY DOCUMENTATION ABSTRACT							
INITIAL STUDY		RESTUDY	X	LOMR		OTHER	

SECTION 1: GENERAL INFORMATION

1A	COMMUNITY	Rio Verde (unincorporated)
1B	COMMUNITY NUMBER	04013
1C	COUNTY	Maricopa
1D	STATE	Arizona
1E	DATE STUDY ACCEPTED	
1F	STUDY CONTRACTOR	McLaughlin Kmetty Engineers, Ltd.
	CONTACTS	Frank Edward Brown, PE Geza E. Kmetty, PE, RLS
	ADDRESS	3501 N. 16th Street Phoenix, Arizona 85016
	PHONE	(602)248-7702 (602)248-7851 (FAX)
	SUBCONSULTANTS	George V. Sabol Consulting Engineers, Inc.
1G	TECH. REVIEWER (FEMA)	
	PHONE	
1H	FEMA REGIONAL REVIEWER	
	PHONE	
1I	STATE REVIEWER	Arizona Department of Water Resources
	PHONE	(602) 542-1541
1J	LOCAL REVIEWER	Flood Control District of Maricopa County Catherine Regester Hasan Mushtaq Sandra Story Pedro Calza
	PHONE	(602) 506-1501
1K	RIVER OR STREAM NAME	Wash 9, Wash 10, Wash 11 & Wash 12
1L	REACH DESCRIPTION	Refer to Exhibit A
1M	STUDY TYPE	Floodplain/Floodway Delineations

STUDY DOCUMENTATION ABSTRACT (continued)

SECTION 2: MAPPING INFORMATION

2A	USGS QUAD SHEETS	Bartlett Dam
		McDowell Peak
		Wildcat Hill
		Fort McDowell
2B	MAPPING FOR HYDROLOGIC STUDY	2-foot contour interval in ACAD Format
	TYPE/SOURCE	Burgess and Niple, Inc.
	SCALE	1 inch = 200 feet
	DATE	12-22-93
2C	MAPPING FOR HYDRAULIC STUDY	
	TYPE/SOURCE	Same as 2B
	SCALE	1 inch = 200 feet
	DATE	12-22-93 and 8-22-94

SECTION 3: HYDROLOGY

3A	MODEL OR METHOD USED (Including vendor and version description)	HEC-1 version 4.0.1E dated May 1991 Dodson & Associates, Inc.
3B	STORM DURATION	6-hour, 24-hour
3C	HYETOGRAPH TYPE	In accordance with Design Manual
3D	FREQUENCIES DETERMINED	100-year
3E	LIST OF GAGES USED IN FREQUENCY ANALYSIS OR CALIBRATION (Location, Years of Record, Gage Ownership)	None available.
3F	RAINFALL AMOUNTS AND REFERENCE	100-year, 6-hour = 3.4 inches 100-year, 24-hour = 4.4 inches NOAA Atlas II
3G	UNIQUE CONDITIONS AND PROBLEMS	Flow Diversions
3H	COORDINATION OF Q'S (Agency, date, comments	

STUDY DOCUMENTATION ABSTRACT (continued)		

SECTION 4: HYDRAULICS

4A	MODEL OR METHOD USED (including vendor and version description)	HEC-2 version 4.6.2 dated May 1991 Dodson & Associates, Inc.
4B	REGIME	Subcritical, with supercritical reaches
4C	FREQUENCIES FOR WHICH PROFILES WERE COMPUTED	100-year
4D	METHOD OF FLOODWAY CALCULATION	Method 1
4E	UNIQUE CONDITIONS AND PROBLEMS	island flow

SECTION 1: GENERAL DOCUMENTATION AND CORRESPONDENCE

1.0 Introduction

The Floodplain Delineation Study for Rio Verde South determines floodplain and floodway limits for four washes within the study area. Three of those washes were studied previously by approximate methods, thus this is a restudy for Washes 9, 10 and 11. Wash 12, named for the purposes of this study, is studied for the first time. In addition, approximately 1 river mile of Wash 11 is added to the previous upstream Limit of Detailed Study. Approximately 6.6 river miles of Floodplain are delineated in this study. Figure 1-1 presents a Location Map for the community of Rio Verde, and the Vicinity Map in Figure 1-2 locates the 4 study washes. In addition to the community of Rio Verde, the study area encompasses the Tonto Verde development, which is currently under construction.

LOCATION MAP

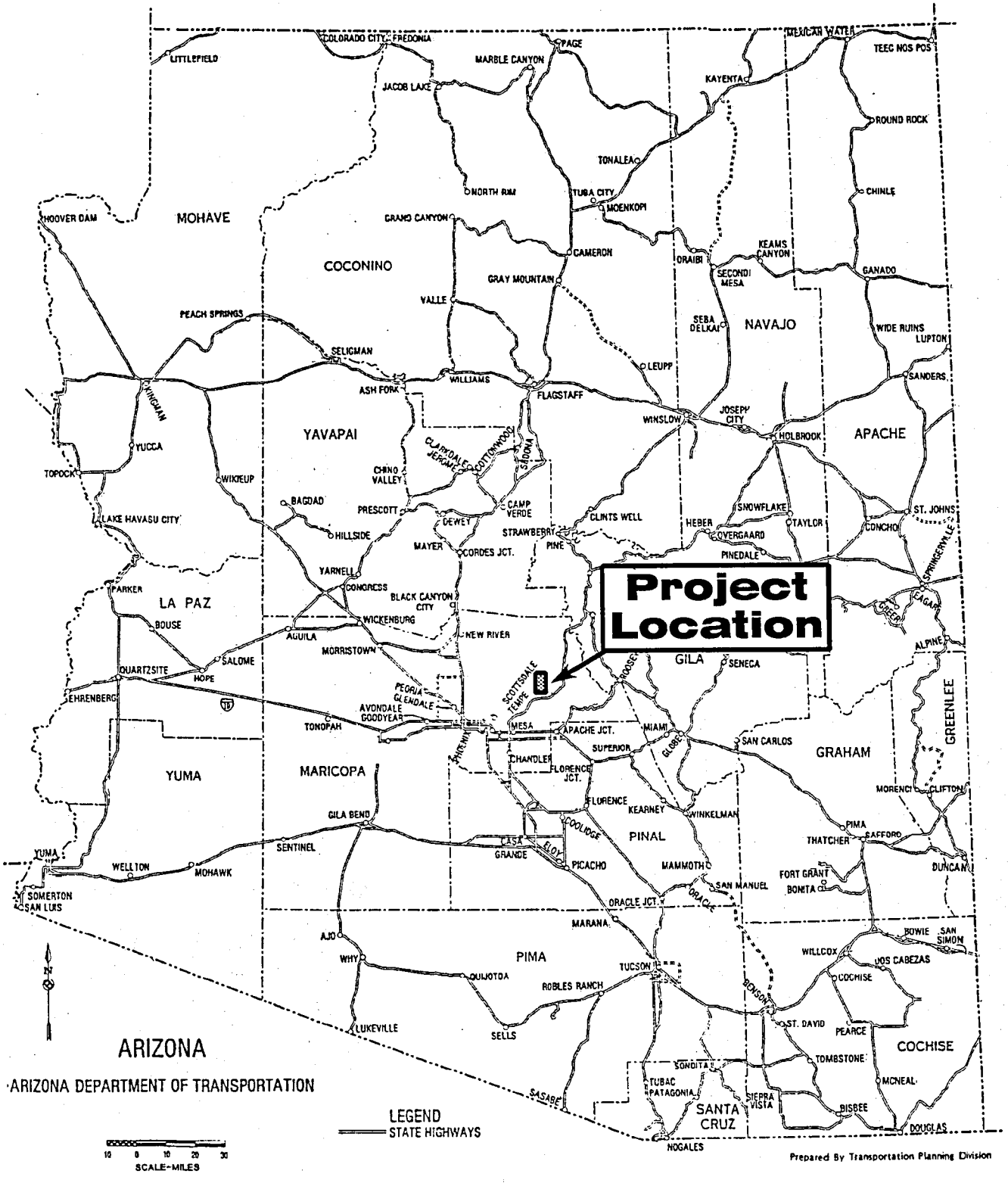

FIGURE 1-1

VICINITY MAP

NOSCALE

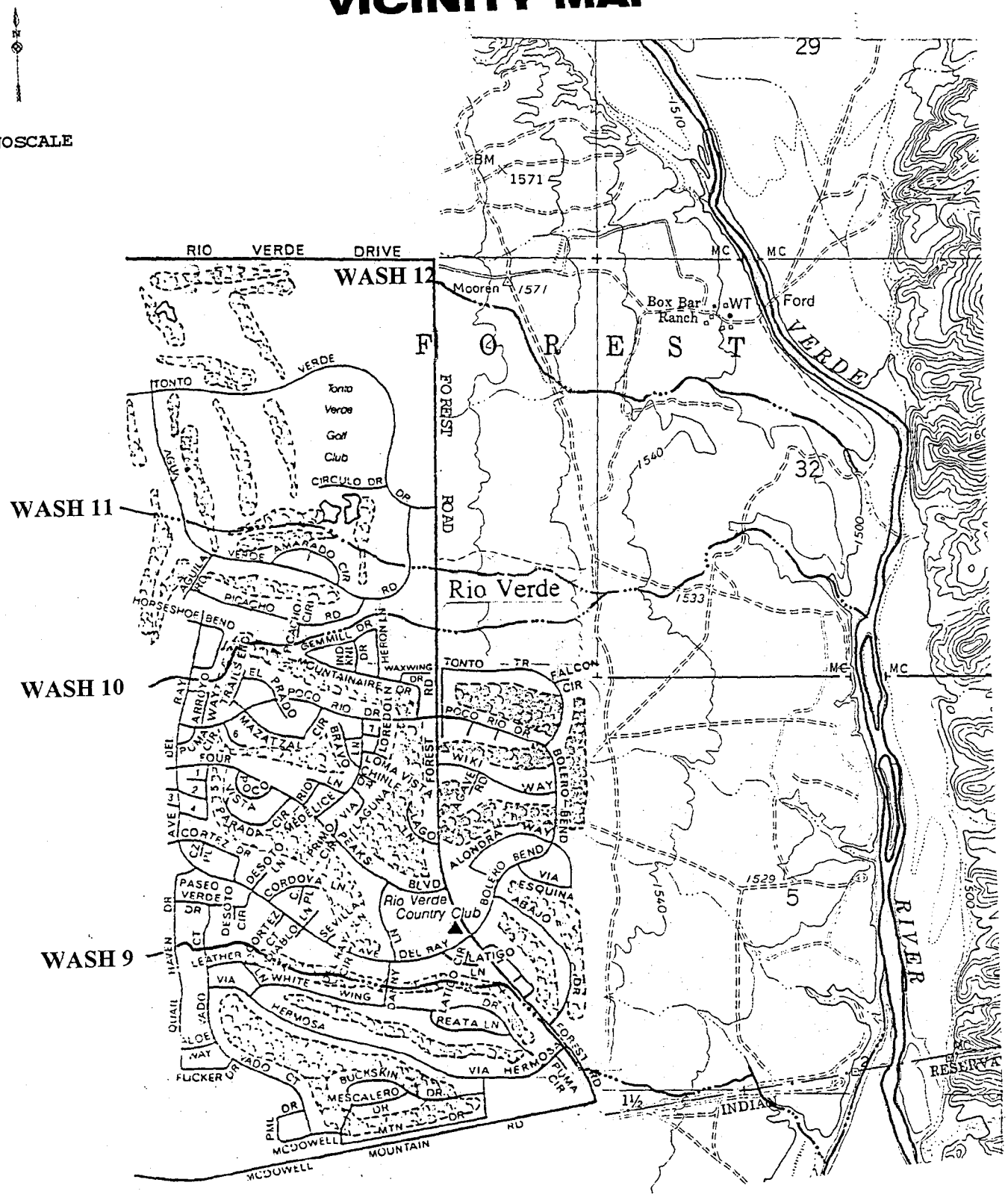

FIGURE 1-2

SECTION 1: General Documentation and Correspondence

1.1 Special Problem Reports

14 October 1994

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HEC-1 Problem Report:

Problem Description:

The HEC-1 model in question uses JD records, S-Graphs and the Green-Ampt equation. Two hydrographs are imported into the model using QI records. The index hydrographs after the import are populated with zero values. The peak discharge reported by HEC-1 at the first downstream concentration point below WP581(C510) is unrealistic (refer to the TEST1.IH1 sample file). C510 combines operations 509510, 500E and 581510 (361, 219 and 207 cfs, respectively). The total discharge cannot be over 787 cfs, yet HEC-1 reports a peak discharge of 1297 cfs. The index hydrographs at C510 appear to be correct. The interpolated hydrograph is not. The operation following C510 is a diversion. The results of the diversion are also unrealistic and do not total 1297 cfs.

Temporary Solution:

I was able to work-around the problem by doing the following (refer to the TEST2.IH1 sample file):

1. I imported the two hydrographs using QI records at the start of the file, and also wrote them out to a Tape21 file.

2. The two hydrographs were then read back into the input file at the appropriate locations using the BI record option. The index hydrographs were then found to be populated with the original hydrographs from the QI records.

3. This still did not solve the problem, although the peak discharge at C510 changed from 1297 cfs to 929 cfs. I then renamed the combination records at C509 and C510 to TEMP1 and TEMP2, respectively, and wrote them out to the Tape21 file. I then read both hydrographs back in using BI records. A reasonable peak discharge was reported and the interpolated hydrograph looked good.

4. I performed a manual calculation of the interpolated hydrograph at C510 (refer to the attached table) and compared it with the HEC-1 results from step 3. The peak discharge is 321 cfs in both cases. This is a reasonable discharge when the watershed area at C510 is considered. The manual results match the work-around HEC-1 solution.

Tom Loomis

Tom Loomis
George V. Sabol Consulting Engineers, Inc.

From Test1

From Test2

Test2.IH1 Comparison of Index Hydrographs and Calculation of Interpolated Hydrograph										
	Index Area = 2.8 square miles				Index Area = 16 square miles				TRL	HEC-1
[redacted]e	509510	500E	WP581	C510	509510	500E	WP581	C510	Log-Averaged	Output
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
3.47	0	0	0	0	0	0	0	0	0	0
3.48	0	0	0	0	0	0	0	0	0	0
3.50	0	0	0	0	0	0	0	0	0	0
3.52	0	0	0	0	0	0	0	0	0	1
3.53	0	1	0	1	0	0	0	0	1	2
3.55	0	1	0	1	0	1	0	1	1	4
3.57	0	2	0	2	0	1	0	1	2	6
3.58	0	3	0	3	0	2	0	2	3	9
3.60	0	4	0	4	0	3	0	3	4	14
3.62	0	6	0	6	0	4	0	4	5	21
3.63	0	9	0	9	0	6	0	6	8	29
3.65	0	12	0	12	0	8	0	8	11	38
3.67	0	15	0	15	0	10	0	10	14	48
3.68	0	18	0	18	0	12	0	12	16	59
3.70	0	22	0	22	0	14	0	14	20	72
3.72	0	27	0	27	0	18	0	18	25	87
3.73	0	32	0	32	0	21	0	21	29	104
3.75	0	36	0	36	0	24	0	24	33	118
3.77	0	41	0	41	0	26	0	26	37	131
3.78	0	44	0	45	0	29	0	29	41	143
3.80	0	48	1	49	0	31	1	32	44	155
3.82	0	52	1	53	0	34	1	35	48	167
3.83	0	56	1	57	0	36	1	37	52	180
[redacted].85	0	60	1	61	0	39	1	40	55	193
[redacted].87	0	64	1	66	0	42	1	43	60	206
3.88	0	69	2	70	0	45	2	46	63	220
3.90	0	73	2	75	0	48	2	50	68	233
3.92	0	77	2	79	0	51	2	53	72	248
3.93	0	82	3	84	0	54	3	56	76	263
3.95	1	86	3	90	0	57	3	60	82	281
3.97	2	91	4	96	0	60	4	64	87	303
3.98	5	96	4	105	1	63	4	68	95	338
4.00	12	100	5	116	1	66	5	72	104	398
4.02	23	103	6	132	3	68	6	76	117	483
4.03	37	106	7	150	6	70	7	82	131	574
4.05	53	108	7	168	12	72	7	91	147	655
4.07	68	110	8	186	22	73	8	103	163	713
4.08	82	112	9	202	32	74	9	115	178	752
4.10	95	112	10	217	43	74	10	128	193	783
4.12	106	112	11	230	53	74	11	139	205	804
4.13	118	111	13	241	63	74	13	149	216	824
4.15	128	110	14	252	72	73	14	159	226	840
4.17	137	108	15	261	79	72	15	166	235	857
4.18	147	106	16	269	87	71	16	174	243	873
4.20	155	104	17	276	94	69	17	179	249	887
4.22	164	100	18	281	100	66	18	184	254	896
4.23	171	95	19	286	106	63	19	188	259	903
4.25	179	93	20	291	111	62	20	193	264	914
[redacted].27	185	90	21	296	116	60	21	197	269	921
[redacted].28	190	88	21	300	121	59	21	201	273	926
4.30	195	86	22	303	124	58	22	204	276	929
4.32	198	84	22	304	127	56	22	206	277	927

Test2.IH1 Comparison of Index Hydrographs and Calculation of Interpolated Hydrograph										
	Index Area = 2.8 square miles				Index Area = 16 square miles				TRL	HEC-1
[illegible]ne	509510	500E	WP581	C510	509510	500E	WP581	C510	Log-Averaged	Output
[illegible])	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
4.33	201	81	23	305	130	54	23	207	278	923
4.35	203	78	24	304	132	52	24	208	278	915
4.37	204	75	24	303	133	50	24	208	277	904
4.38	204	72	25	300	134	48	25	207	274	891
4.40	204	68	25	297	134	46	25	206	272	874
4.42	202	64	26	293	134	43	26	204	269	855
4.43	201	60	27	288	134	41	27	202	264	834
4.45	198	56	28	282	133	38	28	199	259	809
4.47	195	51	29	275	131	35	29	195	253	782
4.48	192	46	30	268	130	31	30	191	247	752
4.50	188	42	31	261	128	29	31	187	241	726
4.52	184	39	32	255	125	27	32	184	235	702
4.53	180	36	33	249	123	25	33	181	230	679
4.55	176	33	35	243	120	23	35	178	225	658
4.57	172	31	36	238	117	22	36	175	221	639
4.58	167	28	37	233	114	20	37	172	216	620
4.60	163	26	39	228	112	19	39	169	212	600
4.62	159	24	40	223	109	18	40	167	208	579
4.63	154	22	42	219	107	16	42	165	204	558
4.65	150	21	43	214	105	15	43	163	200	538
4.67	146	19	45	210	102	14	45	161	197	520
4.68	143	17	47	208	101	13	47	161	195	506
4.70	141	16	50	206	99	12	50	161	194	494
4.72	139	15	52	206	98	11	52	162	194	484
4.73	137	14	55	205	98	10	55	163	193	474
4.75	136	12	57	206	99	9	57	165	195	464
4.77	136	11	60	207	100	8	60	168	196	464
4.78	136	10	63	210	102	8	63	173	200	454
4.80	137	10	66	213	104	7	66	177	203	437
4.82	138	9	69	216	107	7	69	183	207	429
4.83	140	8	72	220	111	6	72	189	211	421
4.85	143	7	77	227	115	6	77	197	219	416
4.87	145	7	81	233	119	5	81	205	225	412
4.88	148	6	86	240	123	5	86	213	233	408
4.90	151	6	90	247	127	4	90	222	240	406
4.92	154	5	95	254	131	4	95	230	247	404
4.93	156	5	99	260	136	4	99	238	254	400
4.95	159	5	102	266	140	3	102	245	260	396
4.97	161	4	106	271	144	3	106	253	266	391
4.98	164	4	109	277	147	3	109	260	272	387
5.00	166	3	113	282	150	3	113	266	278	385
5.02	167	3	116	287	153	2	116	271	283	382
5.03	169	3	119	291	155	2	119	277	287	381
5.05	170	3	122	295	157	2	122	281	291	380
5.07	171	2	125	299	159	2	125	286	295	379
5.08	172	2	128	302	161	2	128	291	299	378
5.10	173	2	130	305	162	1	130	294	302	376
5.12	174	2	133	308	164	1	133	298	305	375
5.13	174	1	135	311	165	1	135	301	308	374
5.15	175	1	138	314	166	1	138	304	311	373
5.17	175	1	140	316	166	1	140	307	314	373
5.18	175	1	142	318	167	1	142	309	316	371

Test2.IH1 Comparison of Index Hydrographs and Calculation of Interpolated Hydrograph										
	Index Area = 2.8 square miles				Index Area = 16 square miles				TRL	HEC-1
[redacted]ne	509510	500E	WP581	C510	509510	500E	WP581	C510	Log-Averaged	Output
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
5.20	175	1	143	319	167	1	143	311	317	369
5.22	175	1	145	321	168	1	145	313	319	368
5.23	175	1	146	322	168	1	146	315	320	366
5.25	174	1	148	323	168	1	148	316	321	365
5.27	173	1	149	323	167	0	149	317	321	363
5.28	173	1	150	323	167	0	150	317	321	360
5.30	172	1	150	322	166	0	150	317	321	358
5.32	170	0	151	322	165	0	151	317	321	356
5.33	169	0	152	322	164	0	152	317	321	354
5.35	168	0	152	320	163	0	152	316	319	351
5.37	166	0	152	319	162	0	152	314	318	348
5.38	165	0	153	318	161	0	153	313	317	345
5.40	163	0	153	316	159	0	153	312	315	342
5.42	161	0	153	315	158	0	153	311	314	339
5.43	160	0	153	313	156	0	153	309	312	336
5.45	158	0	153	311	154	0	153	307	310	333
5.47	156	0	153	309	152	0	153	305	308	330
5.48	153	0	153	306	150	0	153	303	305	327
5.50	151	0	153	304	148	0	153	301	303	323
5.52	149	0	153	302	146	0	153	299	301	320
5.53	146	0	153	299	144	0	153	297	298	317
5.55	144	0	153	297	142	0	153	295	296	313
5.57	142	0	153	295	139	0	153	292	294	309
[redacted]5.58	139	0	153	292	137	0	153	290	291	306
5.60	137	0	153	290	135	0	153	288	289	303
5.62	134	0	153	287	132	0	153	285	286	300
5.63	132	0	152	284	130	0	152	282	283	297
5.65	129	0	152	281	127	0	152	279	280	294
5.67	127	0	152	279	125	0	152	277	278	291
5.68	124	0	152	276	122	0	152	274	275	288
5.70	121	0	152	273	119	0	152	271	272	284
5.72	119	0	151	270	117	0	151	268	269	281
5.73	116	0	151	267	114	0	151	266	267	277
5.75	114	0	151	265	112	0	151	263	264	274
5.77	111	0	151	262	110	0	151	261	262	271
5.78	109	0	151	260	108	0	151	259	260	268
5.80	107	0	151	258	106	0	151	257	258	266
5.82	105	0	151	256	104	0	151	255	256	263
5.83	103	0	151	254	102	0	151	253	254	261
5.85	101	0	152	253	100	0	152	252	253	259
5.87	99	0	152	251	98	0	152	250	251	257
5.88	97	0	153	250	96	0	153	249	250	255
5.90	94	0	153	248	94	0	153	247	248	253
5.92	92	0	154	246	91	0	154	245	246	251
5.93	90	0	155	245	89	0	155	244	245	249
5.95	87	0	156	243	87	0	156	243	243	247
5.97	85	0	157	242	85	0	157	242	242	246
5.98	83	0	158	241	83	0	158	241	241	244
6.00	81	0	159	240	81	0	159	240	240	243
[redacted]6.02	79	0	160	240	79	0	160	239	240	242
6.03	77	0	162	239	77	0	162	239	239	242
6.05	76	0	163	239	75	0	163	238	239	241

Test2.IH1 Comparison of Index Hydrographs and Calculation of Interpolated Hydrograph										
	Index Area = 2.8 square miles				Index Area = 16 square miles				TRL	HEC-1
[redacted]e	509510	500E	WP581	C510	509510	500E	WP581	C510	Log-Averaged	Output
[redacted])	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
6.07	74	0	165	238	73	0	165	238	238	240
6.08	72	0	166	238	72	0	166	238	238	240
6.10	70	0	167	238	70	0	167	238	238	239
6.12	69	0	169	238	69	0	169	237	238	239
6.13	67	0	170	237	67	0	170	237	237	239
6.15	66	0	172	237	66	0	172	237	237	238
6.17	64	0	173	237	64	0	173	237	237	238
6.18	63	0	175	237	63	0	175	237	237	238
6.20	61	0	176	238	61	0	176	238	238	238
6.22	60	0	178	238	60	0	178	238	238	238
6.23	59	0	179	238	59	0	179	238	238	238
6.25	58	0	181	239	58	0	181	239	239	239
6.27	56	0	182	239	56	0	182	239	239	239
6.28	55	0	184	239	55	0	184	239	239	239
6.30	53	0	185	239	54	0	185	239	239	239
6.32	52	0	187	239	52	0	187	239	239	238
6.33	50	0	188	238	50	0	188	238	238	238
6.35	49	0	189	238	49	0	189	238	238	238
6.37	47	0	191	238	47	0	191	238	238	238
6.38	45	0	192	238	45	0	192	238	238	237
6.40	44	0	194	237	44	0	194	237	237	237
6.42	42	0	195	237	42	0	195	237	237	237
6.43	41	0	196	237	41	0	196	237	237	237
[redacted]6.45	39	0	197	237	39	0	197	237	237	237
[redacted]6.47	38	0	199	237	38	0	199	237	237	237
6.48	37	0	200	237	37	0	200	237	237	236
6.50	35	0	201	236	35	0	201	236	236	236
6.52	34	0	202	236	34	0	202	236	236	236
6.53	33	0	203	235	33	0	203	235	235	235
6.55	32	0	203	235	32	0	203	235	235	235
6.57	30	0	204	235	30	0	204	235	235	235
6.58	29	0	205	234	29	0	205	234	234	234
6.60	28	0	205	234	28	0	205	234	234	234
6.62	27	0	206	233	27	0	206	233	233	233
6.63	26	0	206	232	26	0	206	232	232	232
6.65	25	0	207	232	25	0	207	232	232	232
6.67	25	0	207	232	25	0	207	232	232	232
6.68	24	0	207	231	24	0	207	231	231	231
6.70	24	0	207	231	24	0	207	231	231	231
6.72	23	0	208	231	23	0	208	231	231	231
6.73	22	0	208	230	22	0	208	230	230	230
6.75	22	0	208	230	22	0	208	230	230	230
6.77	21	0	208	229	21	0	208	229	229	229
6.78	21	0	207	228	21	0	207	228	228	228
6.80	20	0	207	227	20	0	207	227	227	227
6.82	20	0	206	226	20	0	206	226	226	226
6.83	19	0	206	225	19	0	206	225	225	225
6.85	18	0	206	224	18	0	206	224	224	224
6.87	18	0	205	223	18	0	205	223	223	223
[redacted].88	17	0	205	222	17	0	205	222	222	222
6.90	17	0	204	221	17	0	204	221	221	221
6.92	16	0	204	220	16	0	204	220	220	220

Test2.IH1 Comparison of Index Hydrographs and Calculation of Interpolated Hydrograph										
	Index Area = 2.8 square miles				Index Area = 16 square miles				TRL	HEC-1
Time	509510	500E	WP581	C510	509510	500E	WP581	C510	Log-Averaged	Output
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
6.93	15	0	203	219	15	0	203	219	219	219
6.95	15	0	202	217	15	0	202	217	217	217
6.97	14	0	202	216	14	0	202	216	216	216
6.98	14	0	201	215	14	0	201	215	215	215
7.00	14	0	200	214	14	0	200	214	214	214
7.02	13	0	199	212	13	0	199	212	212	212
7.03	13	0	198	211	13	0	198	211	211	211
7.05	13	0	197	210	13	0	197	210	210	210
7.07	12	0	196	208	12	0	196	208	208	208
7.08	12	0	195	207	12	0	195	207	207	207
7.10	12	0	194	206	12	0	194	206	206	206
7.12	12	0	193	204	12	0	193	204	204	204
7.13	12	0	191	203	12	0	191	203	203	203
7.15	11	0	190	202	11	0	190	202	202	202
7.17	11	0	189	200	11	0	189	200	200	200
7.18	11	0	188	199	11	0	188	199	199	199
7.20	11	0	187	197	11	0	187	197	197	197
7.22	11	0	185	196	11	0	185	196	196	196
7.23	10	0	184	195	10	0	184	195	195	195
7.25	10	0	183	193	10	0	183	193	193	193
7.27	10	0	182	192	10	0	182	192	192	192
7.28	10	0	181	190	10	0	181	190	190	190
7.30	10	0	179	189	10	0	179	189	189	189
7.32	9	0	178	187	9	0	178	187	187	187
7.33	9	0	177	186	9	0	177	186	186	186
7.35	9	0	176	184	9	0	176	184	184	184
7.37	9	0	174	183	9	0	174	183	183	183
7.38	8	0	173	181	8	0	173	181	181	181
7.40	8	0	171	179	8	0	171	179	179	179
7.42	8	0	170	178	8	0	170	178	178	178
7.43	7	0	169	176	7	0	169	176	176	176
7.45	7	0	168	175	7	0	168	175	175	175
7.47	7	0	166	173	7	0	166	173	173	173
7.48	7	0	165	172	7	0	165	172	172	172
7.50	6	0	164	170	6	0	164	170	170	170
7.52	6	0	162	169	6	0	162	169	169	169
7.53	6	0	161	167	6	0	161	167	167	167
7.55	6	0	159	165	6	0	159	165	165	165
7.57	5	0	158	163	5	0	158	163	163	163
7.58	5	0	156	161	5	0	156	161	161	161
7.60	5	0	154	159	5	0	154	159	159	159
7.62	5	0	153	158	5	0	153	158	158	158
7.63	5	0	151	156	5	0	151	156	156	156
7.65	5	0	150	154	5	0	150	154	154	154
7.67	4	0	148	152	4	0	148	152	152	152
7.68	4	0	146	150	4	0	146	150	150	150
7.70	4	0	144	148	4	0	144	148	148	148
7.72	4	0	143	147	4	0	143	147	147	147
7.73	4	0	141	145	4	0	141	145	145	145
7.75	4	0	139	143	4	0	139	143	143	143
7.77	4	0	138	141	4	0	138	141	141	141
7.78	4	0	136	140	4	0	136	140	140	140

Test2.IH1 Comparison of Index Hydrographs and Calculation of Interpolated Hydrograph										
	Index Area = 2.8 square miles				Index Area = 16 square miles				TRL	HEC-1
[redacted]ne	509510	500E	WP581	C510	509510	500E	WP581	C510	Log-Averaged	Output
[redacted])	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
7.80	4	0	135	138	4	0	135	138	138	138
7.82	4	0	133	137	4	0	133	137	137	137
7.83	4	0	132	136	4	0	132	136	136	136
7.85	4	0	131	134	4	0	131	134	134	134
7.87	4	0	129	133	4	0	129	133	133	133
7.88	4	0	128	131	4	0	128	131	131	131
7.90	4	0	126	130	4	0	126	130	130	130
7.92	3	0	125	128	3	0	125	128	128	128
7.93	3	0	123	126	3	0	123	126	126	126
7.95	3	0	121	124	3	0	121	124	124	124
7.97	3	0	119	122	3	0	119	122	122	122
7.98	3	0	117	120	3	0	117	120	120	120
8.00	3	0	115	118	3	0	115	118	118	118
8.02	3	0	113	116	3	0	113	116	116	116
8.03	3	0	111	114	3	0	111	114	114	114
8.05	3	0	109	112	3	0	109	112	112	112
8.07	3	0	107	110	3	0	107	110	110	110
8.08	3	0	105	108	3	0	105	108	108	108
8.10	3	0	103	106	3	0	103	106	106	106
8.12	3	0	101	104	3	0	101	104	104	104
8.13	3	0	98	102	3	0	98	102	102	102
8.15	3	0	96	99	3	0	96	99	99	99
8.17	3	0	94	97	3	0	94	97	97	97
8.18	3	0	92	95	3	0	92	95	95	95
[redacted]8.20	3	0	90	93	3	0	90	93	93	93
8.22	3	0	89	92	3	0	89	92	92	92
8.23	3	0	87	90	3	0	87	90	90	90
8.25	3	0	85	88	3	0	85	88	88	88
8.27	3	0	83	86	3	0	83	86	86	86
8.28	3	0	82	85	3	0	82	85	85	85
8.30	3	0	80	83	3	0	80	83	83	83
8.32	3	0	79	81	3	0	79	81	81	81
8.33	3	0	77	80	3	0	77	80	80	80
8.35	3	0	76	78	3	0	76	78	78	78
8.37	3	0	74	77	3	0	74	77	77	77
8.38	3	0	73	75	3	0	73	75	75	75
8.40	3	0	71	74	3	0	71	74	74	74
8.42	3	0	70	73	3	0	70	73	73	73
8.43	3	0	69	72	3	0	69	72	72	72
8.45	3	0	68	71	3	0	68	71	71	71
8.47	3	0	67	70	3	0	67	70	70	70
8.48	2	0	66	68	2	0	66	68	68	68
8.50	2	0	65	67	2	0	65	67	67	67
8.52	2	0	64	66	2	0	64	66	66	66
8.53	2	0	63	65	2	0	63	65	65	65
8.55	2	0	61	64	2	0	61	64	64	64
8.57	2	0	60	62	2	0	60	62	62	62
8.58	2	0	59	61	2	0	59	61	61	61
8.60	2	0	58	60	2	0	58	60	60	60
[redacted]8.62	2	0	56	58	2	0	56	58	58	58
8.63	2	0	55	57	2	0	55	57	57	57
8.65	2	0	53	55	2	0	53	55	55	55

Test2.IH1 Comparison of Index Hydrographs and Calculation of Interpolated Hydrograph										
	Index Area = 2.8 square miles				Index Area = 16 square miles				TRL	HEC-1
Time	509510	500E	WP581	C510	509510	500E	WP581	C510	Log-Averaged	Output
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
8.67	2	0	52	54	2	0	52	54	54	54
8.68	2	0	51	53	2	0	51	53	53	53
8.70	2	0	49	51	2	0	49	51	51	51
8.72	2	0	48	50	2	0	48	50	50	50
8.73	2	0	46	48	2	0	46	48	48	48
8.75	2	0	45	47	2	0	45	47	47	47
8.77	2	0	44	45	2	0	44	45	45	45
8.78	2	0	42	44	2	0	42	44	44	44
8.80	2	0	41	42	2	0	41	42	42	42
8.82	2	0	39	41	2	0	39	41	41	41
8.83	2	0	38	40	2	0	38	40	40	40
8.85	1	0	37	38	1	0	37	38	38	38
8.87	1	0	35	37	1	0	35	37	37	37
8.88	1	0	34	35	1	0	34	35	35	35
8.90	1	0	32	34	1	0	32	34	34	34
8.92	1	0	31	32	1	0	31	32	32	32
8.93	1	0	30	31	1	0	30	31	31	31
8.95	1	0	28	29	1	0	28	29	29	29
8.97	1	0	27	28	1	0	27	28	28	28
8.98	1	0	25	26	1	0	25	26	26	26
9.00	1	0	24	25	1	0	24	25	25	25
9.02	1	0	22	23	1	0	22	23	23	23
9.03	1	0	20	21	1	0	20	21	21	21
9.05	1	0	18	19	1	0	18	19	19	19
9.07	1	0	16	17	1	0	16	17	17	17
9.08	1	0	14	15	1	0	14	15	15	15
9.10	1	0	13	14	1	0	13	14	14	14
9.12	1	0	12	13	1	0	12	13	13	13
9.13	1	0	11	12	1	0	11	12	12	12
9.15	1	0	10	11	1	0	10	11	11	11
9.17	0	0	9	9	0	0	9	9	9	9
9.18	0	0	9	9	0	0	9	9	9	9
9.20	0	0	8	9	0	0	8	9	9	9
9.22	0	0	8	8	0	0	8	8	8	8

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: FRANK BROWN

FROM: *George V. Sabol Consulting Engineers, Inc.*
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DATE: 10/31/94

PROJECT No./Name: 46 / RIO VERDE SOUTH FIS

SUBJECT: HYDROLOGY

ENCLOSED ARE THE FOLLOWING

TABLES F-3 : 100 YR, 6 & 24 HR PEAK DISCHARGES
F-1 : 100 YR 6 HR STORM RESULTS
F-5 : 100 YR, 6 & 24 HR PEAK DISCHARGES W/O LEVEE

REMARKS

COPIES

SIGNED

Table F-3

Existing Condition
100-year Peak Discharges in HEC-1
In Numerical Order By Operation Type

HEC-1 ID	Discharge, in cfs 6-hour	24-hour	Control
500A	421	280	6-hour controls
500B	325	227	6-hour controls
500C	248	160	6-hour controls
500D	371	250	6-hour controls
500E	219	137	6-hour controls
500F	647	442	6-hour controls
500G	349	228	6-hour controls
500H	340	226	6-hour controls
500I	644	430	6-hour controls
500J	204	124	6-hour controls
500K	219	144	6-hour controls
500L	292	190	6-hour controls
500M	228	142	6-hour controls
500N	228	138	6-hour controls
500O	182	120	6-hour controls
500P	201	125	6-hour controls
501A	111	63	6-hour controls
501B	151	89	6-hour controls
502A	113	69	6-hour controls
502B	139	86	6-hour controls
502C	100	63	6-hour controls
503A	458	292	6-hour controls
503B	171	115	6-hour controls
503C	278	176	6-hour controls
504A	428	290	6-hour controls
505A	341	237	6-hour controls
505B	378	228	6-hour controls
509A	674	498	6-hour controls
509B	638	479	6-hour controls
509C	279	193	6-hour controls
509D	453	324	6-hour controls
509E	340	241	6-hour controls
509F	367	257	6-hour controls
509G	196	134	6-hour controls
509H	109	72	6-hour controls
509I	61	36	6-hour controls
509J	161	106	6-hour controls
509K	60	36	6-hour controls
509L	209	125	6-hour controls
509M	150	101	6-hour controls
509N	250	151	6-hour controls
509O	100	59	6-hour controls
509P	325	193	6-hour controls
509Q	244	148	6-hour controls
509R	245	147	6-hour controls
509S	431	273	6-hour controls

Table F-3

Existing Condition
100-year Peak Discharges in HEC-1
In Numerical Order By Operation Type

HEC-1 ID	Discharge, in cfs 6-hour	24-hour	Control
510A	994	806	6-hour controls
510B	518	374	6-hour controls
510C	850	675	6-hour controls
510D	126	75	6-hour controls
510E	282	195	6-hour controls
510F	207	134	6-hour controls
510G	316	208	6-hour controls
511A	941	704	6-hour controls
511B	948	792	6-hour controls
511C	878	747	6-hour controls
511D	195	140	6-hour controls
511E	579	430	6-hour controls
511F	340	225	6-hour controls
511G	961	768	6-hour controls
511H	458	312	6-hour controls
511I	382	236	6-hour controls
511J	238	136	6-hour controls
511K	1001	788	6-hour controls
511L	336	221	6-hour controls
511M	182	116	6-hour controls
511N	132	85	6-hour controls
511O	78	49	6-hour controls
511P	493	353	6-hour controls
511Q	164	106	6-hour controls
B502L	299	239	6-hour controls
B508L	277	380	24-hour controls
B515L	166	223	24-hour controls
B531L	528	551	24-hour controls
B532AL	468	494	24-hour controls
B532R	877	921	24-hour controls
B534L	240	251	24-hour controls
B535R	896	941	24-hour controls
B537R	746	631	6-hour controls
B539R	158	113	6-hour controls
B553R	367	305	6-hour controls
B554R	261	227	6-hour controls
B557L	144	131	6-hour controls
B558R	263	223	6-hour controls
B559L	76	70	6-hour controls
B560L	40	39	6-hour controls
B573L	53	57	24-hour controls
B574R	211	223	24-hour controls
B578L	234	247	24-hour controls
C502	491	406	6-hour controls
C503	395	297	6-hour controls
C504	162	193	24-hour controls

Table F-3

Existing Condition
100-year Peak Discharges in HEC-1
In Numerical Order By Operation Type

HEC-1 ID	Discharge, in cfs 6-hour	24-hour	Control
C506	265	277	24-hour controls
C507	279	346	24-hour controls
C508	528	682	24-hour controls
C509	371	249	6-hour controls
C510	466	365	6-hour controls
C511	509	670	24-hour controls
C512	579	754	24-hour controls
C515	214	278	24-hour controls
C517	424	517	24-hour controls
C518	463	550	24-hour controls
C519	513	606	24-hour controls
C520	818	1007	24-hour controls
C522	307	209	6-hour controls
C523	949	1108	24-hour controls
C526	1594	1472	6-hour controls
C527	1780	1709	6-hour controls
C528	2229	2257	24-hour controls
C529	2175	2211	24-hour controls
C530	2274	2387	24-hour controls
C531	2232	2337	24-hour controls
C533	757	791	24-hour controls
C534	800	839	24-hour controls
C535	1055	1107	24-hour controls
C536	703	743	24-hour controls
C538	895	930	24-hour controls
C540	1288	1415	24-hour controls
C541	208	220	24-hour controls
C542	1300	1430	24-hour controls
C543	1323	1543	24-hour controls
C545	1592	1996	24-hour controls
C545L	695	735	24-hour controls
C545R	1336	1562	24-hour controls
C546	1666	2085	24-hour controls
C550	886	570	6-hour controls
C550L	717	456	6-hour controls
C553	779	649	6-hour controls
C554	410	347	6-hour controls
C555	394	387	6-hour controls
C556	618	528	6-hour controls
C557	755	722	6-hour controls
C558	612	531	6-hour controls
C559	192	178	6-hour controls
C560	127	121	6-hour controls
C561	128	122	6-hour controls
C562	199	189	6-hour controls
C564	347	209	6-hour controls

Table F-3

Existing Condition
100-year Peak Discharges in HEC-1
In Numerical Order By Operation Type

HEC-1 ID	Discharge, in cfs 6-hour	24-hour	Control
C565	657	637	6-hour controls
C566	762	746	6-hour controls
C567	876	958	24-hour controls
C568	915	1005	24-hour controls
C569	920	1008	24-hour controls
C570	1044	1139	24-hour controls
C571	315	302	6-hour controls
C572	429	422	6-hour controls
C575	705	741	24-hour controls
C576	875	1063	24-hour controls
C577	908	812	6-hour controls
C579	807	845	24-hour controls
C580	518	536	24-hour controls
C581	208	267	24-hour controls
CLEAR	240	278	24-hour controls
CLEAR	2387	3216	24-hour controls
CLEAR	1358	1772	24-hour controls
D502L	299	239	6-hour controls
D502R	192	166	6-hour controls
D508L	277	380	24-hour controls
D508R	251	303	24-hour controls
D510L	190	148	6-hour controls
D510R	276	217	6-hour controls
D515L	166	223	24-hour controls
D515R	49	61	24-hour controls
D531L	528	551	24-hour controls
D531R	1694	1779	24-hour controls
D532AL	468	494	24-hour controls
D532AR	341	353	24-hour controls
D532L	810	848	24-hour controls
D532R	877	921	24-hour controls
D534L	240	251	24-hour controls
D534R	560	586	24-hour controls
D535L	158	166	24-hour controls
D535R	896	941	24-hour controls
D537L	248	175	6-hour controls
D537R	746	631	6-hour controls
D539L	295	211	6-hour controls
D539R	158	113	6-hour controls
D553L	411	344	6-hour controls
D553R	367	305	6-hour controls
D554L	149	120	6-hour controls
D554R	261	227	6-hour controls
D557L	144	131	6-hour controls
D557R	610	591	6-hour controls
D558L	348	308	6-hour controls

Table F-3

Existing Condition
100-year Peak Discharges in HEC-1
In Numerical Order By Operation Type

HEC-1 ID	Discharge, in cfs 6-hour	24-hour	Control
D558R	263	223	6-hour controls
D559L	76	70	6-hour controls
D559R	116	108	6-hour controls
D560L	40	39	6-hour controls
D560R	86	82	6-hour controls
D573L	53	57	24-hour controls
D573R	179	188	24-hour controls
D574L	685	717	24-hour controls
D574R	211	223	24-hour controls
D578L	234	247	24-hour controls
D578R	234	247	24-hour controls
TEMP1	371	249	6-hour controls
TEMP2	466	365	6-hour controls
WP504	162	193	24-hour controls
WP581	208	267	24-hour controls
501502	365	240	6-hour controls
502503	294	233	6-hour controls
502506	189	164	6-hour controls
503508	356	271	6-hour controls
504509	155	181	24-hour controls
506507	264	275	24-hour controls
507508	273	324	24-hour controls
508511	271	357	24-hour controls
508517	249	291	24-hour controls
509510	361	236	6-hour controls
510511	272	215	6-hour controls
511512	492	647	24-hour controls
513512	201	130	6-hour controls
514518	199	121	6-hour controls
515517	159	204	24-hour controls
515575	49	57	24-hour controls
517518	423	511	24-hour controls
518519	455	542	24-hour controls
520576	817	1004	24-hour controls
521522	175	114	6-hour controls
524526	871	638	6-hour controls
525526	943	788	6-hour controls
526527	1562	1432	6-hour controls
527528	1764	1686	6-hour controls
528529	2180	2188	24-hour controls
530531	2238	2337	24-hour controls
531532	1687	1769	24-hour controls
531533	523	544	24-hour controls
532538	866	901	24-hour controls
532580	339	350	24-hour controls
533579	754	788	24-hour controls

Table F-3

Existing Condition
100-year Peak Discharges in HEC-1
In Numerical Order By Operation Type

HEC-1 ID	Discharge, in cfs 6-hour	24-hour	Control
534506	239	250	24-hour controls
534535	550	571	24-hour controls
535515	156	164	24-hour controls
536545	696	735	24-hour controls
537538	237	165	6-hour controls
537577	735	619	6-hour controls
538540	876	900	24-hour controls
539555	152	108	6-hour controls
539577	292	208	6-hour controls
540542	1282	1407	24-hour controls
541543	205	215	24-hour controls
542543	1294	1424	24-hour controls
543545	1311	1530	24-hour controls
545546	1581	1982	24-hour controls
549550	445	283	6-hour controls
552553	626	458	6-hour controls
553554	408	339	6-hour controls
553556	365	301	6-hour controls
554555	148	119	6-hour controls
555557	392	371	6-hour controls
556558	613	521	6-hour controls
557559	143	129	6-hour controls
557565	606	584	6-hour controls
558557	347	307	6-hour controls
558571	260	219	6-hour controls
559560	115	107	6-hour controls
559561	76	69	6-hour controls
560561	40	39	6-hour controls
560566	85	80	6-hour controls
561562	128	121	6-hour controls
562567	198	188	6-hour controls
564570	326	195	6-hour controls
565566	655	635	6-hour controls
566567	760	742	6-hour controls
567568	875	955	24-hour controls
568569	911	993	24-hour controls
569570	918	1001	24-hour controls
571572	311	294	6-hour controls
573580	179	186	24-hour controls
574541	208	220	24-hour controls
574575	680	710	24-hour controls
575536	702	737	24-hour controls
576523	874	1061	24-hour controls
577540	881	772	6-hour controls
578573	232	244	24-hour controls
579534	803	839	24-hour controls

Table F-3

Existing Condition
100-year Peak Discharges in HEC-1
In Numerical Order By Operation Type

HEC-1 ID	Discharge, in cfs 6-hour	24-hour	Control
580535	511	526	24-hour controls
581510	206	265	24-hour controls

Table F-5

Existing Condition, without Levee
100-Year Peak Discharges in HEC-1
In Numerical Order By Operation Type

HEC-1 ID	Discharge, in cfs 6-hr	24-hr	Control
510D	126	75	6-hour controls
510E	282	195	6-hour controls
510G	316	208	6-hour controls
511L	336	221	6-hour controls
511M	182	116	6-hour controls
511N	132	85	6-hour controls
511O	78	49	6-hour controls
511Q	164	106	6-hour controls
B535R	896	941	24-hour controls
B574R	211	223	24-hour controls
C515	214	278	24-hour controls
C535	1055	1107	24-hour controls
C536	272	319	24-hour controls
C541	208	220	24-hour controls
C542	1300	1430	24-hour controls
C543	1615	1891	24-hour controls
C545	1611	2010	24-hour controls
C545L	294	331	24-hour controls
C545R	1634	1914	24-hour controls
C546	1688	2104	24-hour controls
C575	111	157	24-hour controls
C582	884	925	24-hour controls
D515L	166	223	24-hour controls
D515R	49	61	24-hour controls
D535L	158	166	24-hour controls
D535R	896	941	24-hour controls
D574L	685	717	24-hour controls
D574R	211	223	24-hour controls
515575	49	57	24-hour controls
535515	156	164	24-hour controls
536545	266	301	24-hour controls
541582	207	218	24-hour controls
542543	1294	1424	24-hour controls
543545	1609	1876	24-hour controls
545546	1598	1996	24-hour controls
574541	208	220	24-hour controls
574582	681	711	24-hour controls
575536	109	148	24-hour controls

FRANK:

I DID NOT ADJUST ANY AREAS FOR THE W/O LEVEE RUN.

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Table F-1
100-year, 6-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
WP504	162	4.67	0.26	623
WP581	208	6.75	3.92	53
CLEAR	240	5.00	4.18	57
511A	941	4.25	0.65	1448
524526	871	4.72	0.65	1340
511B	948	4.63	1.10	862
525526	943	4.72	1.10	857
511D	195	4.27	0.13	1500
C526	1594	4.73	1.88	848
526527	1562	4.93	1.88	831
511E	579	4.53	0.57	1016
511F	340	4.12	0.15	2267
C527	1780	4.92	2.60	685
527528	1764	5.02	2.60	678
511C	878	4.72	1.20	732
C528	2229	5.00	3.80	587
528529	2180	5.23	3.80	574
511H	458	4.20	0.31	1477
C529	2175	5.23	4.11	529
511G	961	4.37	0.87	1105
C530	2274	5.22	4.97	458
530531	2238	5.47	4.97	450
511I	382	4.12	0.21	1819
C531	2232	5.47	5.18	431
D531L	528	5.47	5.18	102
D531R	1694	5.47	5.18	327
531532	1687	5.53	5.18	326
D532R	877	5.53	5.18	169
D532L	810	5.53	5.18	156
D532AL	468	5.52	5.18	90
D532AR	341	5.53	5.18	66
532580	339	5.68	5.18	65
B532AL	468	5.52	5.18	90
D578L	234	5.52	5.18	45
D578R	234	5.52	5.18	45
578573	232	5.60	5.18	45
D573L	53	5.60	5.18	10
D573R	179	5.62	5.18	35
573580	179	5.68	5.18	35
C580	518	5.68	5.18	100
580535	511	6.08	5.18	99
B531L	528	5.47	5.18	102
531533	523	5.57	5.18	101

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
500A	421	4.13	0.21	2005
500B	325	4.22	0.20	1625
500C	248	4.12	0.12	2067
500D	371	4.17	0.23	1613
500E	219	4.10	0.11	1991
500F	647	4.20	0.44	1470
500G	349	4.13	0.20	1745
500H	340	4.17	0.21	1619
500I	644	4.17	0.41	1571
500J	204	4.08	0.09	2267
500K	219	4.12	0.10	2190
500L	292	4.13	0.16	1825
500M	228	4.12	0.12	1900
500N	228	4.17	0.11	2073
500O	182	4.13	0.10	1820
500P	201	4.10	0.08	2513
501A	111	4.05	0.04	2775
501B	151	4.12	0.07	2157
502A	113	4.10	0.04	2825
502B	139	4.12	0.05	2780
502C	100	4.15	0.05	2000
503A	458	4.12	0.22	2082
503B	171	4.22	0.11	1555
503C	278	4.18	0.12	2317
504A	428	4.22	0.24	1783
505A	341	4.15	0.18	1894
505B	378	4.07	0.14	2700
509A	674	4.45	0.57	1182
509B	638	4.47	0.64	997
509C	279	4.15	0.15	1860
509D	453	4.32	0.34	1332
509E	340	4.20	0.19	1789
509F	367	4.17	0.20	1835
509G	196	4.13	0.09	2178
509H	109	4.23	0.07	1557
509I	61	4.15	0.03	2033
509J	161	4.22	0.10	1610
509K	60	4.13	0.03	2000
509L	209	4.05	0.08	2613
509M	150	4.22	0.10	1500
509N	250	4.08	0.11	2273
509O	100	4.05	0.04	2500
509P	325	4.05	0.11	2955

Table F-1
100-year, 6-hour Storm Results

Existing Condition
In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
B578L	234	5.52	5.18	45
C533	757	5.55	5.18	146
533579	754	5.60	5.18	146
B573L	53	5.60	5.18	10
C579	807	5.60	5.18	156
579534	803	5.67	5.18	155
511J	238	4.08	0.12	1983
C534	800	5.67	5.30	151
D534L	240	5.67	5.30	45
D534R	560	5.67	5.30	106
534535	550	5.95	5.30	104
511K	1001	4.32	0.79	1267
C535	1055	6.00	6.09	173
D535R	896	6.00	6.09	147
D535L	158	6.00	6.09	26
535515	156	6.12	6.09	26
511L	336	4.15	0.19	1768
C515	214	4.27	6.28	34
D515L	166	4.27	6.28	26
D515R	49	4.38	6.28	8
515575	49	4.45	6.28	8
511M	182	4.10	0.08	2275
B535R	896	6.00	6.09	147
D574R	211	6.00	6.09	35
D574L	685	6.00	6.09	112
574575	680	6.13	6.09	112
C575	705	6.13	6.36	111
575536	702	6.23	6.36	110
511Q	164	4.12	0.09	1822
511N	132	4.12	0.07	1886
C536	703	6.23	6.52	108
536545	696	6.42	6.52	107
511O	78	4.18	0.05	1560
C545L	695	6.42	6.56	106
B532R	877	5.53	5.18	169
532538	866	5.83	5.18	167
510A	994	4.40	0.91	1092
D537R	746	4.40	0.91	820
D537L	248	4.40	0.91	273
537538	237	4.63	0.91	260
510B	518	4.32	0.36	1439
C538	895	5.82	5.18	173
538540	876	6.43	5.18	169

Existing Condition
In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
509Q	244	4.08	0.11	2218
509R	245	4.08	0.10	2450
509S	431	4.13	0.19	2268
510A	994	4.40	0.91	1092
510B	518	4.32	0.36	1439
510C	850	4.50	0.85	1000
510D	126	4.15	0.06	2100
510E	282	4.27	0.18	1567
510F	207	4.18	0.12	1725
510G	316	4.20	0.18	1756
511A	941	4.25	0.65	1448
511B	948	4.63	1.10	862
511C	878	4.72	1.20	732
511D	195	4.27	0.13	1500
511E	579	4.53	0.57	1016
511F	340	4.12	0.15	2267
511G	961	4.37	0.87	1105
511H	458	4.20	0.31	1477
511I	382	4.12	0.21	1819
511J	238	4.08	0.12	1983
511K	1001	4.32	0.79	1267
511L	336	4.15	0.19	1768
511M	182	4.10	0.08	2275
511N	132	4.12	0.07	1886
511O	78	4.18	0.05	1560
511P	493	4.28	0.31	1590
511Q	164	4.12	0.09	1822
B502L	299	4.22	0.42	712
B508L	277	4.52	6.88	40
B515L	166	4.27	6.28	26
B531L	528	5.47	5.18	102
B532AL	468	5.52	5.18	90
B532R	877	5.53	5.18	169
B534L	240	5.67	5.30	45
B535R	896	6.00	6.09	147
B537R	746	4.40	0.91	820
B539R	158	4.32	0.34	465
B553R	367	5.05	1.21	303
B554R	261	5.18	1.36	192
B557L	144	4.52	2.18	66
B558R	263	5.35	1.56	169
B559L	76	4.58	2.25	34
B560L	40	4.63	2.28	18

Table F-1
100-year, 6-hour Storm Results

Existing Condition
In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
B537R	746	4.40	0.91	820
537577	735	4.55	0.91	808
509D	453	4.32	0.34	1332
D539R	158	4.32	0.34	465
D539L	295	4.32	0.34	868
539577	292	4.38	0.34	859
C577	908	4.50	1.25	726
577540	881	4.88	1.25	705
510C	850	4.50	0.85	1000
C540	1288	4.97	7.28	177
540542	1282	5.03	7.28	176
510F	207	4.18	0.12	1725
C542	1300	5.03	7.40	176
542543	1294	5.07	7.40	175
B574R	211	6.00	6.09	35
574541	208	6.10	6.09	34
510D	126	4.15	0.06	2100
C541	208	6.10	6.15	34
541543	205	6.45	6.15	33
510E	282	4.27	0.18	1567
C543	1323	5.07	13.73	96
543545	1311	5.18	13.73	95
510G	316	4.20	0.18	1756
C545R	1336	5.17	13.91	96
C545	1592	5.15	20.47	78
545546	1581	5.27	20.47	77
511P	493	4.28	0.31	1590
502A	113	4.10	0.04	2825
C546	1666	5.23	20.82	80
509A	674	4.45	0.57	1182
552553	626	5.12	0.57	1098
509B	638	4.47	0.64	997
C553	779	5.05	1.21	644
D553R	367	5.05	1.21	303
D553L	411	5.05	1.21	340
553554	408	5.20	1.21	337
509C	279	4.15	0.15	1860
C554	410	5.18	1.36	301
D554R	261	5.18	1.36	192
D554L	149	5.18	1.36	110
554555	148	5.23	1.36	109
509E	340	4.20	0.19	1789
B539R	158	4.32	0.34	465

Existing Condition
In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
B573L	53	5.60	5.18	10
B574R	211	6.00	6.09	35
B578L	234	5.52	5.18	45
C502	491	4.22	0.42	1169
C503	395	4.35	0.54	731
C504	162	4.67	0.26	623
C506	265	5.63	5.72	46
C507	279	4.40	5.93	47
C508	528	4.52	6.88	77
C509	371	4.17	0.49	757
C510	466	4.28	0.49	951
C511	509	4.52	7.49	68
C512	579	4.95	7.79	74
C515	214	4.27	6.28	34
C517	424	4.50	7.60	56
C518	463	4.48	7.69	60
C519	513	4.65	7.81	66
C520	818	5.10	8.28	99
C522	307	4.23	0.18	1706
C523	949	4.45	8.58	111
C526	1594	4.73	1.88	848
C527	1780	4.92	2.60	685
C528	2229	5.00	3.80	587
C529	2175	5.23	4.11	529
C530	2274	5.22	4.97	458
C531	2232	5.47	5.18	431
C533	757	5.55	5.18	146
C534	800	5.67	5.30	151
C535	1055	6.00	6.09	173
C536	703	6.23	6.52	108
C538	895	5.82	5.18	173
C540	1288	4.97	7.28	177
C541	208	6.10	6.15	34
C542	1300	5.03	7.40	176
C543	1323	5.07	13.73	96
C545	1592	5.15	20.47	78
C545L	695	6.42	6.56	106
C545R	1336	5.17	13.91	96
C546	1666	5.23	20.82	80
C550	886	4.20	0.45	1969
C550L	717	4.20	0.34	2109
C553	779	5.05	1.21	644
C554	410	5.18	1.36	301

Table F-1
100-year, 6-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
539555	152	4.58	0.34	447
C555	394	4.43	1.88	210
555557	392	4.58	1.88	209
B553R	367	5.05	1.21	303
553556	365	5.18	1.21	302
B554R	261	5.18	1.36	192
C556	618	5.18	1.36	454
556558	613	5.37	1.36	451
509F	367	4.17	0.20	1835
C558	612	5.35	1.56	392
D558R	263	5.35	1.56	169
D558L	348	5.35	1.56	223
558557	347	5.40	1.56	222
509G	196	4.13	0.09	2178
C557	755	4.52	2.18	346
D557L	144	4.52	2.18	66
D557R	610	4.52	2.18	280
557565	606	4.73	2.18	278
509M	150	4.22	0.10	1500
C565	657	4.70	2.28	288
565566	655	4.73	2.28	287
B557L	144	4.52	2.18	66
557559	143	4.65	2.18	66
509H	109	4.23	0.07	1557
C559	192	4.60	2.25	85
D559L	76	4.58	2.25	34
D559R	116	4.60	2.25	52
559560	115	4.67	2.25	51
509I	61	4.15	0.03	2033
C560	127	4.63	2.28	56
D560L	40	4.63	2.28	18
D560R	86	4.63	2.28	38
560566	85	4.80	2.28	37
509L	209	4.05	0.08	2613
C566	762	4.73	2.36	323
566567	760	4.78	2.36	322
B559L	76	4.58	2.25	34
559561	76	4.70	2.25	34
B560L	40	4.63	2.28	18
560561	40	4.70	2.28	18
509K	60	4.13	0.03	2000
C561	128	4.65	2.31	55
561562	128	4.70	2.31	55

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
C555	394	4.43	1.88	210
C556	618	5.18	1.36	454
C557	755	4.52	2.18	346
C558	612	5.35	1.56	392
C559	192	4.60	2.25	85
C560	127	4.63	2.28	56
C561	128	4.65	2.31	55
C562	199	4.52	2.41	83
C564	347	4.07	0.15	2313
C565	657	4.70	2.28	288
C566	762	4.73	2.36	323
C567	876	4.77	4.88	180
C568	915	4.78	4.99	183
C569	920	4.90	5.09	181
C570	1044	4.87	5.43	192
C571	315	4.50	2.13	148
C572	429	4.37	2.28	188
C575	705	6.13	6.36	111
C576	875	5.12	8.47	103
C577	908	4.50	1.25	726
C579	807	5.60	5.18	156
C580	518	5.68	5.18	100
C581	208	6.75	3.92	53
CLEAR	240	5.00	4.18	57
CLEAR	2387	5.17	30.43	78
CLEAR	1358	4.63	17.00	80
D502L	299	4.22	0.42	712
D502R	192	4.22	0.42	457
D508L	277	4.52	6.88	40
D508R	251	4.52	6.88	36
D510L	190	4.28	0.49	388
D510R	276	4.28	0.49	563
D515L	166	4.27	6.28	26
D515R	49	4.38	6.28	8
D531L	528	5.47	5.18	102
D531R	1694	5.47	5.18	327
D532AL	468	5.52	5.18	90
D532AR	341	5.53	5.18	66
D532L	810	5.53	5.18	156
D532R	877	5.53	5.18	169
D534L	240	5.67	5.30	45
D534R	560	5.67	5.30	106
D535L	158	6.00	6.09	26

Table F-1
100-year, 6-hour Storm Results

Existing Condition
In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
509J	161	4.22	0.10	1610
C562	199	4.52	2.41	83
562567	198	4.63	2.41	82
509P	325	4.05	0.11	2955
C567	876	4.77	4.88	180
567568	875	4.82	4.88	179
509Q	244	4.08	0.11	2218
C568	915	4.78	4.99	183
568569	911	4.92	4.99	183
509R	245	4.08	0.10	2450
C569	920	4.90	5.09	181
569570	918	4.97	5.09	180
509O	100	4.05	0.04	2500
509N	250	4.08	0.11	2273
C564	347	4.07	0.15	2313
564570	326	4.27	0.15	2173
509S	431	4.13	0.19	2268
C570	1044	4.87	5.43	192
CLEAR	2387	5.17	30.43	78
B558R	263	5.35	1.56	169
558571	260	5.60	1.56	167
505A	341	4.15	0.18	1894
C571	315	4.50	2.13	148
571572	311	4.65	2.13	146
505B	378	4.07	0.14	2700
C572	429	4.37	2.28	188
500A	421	4.13	0.21	2005
501502	365	4.73	0.21	1738
500B	325	4.22	0.20	1625
C502	491	4.22	0.42	1169
D502L	299	4.22	0.42	712
D502R	192	4.22	0.42	457
502506	189	4.43	0.42	450
B534L	240	5.67	5.30	45
534506	239	5.70	5.30	45
C506	265	5.63	5.72	46
506507	264	5.67	5.72	46
500H	340	4.17	0.21	1619
C507	279	4.40	5.93	47
507508	273	4.67	5.93	46
B502L	299	4.22	0.42	712
502503	294	4.40	0.42	700
500C	248	4.12	0.12	2067

Existing Condition
In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
D535R	896	6.00	6.09	147
D537L	248	4.40	0.91	273
D537R	746	4.40	0.91	820
D539L	295	4.32	0.34	868
D539R	158	4.32	0.34	465
D553L	411	5.05	1.21	340
D553R	367	5.05	1.21	303
D554L	149	5.18	1.36	110
D554R	261	5.18	1.36	192
D557L	144	4.52	2.18	66
D557R	610	4.52	2.18	280
D558L	348	5.35	1.56	223
D558R	263	5.35	1.56	169
D559L	76	4.58	2.25	34
D559R	116	4.60	2.25	52
D560L	40	4.63	2.28	18
D560R	86	4.63	2.28	38
D573L	53	5.60	5.18	10
D573R	179	5.62	5.18	35
D574L	685	6.00	6.09	112
D574R	211	6.00	6.09	35
D578L	234	5.52	5.18	45
D578R	234	5.52	5.18	45
TEMP1	371	4.17	0.49	757
TEMP2	466	4.28	0.49	951
WP504	162	4.67	0.26	623
WP581	208	6.75	3.92	53
501502	365	4.73	0.21	1738
502503	294	4.40	0.42	700
502506	189	4.43	0.42	450
503508	356	4.90	0.54	659
504509	155	5.10	0.26	596
506507	264	5.67	5.72	46
507508	273	4.67	5.93	46
508511	271	5.28	6.88	39
508517	249	5.27	6.88	36
509510	361	4.33	0.49	737
510511	272	4.35	0.49	555
511512	492	5.03	7.49	66
513512	201	4.38	0.10	2010
514518	199	4.15	0.09	2211
515517	159	4.52	6.28	25
515575	49	4.45	6.28	8

Table F-1
100-year, 6-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
C503	395	4.35	0.54	731
503508	356	4.90	0.54	659
500I	644	4.17	0.41	1571
C508	528	4.52	6.88	77
D508L	277	4.52	6.88	40
D508R	251	4.52	6.88	36
508517	249	5.27	6.88	36
B515L	166	4.27	6.28	26
515517	159	4.52	6.28	25
500L	292	4.13	0.16	1825
C517	424	4.50	7.60	56
517518	423	4.55	7.60	56
500J	204	4.08	0.09	2267
514518	199	4.15	0.09	2211
C518	463	4.48	7.69	60
518519	455	4.68	7.69	59
500M	228	4.12	0.12	1900
C519	513	4.65	7.81	66
C504	162	4.67	0.26	623
504509	155	5.10	0.26	596
500D	371	4.17	0.23	1613
TEMP1	371	4.17	0.49	757
C509	371	4.17	0.49	757
509510	361	4.33	0.49	737
500E	219	4.10	0.11	1991
C581	208	6.75	3.92	53
581510	206	6.87	3.92	53
TEMP2	466	4.28	0.49	951
C510	466	4.28	0.49	951
D510L	190	4.28	0.49	388
D510R	276	4.28	0.49	563
510511	272	4.35	0.49	555
B508L	277	4.52	6.88	40
508511	271	5.28	6.88	39
500F	647	4.20	0.44	1470
C511	509	4.52	7.49	68
511512	492	5.03	7.49	66
500K	219	4.12	0.10	2190
513512	201	4.38	0.10	2010
500G	349	4.13	0.20	1745
C512	579	4.95	7.79	74
C520	818	5.10	8.28	99
520576	817	5.17	8.28	99

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
517518	423	4.55	7.60	56
518519	455	4.68	7.69	59
520576	817	5.17	8.28	99
521522	175	4.35	0.10	1750
524526	871	4.72	0.65	1340
525526	943	4.72	1.10	857
526527	1562	4.93	1.88	831
527528	1764	5.02	2.60	678
528529	2180	5.23	3.80	574
530531	2238	5.47	4.97	450
531532	1687	5.53	5.18	326
531533	523	5.57	5.18	101
532538	866	5.83	5.18	167
532580	339	5.68	5.18	65
533579	754	5.60	5.18	146
534506	239	5.70	5.30	45
534535	550	5.95	5.30	104
535515	156	6.12	6.09	26
536545	696	6.42	6.52	107
537538	237	4.63	0.91	260
537577	735	4.55	0.91	808
538540	876	6.43	5.18	169
539555	152	4.58	0.34	447
539577	292	4.38	0.34	859
540542	1282	5.03	7.28	176
541543	205	6.45	6.15	33
542543	1294	5.07	7.40	175
543545	1311	5.18	13.73	95
545546	1581	5.27	20.47	77
549550	445	4.22	0.22	2023
552553	626	5.12	0.57	1098
553554	408	5.20	1.21	337
553556	365	5.18	1.21	302
554555	148	5.23	1.36	109
555557	392	4.58	1.88	209
556558	613	5.37	1.36	451
557559	143	4.65	2.18	66
557565	606	4.73	2.18	278
558557	347	5.40	1.56	222
558571	260	5.60	1.56	167
559560	115	4.67	2.25	51
559561	76	4.70	2.25	34
560561	40	4.70	2.28	18

Table F-1
100-year, 6-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
500O	182	4.13	0.10	1820
521522	175	4.35	0.10	1750
500P	201	4.10	0.08	2513
C522	307	4.23	0.18	1706
C576	875	5.12	8.47	103
576523	874	5.15	8.47	103
500N	228	4.17	0.11	2073
C523	949	4.45	8.58	111
501A	111	4.05	0.04	2775
501B	151	4.12	0.07	2157
CLEAR	1358	4.63	17.00	80
502B	139	4.12	0.05	2780
502C	100	4.15	0.05	2000
503A	458	4.12	0.22	2082
549550	445	4.22	0.22	2023
503C	278	4.18	0.12	2317
C550L	717	4.20	0.34	2109
503B	171	4.22	0.11	1555
C550	886	4.20	0.45	1969
504A	428	4.22	0.24	1783

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
560566	85	4.80	2.28	37
561562	128	4.70	2.31	55
562567	198	4.63	2.41	82
564570	326	4.27	0.15	2173
565566	655	4.73	2.28	287
566567	760	4.78	2.36	322
567568	875	4.82	4.88	179
568569	911	4.92	4.99	183
569570	918	4.97	5.09	180
571572	311	4.65	2.13	146
573580	179	5.68	5.18	35
574541	208	6.10	6.09	34
574575	680	6.13	6.09	112
575536	702	6.23	6.36	110
576523	874	5.15	8.47	103
577540	881	4.88	1.25	705
578573	232	5.60	5.18	45
579534	803	5.67	5.18	155
580535	511	6.08	5.18	99
581510	206	6.87	3.92	53

14 October 1994

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HEC-1 Problem Report:

Problem Description:

The HEC-1 model in question uses JD records, S-Graphs and the Green-Ampt equation. Two hydrographs are imported into the model using QI records. The index hydrographs after the import are populated with zero values. The peak discharge reported by HEC-1 at the first downstream concentration point below WP581(C510) is unrealistic (refer to the TEST1.IH1 sample file). C510 combines operations 509510, 500E and 581510 (361, 219 and 207 cfs, respectively). The total discharge cannot be over 787 cfs, yet HEC-1 reports a peak discharge of 1297 cfs. The index hydrographs at C510 appear to be correct. The interpolated hydrograph is not. The operation following C510 is a diversion. The results of the diversion are also unrealistic and do not total 1297 cfs.

Temporary Solution:

I was able to work-around the problem by doing the following (refer to the TEST2.IH1 sample file):

1. I imported the two hydrographs using QI records at the start of the file, and also wrote them out to a Tape21 file.

2. The two hydrographs were then read back into the input file at the appropriate locations using the BI record option. The index hydrographs were then found to be populated with the original hydrographs from the QI records.

3. This still did not solve the problem, although the peak discharge at C510 changed from 1297 cfs to 929 cfs. I then renamed the combination records at C509 and C510 to TEMP1 and TEMP2, respectively, and wrote them out to the Tape21 file. I then read both hydrographs back in using BI records. A reasonable peak discharge was reported and the interpolated hydrograph looked good.

4. I performed a manual calculation of the interpolated hydrograph at C510 (refer to the attached table) and compared it with the HEC-1 results from step 3. The peak discharge is 321 cfs in both cases. This is a reasonable discharge when the watershed area at C510 is considered. The manual results match the work-around HEC-1 solution.

Tom Loomis

Tom Loomis
George V. Sabol Consulting Engineers, Inc.

From Test1

From Test2

Test2.IH1 Comparison of Index Hydrographs and Calculation of Interpolated Hydrograph										
	Index Area = 2.8 square miles				Index Area = 16 square miles				TRL	HEC-1
ne	509510	500E	WP581	C510	509510	500E	WP581	C510	Log-Averaged	Output
)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
3.47	0	0	0	0	0	0	0	0	0	0
3.48	0	0	0	0	0	0	0	0	0	0
3.50	0	0	0	0	0	0	0	0	0	0
3.52	0	0	0	0	0	0	0	0	0	1
3.53	0	1	0	1	0	0	0	0	1	2
3.55	0	1	0	1	0	1	0	1	1	4
3.57	0	2	0	2	0	1	0	1	2	6
3.58	0	3	0	3	0	2	0	2	3	9
3.60	0	4	0	4	0	3	0	3	4	14
3.62	0	6	0	6	0	4	0	4	5	21
3.63	0	9	0	9	0	6	0	6	8	29
3.65	0	12	0	12	0	8	0	8	11	38
3.67	0	15	0	15	0	10	0	10	14	48
3.68	0	18	0	18	0	12	0	12	16	59
3.70	0	22	0	22	0	14	0	14	20	72
3.72	0	27	0	27	0	18	0	18	25	87
3.73	0	32	0	32	0	21	0	21	29	104
3.75	0	36	0	36	0	24	0	24	33	118
3.77	0	41	0	41	0	26	0	26	37	131
3.78	0	44	0	45	0	29	0	29	41	143
3.80	0	48	1	49	0	31	1	32	44	155
3.82	0	52	1	53	0	34	1	35	48	167
3.83	0	56	1	57	0	36	1	37	52	180
3.85	0	60	1	61	0	39	1	40	55	193
3.87	0	64	1	66	0	42	1	43	60	206
3.88	0	69	2	70	0	45	2	46	63	220
3.90	0	73	2	75	0	48	2	50	68	233
3.92	0	77	2	79	0	51	2	53	72	248
3.93	0	82	3	84	0	54	3	56	76	263
3.95	1	86	3	90	0	57	3	60	82	281
3.97	2	91	4	96	0	60	4	64	87	303
3.98	5	96	4	105	1	63	4	68	95	338
4.00	12	100	5	116	1	66	5	72	104	398
4.02	23	103	6	132	3	68	6	76	117	483
4.03	37	106	7	150	6	70	7	82	131	574
4.05	53	108	7	168	12	72	7	91	147	655
4.07	68	110	8	186	22	73	8	103	163	713
4.08	82	112	9	202	32	74	9	115	178	752
4.10	95	112	10	217	43	74	10	128	193	783
4.12	106	112	11	230	53	74	11	139	205	804
4.13	118	111	13	241	63	74	13	149	216	824
4.15	128	110	14	252	72	73	14	159	226	840
4.17	137	108	15	261	79	72	15	166	235	857
4.18	147	106	16	269	87	71	16	174	243	873
4.20	155	104	17	276	94	69	17	179	249	887
4.22	164	100	18	281	100	66	18	184	254	896
4.23	171	95	19	286	106	63	19	188	259	903
4.25	179	93	20	291	111	62	20	193	264	914
4.27	185	90	21	296	116	60	21	197	269	921
4.28	190	88	21	300	121	59	21	201	273	926
4.30	195	86	22	303	124	58	22	204	276	929
4.32	198	84	22	304	127	56	22	206	277	927

Test2.IH1 Comparison of Index Hydrographs and Calculation of Interpolated Hydrograph										
	Index Area = 2.8 square miles				Index Area = 16 square miles				TRL	HEC-1
[illegible]e	509510	500E	WP581	C510	509510	500E	WP581	C510	Log-Averaged	Output
[illegible])	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
4.33	201	81	23	305	130	54	23	207	278	923
4.35	203	78	24	304	132	52	24	208	278	915
4.37	204	75	24	303	133	50	24	208	277	904
4.38	204	72	25	300	134	48	25	207	274	891
4.40	204	68	25	297	134	46	25	206	272	874
4.42	202	64	26	293	134	43	26	204	269	855
4.43	201	60	27	288	134	41	27	202	264	834
4.45	198	56	28	282	133	38	28	199	259	809
4.47	195	51	29	275	131	35	29	195	253	782
4.48	192	46	30	268	130	31	30	191	247	752
4.50	188	42	31	261	128	29	31	187	241	726
4.52	184	39	32	255	125	27	32	184	235	702
4.53	180	36	33	249	123	25	33	181	230	679
4.55	176	33	35	243	120	23	35	178	225	658
4.57	172	31	36	238	117	22	36	175	221	639
4.58	167	28	37	233	114	20	37	172	216	620
4.60	163	26	39	228	112	19	39	169	212	600
4.62	159	24	40	223	109	18	40	167	208	579
4.63	154	22	42	219	107	16	42	165	204	558
4.65	150	21	43	214	105	15	43	163	200	538
4.67	146	19	45	210	102	14	45	161	197	520
4.68	143	17	47	208	101	13	47	161	195	506
4.70	141	16	50	206	99	12	50	161	194	494
4.72	139	15	52	206	98	11	52	162	194	484
[illegible]4.73	137	14	55	205	98	10	55	163	193	474
4.75	136	12	57	206	99	9	57	165	195	464
4.77	136	11	60	207	100	8	60	168	196	464
4.78	136	10	63	210	102	8	63	173	200	454
4.80	137	10	66	213	104	7	66	177	203	437
4.82	138	9	69	216	107	7	69	183	207	429
4.83	140	8	72	220	111	6	72	189	211	421
4.85	143	7	77	227	115	6	77	197	219	416
4.87	145	7	81	233	119	5	81	205	225	412
4.88	148	6	86	240	123	5	86	213	233	408
4.90	151	6	90	247	127	4	90	222	240	406
4.92	154	5	95	254	131	4	95	230	247	404
4.93	156	5	99	260	136	4	99	238	254	400
4.95	159	5	102	266	140	3	102	245	260	396
4.97	161	4	106	271	144	3	106	253	266	391
4.98	164	4	109	277	147	3	109	260	272	387
5.00	166	3	113	282	150	3	113	266	278	385
5.02	167	3	116	287	153	2	116	271	283	382
5.03	169	3	119	291	155	2	119	277	287	381
5.05	170	3	122	295	157	2	122	281	291	380
5.07	171	2	125	299	159	2	125	286	295	379
5.08	172	2	128	302	161	2	128	291	299	378
5.10	173	2	130	305	162	1	130	294	302	376
5.12	174	2	133	308	164	1	133	298	305	375
5.13	174	1	135	311	165	1	135	301	308	374
[illegible]5.15	175	1	138	314	166	1	138	304	311	373
5.17	175	1	140	316	166	1	140	307	314	373
5.18	175	1	142	318	167	1	142	309	316	371

Test2.IH1 Comparison of Index Hydrographs and Calculation of Interpolated Hydrograph										
	Index Area = 2.8 square miles				Index Area = 16 square miles				TRL	HEC-1
[redacted]e	509510	500E	WP581	C510	509510	500E	WP581	C510	Log-Averaged	Output
[redacted]	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
5.20	175	1	143	319	167	1	143	311	317	369
5.22	175	1	145	321	168	1	145	313	319	368
5.23	175	1	146	322	168	1	146	315	320	366
5.25	174	1	148	323	168	1	148	316	321	365
5.27	173	1	149	323	167	0	149	317	321	363
5.28	173	1	150	323	167	0	150	317	321	360
5.30	172	1	150	322	166	0	150	317	321	358
5.32	170	0	151	322	165	0	151	317	321	356
5.33	169	0	152	322	164	0	152	317	321	354
5.35	168	0	152	320	163	0	152	316	319	351
5.37	166	0	152	319	162	0	152	314	318	348
5.38	165	0	153	318	161	0	153	313	317	345
5.40	163	0	153	316	159	0	153	312	315	342
5.42	161	0	153	315	158	0	153	311	314	339
5.43	160	0	153	313	156	0	153	309	312	336
5.45	158	0	153	311	154	0	153	307	310	333
5.47	156	0	153	309	152	0	153	305	308	330
5.48	153	0	153	306	150	0	153	303	305	327
5.50	151	0	153	304	148	0	153	301	303	323
5.52	149	0	153	302	146	0	153	299	301	320
5.53	146	0	153	299	144	0	153	297	298	317
5.55	144	0	153	297	142	0	153	295	296	313
5.57	142	0	153	295	139	0	153	292	294	309
5.58	139	0	153	292	137	0	153	290	291	306
[redacted]60	137	0	153	290	135	0	153	288	289	303
5.62	134	0	153	287	132	0	153	285	286	300
5.63	132	0	152	284	130	0	152	282	283	297
5.65	129	0	152	281	127	0	152	279	280	294
5.67	127	0	152	279	125	0	152	277	278	291
5.68	124	0	152	276	122	0	152	274	275	288
5.70	121	0	152	273	119	0	152	271	272	284
5.72	119	0	151	270	117	0	151	268	269	281
5.73	116	0	151	267	114	0	151	266	267	277
5.75	114	0	151	265	112	0	151	263	264	274
5.77	111	0	151	262	110	0	151	261	262	271
5.78	109	0	151	260	108	0	151	259	260	268
5.80	107	0	151	258	106	0	151	257	258	266
5.82	105	0	151	256	104	0	151	255	256	263
5.83	103	0	151	254	102	0	151	253	254	261
5.85	101	0	152	253	100	0	152	252	253	259
5.87	99	0	152	251	98	0	152	250	251	257
5.88	97	0	153	250	96	0	153	249	250	255
5.90	94	0	153	248	94	0	153	247	248	253
5.92	92	0	154	246	91	0	154	245	246	251
5.93	90	0	155	245	89	0	155	244	245	249
5.95	87	0	156	243	87	0	156	243	243	247
5.97	85	0	157	242	85	0	157	242	242	246
5.98	83	0	158	241	83	0	158	241	241	244
6.00	81	0	159	240	81	0	159	240	240	243
[redacted]02	79	0	160	240	79	0	160	239	240	242
6.03	77	0	162	239	77	0	162	239	239	242
6.05	76	0	163	239	75	0	163	238	239	241

Test2.IH1 Comparison of Index Hydrographs and Calculation of Interpolated Hydrograph										
	Index Area = 2.8 square miles				Index Area = 16 square miles				TRL	HEC-1
[redacted]ne	509510	500E	WP581	C510	509510	500E	WP581	C510	Log-Averaged	Output
[redacted])	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
6.07	74	0	165	238	73	0	165	238	238	240
6.08	72	0	166	238	72	0	166	238	238	240
6.10	70	0	167	238	70	0	167	238	238	239
6.12	69	0	169	238	69	0	169	237	238	239
6.13	67	0	170	237	67	0	170	237	237	239
6.15	66	0	172	237	66	0	172	237	237	238
6.17	64	0	173	237	64	0	173	237	237	238
6.18	63	0	175	237	63	0	175	237	237	238
6.20	61	0	176	238	61	0	176	238	238	238
6.22	60	0	178	238	60	0	178	238	238	238
6.23	59	0	179	238	59	0	179	238	238	238
6.25	58	0	181	239	58	0	181	239	239	239
6.27	56	0	182	239	56	0	182	239	239	239
6.28	55	0	184	239	55	0	184	239	239	239
6.30	53	0	185	239	54	0	185	239	239	239
6.32	52	0	187	239	52	0	187	239	239	238
6.33	50	0	188	238	50	0	188	238	238	238
6.35	49	0	189	238	49	0	189	238	238	238
6.37	47	0	191	238	47	0	191	238	238	238
6.38	45	0	192	238	45	0	192	238	238	237
6.40	44	0	194	237	44	0	194	237	237	237
6.42	42	0	195	237	42	0	195	237	237	237
6.43	41	0	196	237	41	0	196	237	237	237
6.45	39	0	197	237	39	0	197	237	237	237
[redacted]6.47	38	0	199	237	38	0	199	237	237	237
6.48	37	0	200	237	37	0	200	237	237	236
6.50	35	0	201	236	35	0	201	236	236	236
6.52	34	0	202	236	34	0	202	236	236	236
6.53	33	0	203	235	33	0	203	235	235	235
6.55	32	0	203	235	32	0	203	235	235	235
6.57	30	0	204	235	30	0	204	235	235	235
6.58	29	0	205	234	29	0	205	234	234	234
6.60	28	0	205	234	28	0	205	234	234	234
6.62	27	0	206	233	27	0	206	233	233	233
6.63	26	0	206	232	26	0	206	232	232	232
6.65	25	0	207	232	25	0	207	232	232	232
6.67	25	0	207	232	25	0	207	232	232	232
6.68	24	0	207	231	24	0	207	231	231	231
6.70	24	0	207	231	24	0	207	231	231	231
6.72	23	0	208	231	23	0	208	231	231	231
6.73	22	0	208	230	22	0	208	230	230	230
6.75	22	0	208	230	22	0	208	230	230	230
6.77	21	0	208	229	21	0	208	229	229	229
6.78	21	0	207	228	21	0	207	228	228	228
6.80	20	0	207	227	20	0	207	227	227	227
6.82	20	0	206	226	20	0	206	226	226	226
6.83	19	0	206	225	19	0	206	225	225	225
6.85	18	0	206	224	18	0	206	224	224	224
6.87	18	0	205	223	18	0	205	223	223	223
[redacted]6.88	17	0	205	222	17	0	205	222	222	222
6.90	17	0	204	221	17	0	204	221	221	221
6.92	16	0	204	220	16	0	204	220	220	220

Test2.IH1 Comparison of Index Hydrographs and Calculation of Interpolated Hydrograph										
	Index Area = 2.8 square miles				Index Area = 16 square miles				TRL	HEC-1
e	509510	500E	WP581	C510	509510	500E	WP581	C510	Log-Averaged	Output
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
6.93	15	0	203	219	15	0	203	219	219	219
6.95	15	0	202	217	15	0	202	217	217	217
6.97	14	0	202	216	14	0	202	216	216	216
6.98	14	0	201	215	14	0	201	215	215	215
7.00	14	0	200	214	14	0	200	214	214	214
7.02	13	0	199	212	13	0	199	212	212	212
7.03	13	0	198	211	13	0	198	211	211	211
7.05	13	0	197	210	13	0	197	210	210	210
7.07	12	0	196	208	12	0	196	208	208	208
7.08	12	0	195	207	12	0	195	207	207	207
7.10	12	0	194	206	12	0	194	206	206	206
7.12	12	0	193	204	12	0	193	204	204	204
7.13	12	0	191	203	12	0	191	203	203	203
7.15	11	0	190	202	11	0	190	202	202	202
7.17	11	0	189	200	11	0	189	200	200	200
7.18	11	0	188	199	11	0	188	199	199	199
7.20	11	0	187	197	11	0	187	197	197	197
7.22	11	0	185	196	11	0	185	196	196	196
7.23	10	0	184	195	10	0	184	195	195	195
7.25	10	0	183	193	10	0	183	193	193	193
7.27	10	0	182	192	10	0	182	192	192	192
7.28	10	0	181	190	10	0	181	190	190	190
7.30	10	0	179	189	10	0	179	189	189	189
7.32	9	0	178	187	9	0	178	187	187	187
7.33	9	0	177	186	9	0	177	186	186	186
7.35	9	0	176	184	9	0	176	184	184	184
7.37	9	0	174	183	9	0	174	183	183	183
7.38	8	0	173	181	8	0	173	181	181	181
7.40	8	0	171	179	8	0	171	179	179	179
7.42	8	0	170	178	8	0	170	178	178	178
7.43	7	0	169	176	7	0	169	176	176	176
7.45	7	0	168	175	7	0	168	175	175	175
7.47	7	0	166	173	7	0	166	173	173	173
7.48	7	0	165	172	7	0	165	172	172	172
7.50	6	0	164	170	6	0	164	170	170	170
7.52	6	0	162	169	6	0	162	169	169	169
7.53	6	0	161	167	6	0	161	167	167	167
7.55	6	0	159	165	6	0	159	165	165	165
7.57	5	0	158	163	5	0	158	163	163	163
7.58	5	0	156	161	5	0	156	161	161	161
7.60	5	0	154	159	5	0	154	159	159	159
7.62	5	0	153	158	5	0	153	158	158	158
7.63	5	0	151	156	5	0	151	156	156	156
7.65	5	0	150	154	5	0	150	154	154	154
7.67	4	0	148	152	4	0	148	152	152	152
7.68	4	0	146	150	4	0	146	150	150	150
7.70	4	0	144	148	4	0	144	148	148	148
7.72	4	0	143	147	4	0	143	147	147	147
7.73	4	0	141	145	4	0	141	145	145	145
7.75	4	0	139	143	4	0	139	143	143	143
7.77	4	0	138	141	4	0	138	141	141	141
7.78	4	0	136	140	4	0	136	140	140	140

Test2.IH1 Comparison of Index Hydrographs and Calculation of Interpolated Hydrograph										
	Index Area = 2.8 square miles				Index Area = 16 square miles				TRL	HEC-1
Time	509510	500E	WP581	C510	509510	500E	WP581	C510	Log-Averaged	Output
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
7.80	4	0	135	138	4	0	135	138	138	138
7.82	4	0	133	137	4	0	133	137	137	137
7.83	4	0	132	136	4	0	132	136	136	136
7.85	4	0	131	134	4	0	131	134	134	134
7.87	4	0	129	133	4	0	129	133	133	133
7.88	4	0	128	131	4	0	128	131	131	131
7.90	4	0	126	130	4	0	126	130	130	130
7.92	3	0	125	128	3	0	125	128	128	128
7.93	3	0	123	126	3	0	123	126	126	126
7.95	3	0	121	124	3	0	121	124	124	124
7.97	3	0	119	122	3	0	119	122	122	122
7.98	3	0	117	120	3	0	117	120	120	120
8.00	3	0	115	118	3	0	115	118	118	118
8.02	3	0	113	116	3	0	113	116	116	116
8.03	3	0	111	114	3	0	111	114	114	114
8.05	3	0	109	112	3	0	109	112	112	112
8.07	3	0	107	110	3	0	107	110	110	110
8.08	3	0	105	108	3	0	105	108	108	108
8.10	3	0	103	106	3	0	103	106	106	106
8.12	3	0	101	104	3	0	101	104	104	104
8.13	3	0	98	102	3	0	98	102	102	102
8.15	3	0	96	99	3	0	96	99	99	99
8.17	3	0	94	97	3	0	94	97	97	97
8.18	3	0	92	95	3	0	92	95	95	95
8.20	3	0	90	93	3	0	90	93	93	93
8.22	3	0	89	92	3	0	89	92	92	92
8.23	3	0	87	90	3	0	87	90	90	90
8.25	3	0	85	88	3	0	85	88	88	88
8.27	3	0	83	86	3	0	83	86	86	86
8.28	3	0	82	85	3	0	82	85	85	85
8.30	3	0	80	83	3	0	80	83	83	83
8.32	3	0	79	81	3	0	79	81	81	81
8.33	3	0	77	80	3	0	77	80	80	80
8.35	3	0	76	78	3	0	76	78	78	78
8.37	3	0	74	77	3	0	74	77	77	77
8.38	3	0	73	75	3	0	73	75	75	75
8.40	3	0	71	74	3	0	71	74	74	74
8.42	3	0	70	73	3	0	70	73	73	73
8.43	3	0	69	72	3	0	69	72	72	72
8.45	3	0	68	71	3	0	68	71	71	71
8.47	3	0	67	70	3	0	67	70	70	70
8.48	2	0	66	68	2	0	66	68	68	68
8.50	2	0	65	67	2	0	65	67	67	67
8.52	2	0	64	66	2	0	64	66	66	66
8.53	2	0	63	65	2	0	63	65	65	65
8.55	2	0	61	64	2	0	61	64	64	64
8.57	2	0	60	62	2	0	60	62	62	62
8.58	2	0	59	61	2	0	59	61	61	61
8.60	2	0	58	60	2	0	58	60	60	60
8.62	2	0	56	58	2	0	56	58	58	58
8.63	2	0	55	57	2	0	55	57	57	57
8.65	2	0	53	55	2	0	53	55	55	55

Test2.IH1 Comparison of Index Hydrographs and Calculation of Interpolated Hydrograph										
	Index Area = 2.8 square miles				Index Area = 16 square miles				TRL	HEC-1
Time	509510	500E	WP581	C510	509510	500E	WP581	C510	Log-Averaged	Output
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
8.67	2	0	52	54	2	0	52	54	54	54
8.68	2	0	51	53	2	0	51	53	53	53
8.70	2	0	49	51	2	0	49	51	51	51
8.72	2	0	48	50	2	0	48	50	50	50
8.73	2	0	46	48	2	0	46	48	48	48
8.75	2	0	45	47	2	0	45	47	47	47
8.77	2	0	44	45	2	0	44	45	45	45
8.78	2	0	42	44	2	0	42	44	44	44
8.80	2	0	41	42	2	0	41	42	42	42
8.82	2	0	39	41	2	0	39	41	41	41
8.83	2	0	38	40	2	0	38	40	40	40
8.85	1	0	37	38	1	0	37	38	38	38
8.87	1	0	35	37	1	0	35	37	37	37
8.88	1	0	34	35	1	0	34	35	35	35
8.90	1	0	32	34	1	0	32	34	34	34
8.92	1	0	31	32	1	0	31	32	32	32
8.93	1	0	30	31	1	0	30	31	31	31
8.95	1	0	28	29	1	0	28	29	29	29
8.97	1	0	27	28	1	0	27	28	28	28
8.98	1	0	25	26	1	0	25	26	26	26
9.00	1	0	24	25	1	0	24	25	25	25
9.02	1	0	22	23	1	0	22	23	23	23
9.03	1	0	20	21	1	0	20	21	21	21
9.05	1	0	18	19	1	0	18	19	19	19
9.07	1	0	16	17	1	0	16	17	17	17
9.08	1	0	14	15	1	0	14	15	15	15
9.10	1	0	13	14	1	0	13	14	14	14
9.12	1	0	12	13	1	0	12	13	13	13
9.13	1	0	11	12	1	0	11	12	12	12
9.15	1	0	10	11	1	0	10	11	11	11
9.17	0	0	9	9	0	0	9	9	9	9
9.18	0	0	9	9	0	0	9	9	9	9
9.20	0	0	8	9	0	0	8	9	9	9
9.22	0	0	8	8	0	0	8	8	8	8

FR/GEK

RECEIVED MAR 2 2 1994

MEMORANDUM

To: Ash Patel, Wood, Patel & Associates, Inc. (W&P)
Russ Cruff, Burgess & Niple, Inc.
Geza Kmetty, McLaughlin Kmetty Engineers, Ltd.

From: G.V. Sabol, GVSCE

Subject: Rio Verde (North & South) FIS

Date: 21 March 1994

I reviewed the preliminary hydrology study results that were provided at our coordination meeting of 22 February 1994. I have used the HEC-1 files that were provided to also evaluate an additional S-graph and various values of K_n. The rainfall distribution that was used in our evaluation is the FCDMC 6-hour storm as defined in the hydrology manual. The results of our study are included for your review and consideration.

The S-graph that was used is S-graph #18, Indian Bend Wash, June 1972, from the S-Graph Study (November 1987). That S-graph was recommended for consideration for use with alluvial fans and distributed flow situations (herein called peidmonts) in a technical memorandum to FCDMC dated 31 March 1993 (Attachment A).

A range of K_n was used from a high of 0.055 to a low of 0.015. A value of 0.055 was used by W&P in its preliminary study. An evaluation of K_n values was recently performed for the FCDMC (Attachment B), and K_n values from 0.015 to 0.03 are suggested for use with peidmont watersheds.

The results of the GVSCE study results and the W&P study results are tabulated below for the various unit hydrographs.

Unit Hydrograph	Peak Discharge, in cfs, at concentration points		
	15 C	25 C	35 C
(1)	(2)	(3)	(4)
Clark	1,027	1,176	1,594
Phx. Mtn. (K_n=.055)	1,098	1,224	1,715
Phx. Valley (K_n=.055)	1,313	1,512	2,198
#18 (K_n=.055)	900	1,007	1,352
#18 (K_n=.030)	1,243	1,283	1,693
#18 (K_n=.025)	1,331	1,335	1,765
#18 (K_n=.020)	1,454	1,394	1,817
#18 (K_n=.015)	1,561	1,450	2,095

A value of K_n = 0.020 is generally recommended for peidmonts in Attachment B, and the results using S-graph #18 along with K_n = 0.020 are reasonably similar to the results for the Phoenix Valley S-graph with K_n = 0.055 and to the LP3 Q100 regression results as reported in the W&P summary sheet.

I suggest that we meet with the FCDMC to discuss these results and to determine if there is consensus agreement as to the unit hydrograph approach that should be considered for use in the Rio Verde (North & South) FIS.

It is noted, however, that the results contained herein are only for a preliminary study using the HEC-1 models that were provided to us by W&P. As we begin our hydrology study, we will be undertaking more extensive evaluations on our own, and those evaluations could lead to different recommendations than have been considered at this time.

In addition to the above, I recommend that we also consider entering into a discussion with the FCDMC staff as to the other model issues for Rio Verde, such as, flow splits and channel routing. These may be more critical than selection of unit hydrograph procedure. I would like to discuss the modeling concept, in general, for this peidmont with the FCDMC before embarking on our hydrology study. I suspect that you share my interest in this regard.

A diskette of the HEC-1 files for our study is included with this memorandum.

Attachment A

TECHNICAL MEMORANDUM

To: Maricopa County Hydrology Manual Committee
From: G.V. Sabol
Subject: Rainfall-Runoff data that was submitted by FCDMC, February 1993
Date: 31 March 1993

I received the diskettes of rainfall-runoff data from the District under Letter of Transmittal dated 22 February 1993. One diskette contains data for two streamgaging stations on Indian Bend Wash, and records of rainfall for seven raingages within and surrounding the watersheds. The two streamgages are located at McKellips and Sweetwater. A summary of that data is shown in Table 1. Clearly, the data is important and analysis of the data may provide useful information on unit hydrograph shape (S-graphs) and on unit hydrograph parameters (Lag and K_n). However, the analysis of all or part of the data is a relatively costly process and this needs to be considered as this project nears completion and there are several issues that have yet to be resolved.

Receiving this data did cause me to reconsider the S-graph data that we presently have for Indian Bend Wash. In the S-Graph Study (1987) there are three S-graphs for Indian Bend Wash (#16, #17 and #18). Those were developed by the Corps of Engineers from data for three different storms. Watershed and Lag data for those three S-graphs are shown in Table 4 of the enclosed S-Graph K_n Study, and descriptions of the three storms are shown in Appendix C of the S-Graph Study (1987). Review of that information leads to several observations:

1. We presently have available three S-graphs for Indian Bend Wash.
2. The shapes of those S-graphs are significantly different. The only explanation for the difference in shape is that the rainfall characteristics (mainly rainfall intensity) play an important role in S-graph shape. (An observation that we have made in the past.)
3. The K_n values are significantly different. This is probably because the hydraulic efficiency of runoff is impacted by the storm characteristics. Below is a brief summary of the storms and K_n values for each of those three S-graphs:

S-graph	Storm Date	Type of Rainfall	Peak Discharge	K_n
#16	Dec 1967	General Storm	2,000 cfs	0.071
#17	Sept 1970	General Storm with imbedded Local storm cells	1,120 cfs	0.065
#18	June 1972	Local Storm	10,000 cfs	0.028

4. S-graph #18 appears to represent the type of storm condition that we are attempting to perform flood analyses for in Maricopa County.
5. S-graph #18 is nearly identical to the Q11 S-graph that was suggested as a candidate for an alluvial fan S-graph in the Small Watershed S-Graph Study, January 1993.
6. The K_n for S-graph #18 is 0.028. The K_n for S-graph Q11 is 0.024. My observation of the Albuquerque alluvial fan watershed for which S-graph Q11 was derived is that it is hydraulically smoother than the Indian Bend Wash distributary flow watershed, and this accounts for the moderate difference in the K_n values. From a hydrologic perspective, the K_n values for these two S-graphs are very supportive of each other and are reasonable values.

In conclusion, it is my opinion that S-graph #18 should be considered for adoption as the recommended alluvial fan S-graph for Maricopa County. Analysis of the Indian Bend Wash data does not seem to be justified at this time.

The second diskette contains data for 33 rainfall-runoff events for Walnut Gulch Watershed 63.011 (3.18 square miles). Again, I'm confident that the data is of high quality and the results would be informative. However, I previously have analyzed numerous data sets for several different Walnut Gulch watersheds, and the results of eight analyses (S-graphs, watershed

characteristics, Lag, and K_n) are reported in the Small Watershed S-Graph Study, January 1993, and the enclosed S-Graph K_n Study. Although useful information may be gained from an analysis of the data, I'm apprehensive to recommend a major data analysis at this time. Only marginal improvement to our existing S-graph and K_n data base may result from such an endeavor.

TABLE 1

Summary of FCDMC rainfall/runoff data
received in February 1993

	Runoff		Rainfall, in inches								
Indian Bend Wash Streamgages	Date	Peak Discharge Cfs	Date	IBW @ McKellips	IBW @ Indian School	IBW @ Inter-Ceptor	Paradise Valley CC	Sweet-water	Dreamy Draw	Thunder-bird Academy	Average
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
@ McKellips	7-13 Jan 93	3,089	5-8 Jan 93	1.69	2.01	2.32	1.26	1.50	1.61	1.46	1.69
@ Sweetwater	10-11 Jan 93	149	10-13 Jan 93	.87	1.34	.39	1.02	.87	1.14	.87	.93
@ Sweetwater	18-19 Jan 93	384	15-18 Jan 93	1.02	.63	.47	.83	2.09	1.57	1.38	1.14
@ Sweetwater	23 May 92	340	23 May 92	0	.20	.12	.20	.91	.16	.08	.24
@ McKellips	23-29 July 92	3,089	22-24 Jul 92	.91	1.73	1.02	2.83	1.02	1.93	2.20	1.66
@ Sweetwater	24 July 92	113									
@ McKellips	22 Aug 92	1,308	18-20 Aug 92	.16	0	.20	.08	.28	.16	.24	.16
			21-23 Aug 92	.63	1.69	1.57	.87	.63	.67	1.42	1.07
@ McKellips	4-11 Dec 92	953	2-5 Dec 92	1.34	1.93	2.20	1.30	1.02	.94	.94	1.38
			8 Dec 92	.79	.87	.94	.91	---	.87	.75	.86
@ McKellips	2-17 Sept 90	2,485	1-3 Sept 90	.12	---	.31	.79	---	.31	1.34	.57

Attachment B

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

S-GRAPH K_n STUDY

Contract FCD 90-04

GEORGE V. SABOL CONSULTING ENGINEERS, INC.

DENVER, COLORADO
and
PHOENIX, ARIZONA

March 1993

INTRODUCTION

The Drainage Design Manual for Maricopa County, Volume 1, Hydrology (June 1992) contains two S-graphs (the Phoenix Valley and the Phoenix Mountain). The manual states that other S-graphs can be used, and the "selection of S-graph should be made based on a comparison of the watershed of interest to the watershed(s) used to develop the various S-graphs" p. 5-20. A procedure is provided in the manual to calculate Lag and this procedure requires an estimate of K_n. General guidance is provided in the manual for the selection of K_n, but that guidance is not always satisfactory for the use of S-graphs in Maricopa County.

Presently, the FCDMC is considering an expanded list of recommended S-graphs. Those S-graphs may be selected to be representative of the following types of watersheds in Maricopa County:

1. urban
2. mountain and foothill
3. desert/rangeland
4. alluvial fan
5. agricultural.

There is also the need to provide better guidance for the selection of K_n for the Lag equation. That guidance should correspond to the five types of S-graphs that are considered for use, as noted above.

This report presents a data compilation of watershed characteristics, measured Lag, and calculated K_n. This compilation represents all known data (representative of hydrologic conditions in Arizona) that presently exists in published documents and from readily obtainable files of unpublished data. The source of this data is generally from the U.S. Bureau of Reclamation (USBR) and the U.S. Army Corps of Engineers (Corps). A major effort has been expended over the past 6 years in compiling this data, and it is unlikely that significant amounts of additional data are available that are not reported, herein.

The Lag and related K_n data were analyzed and recommendations are

presented for either (1) selecting K_n based on the data and present data analyses, or (2) additional analyses of the data to develop improved guidelines for selecting K_n.

SOURCES OF DATA

Watershed characteristics, Lag, and K_n data were obtained from the following:

Reference	Description
A	Flood Hydrology Manual, Table 4-6, USBR, 1989.
B	Flood Hydrology Manual, Table 4-2, USBR, 1989.
C	Flood Hydrology Manual, Table 4-3, USBR, 1989.
D	S-Graph Study, Table 7, report to FCDMC by G.V. Sabol, November 1987
E	Small Watershed S-Graph Study, Table 1, report to FCDMC by GVSCE, January 1993.
F	Small Watershed S-Graph Study, Table 2, report to FCDMC by GVSCE, January 1993.
G	Small Watershed S-Graph Study, Table 3, report to FCDMC by GVSCE, January 1993.

These data sources are believed to represent all available S-graph Lag and K_n data that are presently available for Arizona hydrologic conditions. No data are known to exist for agricultural watersheds.

DATA

The available watershed characteristics, Lag, and K_n data are grouped into four watershed categories and the data are presented in tables, as follows:

Watershed Category	Table No. Ordered as per references	Table No. Ordered in ascending K_n value
Urban	1	1-A
Mountain and Foothill	2	2-A
Desert/Rangeland	3	3-A
Alluvial Fan	4	4-A

At the bottom of each column are the maximum, minimum, mean, and sample standard deviation for the various watershed characteristic, Lag, and K_n data.

ANALYSIS OF K_n DATA

Urban Watersheds - There are 42 complete sets of data and only one incomplete set for urban watersheds (Tables 1 and 1-A). The K_n values range from a minimum of 0.0113 to a maximum of 0.1029, with a mean of 0.0313 and sample standard deviation of 0.0200.

Using the guidance in the Drainage Design Manual for Maricopa County (Figure 5.11), the value of K_n for urban watersheds is 0.015. That value for K_n does not seem to be supported by the K_n values that are listed in Table 1. The value of K_n is not correlated to any single independent variable (A, L, S and RTIMP), see Figures 1 through 4. It is my opinion that it would be difficult to use the data of Table 1 to select a K_n value for a watershed that is not listed in Table 1. Also, it does not seem prudent to use the mean value of K_n (about 0.030) for urban watersheds since that value appears to be too high for use with 100-year flood hydrology.

Some of the data in Table 1 (T9, #10, and #11) look suspicious. Those K_n values appear unrealistically high. Elimination of those three data sets results in a minimum of 0.0113, maximum of 0.0596, mean of 0.0267 and sample standard deviation of 0.0107. Although this produces a more reasonable K_n analysis, the result (mean K_n of about 0.027) is still unacceptable.

I suspect that the reason for the broad range of K_n values is because the data are not representative of floods of the same return period. The data probably represents floods that have return periods in excess of the 100-year and as low as the 10-year or so. More severe floods will have shorter Lags and consequently lower values of K_n. Smaller and less intense rainfalls (even on the same watershed) will produce longer Lags and consequently higher values of K_n. It is difficult, if not impossible, to draw firm guidelines for selecting K_n for ungaged urban watersheds from the data shown in Table 1 and the analyses of the data, as presented.

It is possible that a multiple regression of the data would give a better indicator of the average value of K_n as a function of the independent variables (A, L, S, and RTIMP). After such an analysis and inspection of the

result, it may be necessary to apply a correction factor (less than 1.0) to judgementally account for the probable fact that some of the data represents small floods. This may yield a reproducible procedure to calculate reasonable values of K_n as a function of measurable watershed characteristics for urban watersheds.

Mountain and Foothill Watersheds - There are 51 complete sets of data for mountain and foothill watersheds (Tables 2 and 2-A). Regrettably, there are 35 data sets for which watershed characteristics or Lag are not available. I previously have tried to obtain the missing data from the USBR in Denver, but was unsuccessful. A major effort, and maybe an unfruitful one, would be required to attempt to extract that data from old USBR project files. I don't recommend that we attempt to locate the unreported watershed characteristics and Lag data of Table 2.

The K_n values range from a minimum of 0.0150 to a maximum of 0.3390, with a mean of 0.0893 and sample standard deviation of 0.0817. The value of K_n is not correlated to any single independent variable (A, L and S), see Figures 5 through 7.

Inspection of Table 2-A indicates that large values of K_n are associated with watersheds that are north of Arizona (Colorado, Wyoming, Utah, Montana, Idaho and Oregon). I suspect that the large K_n values may be more representative of densely vegetated watersheds. We probably should eliminate data with exceptionally large K_n values from consideration for developing guidelines for Maricopa County. Table 2-A indicates the data that are not considered representative of watersheds in Maricopa County.

Elimination of the data as discussed above leaves 53 K_n values and 46 data sets with watershed characteristics. The K_n values of the reduced data base range from a minimum of 0.0150 to a maximum of 0.0635, with a mean of 0.0461 and sample standard deviation of 0.0099.

Using the guidance in the Drainage Design Manual for Maricopa County (Figure 5.11), the value of K_n for mountain watersheds is about 0.050, and for foothill watersheds is about 0.030. Those values seem to agree with the data

presented in Tables 2 and 2-A.

Based on the available data, it is my opinion that the following guidance could be provided for selecting K_n for mountain and foothill watersheds:

K_n			Description
minimum	average	maximum	
			Mountain Watersheds
0.045	0.050	0.055	Drainage area is quite rugged, with sharp ridges and narrow, steep canyons through which watercourses meander around sharp bends, over large boulders, and considerable debris obstruction. The ground cover, excluding small areas of rock outcrops, includes many trees and considerable underbrush. No drainage improvements exist in the area.
			Foothill Watersheds
0.027	0.030	0.033	Drainage area is generally rolling, with rounded ridges and moderate side slopes. Watercourses meander in fairly straight channels with some boulders and lodged debris. Ground cover includes scattered brush, cactus and grasses. No drainage improvements exist in the area.

Desert/Rangeland - There are 18 data sets for desert/rangeland watersheds (Tables 3 and 3-A). There are only two incomplete data sets. Eight of the data sets are for Walnut Gulch for which the data should be of good quality. The remaining data sets are from USBR and Corps sources.

The three data sets for the Queen Creek tributary have exceptionally high K_n values. The reason for this is unknown. The Queen Creek K_n data should be eliminated from analysis since the K_n values seem unrealistically high.

Analysis of the remaining 14 data sets containing K_n values results in a range of K_n from a minimum of 0.0230 to a maximum of 0.0580, and a mean of 0.0360 with a sample standard deviation of 0.0090.

Analysis of the 8 data sets for Walnut Gulch results in a range of K_n from a minimum of 0.0230 to a maximum of 0.0385, and a mean of 0.0324 with a sample standard deviation of 0.0057. It is noted that the minimum value of K_n (0.0230) is associated with a runoff depth of 0.97 inches (see data in Table 5 of the Small Watershed S-Graph Study, January 1993 by GVSCE), and that runoff depth is the greatest for any of the eight Walnut Gulch data sets.

Guidance for selecting K_n (Figure 5.11 of the Drainage Design Manual for Maricopa County) indicates that K_n for a desert/rangeland watershed would normally be selected at about 0.03. That value agrees reasonably well with the analyses from above.

It is my opinion, mainly based on the Walnut Gulch data and from general hydrologic considerations, that the following general guidance could be provided for selecting K_n for desert/rangeland watersheds in Arizona:

K_n	Description Desert/Rangeland
.020	Desert/rangeland watersheds with defined watercourses, and/or very sparse vegetation, and/or relatively low hydraulic roughness of the land surface.
.025	Desert/rangeland watersheds without defined watercourses, with average vegetation conditions, and average hydraulic roughness of the land surface.
.030	Desert/rangeland watersheds without defined watercourses, with relatively dense native vegetation, and more severe than average hydraulic roughness of the land surface.

Alluvial Fan - There are 10 complete sets of data for alluvial fan watersheds (Tables 4 and 4-A). Seven of these are for "true" alluvial fans in the Albuquerque area. Notice that the slopes for the Albuquerque alluvial fans are fairly steep (177 to 432 feet/mile). The soil of those alluvial fans are sandy loam and are essentially decomposed granite. The vegetation is mainly clump grasses and small brush. Very little coarse gravel and cobble is exposed on the land surface. The land surface would be classified as relatively hydraulically smooth as compared to many watersheds that are classified as alluvial fans in Maricopa County (for example the North Scottsdale area).

The K_n is plotted against A, L and S for all 10 data sets in Figures 11 through 13. No correlation exists between K_n and any of those independent variables.

Using only the Albuquerque alluvial fan data, the K_n ranges from a minimum of 0.0209 to a maximum of 0.0747, the mean is 0.0391 with a sample standard deviation of 0.0189.

Comparison of the K_n values with runoff depth for the Albuquerque

alluvial fans (see data in Table 6 of the Small Watershed S-Graph Study, January 1993 by GVSCE) results in the following:

I.D. No.	K_n (ascending order)	Runoff Depth inches
Q12	0.0209	0.48
Q9	0.0255	0.40
Q11	0.0240	0.43
Q6	0.0287	0.26
Q10	0.0509	0.27
Q7	0.0517	0.14
Q8	0.0747	0.20

Notice that, in general, K_n increases with a decrease in runoff depth. This is as expected, but the large range of K_n is indicative of factors other than simply runoff depth.

The Indian Bend Wash K_n data has a range from 0.0276 to 0.0714. Since these are for the same watershed, it is reasonable to conclude that the difference in K_n is due to rainfall factors and not watershed characteristics. Descriptions of the three Indian Bend Wash storms are provided in the S-Graph Report, Appendix C. Notice that the June 1972 storm produced much greater rainfall over the Indian Bend Wash watershed than either of the other two storms. It is concluded that the Indian Bend Wash (June 1972) K_n of 0.0276 is appropriate for 100-year design storm conditions for that watershed. That value is somewhat lower than the average (0.0391) for the Albuquerque alluvial fans, but none of the Albuquerque K_n data are representative of storms as severe as the June 1972 storm. Lower K_n values can be expected for more severe storms.

It is my opinion that a reasonable value of K_n for a "true" alluvial fan is probably somewhere around 0.02, but I would accept a K_n as low as 0.015 for alluvial fans that are exceptionally hydraulically smooth. Watersheds that are classified as alluvial fans in Maricopa County are often of the distributed flow type, such as Indian Bend Wash. In those situations, I suspect that the same guidance can be used as is suggested for desert/rangeland.

SUMMARY

For urban watersheds, additional data analyses (such as multiple regression of the urban watershed characteristics and K_n data) should be performed to attempt to develop guidelines for selecting K_n. The available data base presents too large of a range of K_n to provide simple rules for selecting K_n for urban watersheds. It is suspected that urban watersheds have large variability in drainage development, land-use, imperviousness, slope, watershed shape, etc., and this makes it difficult to select the appropriate K_n. It is also suspected that rainfall characteristics (intensity and duration) have a significant impact on K_n. Overall, it is my opinion that the Clark unit hydrograph should be used whenever possible for urban watersheds. The Clark unit hydrograph procedure accounts for many of the variables that are probably producing the large range in reported K_n values.

For mountain and foothill watersheds, some relatively simple guidance is presented for selecting K_n. That guidance is consistent with the guidance that is presently provided in the Drainage Design Manual for Maricopa County (Figure 5.11), but a range is provided that is ± 10 percent of the average value of K_n. The available data supports the suggested guidelines for the selection of those K_n values.

For desert/rangeland watersheds, some relatively simple guidance is presented for selecting K_n. That guidance is generally a little lower than the guidance that is presently provided in the Drainage Design Manual for Maricopa County (Figure 5.11). A range of K_n values is recommended with a description of watershed conditions that are representative of each suggested K_n value. The data base supports the recommended K_n values.

For alluvial fan watersheds, two recommendations are made. First, for the typical distributed flow type of alluvial fans that generally occur in Maricopa County, the same guidelines can be applied as are recommended for desert/rangeland watersheds. Second, for "true" alluvial fans, that is active alluvial fans with poorly defined and highly mobile drainage patterns, a K_n of 0.02 is probably appropriate.

For agricultural watersheds, no data exists and therefore it is difficult to establish highly defensible guidelines for selecting K_n values. Using the information that was presented in the Buckeye FIS Technical Memorandum dated 14 January 1992, it is my opinion that the K_n for agricultural watersheds is about 3 times greater than that for a desert/rangeland watershed. Therefore, a K_n in the range of 0.060 to 0.090 or larger is probably appropriate. It will be difficult to distinguish when to use upper or lower values of K_n and a value of 0.10 may be appropriate for "typical" agricultural watersheds. This will have to be a judgement decision.

Table 1
Lag and kn data for Urban watersheds

Reference and I.D. No.			Watershed	Location	A	L	Lca	S	RTIMP	L*Lca / S^.5	Lag	kn
A	D	E			(sq. miles)	(miles)	(miles)	(ft/mi)	(%)		(hrs)	
1	34		Alhambra Wash above Short St.	Monterey Park, CA	14.000	9.50	4.60	85.0	40.0	4.7399	0.60	0.0128
2	33		San Jose Cr. at Workman Mill Rd	Whittier, CA	81.300	23.70	9.10	75.0	35.0	24.9034	2.40	0.0272
3	35		Broadway Drain at Raymond Dike	L.A., CA	2.500	3.40	1.70	100.0	45.0	0.5780	0.30	0.0142
4			Compton Cr. below Hooper Ave Storm Drain	L.A., CA	19.500	8.80	4.20	14.6	60.0	9.6729	1.80	0.0292
5			Ballomna Cr. at Sawtelle Blvd.	L.A., CA	88.600	11.80	5.60	64.0	40.0	8.2600	1.20	0.0207
6			Brays Bayou	Houston, TX	88.400	23.30	10.40	4.1	40.0	119.6733	2.10	0.0131
7			White Oak Bayou	Houston, TX	92.000	23.10	12.80	5.0	35.0	132.2321	3.10	0.0186
8			Boneyard Cr.	Austin, TX	4.500	2.80	1.30	9.5	37.0	1.1810	0.80	0.0289
9			Waller Cr.	Austin, TX	4.100	5.20	1.90	48.0	27.0	1.4261	1.00	0.0336
10			Beargrass Cr.	Louisville, KY	9.700	5.60	2.50	6.3	70.0	5.5777	0.90	0.0180
11			17th Street Sewer	Louisville, KY	0.200	0.90	0.30	48.0	93.0	0.0390	0.15	0.0198
12			Northwest Trunk	Louisville, KY	1.900	3.00	1.10	19.0	50.0	0.7571	0.40	0.0171
13			Southern Outfall	Louisville, KY	6.400	6.40	2.50	13.0	48.0	4.4376	0.70	0.0153
14			Southwest Outfall	Louisville, KY	7.500	6.50	2.70	18.5	33.0	4.0803	0.50	0.0113
15			Beargrass Cr.	Louisville, KY	6.300	4.00	1.80	4.5	20.0	3.3941	1.00	0.0242
16			Tripps Run	near Falls Church, VA	4.600	4.10	1.90	52.0	28.0	1.0803	0.90	0.0336
17			Tripps Run	Falls Church, VA	1.800	2.30	1.00	79.0	25.0	0.2588	0.50	0.0321
18			Four Mile Run	Alexandria, VA	14.400	7.80	3.50	43.0	20.0	4.1632	1.40	0.0313
19			Little Pimmit Run	Arlington, VA	2.300	2.20	1.00	77.0	20.0	0.2507	0.40	0.0260
20			Piney Branch	Vienna, VA	0.300	0.50	0.20	87.0	30.0	0.0107	0.20	0.0431
21			Walker Avenue Drain	Baltimore, MD	0.200	1.00	0.40	83.0	33.0	0.0439	0.20	0.0252
		T1	High School Wash	Tuscon, AZ	0.950	1.60	0.75	58.0	10.7	0.1576	0.43	0.0334
		T2	High School Wash	Tucson, AZ	0.950	1.60	0.75	58.0	10.7	0.1576	0.30	0.0233
		T3	Arcadia	Tucson, AZ	2.720	3.85	2.25	42.0	13.9	1.3367	0.90	0.0310
		T4	Arcadia	Tuscon, AZ	2.720	3.85	2.25	42.0	13.9	1.3367	0.75	0.0258
		T5	Arcadia, Part 1	Tucson, AZ	2.720	3.85	2.25	42.0	13.9	1.3367	0.84	0.0289
		T6	Arcadia, Part 2	Tucson, AZ	2.720	3.85	2.25	42.0	13.9	1.3367	0.81	0.0279
		T7	Railroad	Tucson, AZ	2.300	2.30	1.48	46.0	17.0	0.5019	1.10	0.0550
		T8	Railroad	Tucson, AZ	2.300	2.30	1.48	46.0	17.0	0.5019	0.89	0.0445
		T9	Atterbury	Tucson, AZ	4.970	6.67	3.87	26.0	3.0	5.0623	3.42	0.0710
		Q1	Villa Del Oso	Albuquerque, NM	0.052	0.54	0.27	111.0	16.4	0.0138	0.09	0.0176
		Q2	Villa Del Oso	Albuquerque, NM	0.052	0.54	0.27	111.0	16.4	0.0138	0.13	0.0254
		Q3	Academy Acres	Albuquerque, NM	0.124	0.90	0.53	100.0	16.3	0.0477	0.29	0.0354
		Q4	Academy Acres	Albuquerque, NM	0.124	0.90	0.53	100.0	16.3	0.0477	0.16	0.0196
		Q5	Taylor Ranch	Albuquerque, NM	0.136	0.55	0.23	25.0	9.6	0.0253	0.12	0.0187
		D1	116 Ave & Claude Ct.	Denver, CO	0.260	1.16	0.49	69.0	13.3	0.0684	0.21	0.0224
		D2	Villa Italia	Denver, CO	0.120	0.67	0.33	100.0	77.0	0.0221	0.20	0.0327
		D3	Concourse D	Denver, CO	0.150	0.97	0.43	a	a	b	0.24	b
		D4	Goose Creek	Denver, CO	1.340	1.34	0.60	74.0	15.4	0.0935	0.63	0.0596
		D5	Sand Creek	Denver, CO	0.290	0.84	0.21	41.0	24.0	0.0275	0.14	0.0211
		D6	Sand Creek	Denver, CO	0.290	0.84	0.21	41.0	24.0	0.0275	0.15	0.0226
	10		Aqua Fria R. trib. (Sept, 1970)	Phoenix, AZ	0.130	0.77	0.39	16.0	25.0	0.0751	0.96	0.0988
	11		Aqua Fria R. trib. (Sept, 1970)	Phoenix, AZ	0.130	0.77	0.39	16.0	25.0	0.0751	1.00	0.1029
				Maximum	92.000	23.70	12.80	111.0	93.0	132.2321	3.42	0.1029
				Minimum	0.052	0.50	0.20	4.1	3.0	0.0107	0.09	0.0113
				Mean	11.071	4.57	2.16	51.0	29.1	8.0720	0.81	0.0313
				Standard Deviation	25.179	5.88	2.75	32.3	19.1	27.0547	0.77	0.0200

NOTE: a - unknown value, b - cannot calculate

Table 1-A
Lag and kn Data for Urban Watersheds
(kn values sorted by ascending order)

Reference and I.D. No.			Watershed	Location	A	L	Lca	S	RTIMP	L*Lca	Lag	kn
A	D	E			(sq. miles	(miles)	(miles)	(ft/mi)	(%)	S^.5	(hrs)	
		D3	Concourse D	Denver, CO	0.150	0.97	0.43	a	a	b	0.24	b
14			Southwest Outfall	Louisville, KY	7.500	6.50	2.70	18.5	33.0	4.0803	0.50	0.0113
1	34		Alhambra Wash above Short St.	Monterey Park, CA	14.000	9.50	4.60	85.0	40.0	4.7399	0.60	0.0128
6			Brays Bayou	Houston, TX	88.400	23.30	10.40	4.1	40.0	119.6733	2.10	0.0131
3	35		Broadway Drain at Raymond Dike	L.A., CA	2.500	3.40	1.70	100.0	45.0	0.5780	0.30	0.0142
13			Southern Outfall	Louisville, KY	6.400	6.40	2.50	13.0	48.0	4.4376	0.70	0.0153
12			Northwest Trunk	Louisville, KY	1.900	3.00	1.10	19.0	50.0	0.7571	0.40	0.0171
		Q1	Villa Del Oso	Albuquerque, NM	0.052	0.54	0.27	111.0	16.4	0.0138	0.09	0.0176
10			Beargrass Cr.	Louisville, KY	9.700	5.60	2.50	6.3	70.0	5.5777	0.90	0.0180
7			White Oak Bayou	Houston, TX	92.000	23.10	12.80	5.0	35.0	132.2321	3.10	0.0186
		Q5	Taylor Ranch	Albuquerque, NM	0.136	0.55	0.23	25.0	9.6	0.0253	0.12	0.0187
		Q4	Academy Acres	Albuquerque, NM	0.124	0.90	0.53	100.0	16.3	0.0477	0.16	0.0196
11			17th Street Sewer	Louisville, KY	0.200	0.90	0.30	48.0	93.0	0.0390	0.15	0.0198
5			Ballomna Cr. at Sawtelle Blvd.	L.A., CA	88.600	11.80	5.60	64.0	40.0	8.2600	1.20	0.0207
		D5	Sand Creek	Denver, CO	0.290	0.84	0.21	41.0	24.0	0.0275	0.14	0.0211
		D1	116 Ave & Claude Ct.	Denver, CO	0.260	1.16	0.49	69.0	13.3	0.0684	0.21	0.0224
		D6	Sand Creek	Denver, CO	0.290	0.84	0.21	41.0	24.0	0.0275	0.15	0.0226
		T2	High School Wash	Tucson, AZ	0.950	1.60	0.75	58.0	10.7	0.1576	0.30	0.0233
15			Beargrass Cr.	Louisville, KY	6.300	4.00	1.80	4.5	20.0	3.3941	1.00	0.0242
21			Walker Avenue Drain	Baltimore, MD	0.200	1.00	0.40	83.0	33.0	0.0439	0.20	0.0252
		Q2	Villa Del Oso	Albuquerque, NM	0.052	0.54	0.27	111.0	16.4	0.0138	0.13	0.0254
		T4	Arcadia	Tuscon, AZ	2.720	3.85	2.25	42.0	13.9	1.3367	0.75	0.0258
19			Little Pimmit Run	Arlington, VA	2.300	2.20	1.00	77.0	20.0	0.2507	0.40	0.0260
2	33		San Jose Cr. at Workman Mill Rd	Whittier, CA	81.300	23.70	9.10	75.0	35.0	24.9034	2.40	0.0272
		T6	Arcadia, Part 2	Tucson, AZ	2.720	3.85	2.25	42.0	13.9	1.3367	0.81	0.0279
8			Boneyard Cr.	Austin, TX	4.500	2.80	1.30	9.5	37.0	1.1810	0.80	0.0289
		T5	Arcadia, Part 1	Tucson, AZ	2.720	3.85	2.25	42.0	13.9	1.3367	0.84	0.0289
4			Compton Cr. below Hooper Ave Storm Drain	L.A., CA	19.500	8.80	4.20	14.6	60.0	9.6729	1.80	0.0292
		T3	Arcadia	Tucson, AZ	2.720	3.85	2.25	42.0	13.9	1.3367	0.90	0.0310
18			Four Mile Run	Alexandria, VA	14.400	7.80	3.50	43.0	20.0	4.1632	1.40	0.0313
17			Tripps Run	Falls Church, VA	1.800	2.30	1.00	79.0	25.0	0.2588	0.50	0.0321
		D2	Villa Italia	Denver, CO	0.120	0.67	0.33	100.0	77.0	0.0221	0.20	0.0327
		T1	High School Wash	Tuscon, AZ	0.950	1.60	0.75	58.0	10.7	0.1576	0.43	0.0334
9			Waller Cr.	Austin, TX	4.100	5.20	1.90	48.0	27.0	1.4261	1.00	0.0336
16			Tripps Run	near Falls Church, VA	4.600	4.10	1.90	52.0	28.0	1.0803	0.90	0.0336
		Q3	Academy Acres	Albuquerque, NM	0.124	0.90	0.53	100.0	16.3	0.0477	0.29	0.0354
20			Piney Branch	Vienna, VA	0.300	0.50	0.20	87.0	30.0	0.0107	0.20	0.0431
		T8	Railroad	Tucson, AZ	2.300	2.30	1.48	46.0	17.0	0.5019	0.89	0.0445
		T7	Railroad	Tucson, AZ	2.300	2.30	1.48	46.0	17.0	0.5019	1.10	0.0550
		D4	Goose Creek	Denver, CO	1.340	1.34	0.60	74.0	15.4	0.0935	0.63	0.0596
		T9	Atterbury	Tucson, AZ	4.970	6.67	3.87	26.0	3.0	5.0623	3.42	0.0710
	10		Aqua Fria R. trib. (Sept. 1970)	Phoenix, AZ	0.130	0.77	0.39	16.0	25.0	0.0751	0.96	0.0988
	11		Aqua Fria R. trib. (Sept. 1970)	Phoenix, AZ	0.130	0.77	0.39	16.0	25.0	0.0751	1.00	0.1029
				Maximum	92.000	23.70	12.80	111.0	93.0	132.2321	3.42	0.1029
				Minimum	0.052	0.50	0.20	4.1	3.0	0.0107	0.09	0.0113
				Mean	11.071	4.57	2.16	51.0	29.1	8.0720	0.81	0.0313
				Standard Deviation	25.179	5.88	2.75	32.3	19.1	27.0547	0.77	0.0200

NOTE: a - unknown value, b - cannot calculate

Table 2

Lag and kn data for Mountain and Foothill watersheds

Reference and I.D. No.				Watershed	Location	A	L	Lca	S	L*Lca	Lag	kn
B	C	D	F			(sq. miles)	(miles)	(miles)	(ft/mi)	S^.5	(hrs)	
1				Purgatoire River	at Trinidad, CO	742.00	44.00	20.00	159.00	69.7885	8.000	0.0613
2				Wood River	near Meeteetse, WY	194.00	a	a	a	41.9000	21.500	0.2410
3				Grey Bull River	near Meeteetse, WY	681.00	a	a	a	88.3000	34.000	0.3240
4				San Miguel River	at Naturita, CO	1080.00	a	a	a	174.0000	34.000	0.2380
5				Uncompaghre River	at Delta, CO	1110.00	a	a	a	216.0000	36.000	0.2350
6				Dry Gulch	near Estes Park, CO	2.10	2.70	1.00	295.00	0.1572	0.900	0.0699
7				Rabbit Gulch	near Estes Park, CO	3.40	3.30	1.50	480.00	0.2259	1.000	0.0677
8				North Fk Big Thompson River	near Glen Haven, CO	1.30	1.90	1.30	709.00	0.0928	0.700	0.0665
9		54		Uintah River	near Neola, UT	181.00	a	a	a	59.0000	32.000	0.3240
10				South Fk. Payette River	near Garden Valley, ID	779.00	a	a	a	123.0000	30.000	0.2360
11				Malheur River	near Drewsy, OR	910.00	a	a	a	114.0000	30.000	0.2420
12				Weiser River	above Craney Cr. near Weiser, ID	1160.00	a	a	a	310.0000	37.000	0.2140
13				Madison River	near Three Forks, MT	2511.00	a	a	a	2060.0000	50.000	0.1550
14				Gallatin River	at Logan, MT	1795.00	a	a	a	443.0000	38.000	0.1960
15				Surface Cr.	at Cedaredge, CO	43.00	a	a	a	11.3000	11.300	0.1950
16				South Piney Cr.	at Willow Park, WY	28.90	a	a	a	3.8000	10.500	0.2600
17				Piney Cr.	at Kearney, WY	106.00	a	a	a	29.0000	16.500	0.2090
18				Coal Cr.	near Cedar City, UT	92.00	16.50	7.10	310.00	6.6537	2.400	0.0449
19				Sevier River	near Hatch, UT	260.00	29.00	14.00	100.00	40.6000	5.100	0.0480
20				Sevier River	near Kingston, UT	1110.00	82.00	40.00	49.00	468.5714	11.000	0.0409
21				Centerville Cr.	near Centerville, UT	3.90	a	a	a	0.4000	2.400	0.1240
22				Parrish Cr.	near Centerville, UT	2.00	a	a	a	0.3000	2.200	0.1260
23				Florida River	near Hermosa, CO	69.40	a	a	a	12.5000	15.500	0.2590
24				Dolores River	near McPhee, CO	793.00	a	a	a	193.0000	9.000	0.0610
25				Los Pinos River	near Bayfield, CO	284.00	a	a	a	35.0000	28.500	0.3390
	1			Salt River	at Roosevelt,AZ	4341.00	145.00	60.00	47.00	1269.0254	16.000	0.0407
	2			Verde River	below Jerome, AZ	3190.00	110.00	47.00	46.40	758.9821	12.000	0.0371
	3			Tonto Creek	above Gun Cr., AZ	678.00	41.00	16.50	104.60	66.1458	6.500	0.0508
	4			Agua Fria R.	near Mayer, AZ	590.00	42.00	14.00	87.10	63.0040	5.400	0.0430
		21		Agua Fria R. (Dec., 1967)	at Avondale, AZ	718.00	61.00	27.20	68.90	199.8891	10.680	0.0549
		22		Agua Fria R. (Sept., 1970)	at Avondale, AZ	718.00	61.00	27.20	68.90	199.8891	7.800	0.0401
	5	45		San Gabriel River	at San Gabriel Dam, CA	162.00	23.20	11.60	350.00	14.3851	3.300	0.0461
		44		San Gabriel River	at San Gabriel Dam No. 1, CA	162.00	23.20	11.60	350.00	14.3851	a	b
	6	47		West Fork San Gabriel River	at Cogswell Dam, CA	40.40	9.30	4.20	450.00	1.8413	1.600	0.0488
		46		West Fork San Gabriel River	at Cogswell Dam (No. 2), CA	40.40	11.40	3.90	400.00	2.2230	a	b
		48		West Fork San Gabriel River	at Cogswell Dam (No. 2), CA	40.40	11.40	3.90	400.00	2.2230	a	b
		39		Santa Anita Creek (general storm)	at Santa Anita Dam, CA	10.80	5.10	2.10	898.00	0.3574	a	b
		40		Santa Anita Creek (local storm)	at Santa Anita Dam, CA	10.80	5.10	2.10	898.00	0.3574	a	b
	7	38		Santa Anita Creek	at Santa Anita Dam, CA	10.80	5.80	2.50	690.00	0.5520	1.100	0.0530
	8	30		San Dimas Creek	at San Dimas Dam, CA	16.20	8.60	4.80	440.00	1.9679	1.500	0.0446
	9	31		Eaton Wash	at Eaton Wash Dam, CA	9.50	7.30	4.40	600.00	1.3113	1.300	0.0451
	10			San Antonio Creek	near Claremont, CA	16.90	5.90	3.00	1017.00	0.5550	1.200	0.0577
	11	36		Santa Clara River	near Saugus, CA	355.00	36.00	15.80	140.00	48.0724	5.600	0.0494
	12	28		Temecula Creek	at Pauba Canyon, CA	168.00	26.00	11.30	150.00	23.9887	3.700	0.0425
	13	27		Santa Margarita River	near Fallbrook, CA	645.00	46.00	22.00	105.00	98.7811	7.300	0.0490
		49		San Jose Creek	CA	a	a	a	a	b	a	b

NOTE: a - unknown, b - cannot calculate

Table 2 (cont.)
Lag and kn data for Mountain and Foothill watersheds

Reference and I.D. No.				Watershed	Location	A	L	Lca	S	L*Lca	Lag	kn
B	C	D	F			(sq. miles)	(miles)	(miles)	(ft/mi)	S^.5	(hrs)	
	14	26		Santa Margarita River	at Ysidora, CA	740.00	61.20	34.30	85.00	227.6859	9.500	0.0464
	15	43		Live Oak Creek	at Live Oak Dam, CA	2.30	2.90	1.50	700.00	0.1644	0.800	0.0611
	16	29		Tujunga Creek	at Big Tujunga Dam, CA	81.40	15.10	7.30	290.00	6.4729	2.500	0.0473
	17	25		Murrieta Creek	at Temecula, CA	220.00	27.20	10.30	95.00	28.7438	4.000	0.0429
	18			Los Angeles River	at Sepulveda Dam, CA	152.00	19.00	9.00	145.00	14.2008	3.500	0.0491
	19			Pacoima Wash	at Pacoima Dam, CA	27.80	15.00	8.00	315.00	6.7612	2.400	0.0447
	20	32		East Fullerton Creek	at Fullerton Dam, CA	3.10	3.20	1.70	140.00	0.4598	0.600	0.0310
	21	33		San Jose Creek	at Workman Mill Rd., CA	81.30	23.70	9.10	75.00	24.9034	2.400	0.0272
	22			San Vincente Creek	at Foster, CA	75.00	a	a	a	12.8000	3.200	0.0530
	23			San Diego River	near Santee, CA	380.00	a	a	a	95.4000	9.200	0.0780
	24			Deep Creek	near Hesperia, CA	137.00	a	a	a	28.1000	2.800	0.0360
	25			Bill Williams River	at Planet, AZ	4730.00	a	a	a	1476.0000	16.200	0.0560
	27			San Francisco River	at Jct. with Blue River, AZ	2000.00	130.00	74.00	32.00	1700.5918	20.600	0.0469
	28			Blue River	near Clifton, AZ	790.00	77.00	37.00	65.00	353.3750	10.300	0.0426
	32			Plateau Creek	near Cameo, CO	604.00	a	a	a	89.9000	7.900	0.0690
	33			White River	near Watson, UT	4020.00	a	a	a	1473.0000	15.700	0.0540
	34			Paria River	at Lees Ferry, AZ	1570.00	a	a	a	296.0000	10.200	0.0600
	35			New River	at Rock Springs, AZ	67.30	20.20	9.70	141.40	16.4778	3.100	0.0411
	36			New River	at New River, AZ	85.70	23.20	13.60	145.00	26.2025	3.700	0.0411
	37	2		New River (Sept., 1970)	at Bell Road near Phoenix, AZ	187.00	47.60	20.70	83.40	107.8932	5.380	0.0349
		1		New River (Dec., 1967)	at Bell Road near Phoenix, AZ	187.00	47.60	20.70	83.40	107.8932	8.850	0.0575
		12		New River (Dec., 1967)	near Rock Springs, AZ	67.30	20.20	9.70	141.00	16.5011	2.590	0.0343
		13		New River (Sept., 1970)	near Rock Springs, AZ	67.30	20.20	9.70	141.40	16.4778	2.500	0.0332
		14		New River (Dec., 1967)	at New River, AZ	85.70	26.20	12.40	121.60	29.4616	4.250	0.0452
		15		New River (Sept., 1970)	at New River, AZ	85.70	26.20	12.40	121.60	29.4616	2.720	0.0289
		19		New River (Dec., 1967)	near Glendale, AZ	323.00	55.50	20.60	73.60	133.2666	10.590	0.0635
		20		New River (Sept., 1970)	near Glendale, AZ	323.00	55.50	20.60	73.60	133.2666	6.900	0.0414
		5		Cave Creek (Dec., 1967)	Phoenix, AZ	70.00	26.00	11.80	75.90	35.2155	4.990	0.0496
		6		Cave Creek (Sept., 1970)	Phoenix, AZ	70.00	26.00	11.80	75.90	35.2155	5.880	0.0584
		50		Verdugo Wash (LACDA)	CA	26.80	11.40	5.70	310.00	3.6906	0.640	0.0150
		52		Animas River	at Farmington, NM	1360.00	106.30	55.20	72.40	689.6092	12.900	0.0414
		53		Buckhorn Creek	near Masonville, CO	6.90	6.40	3.40	312.00	1.2319	1.000	0.0355
			Y2	West Fork Dry Cheyenne Creek	WY	0.69	1.93	0.88	240.00	0.1096	0.910	0.0811
			Y3	West Fork Dry Cheyenne Creek Trib.	WY	1.85	2.39	1.27	356.00	0.1609	1.060	0.0816
			Y4	West Fork Dry Cheyenne Creek Trib.	WY	1.85	2.39	1.27	356.00	0.1609	0.790	0.0608
			Y9	Medicine Bow River	WY	3.01	3.79	1.92	550.00	0.3103	0.890	0.0534
		42		Santa Barbara (Mission Creek)	at Los Olivos Street, CA	7.70	a	a	a	b	a	0.0500
		51		Trinity River	near Louiston, CA	a	a	a	a	b	a	b
		41		San Dieguito River	CA	a	a	a	a	b	a	b
		37		Colma Creek Basin	CA	a	a	a	a	b	a	b
					Maximum	4730.00	145.00	74.00	1017.00	2060.00	50.000	0.3390
					Minimum	0.69	1.90	0.88	32.00	0.09	0.600	0.0150
					Mean	542.77	31.55	14.56	264.81	178.59	9.920	0.0893
					Standard Deviation	956.60	32.81	15.75	243.35	398.21	11.178	0.0817

NOTE: a - unknown, b - cannot calculate

Table 2-A
Lag and kn data for Mountain and Foothill watersheds
(kn values sorted by ascending order)

Reference and I.D. No.				Watershed	Location	A	L	Lca	S	L*Lca	Lag	kn
B	C	D	F			(sq. miles)	(miles)	(miles)	(ft/mi)	S^.5	(hrs)	
		48		West Fork San Gabriel River	at Cogswell Dam (No. 2), CA	40.40	11.40	3.90	400.00	2.2230	a	b
		39		Santa Anita Creek (general storm)	at Santa Anita Dam, CA	10.80	5.10	2.10	898.00	0.3574	a	b
		44		San Gabriel River	at San Gabriel Dam No. 1, CA	162.00	23.20	11.60	350.00	14.3851	a	b
		46		West Fork San Gabriel River	at Cogswell Dam (No. 2), CA	40.40	11.40	3.90	400.00	2.2230	a	b
		40		Santa Anita Creek (local storm)	at Santa Anita Dam, CA	10.80	5.10	2.10	898.00	0.3574	a	b
		51		Trinity River	near Louiston, CA	a	a	a	a	b	a	b
		41		San Dieguito River	CA	a	a	a	a	b	a	b
		37		Colma Creek Basin	CA	a	a	a	a	b	a	b
		49		San Jose Creek	CA	a	a	a	a	b	a	b
		50		Verdugo Wash (LACDA)	CA	26.80	11.40	5.70	310.00	3.6906	0.640	0.0150
	21	33		San Jose Creek	at Workman Mill Rd., CA	81.30	23.70	9.10	75.00	24.9034	2.400	0.0272
		15		New River (Sept., 1970)	at New River, AZ	85.70	26.20	12.40	121.60	29.4616	2.720	0.0289
	20	32		East Fullerton Creek	at Fullerton Dam, CA	3.10	3.20	1.70	140.00	0.4598	0.600	0.0310
		13		New River (Sept., 1970)	near Rock Springs, AZ	67.30	20.20	9.70	141.40	16.4778	2.500	0.0332
		12		New River (Dec., 1967)	near Rock Springs, AZ	67.30	20.20	9.70	141.00	16.5011	2.590	0.0343
	37	2		New River (Sept., 1970)	at Bell Road near Phoenix, AZ	187.00	47.60	20.70	83.40	107.8932	5.380	0.0349
		53		Buckhorn Creek	near Masonville, CO	6.90	6.40	3.40	312.00	1.2319	1.000	0.0355
	24			Deep Creek	near Hesperia, CA	137.00	a	a	a	26.1000	2.800	0.0360
	2			Verde River	below Jerome, AZ	3190.00	110.00	47.00	46.40	758.9821	12.000	0.0371
		22		Agua Fria R. (Sept., 1970)	at Avondale, AZ	718.00	61.00	27.20	68.90	199.8891	7.800	0.0401
	1			Salt River	at Roosevelt,AZ	4341.00	145.00	60.00	47.00	1269.0254	16.000	0.0407
20				Sevier River	near Kingston, UT	1110.00	82.00	40.00	49.00	468.5714	11.000	0.0409
	35			New River	at Rock Springs, AZ	67.30	20.20	9.70	141.40	16.4778	3.100	0.0411
	36			New River	at New River, AZ	85.70	23.20	13.60	145.00	26.2025	3.700	0.0411
		20		New River (Sept., 1970)	near Glendale, AZ	323.00	55.50	20.60	73.60	133.2666	6.900	0.0414
		52		Animas River	at Farmington, NM	1360.00	106.30	55.20	72.40	689.6092	12.900	0.0414
	12	28		Temecula Creek	at Pauba Canyon, CA	168.00	26.00	11.30	150.00	23.9887	3.700	0.0425
	28			Blue River	near Clifton, AZ	790.00	77.00	37.00	65.00	353.3750	10.300	0.0426
	17	25		Murrieta Creek	at Temecula, CA	220.00	27.20	10.30	95.00	28.7438	4.000	0.0429
	4			Agua Fria R.	near Mayer, AZ	590.00	42.00	14.00	87.10	63.0040	5.400	0.0430
	8	30		San Dimas Creek	at San Dimas Dam, CA	16.20	8.60	4.80	440.00	1.9679	1.500	0.0446
	19			Pacoima Wash	at Pacoima Dam, CA	27.80	15.00	8.00	315.00	6.7812	2.400	0.0447
18				Coal Cr.	near Cedar City, UT	92.00	18.50	7.10	310.00	8.6537	2.400	0.0449
	9	31		Eaton Wash	at Eaton Wash Dam, CA	9.50	7.30	4.40	600.00	1.3113	1.300	0.0451
	14			New River (Dec., 1967)	at New River, AZ	85.70	26.20	12.40	121.60	29.4616	4.250	0.0452
	5	45		San Gabriel River	at San Gabriel Dam, CA	162.00	23.20	11.60	350.00	14.3851	3.300	0.0461
	14	26		Santa Margarita River	at Ysidora, CA	740.00	61.20	34.30	85.00	227.6859	9.500	0.0464
	27			San Francisco River	at Jct. with Blue River, AZ	2000.00	130.00	74.00	32.00	1700.5918	20.600	0.0469
	16	29		Tujunga Creek	at Big Tujunga Dam, CA	81.40	15.10	7.30	290.00	6.4729	2.500	0.0473
19				Sevier River	near Hatch, UT	260.00	29.00	14.00	100.00	40.6000	5.100	0.0480
	6	47		West Fork San Gabriel River	at Cogswell Dam, CA	40.40	9.30	4.20	450.00	1.8413	1.600	0.0488
	13	27		Santa Margarita River	near Fallbrook, CA	645.00	46.00	22.00	105.00	98.7611	7.300	0.0490
	18			Los Angeles River	at Sepulveda Dam, CA	152.00	19.00	9.00	145.00	14.2008	3.500	0.0491
	11	36		Santa Clara River	near Saugus, CA	355.00	36.00	15.80	140.00	48.0724	5.600	0.0494
		5		Cave Creek (Dec., 1967)	Phoenix, AZ	70.00	26.00	11.80	75.90	35.2155	4.990	0.0496
		42		Santa Barbara (Mission Creek)	at Los Olivos Street, CA	7.70	a	a	a	b	a	0.0500

NOTE: a - unknown, b - cannot calculate

Table 2-A (cont.)
Lag and kn data for Mountain and Foothill watersheds
(kn values sorted by ascending order)

Reference and I.D. No.				Watershed	Location	A	L	Lca	S	L*Lca	Lag	kn
B	C	D	F			(sq. miles)	(miles)	(miles)	(ft/mi)	S^.5	(hrs)	
	3			Tonto Creek	above Gun Cr., AZ	678.00	41.00	16.50	104.60	66.1458	6.500	0.0508
	22			San Vincente Creek	at Foster, CA	75.00	a	a	a	12.8000	3.200	0.0530
	7	38		Santa Anita Creek	at Santa Anita Dam, CA	10.80	5.80	2.50	690.00	0.5520	1.100	0.0530
			Y9	Medicine Bow River	WY	3.01	3.79	1.92	550.00	0.3103	0.890	0.0534
	33			White River	near Watson, UT	4020.00	a	a	a	1473.0000	15.700	0.0540
		21		Agua Fria R. (Dec., 1967)	at Avondale, AZ	718.00	61.00	27.20	68.90	199.8891	10.680	0.0549
	25			Bill Williams River	at Planet, AZ	4730.00	a	a	a	1476.0000	16.200	0.0560
		1		New River (Dec., 1967)	at Bell Road near Phoenix, AZ	187.00	47.60	20.70	83.40	107.8932	8.850	0.0575
	10			San Antonio Creek	near Claremont, CA	16.90	5.90	3.00	1017.00	0.5550	1.200	0.0577
		6		Cave Creek (Sept., 1970)	Phoenix, AZ	70.00	26.00	11.80	75.90	35.2155	5.880	0.0584
	34			Paria River	at Lees Ferry, AZ	1570.00	a	a	a	296.0000	10.200	0.0600
			Y4	West Fork Dry Cheyenne Creek Trib.	WY	1.85	2.39	1.27	356.00	0.1609	0.790	0.0608
24				Dolores River	near McPhee, CO	793.00	a	a	a	193.0000	9.000	0.0610
	15	43		Live Oak Creek	at Live Oak Dam, CA	2.30	2.90	1.50	700.00	0.1844	0.800	0.0611
1				Purgatoire River	at Trinidad, CO	742.00	44.00	20.00	159.00	69.7885	8.000	0.0613
		19		New River (Dec., 1967)	near Glendale, AZ	323.00	55.50	20.60	73.60	133.2666	10.590	0.0635
8				North Fk Big Thompson River	near Glen Haven, CO	1.30	1.90	1.30	709.00	0.0928	0.700	0.0665
7				Rabbit Gulch	near Estes Park, CO	3.40	3.30	1.50	480.00	0.2259	1.000	0.0677
	32			Plateau Creek	near Cameo, CO	604.00	a	a	a	89.9000	7.900	0.0690
6				Dry Gulch	near Estes Park, CO	2.10	2.70	1.00	295.00	0.1572	0.900	0.0699
	23			San Diego River	near Santee, CA	360.00	a	a	a	95.4000	9.200	0.0780
			Y2	West Fork Dry Cheyenne Creek	WY	0.69	1.93	0.88	240.00	0.1096	0.910	0.0811
			Y3	West Fork Dry Cheyenne Creek Trib.	WY	1.85	2.39	1.27	356.00	0.1609	1.060	0.0816
21				Centerville Cr.	near Centerville, UT	3.90	a	a	a	0.4000	2.400	0.1240
22				Parrish Cr.	near Centerville, UT	2.00	a	a	a	0.3000	2.200	0.1260
13				Madison River	near Three Forks, MT	2511.00	a	a	a	2060.0000	50.000	0.1550
15				Surface Cr.	at Cedaredge, CO	43.00	a	a	a	11.3000	11.300	0.1950
14				Gallatin River	at Logan, MT	1795.00	a	a	a	443.0000	38.000	0.1960
17				Piney Cr.	at Kearney, WY	106.00	a	a	a	29.0000	16.500	0.2090
12				Weiser River	above Crane Cr. near Weiser, ID	1160.00	a	a	a	310.0000	37.000	0.2140
5				Uncompaghre River	at Delta, CO	1110.00	a	a	a	216.0000	36.000	0.2350
10				South Fk. Payette River	near Garden Valley, ID	779.00	a	a	a	123.0000	30.000	0.2360
4				San Miguel River	at Naturita, CO	1080.00	a	a	a	174.0000	34.000	0.2380
2				Wood River	near Meeteetse, WY	194.00	a	a	a	41.9000	21.500	0.2410
11				Malheur River	near Drewsy, OR	910.00	a	a	a	114.0000	30.000	0.2420
23				Florida River	near Hermosa, CO	69.40	a	a	a	12.5000	15.500	0.2590
16				South Piney Cr.	at Willow Park, WY	28.90	a	a	a	3.8000	10.500	0.2600
3				Grey Bull River	near Meeteetse, WY	681.00	a	a	a	68.3000	34.000	0.3240
9		54		Uintah River	near Neola, UT	181.00	a	a	a	59.0000	32.000	0.3240
25				Los Pinos River	near Bayfield, CO	284.00	a	a	a	35.0000	28.500	0.3390
					Maximum	4730.00	145.00	74.00	1017.00	2060.00	50.000	0.3390
					Minimum	0.69	1.90	0.88	32.00	0.09	0.600	0.0150
					Mean	542.77	31.55	14.56	264.81	178.59	9.920	0.0893
					Standard Deviation	956.60	32.81	15.75	243.35	398.21	11.178	0.0817

NOTE: a - unknown, b - cannot calculate

Not representative of Maricopa County mountain and foothill watersheds.

Table 3
Lag and kn data for Desert/Rangeland watersheds

Reference and I.D. No.			Watershed	Location	A	L	Lca	S	L*Lca	Lag	kn
C	D	F			(sq. miles)	(miles)	(miles)	(ft/mi)	S^.5	(hrs)	
		X1	Walnut Gulch 63.004	Tombstone, AZ	0.880	2.10	1.040	112.00	0.2064	0.470	0.0329
		X2	Walnut Gulch 63.004	Tombstone, AZ	0.880	2.10	1.040	112.00	0.2064	0.550	0.0385
		X6	Walnut Gulch 63.011	Tombstone, AZ	3.180	4.02	1.780	117.00	0.6615	0.510	0.0230
		X7	Walnut Gulch 63.015	Tombstone, AZ	9.240	4.25	2.500	60.00	1.3717	1.070	0.0365
		X8	Walnut Gulch 63.103	Tombstone, AZ	0.013	0.22	0.094	195.00	0.0015	0.082	0.0375
		X9	Walnut Gulch 63.103	Tombstone, AZ	0.013	0.22	0.094	195.00	0.0015	0.075	0.0343
		X11	Walnut Gulch 63.111	Tombstone, AZ	0.220	0.95	0.480	150.00	0.0372	0.210	0.0282
		X12	Walnut Gulch 63.111	Tombstone, AZ	0.220	0.95	0.480	150.00	0.0372	0.200	0.0269
	7		Queen Creek Tributary (Dec., 1967)	Phoenix, AZ	0.510	1.50	0.750	67.00	0.1374	0.860	0.0703
	8		Queen Creek Tributary (Sept., 1970)	Phoenix, AZ	0.510	1.50	0.750	67.00	0.1374	0.950	0.0777
	9		Queen Creek Tributary (Sept., 1970)	Phoenix, AZ	0.510	1.50	0.750	67.00	0.1374	0.790	0.0646
26			Gila River	at Conner No. 4 Damsite, AZ	2840.000	131.00	71.000	29.00	1727.1523	21.500	0.0487
29	23		Moencopi Wash	near Tuba City, AZ	2490.000	84.50	36.300	42.10	472.7399	9.200	0.0341
30	24		Clear Creek	near Winslow, AZ	607.000	78.00	46.800	41.00	570.0967	11.200	0.0386
38	4		Skunk Creek (Sept., 1970)	near Phoenix, AZ	64.600	17.60	9.900	101.90	17.2608	2.190	0.0285
	3		Skunk Creek (Dec., 1967)	near Phoenix, AZ	64.600	17.60	9.900	101.90	17.2608	2.950	0.0384
31			Puerco River	near Admana, AZ	2760.000	a	a	a	1225.0000	15.900	0.0580
	55		Arbuckle Creek and Dam	OK	a	a	a	a	b	a	b
NOTE: a - unknown value, b - cannot calculate				Maximum	2840.000	131.00	71.000	195.00	1727.1523	21.500	0.0777
				Minimum	0.013	0.22	0.094	29.00	0.0015	0.075	0.0230
				Mean	520.140	21.75	11.479	100.49	237.2027	4.042	0.0422
				Standard Deviation	1050.622	39.57	21.056	51.88	504.7440	6.448	0.0161

Table 3-A
Lag and kn data for Desert/Rangeland watersheds
(kn values sorted in ascending order)

Reference and I.D. No.			Watershed	Location	A	L	Lca	S	L*Lca	Lag	kn
C	D	F			(sq. miles)	(miles)	(miles)	(ft/mi)	S^.5	(hrs)	
	55		Arbuckle Creek and Dam	OK	a	a	a	a	b	a	b
		X6	Walnut Gulch 63.011	Tombstone, AZ	3.180	4.02	1.780	117.00	0.6615	0.510	0.0230
		X12	Walnut Gulch 63.111	Tombstone, AZ	0.220	0.95	0.480	150.00	0.0372	0.200	0.0269
		X11	Walnut Gulch 63.111	Tombstone, AZ	0.220	0.95	0.480	150.00	0.0372	0.210	0.0282
38	4		Skunk Creek (Sept., 1970)	near Phoenix, AZ	64.600	17.60	9.900	101.90	17.2608	2.190	0.0285
		X1	Walnut Gulch 63.004	Tombstone, AZ	0.880	2.10	1.040	112.00	0.2064	0.470	0.0329
29	23		Moencopi Wash	near Tuba City, AZ	2490.000	84.50	36.300	42.10	472.7399	9.200	0.0341
		X9	Walnut Gulch 63.103	Tombstone, AZ	0.013	0.22	0.094	195.00	0.0015	0.075	0.0343
		X7	Walnut Gulch 63.015	Tombstone, AZ	9.240	4.25	2.500	60.00	1.3717	1.070	0.0365
		X8	Walnut Gulch 63.103	Tombstone, AZ	0.013	0.22	0.094	195.00	0.0015	0.082	0.0375
	3		Skunk Creek (Dec., 1967)	near Phoenix, AZ	64.600	17.60	9.900	101.90	17.2608	2.950	0.0384
		X2	Walnut Gulch 63.004	Tombstone, AZ	0.880	2.10	1.040	112.00	0.2064	0.550	0.0385
30	24		Clear Creek	near Winslow, AZ	607.000	78.00	46.800	41.00	570.0967	11.200	0.0386
26			Gila River	at Conner No. 4 Damsite, AZ	2840.000	131.00	71.000	29.00	1727.1523	21.500	0.0487
31			Puerco River	near Admana, AZ	2760.000	a	a	a	1225.0000	15.900	0.0580
	9		Queen Creek Tributary (Sept., 1970)	Phoenix, AZ	0.510	1.50	0.750	67.00	0.1374	0.790	0.0646
	7		Queen Creek Tributary (Dec., 1967)	Phoenix, AZ	0.510	1.50	0.750	67.00	0.1374	0.860	0.0703
	8		Queen Creek Tributary (Sept., 1970)	Phoenix, AZ	0.510	1.50	0.750	67.00	0.1374	0.950	0.0777
				Maximum	2840.000	131.00	71.000	195.00	1727.1523	21.500	0.0777
				Minimum	0.013	0.22	0.094	29.00	0.0015	0.075	0.0230
				Mean	520.140	21.75	11.479	100.49	237.2027	4.042	0.0422
				Standard Deviation	1050.622	39.57	21.058	51.88	504.7440	6.448	0.0161

NOTE: a - unknown value, b - cannot calculate

Table 4
Lag and kn data for Alluvial Fan watersheds

Ref. and I.D. No		Watershed	Location	A	L	Lca	S	L*Lca	Lag	kn
D	G			(sq. miles	(miles)	(miles)	(ft/mi)	S^.5	(hrs)	
	Q6	La Cueva Arroyo Trib.	Albuquerque, NM	0.090	0.76	0.40	432.0	0.0146	0.15	0.0287
	Q7	La Cueva Arroyo Trib.	Albuquerque, NM	0.090	0.76	0.40	432.0	0.0146	0.27	0.0517
	Q8	La Cueva Arroyo Trib.	Albuquerque, NM	0.090	0.76	0.40	432.0	0.0146	0.39	0.0747
	Q9	Camino Arroyo Trib.	Albuquerque, NM	0.089	0.93	0.40	177.0	0.0280	0.15	0.0225
	Q10	Camino Arroyo Trib.	Albuquerque, NM	0.089	0.93	0.40	177.0	0.0280	0.34	0.0509
	Q11	N. Camino Arroyo Trib.	Albuquerque, NM	0.210	2.12	1.05	196.0	0.1590	0.31	0.0240
	Q12	N. Camino Arroyo Trib.	Albuquerque, NM	0.210	2.12	1.05	196.0	0.1590	0.27	0.0209
16		Indian Bend Wash (Dec., 1967)	near Scottsdale, AZ	142.000	27.70	13.60	64.2	47.0166	8.02	0.0714
17		Indian Bend Wash (Sept., 1970)	near Scottsdale, AZ	142.000	27.70	13.60	64.2	47.0166	7.31	0.0651
18		Indian Bend Wash (June, 1972)	near Scottsdale, AZ	142.000	27.70	13.60	64.2	47.0166	3.10	0.0276
			Maximum	142.000	27.70	13.60	432.0	47.0166	8.02	0.0747
			Minimum	0.089	0.76	0.40	64.2	0.0146	0.15	0.0209
			Mean	42.687	9.15	4.49	223.5	14.1468	2.03	0.0437
			Standard Deviation	68.533	12.81	6.29	153.6	22.6824	3.10	0.0215

Table 4-A
Lag and kn Data for Alluvial Fan watersheds
(kn values sorted by ascending order)

Ref. and I.D. No		Watershed	Location	A	L	Lca	S	L*Lca	Lag	kn
D	G			(sq. miles	(miles)	(miles)	(ft/mi)	S^.5	(hrs)	
	Q12	N. Camino Arroyo Trib.	Albuquerque, NM	0.210	2.12	1.05	196.0	0.1590	0.27	0.0209
	Q9	Camino Arroyo Trib.	Albuquerque, NM	0.089	0.93	0.40	177.0	0.0280	0.15	0.0225
	Q11	N. Camino Arroyo Trib.	Albuquerque, NM	0.210	2.12	1.05	196.0	0.1590	0.31	0.0240
18		Indian Bend Wash (June, 1972)	near Scottsdale, AZ	142.000	27.70	13.60	64.2	47.0166	3.10	0.0276
	Q6	La Cueva Arroyo Trib.	Albuquerque, NM	0.090	0.76	0.40	432.0	0.0146	0.15	0.0287
	Q10	Camino Arroyo Trib.	Albuquerque, NM	0.089	0.93	0.40	177.0	0.0280	0.34	0.0509
	Q7	La Cueva Arroyo Trib.	Albuquerque, NM	0.090	0.76	0.40	432.0	0.0146	0.27	0.0517
17		Indian Bend Wash (Sept., 1970)	near Scottsdale, AZ	142.000	27.70	13.60	64.2	47.0166	7.31	0.0651
16		Indian Bend Wash (Dec., 1967)	near Scottsdale, AZ	142.000	27.70	13.60	64.2	47.0166	8.02	0.0714
	Q8	La Cueva Arroyo Trib.	Albuquerque, NM	0.090	0.76	0.40	432.0	0.0146	0.39	0.0747
			Maximum	142.000	27.70	13.60	432.0	47.0166	8.02	0.0747
			Minimum	0.089	0.76	0.40	64.2	0.0146	0.15	0.0209
			Mean	42.687	9.15	4.49	223.5	14.1468	2.03	0.0437
			Standard Deviation	68.533	12.81	6.29	153.6	22.6824	3.10	0.0215

Figure 1

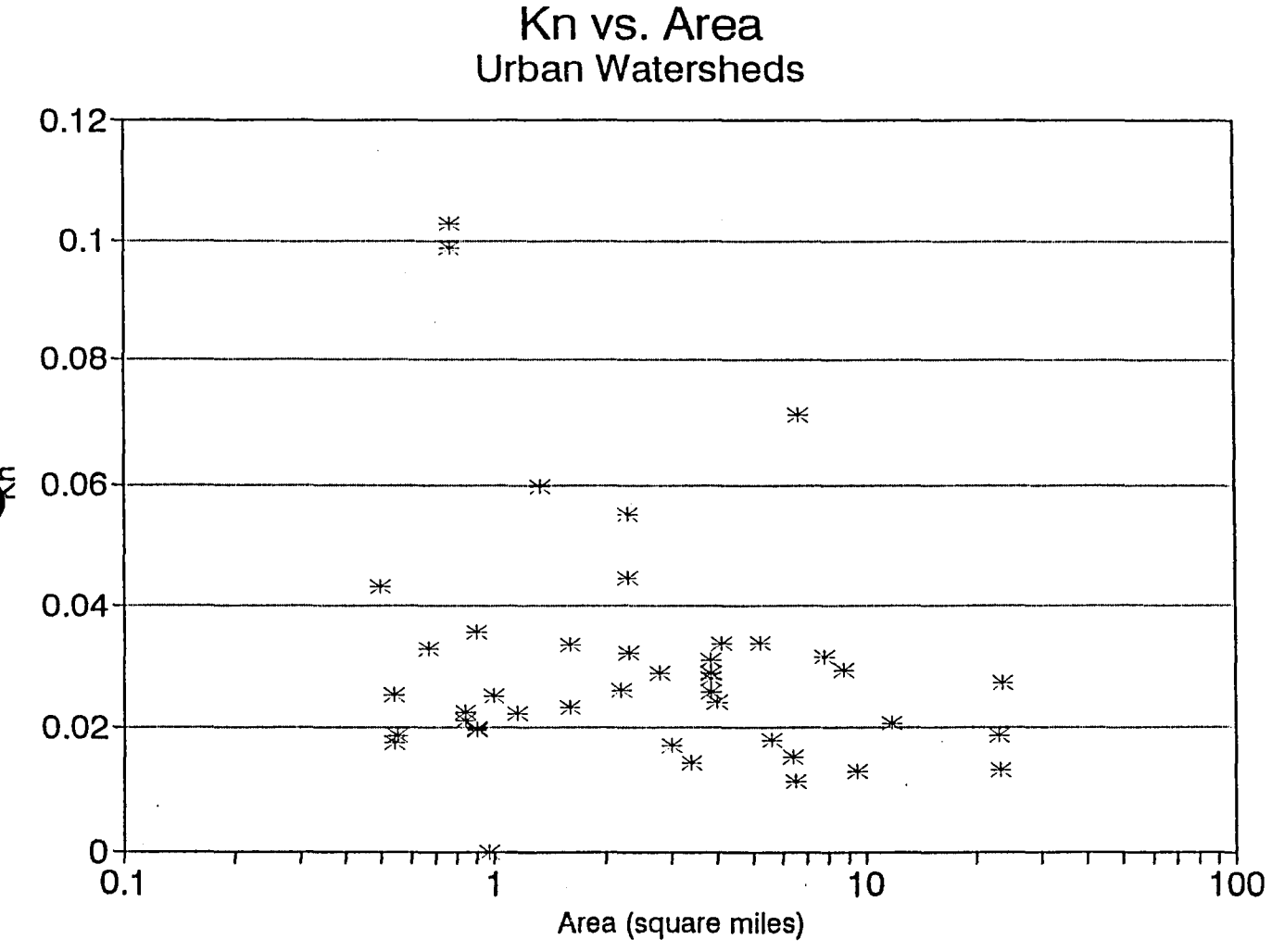

Kn vs. Area
Urban Watersheds
0.12
0.1
0.08
0.06
0.04
0.02
0
Kn
0.1
1
10
100
Area (square miles)

Figure 2

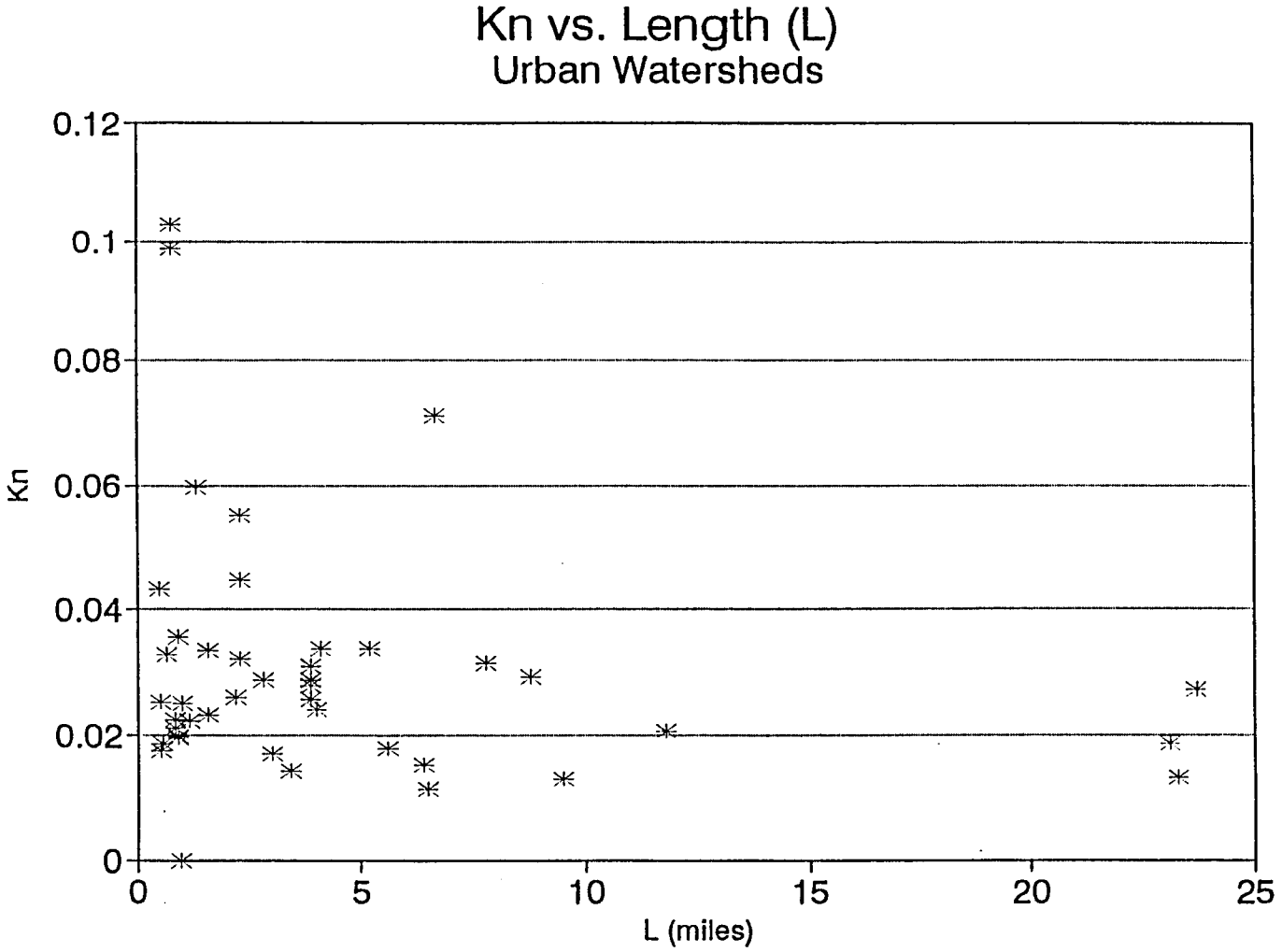

Kn vs. Length (L)
Urban Watersheds
Kn
0.12
0.1
0.08
0.06
0.04
0.02
0
0
5
10
15
20
25
L (miles)

Figure 3

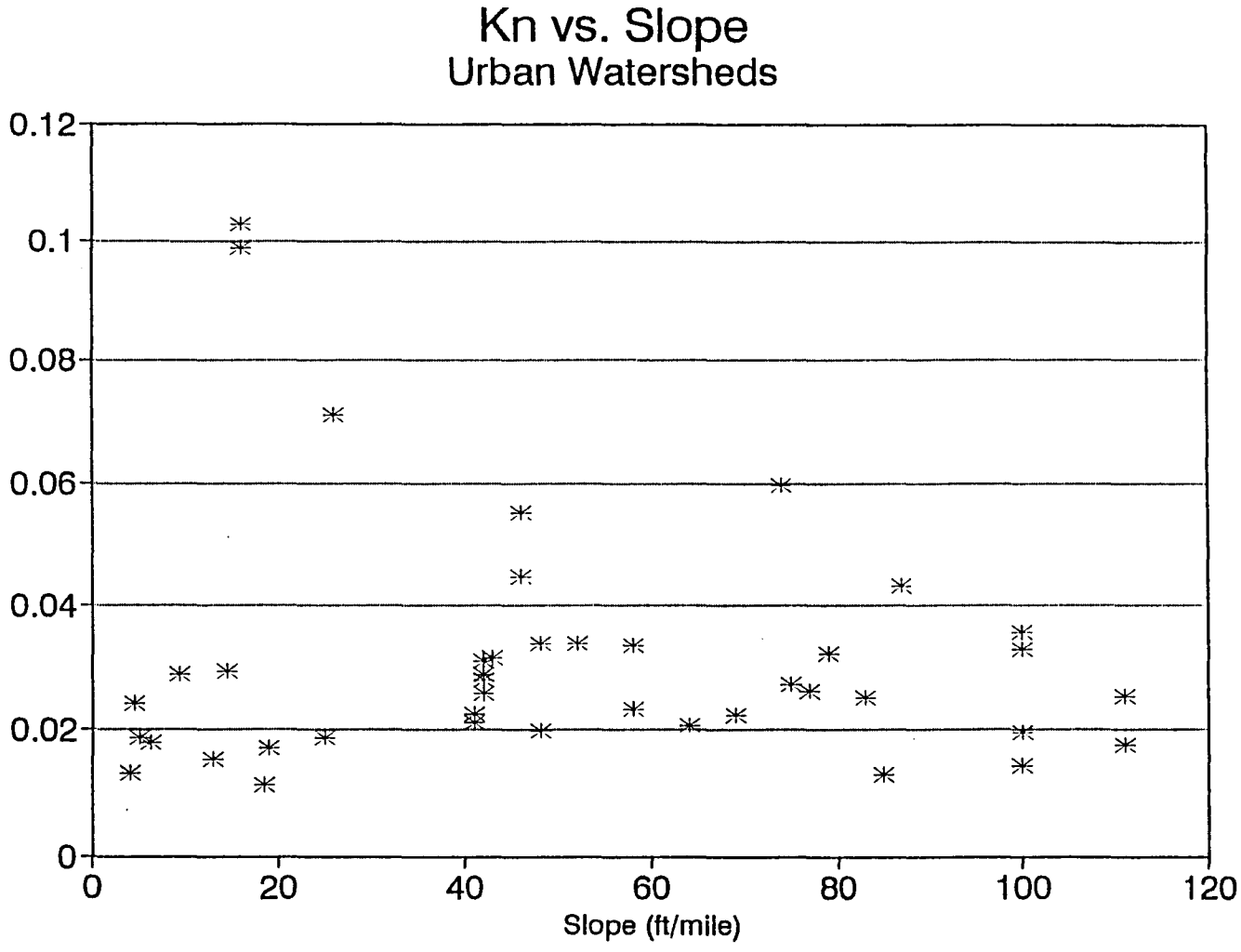

Kn vs. Slope
Urban Watersheds
0.12
0.1
0.08
0.06
0.04
0.02
0
0
20
40
60
80
100
120
Slope (ft/mile)

Figure 4

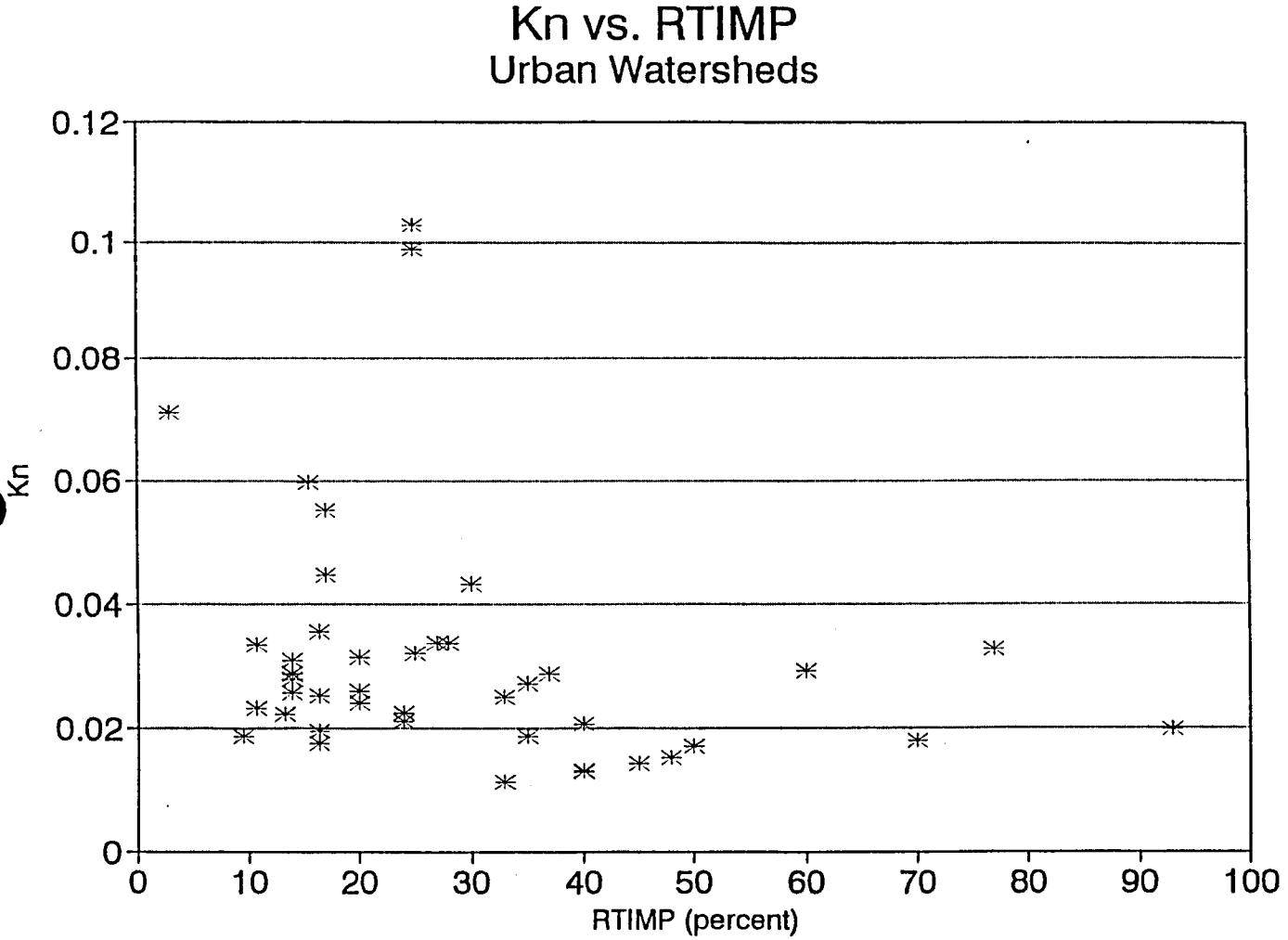

Kn vs. RTIMP
Urban Watersheds
Kn
0.12
0.1
0.08
0.06
0.04
0.02
0
0
10
20
30
40
50
60
70
80
90
100
RTIMP (percent)

Figure 5

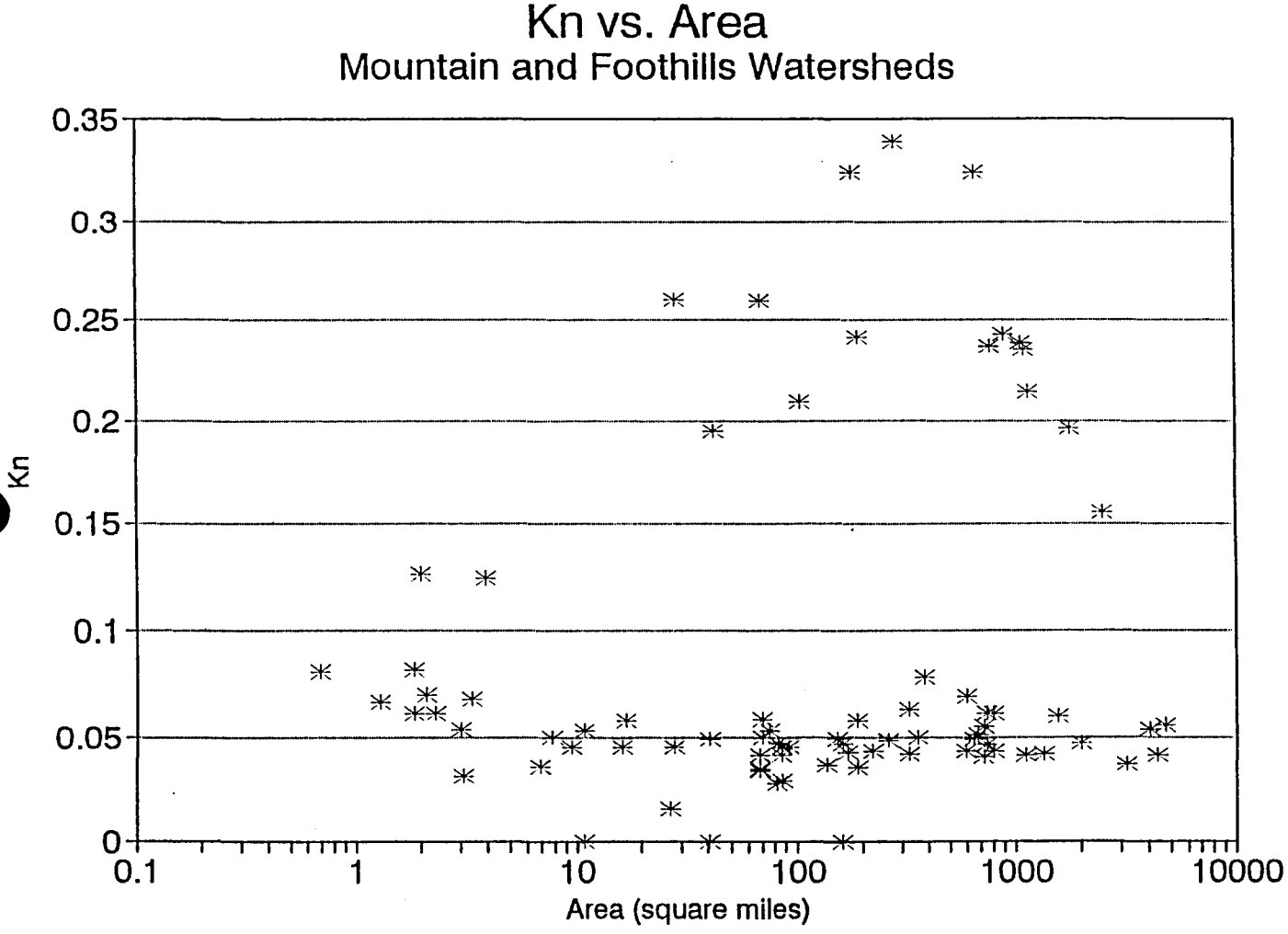

Kn vs. Area
Mountain and Foothills Watersheds
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Kn
0.1
1
10
100
1000
10000
Area (square miles)

Figure 6

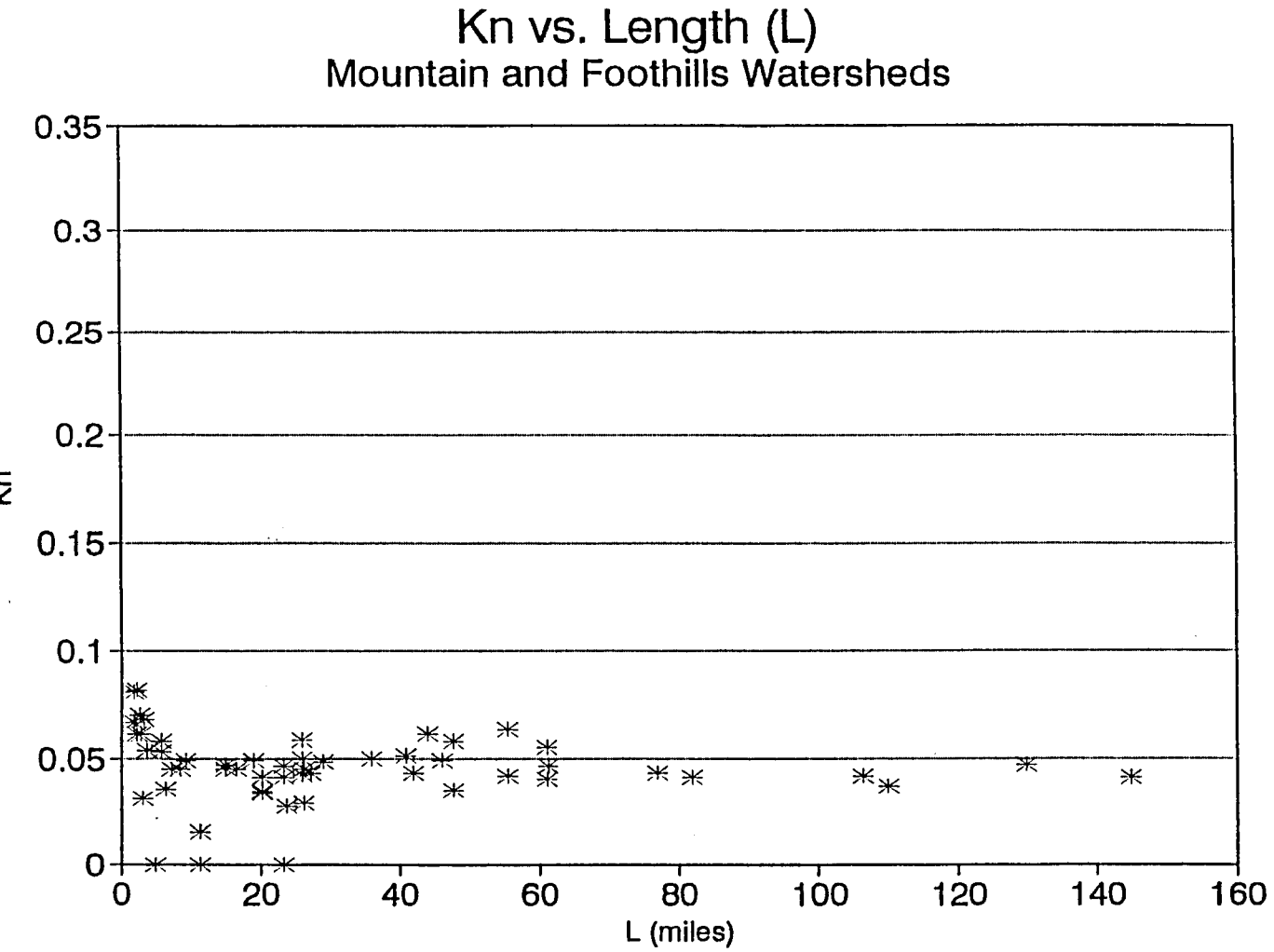

Kn vs. Length (L)
Mountain and Foothills Watersheds
Kn
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
20
40
60
80
100
120
140
160
L (miles)

Figure 7

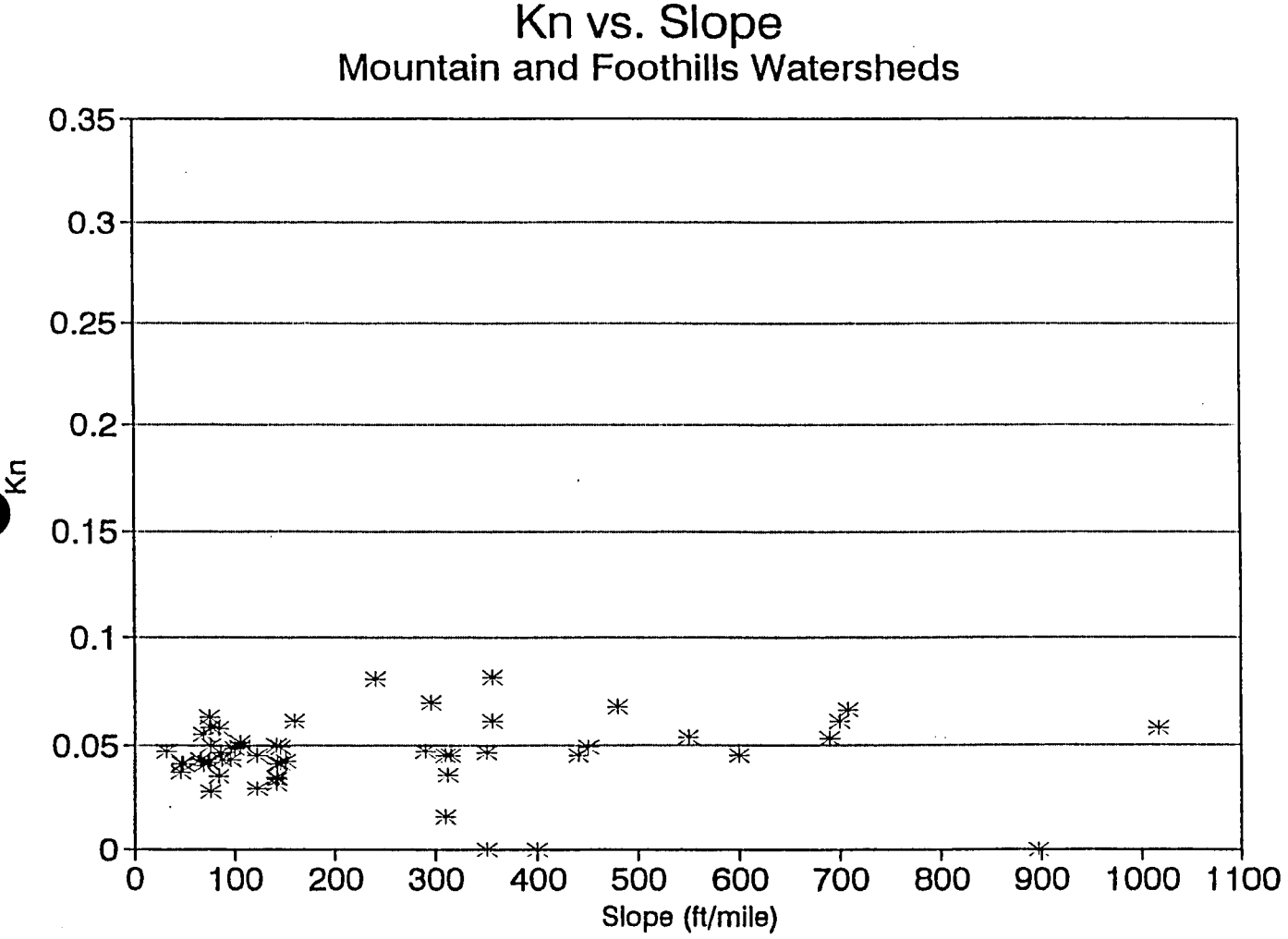

Kn vs. Slope
Mountain and Foothills Watersheds
Kn
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
100
200
300
400
500
600
700
800
900
1000
1100
Slope (ft/mile)

Figure 8

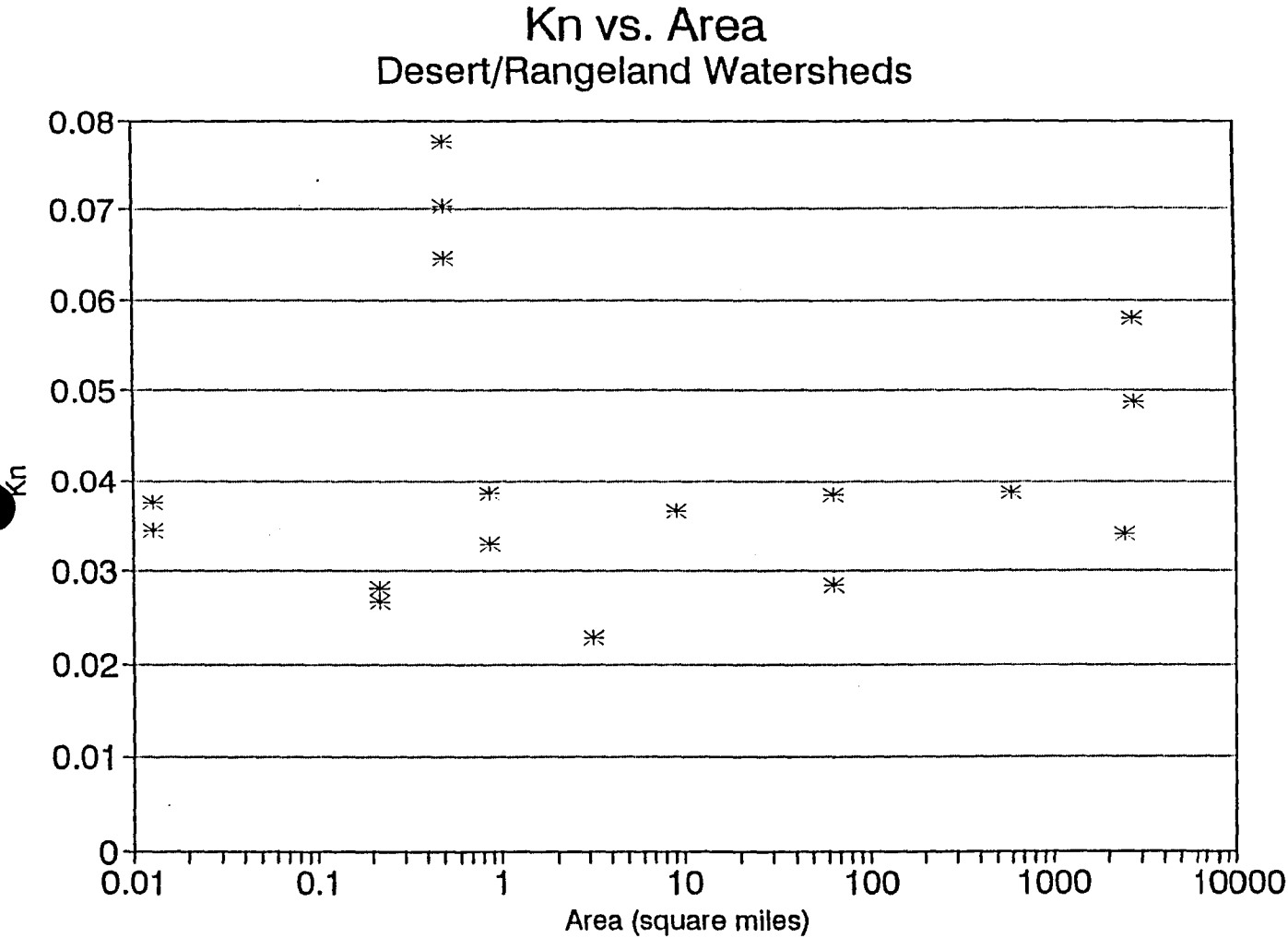

Kn vs. Area
Desert/Rangeland Watersheds
Kn
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0.01
0.1
1
10
100
1000
10000
Area (square miles)

Figure 9

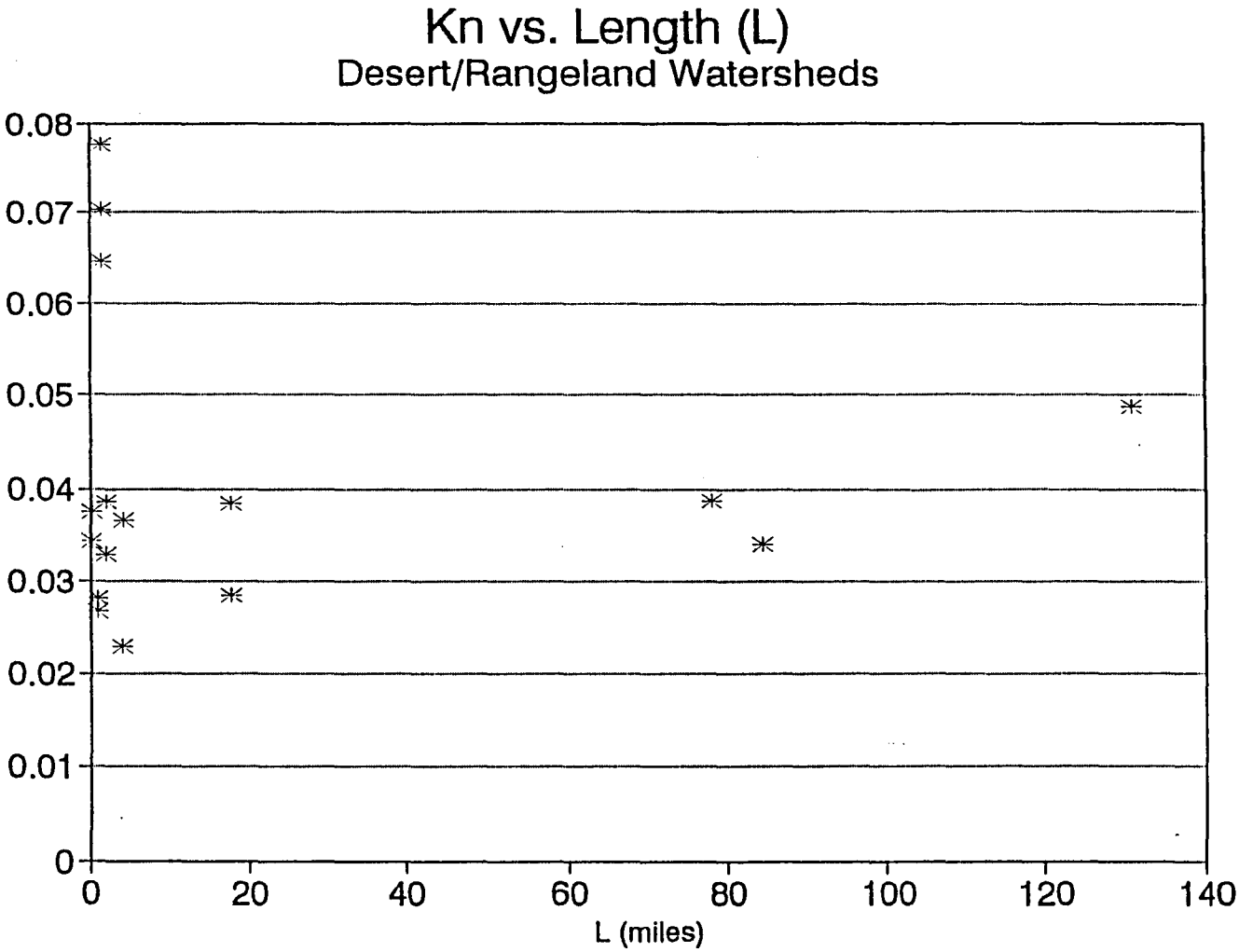

Kn vs. Length (L)
Desert/Rangeland Watersheds
Kn
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
20
40
60
80
100
120
140
L (miles)

Figure 10

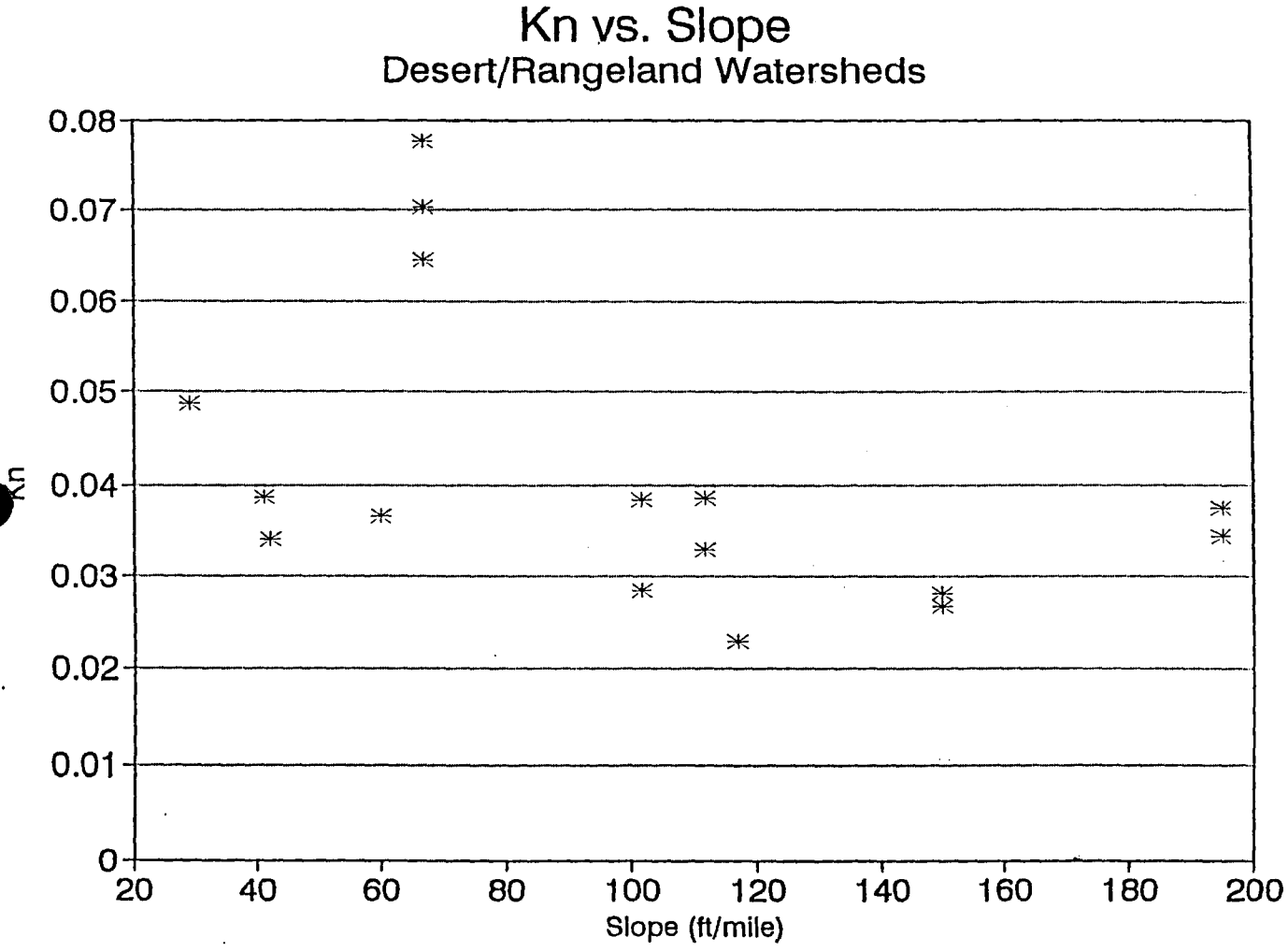

Kn vs. Slope
Desert/Rangeland Watersheds
Kn
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
20
40
60
80
100
120
140
160
180
200
Slope (ft/mile)

Figure 11

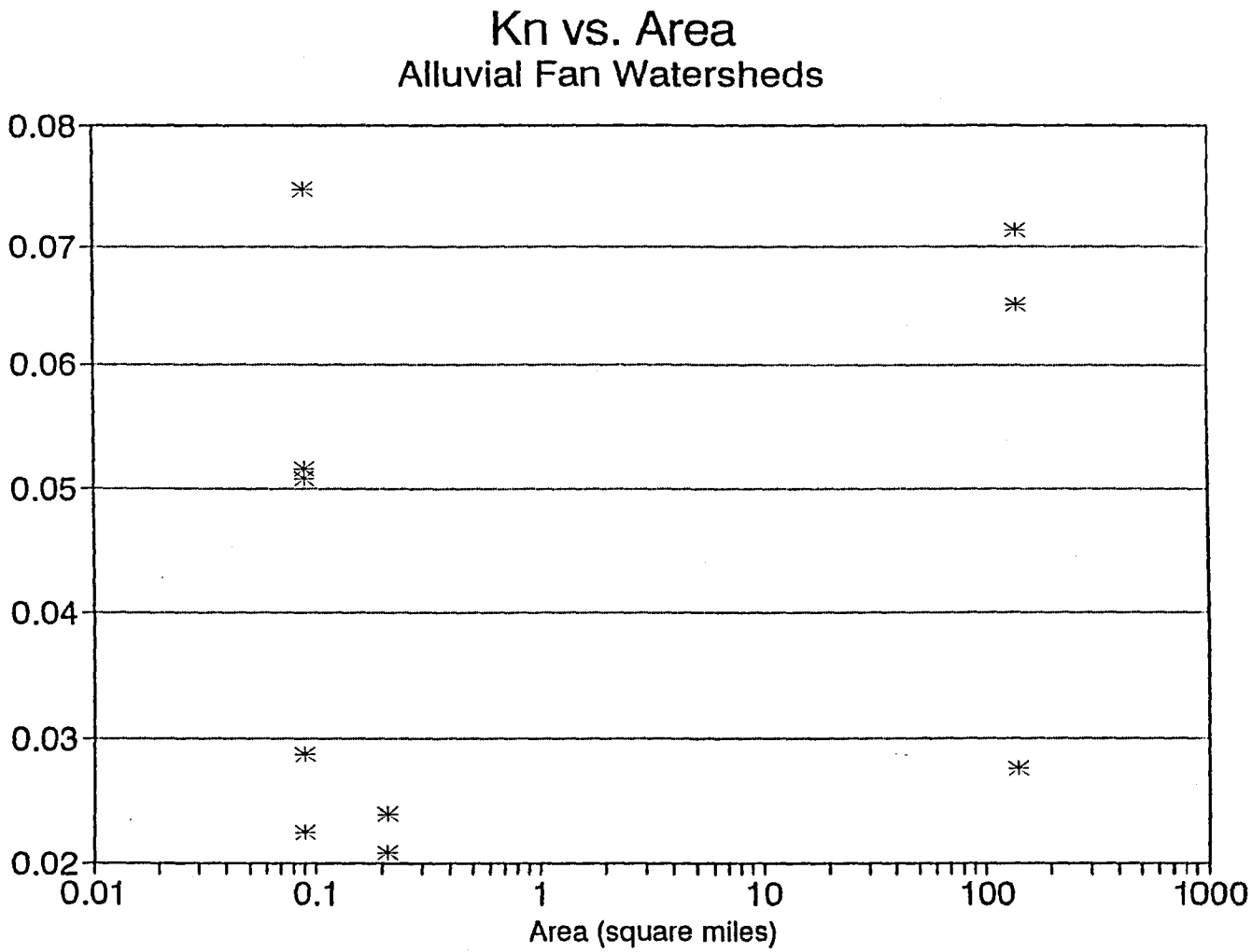

Kn vs. Area
Alluvial Fan Watersheds
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.1
1
10
100
1000
Area (square miles)

Figure 12

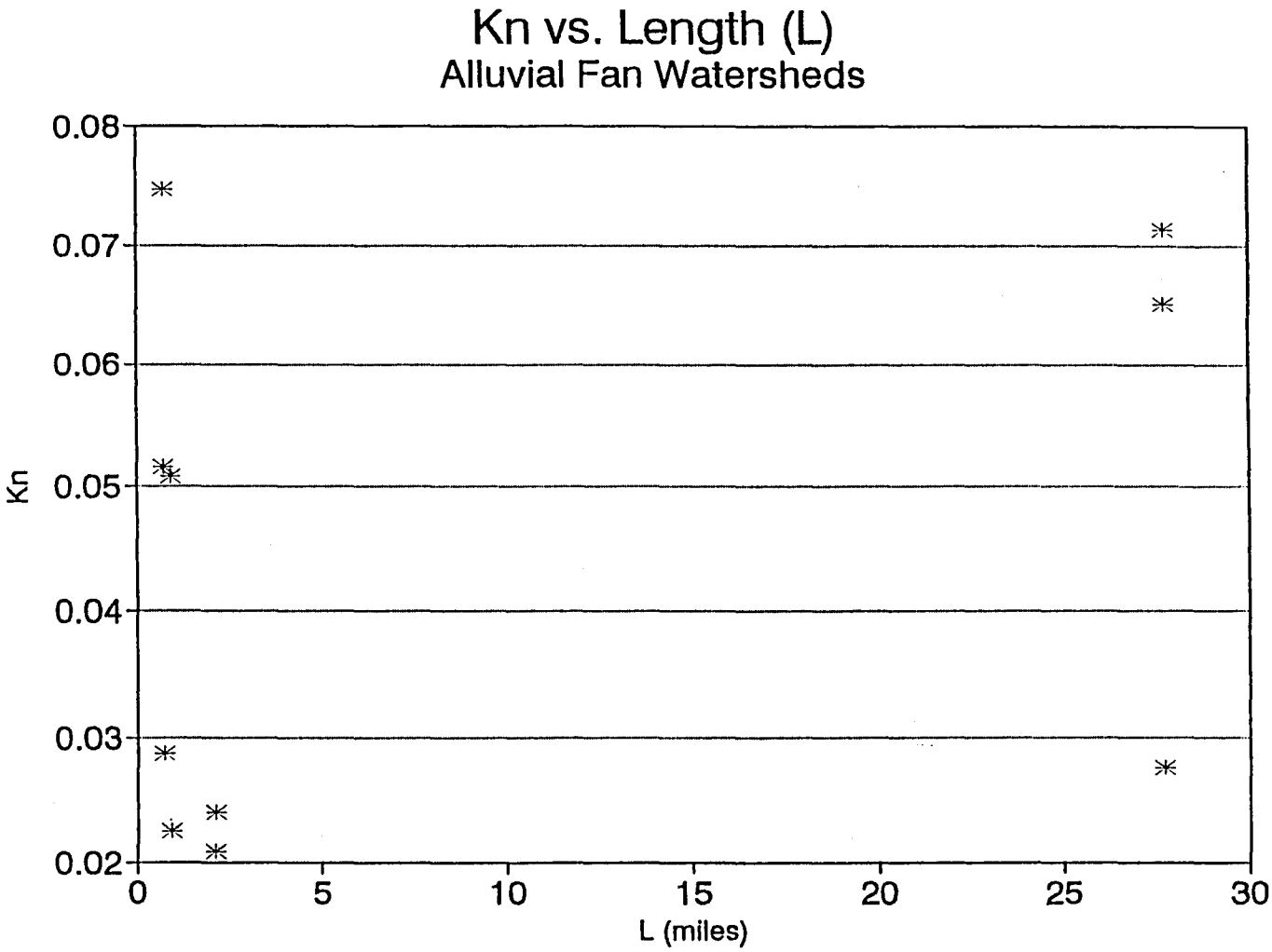
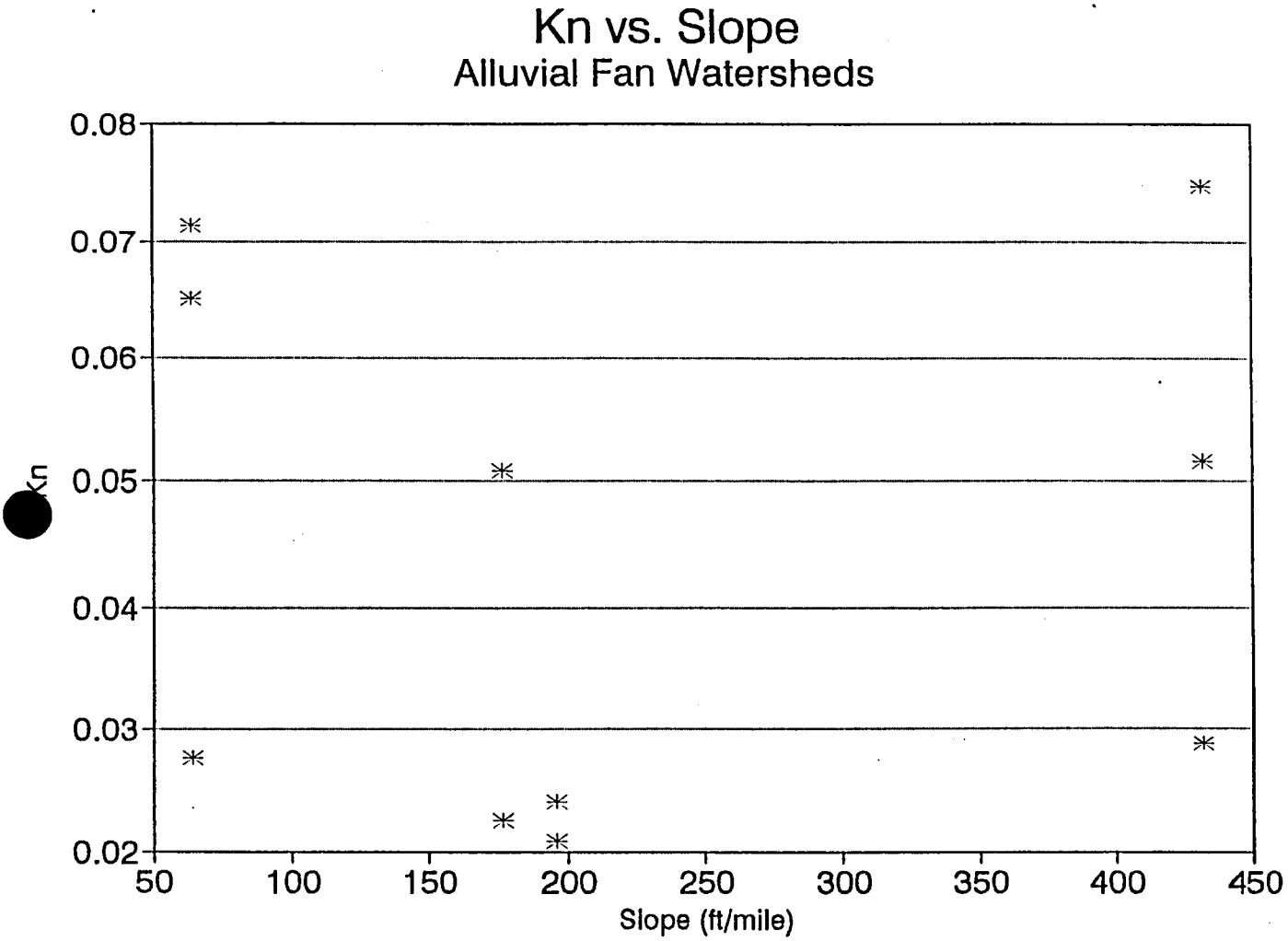

Kn vs. Length (L)
Alluvial Fan Watersheds
0.08
0.07
0.06
0.05
0.04
0.03
0.02
Kn
0
5
10
15
20
25
30
L (miles)

Figure 13


Kn vs. Slope
Alluvial Fan Watersheds
0.08
0.07
0.06
0.05
0.04
0.03
0.02
Kn
50
100
150
200
250
300
350
400
450
Slope (ft/mile)

MEMORANDUM

To: Maricopa County Hydrology Manual Committee
From: G.V. Sabol
Subject: Addendum to the S-Graph K_n Study, March 1993
Date: 11 May 1993

The S-Graph K_n Study report was reviewed with the Committee during a meeting of 4 May 1993. The effect of rainfall frequency on resultant K_n values was discussed, especially with regard to urban watersheds (Tables 1 and 1-A). The Committee requested that rainfall data be added to Table 1 for urban watersheds. Those data are available for the watersheds that were analyzed in the Unit Hydrograph Study and were reported in the Small Watershed S-Graph Study, January 1993. Rainfall data are not available for S-graphs that were compiled from Corps and USBR files.

The rainfall data are obtained from the files of the Unit Hydrograph Study (Documentation Manual, Part 3, Books 1 and 2). Those data are enclosed in Table 5.

For each S-graph, the total storm rainfall depth, rainfall duration, and maximum rainfall intensity are tabulated. For some of these watersheds there were multiple recording raingages in the watershed, and in those cases, the rainfall data that are tabulated are for the "representative" rainfall that was used in the unit hydrograph reconstitution. The maximum rainfall intensity is for the incremental time period that is used to report the data, and this is either 5-, 10-, or 15-minutes.

This memo and Table 5 can be added to the S-Graph K_n Study, March 1993, as an addendum.

TABLE 5

Rainfall data for Urban watersheds
(from Small Watershed S-Graph Study)

S-graph	Rainfall inches	Duration minutes	Max. Intensity in/hr	
T1	1.90	220	3.0	
T2	1.83	410	2.8	(3 bursts of rainfall)
T3	1.45	225	3.4	
T4	1.03	120	.96	
T5	1.00	60	3.0	
T6	1.50	180	3.8	
T7	.75	105	2.4	(2 bursts of rainfall)
T8	.95	200	1.3	(4 bursts of rainfall)
T9	1.40	330	.68	
Q1	.50	25	2.8	
Q2	1.12	80	3.2	
Q3	.67	50	1.9	
Q4	.57	30	2.4	
Q5	.57	45	1.7	
D1	.93	35	2.6	
D2	.54	40	1.7	
D3	1.97	55	4.3	
D4	.76	30	4.7	
D5	1.38	40	4.0	
D6	1.28	45	4.2	

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*           VERSION 4.0.1E              *
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*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X       XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  1           ID   RIO VERDE NORTH FIS
  2           ID   TEST RUN USING Kn = 0.055
  3           ID   FILE:TESTK1_A.IH1
  4           ID   MG
  5           ID
  6           IT       5                    300
  7           IO       5
              *DIAGRAM
              *

  8           KK     5S
  9           KM   Sub-Basin     5S
 10           KM
 11           KM      The S-Graph #18 is used for this basin.
 12           KM      The following parameters are used for this basin:
 13           KM          L=      2.5  Lca=      1.0   S=  311.4  Kn= .055  LAG=  37.7
 14           KM
 15           BA   1.270
 16           IN     15
 17           KM   RAINFALL DEPTH OF 3.40 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
 18           KM   AN AREAL REDUCTION COEFFICIENT OF .929 WAS USED
 19           PB    3.16
```

```
20        KM   THE FOLLOWING PC RECORD USED A 6-HOUR RAINFALL WITH PATTERN NO. 2.91
21        PC    .000    .014    .020    .030    .047    .061    .074    .087    .101    .115
22        PC    .131    .147    .170    .217    .299    .470    .672    .800    .871    .914
23        PC    .946    .960    .973    .987   1.000
24        LG   0.16    0.40    6.00    0.24    0.75
25        UI    271     602     823     859     769     674     616     544     490     445
26        UI    401     348     314     282     255     228     206     182     162     144
27        UI    131     122     100      96      81      81      63      58      58      50
28        UI     37      37      37      37      35      13      13      13      13      13
29        UI     13      13      13      13      13      13      13      13      13       0
30        UI      0       0       0       0       0       0       0       0       0       0
31        UI      0       0       0       0       0       0       0       0       0       0
          *

32        KK     6R
33        KM   ROUTE FLOW FROM SUBAREA 5S TO SUBAREA 10S OUTLET
34        RS      3    FLOW      -1
35        RC   .070    .030    .070    2786   .0126
36        RX      0     1.5   201.5   202.5   207.5   208.5   408.5   410.0
37        RY    100    98.5    98.5    97.5    97.5    98.5    98.5     100
          *

38        KK    10S
39        KM   Sub-Basin    10S
40        KM
41        KM      The S-Graph #18 is used for this basin.
42        KM      The following parameters are used for this basin:
43        KM          L=      2.1  Lca=      0.8   S=  106.0  Kn= .055  LAG=  39.8
44        KM
45        BA   0.600
46        LG    0.17    0.39    6.20    0.24    7.34
47        UI     119     256     359     395     351     310     285     261     227     209
48        UI     189     169     152     138     121     112     101      91      81      73
```



```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

49        UI      65      60      56      45      45      37      36      33      26      26
50        UI      26      19      17      17      17      17      15       6       6       6
51        UI       6       6       6       6       6       6       6       6       6       6
52        UI       6       6       0       0       0       0       0       0       0       0
53        UI       0       0       0       0       0       0       0       0       0       0
          *

54        KK     15C
55        KM   COMBINE HYDROGRAPHS 6R AND 10S
56        HC       2
          *

57        KK     16R
58        KM   ROUTE FLOW FROM CP 15 TO SUBAREA 20 OUTLET
59        RS      10    FLOW      -1
60        RC   .080    .030    .080    9104   .0214
61        RX      0     1.5   201.5   202.5   207.5   208.5   408.5   410.0
62        RY    100    98.5    98.5    97.5    97.5    98.5    98.5     100
          *

63        KK     20S
64        KM   Sub-Basin    20S
65        KM
```

```
 66          KM      The S-Graph #18 is used for this basin.
 67          KM      The following parameters are used for this basin:
 68          KM         L=      3.7  Lca=      1.2   S=  115.9  Kn= .055  LAG=  56.6
 69          KM
 70          BA   1.170
 71          LG    0.16    0.37    5.30    0.29    0.87
 72          UI     153     207     444     481     552     515     480     435     414     381
 73          UI     365     322     308     285     269     249     228     214     195     189
 74          UI     166     158     148     139     131     116     110     101      93      88
 75          UI      82      77      74      61      61      58      49      49      49      41
 76          UI      36      36      36      36      29      23      23      23      23      23
 77          UI      23      23      14       8       8       8       8       8       8       8
 78          UI       8       8       8       8       8       8       8       8       8       8
 79          UI       8       8       8       8       0       0       0       0       0       0
 80          UI       0       0       0       0       0       0       0       0       0       0
             *

 81          KK     25C
 82          KM   COMBINE HYDROGRAPHS 16R AND 20S
 83          HC       2
             *

 84          KK     30S
 85          KM   Sub-Basin    30S
 86          KM
 87          KM      The S-Graph #18 is used for this basin.
 88          KM      The following parameters are used for this basin:
 89          KM         L=      4.5  Lca=      2.6   S=  219.2  Kn= .055  LAG=  72.4
 90          KM
 91          BA   1.460
 92          LG    0.17    0.39    6.20    0.22    2.97
 93          UI     149     180     307     438     466     537     530     475     471     428
1                                        HEC-1 INPUT                                        PAGE  3

LINE         ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

 94          UI     406     392     363     357     318     305     290     276     262     247
 95          UI     238     212     208     192     185     177     159     154     148     139
 96          UI     131     128     114     113      99      98      90      86      86      75
 97          UI      75      75      60      60      60      57      48      48      48      48
 98          UI      40      35      35      35      35      35      34      22      22      22
 99          UI      22      22      22      22      22      22      22       9       8       8
100          UI       8       8       8       8       8       8       8       8       8       8
101          UI       8       8       8       8       8       8       8       8       8       8
102          UI       8       8       8       8       8       0       0       0       0       0
103          UI       0       0       0       0       0       0       0       0       0       0
             *

104          KK     35C
105          KM   COMBINE HYDROGRAPHS 25C AND 30S
106          HC       2
             *
107          ZZ
1
          SCHEMATIC DIAGRAM OF STREAM NETWORK

LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

NO.       (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW
```

```
  8          5S
              V
              V
             6R
              .
              .
 38           .          10S
              .           .
              .           .
 54         15C.............
              V
              V
 57         16R
              .
              .
 63           .          20S
              .           .
              .           .
 81         25C.............
              .
              .
 84           .          30S
              .           .
              .           .
104         35C.............

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
1*****************************************
*                                       *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*               MAY   1991              *
*            VERSION 4.0.1E             *
*                                       *
*  RUN DATE  03/18/94  TIME  14:48:26   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************
```

```
RIO VERDE NORTH FIS
TEST RUN USING Kn = 0.055
FILE:TESTK1_A.IH1
MG

 7 IO          OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT          HYDROGRAPH TIME DATA
                      NMIN          5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1    0  STARTING DATE
                     ITIME         0000  STARTING TIME
                        NQ          300  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      2    0  ENDING DATE
                    NDTIME         0055  ENDING TIME
                    ICENT           19  CENTURY MARK
```

COMPUTATION INTERVAL 0.08 HOURS
TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

DRAINAGE AREA	SQUARE MILES
PRECIPITATION DEPTH	INCHES
LENGTH, ELEVATION	FEET
FLOW	CUBIC FEET PER SECOND
STORAGE VOLUME	ACRE-FEET
SURFACE AREA	ACRES
TEMPERATURE	DEGREES FAHRENHEIT

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	5S	655.	4.25	147.	37.	35.	1.27		
ROUTED TO	6R	616.	4.58	147.	37.	35.	1.27		
								99.21	4.58
HYDROGRAPH AT	10S	314.	4.25	77.	20.	19.	0.60		
2 COMBINED AT	15C	900.	4.50	224.	56.	54.	1.87		
ROUTED TO	16R	773.	5.33	223.	56.	54.	1.87		
								99.25	5.33
HYDROGRAPH AT	20S	449.	4.42	130.	33.	32.	1.17		
2 COMBINED AT	25C	1007.	5.25	353.	89.	86.	3.04		
HYDROGRAPH AT	30S	510.	4.50	179.	46.	44.	1.46		
2 COMBINED AT	35C	1352.	5.25	532.	135.	130.	4.50		

*** NORMAL END OF HEC-1 ***

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              MAY   1991               *
*           VERSION 4.0.1E              *
*                                       *
*  RUN DATE  03/18/94  TIME  14:48:42   *
*                                       *
*****************************************
```

```
*************************************
*                                   *
*    U.S. ARMY CORPS OF ENGINEERS   *
*    HYDROLOGIC ENGINEERING CENTER  *
*         609 SECOND STREET         *
*       DAVIS, CALIFORNIA 95616     *
*           (916) 551-1748          *
*                                   *
*************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

    1         ID   RIO VERDE NORTH.FIS
    2         ID   TEST RUN USING Kn = 0.030
    3         ID   FILE:TESTK2_A.IH1
    4         ID   MG
    5         ID
    6         IT       5                    300
    7         IO       5
              *DIAGRAM
              *

    8         KK      5S
    9         KM   Sub-Basin     5S
   10         KM
   11         KM      The S-Graph #18 is used for this basin.
   12         KM      The following parameters are used for this basin:
   13         KM          L=      2.5  Lca=      1.0   S=  311.4  Kn= .030  LAG=  20.6
   14         KM
   15         BA   1.270
   16         IN      15
   17         KM   RAINFALL DEPTH OF 3.40 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
   18         KM   AN AREAL REDUCTION COEFFICIENT OF .929 WAS USED
   19         PB    3.16
```

```
20          KM   THE FOLLOWING PC RECORD USED A 6-HOUR RAINFALL WITH PATTERN NO. 2.91
21          PC    .000    .014    .020    .030    .047    .061    .074    .087    .101    .115
22          PC    .131    .147    .170    .217    .299    .470    .672    .800    .871    .914
23          PC    .946    .960    .973    .987   1.000
24          LG   0.16    0.40    6.00    0.24    0.75
25          UI    750    1537    1376    1145     917     769     611     505     418     335
26          UI    276     229     183     148     119     107      74      68      68      26
27          UI     24      24      24      24      24      24      24       0       0       0
28          UI      0       0       0       0       0       0       0       0       0       0
            *

29          KK     6R
30          KM   ROUTE FLOW FROM SUBAREA 5S TO SUBAREA 10S OUTLET
31          RS      3    FLOW      -1
32          RC   .070    .030    .070    2786   .0126
33          RX      0     1.5   201.5   202.5   207.5   208.5   408.5   410.0
34          RY    100    98.5    98.5    97.5    97.5    98.5    98.5     100
            *

35          KK    10S
36          KM   Sub-Basin    10S
37          KM
38          KM      The S-Graph #18 is used for this basin.
39          KM      The following parameters are used for this basin:
40          KM          L=      2.1  Lca=      0.8   S=  106.0  Kn= .030  LAG=  21.7
41          KM
42          BA   0.600
43          LG    0.17    0.39    6.20    0.24    7.34
44          UI     321     682     635     527     434     361     298     243     203     168
45          UI     137     113      94      77      66      50      48      31      31      31
46          UI      12      11      11      11      11      11      11      11       0       0
47          UI       0       0       0       0       0       0       0       0       0       0
            *
```



```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

48          KK    15C
49          KM   COMBINE HYDROGRAPHS 6R AND 10S
50          HC      2
            *

51          KK    16R
52          KM   ROUTE FLOW FROM CP 15 TO SUBAREA 20 OUTLET
53          RS     10    FLOW      -1
54          RC   .080    .030    .080    9104   .0214
55          RX      0     1.5   201.5   202.5   207.5   208.5   408.5   410.0
56          RY    100    98.5    98.5    97.5    97.5    98.5    98.5     100
            *

57          KK    20S
58          KM   Sub-Basin    20S
59          KM
60          KM      The S-Graph #18 is used for this basin.
61          KM      The following parameters are used for this basin:
62          KM          L=      3.7  Lca=      1.2   S=  115.9  Kn= .030  LAG=  30.9
63          KM
64          BA   1.170
65          LG    0.16    0.37    5.30    0.29    0.87
```

```
 66          UI     323     783     999     881     762     680     579     517     457     388
 67          UI     346     295     265     231     199     173     154     138     113     101
 68          UI      91      78      65      65      48      42      42      42      30      15
 69          UI      15      15      15      15      15      15      15      15      15      15
 70          UI       0       0       0       0       0       0       0       0       0       0
 71          UI       0       0       0       0       0       0       0       0       0       0
             *

 72          KK    25C
 73          KM   COMBINE HYDROGRAPHS 16R AND 20S
 74          HC      2
             *

 75          KK    30S
 76          KM   Sub-Basin    30S
 77          KM
 78          KM      The S-Graph #18 is used for this basin.
 79          KM      The following parameters are used for this basin:
 80          KM          L=      4.5  Lca=      2.6   S=  219.2  Kn= .030  LAG=  39.5
 81          KM
 82          BA   1.460
 83          LG    0.17    0.39    6.20    0.22    2.97
 84          UI     293     632     882     963     859     756     694     633     555     511
 85          UI     458     409     370     338     292     271     245     220     195     176
 86          UI     158     143     135     110     108      88      88      76      64      64
 87          UI      64      42      41      41      41      41      30      14      14      14
 88          UI      14      14      14      14      14      14      14      14      14      14
 89          UI      14      14       0       0       0       0       0       0       0       0
 90          UI       0       0       0       0       0       0       0       0       0       0
             *
1                                        HEC-1 INPUT                                    PAGE  3

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 91          KK    35C
 92          KM   COMBINE HYDROGRAPHS 25C AND 30S
 93          HC      2
             *
 94          ZZ
1
          SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (---->) DIVERSION OR PUMP FLOW

  NO.       (.) CONNECTOR        (<----) RETURN OF DIVERTED OR PUMPED FLOW

    8          5S
               V
               V
   29          6R
               .
               .
   35          .          10S
               .           .
               .           .
   48         15C.....
               V
               V
   51         16R
```

```
                .
                .
   57           .         20S
                .           .
                .           .
   72         25C.............
                .
                .
   75           .         30S
                .           .
                .           .
   91         35C.............

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               MAY   1991              *
*            VERSION 4.0.1E             *
*                                       *
*  RUN DATE  03/18/94  TIME  14:48:42   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************
```

RIO VERDE NORTH FIS
TEST RUN USING Kn = 0.030
FILE:TESTK2_A.IH1
MG

7 IO OUTPUT CONTROL VARIABLES

IPRNT	5	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA

NMIN	5	MINUTES IN COMPUTATION INTERVAL
IDATE	1 0	STARTING DATE
ITIME	0000	STARTING TIME
NQ	300	NUMBER OF HYDROGRAPH ORDINATES
NDDATE	2 0	ENDING DATE
NDTIME	0055	ENDING TIME
ICENT	19	CENTURY MARK

COMPUTATION INTERVAL 0.08 HOURS
TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

DRAINAGE AREA	SQUARE MILES
PRECIPITATION DEPTH	INCHES
LENGTH, ELEVATION	FEET
FLOW	CUBIC FEET PER SECOND
STORAGE VOLUME	ACRE-FEET
SURFACE AREA	ACRES
TEMPERATURE	DEGREES FAHRENHEIT

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
	HYDROGRAPH AT									
+		5S	914.	4.08	147.	37.	36.	1.27		
	ROUTED TO									
+		6R	849.	4.42	147.	37.	36.	1.27		
+									99.37	4.42
	HYDROGRAPH AT									
+		10S	436.	4.08	78.	20.	19.	0.60		
	2 COMBINED AT									
+		15C	1243.	4.33	225.	56.	54.	1.87		
	ROUTED TO									
+		16R	1024.	5.08	224.	56.	54.	1.87		
+									99.39	5.08
	HYDROGRAPH AT									
+		20S	661.	4.25	131.	33.	32.	1.17		
	2 COMBINED AT									
+		25C	1283.	5.00	355.	89.	86.	3.04		
	HYDROGRAPH AT									
+		30S	770.	4.25	183.	46.	44.	1.46		
	2 COMBINED AT									
+		35C	1693.	5.00	538.	135.	130.	4.50		

*** NORMAL END OF HEC-1 ***

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             MAY   1991                *
*          VERSION 4.0.1E               *
*                                       *
*  RUN DATE  03/18/94  TIME  14:49:14   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*        DAVIS, CALIFORNIA 95616        *
*           (916) 551-1748              *
*                                       *
*****************************************
```

```
X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  1           ID   RIO VERDE NORTH FIS
  2           ID   TEST RUN USING Kn = 0.025
  3           ID   FILE:TESTK3_A.IH1
  4           ID   MG
  5           ID
  6           IT      5                   300
  7           IO      5
              *DIAGRAM
              *

  8           KK     5S
  9           KM   Sub-Basin     5S
 10           KM
 11           KM      The S-Graph #18 is used for this basin.
 12           KM      The following parameters are used for this basin:
 13           KM          L=      2.5  Lca=      1.0   S=  311.4  Kn= .025  LAG=  17.1
 14           KM
 15           BA   1.270
 16           IN     15
 17           KM   RAINFALL DEPTH OF 3.40 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
 18           KM   AN AREAL REDUCTION COEFFICIENT OF .929 WAS USED
 19           PB    3.16
```

```
20          KM   THE FOLLOWING PC RECORD USED A 6-HOUR RAINFALL WITH PATTERN NO. 2.91
21          PC    .000    .014    .020    .030    .047    .061    .074    .087    .101    .115
22          PC    .131    .147    .170    .217    .299    .470    .672    .800    .871    .914
23          PC    .946    .960    .973    .987   1.000
24          LG   0.16    0.40    6.00    0.24    0.75
25          UI   1021    1844    1506    1184     940     724     569     454     346     281
26          UI    212     174     128     103      82      75      29      29      29      29
27          UI     29      29       0       0       0       0       0       0       0       0
28          UI      0       0       0       0       0       0       0       0       0       0
            *

29          KK     6R
30          KM   ROUTE FLOW FROM SUBAREA 5S TO SUBAREA 10S OUTLET
31          RS      3    FLOW      -1
32          RC   .070    .030    .070    2786   .0126
33          RX      0     1.5   201.5   202.5   207.5   208.5   408.5   410.0
34          RY    100    98.5    98.5    97.5    97.5    98.5    98.5     100
            *

35          KK    10S
36          KM   Sub-Basin    10S
37          KM
38          KM      The S-Graph #18 is used for this basin.
39          KM      The following parameters are used for this basin:
40          KM         L=      2.1  Lca=      0.8   S=  106.0  Kn= .025  LAG=  18.1
41          KM
42          BA   0.600
43          LG    0.17    0.39    6.20    0.24    7.34
44          UI     442     826     697     552     442     349     277     224     174     138
45          UI     111      87      70      57      41      37      30      13      13      13
46          UI      13      13      13       0       0       0       0       0       0       0
47          UI       0       0       0       0       0       0       0       0       0       0
            *
```



```
LINE        ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

48          KK    15C
49          KM   COMBINE HYDROGRAPHS 6R AND 10S
50          HC      2
            *

51          KK    16R
52          KM   ROUTE FLOW FROM CP 15 TO SUBAREA 20 OUTLET
53          RS     10    FLOW      -1
54          RC   .080    .030    .080    9104   .0214
55          RX      0     1.5   201.5   202.5   207.5   208.5   408.5   410.0
56          RY    100    98.5    98.5    97.5    97.5    98.5    98.5     100
            *

57          KK    20S
58          KM   Sub-Basin    20S
59          KM
60          KM      The S-Graph #18 is used for this basin.
61          KM      The following parameters are used for this basin:
62          KM         L=      3.7  Lca=      1.2   S=  115.9  Kn= .025  LAG=  25.7
63          KM
64          BA   1.170
65          LG    0.16    0.37    5.30    0.29    0.87
```

```
66          UI    445   1060   1132    962    827    688    596    504    432    362
67          UI    313    268    222    190    166    135    115    106     78     78
68          UI     56     50     50     44     18     18     18     18     18     18
69          UI     18     18     18     18      0      0      0      0      0      0
70          UI      0      0      0      0      0      0      0      0      0      0
            *

71          KK    25C
72          KM   COMBINE HYDROGRAPHS 16R AND 20S
73          HC      2
            *

74          KK    30S
75          KM   Sub-Basin    30S
76          KM
77          KM      The S-Graph #18 is used for this basin.
78          KM      The following parameters are used for this basin:
79          KM          L=      4.5  Lca=      2.6   S=  219.2  Kn= .025  LAG=  32.9
80          KM
81          BA   1.460
82          LG    0.17   0.39   6.20   0.22   2.97
83          UI     371    877   1150   1058    929    827    725    640    570    498
84          UI     438    389    341    301    267    231    203    183    166    134
85          UI     126    106    104     76     76     73     49     49     49     49
86          UI      33     17     17     17     17     17     17     17     17     17
87          UI      17     17     17      0      0      0      0      0      0      0
88          UI       0      0      0      0      0      0      0      0      0      0
            *
```



```
LINE        ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

89          KK    35C
90          KM   COMBINE HYDROGRAPHS 25C AND 30S
91          HC      2
            *
92          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE      (V) ROUTING          (---->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<----) RETURN OF DIVERTED OR PUMPED FLOW

    8         5S
              V
              V
   29         6R
              .
              .
   35         .          10S
              .           .
              .           .
             15C.....
              V
              V
   51         16R
              .
              .
```

```
 57          .         20S
             .          .
             .          .
 71         25C.....
             .
             .
 74          .         30S
             .          .
             .          .
 89         35C.....

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                ****************************************
*                                      *                *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                *   U.S. ARMY CORPS OF ENGINEERS       *
*              MAY   1991              *                *   HYDROLOGIC ENGINEERING CENTER      *
*            VERSION 4.0.1E            *                *        609 SECOND STREET             *
*                                      *                *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE  03/18/94  TIME  14:49:14  *                *          (916) 551-1748              *
*                                      *                *                                      *
****************************************                ****************************************

                    RIO VERDE NORTH FIS
                    TEST RUN USING Kn = 0.025
                    FILE:TESTK3_A.IH1
                    MG

  7 IO          OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                      NMIN          5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1    0  STARTING DATE
                     ITIME        0000  STARTING TIME
                        NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      2    0  ENDING DATE
                    NDTIME        0055  ENDING TIME
                     ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL    0.08 HOURS
                       TOTAL TIME BASE   24.92 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
             FLOW                  CUBIC FEET PER SECOND
             STORAGE VOLUME        ACRE-FEET
             SURFACE AREA          ACRES
             TEMPERATURE           DEGREES FAHRENHEIT
1

                                        RUNOFF SUMMARY
                                    FLOW IN CUBIC FEET PER SECOND
```

TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
	HYDROGRAPH AT									
+		5S	1000.	4.08	147.	37.	35.	1.27		
	ROUTED TO									
+		6R	923.	4.33	147.	37.	35.	1.27		
+									99.42	4.33
	HYDROGRAPH AT									
+		10S	478.	4.08	78.	19.	19.	0.60		
	2 COMBINED AT									
+		15C	1331.	4.25	225.	56.	54.	1.87		
	ROUTED TO									
+		16R	1102.	5.00	224.	56.	54.	1.87		
+									99.44	5.00
	HYDROGRAPH AT									
+		20S	728.	4.17	131.	33.	32.	1.17		
	2 COMBINED AT									
+		25C	1335.	4.92	355.	89.	86.	3.04		
	HYDROGRAPH AT									
+		30S	860.	4.25	183.	46.	44.	1.46		
	2 COMBINED AT									
+		35C	1765.	4.92	538.	135.	130.	4.50		

*** NORMAL END OF HEC-1 ***

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              MAY   1991               *
*            VERSION 4.0.1E             *
*                                       *
*  RUN DATE  03/18/94  TIME  14:48:26   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

    1         ID   RIO VERDE NORTH FIS
    2         ID   TEST RUN USING Kn = 0.055
    3         ID   FILE:TESTK1_A.IH1
    4         ID   MG
    5         ID
    6         IT       5                   300
    7         IO       5
              *DIAGRAM
              *

    8         KK      5S
    9         KM   Sub-Basin     5S
   10         KM
   11         KM      The S-Graph #18 is used for this basin.
   12         KM      The following parameters are used for this basin:
   13         KM          L=       2.5  Lca=       1.0   S=  311.4  Kn= .055  LAG=  37.7
   14         KM
   15         BA   1.270
   16         IN      15
   17         KM   RAINFALL DEPTH OF 3.40 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
   18         KM   AN AREAL REDUCTION COEFFICIENT OF .929 WAS USED
   19         PB    3.16
```

```
20          KM   THE FOLLOWING PC RECORD USED A 6-HOUR RAINFALL WITH PATTERN NO. 2.91
21          PC    .000    .014    .020    .030    .047    .061    .074    .087    .101    .115
22          PC    .131    .147    .170    .217    .299    .470    .672    .800    .871    .914
23          PC    .946    .960    .973    .987   1.000
24          LG   0.16    0.40    6.00    0.24    0.75
25          UI    271     602     823     859     769     674     616     544     490     445
26          UI    401     348     314     282     255     228     206     182     162     144
27          UI    131     122     100      96      81      81      63      58      58      50
28          UI     37      37      37      37      35      13      13      13      13      13
29          UI     13      13      13      13      13      13      13      13      13       0
30          UI      0       0       0       0       0       0       0       0       0       0
31          UI      0       0       0       0       0       0       0       0       0       0
            *

32          KK     6R
33          KM   ROUTE FLOW FROM SUBAREA 5S TO SUBAREA 10S OUTLET
34          RS      3    FLOW      -1
35          RC   .070    .030    .070    2786   .0126
36          RX      0     1.5   201.5   202.5   207.5   208.5   408.5   410.0
37          RY    100    98.5    98.5    97.5    97.5    98.5    98.5     100
            *

38          KK    10S
39          KM   Sub-Basin    10S
40          KM
41          KM      The S-Graph #18 is used for this basin.
42          KM      The following parameters are used for this basin:
43          KM          L=      2.1  Lca=      0.8   S=  106.0  Kn= .055  LAG=  39.8
44          KM
45          BA   0.600
46          LG    0.17    0.39    6.20    0.24    7.34
47          UI     119     256     359     395     351     310     285     261     227     209
48          UI     189     169     152     138     121     112     101      91      81      73
```



```
LINE        ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

49          UI      65      60      56      45      45      37      36      33      26      26
50          UI      26      19      17      17      17      17      15       6       6       6
51          UI       6       6       6       6       6       6       6       6       6       6
52          UI       6       6       0       0       0       0       0       0       0       0
53          UI       0       0       0       0       0       0       0       0       0       0
            *

54          KK    15C
55          KM   COMBINE HYDROGRAPHS 6R AND 10S
56          HC      2
            *

57          KK    16R
58          KM   ROUTE FLOW FROM CP 15 TO SUBAREA 20 OUTLET
59          RS     10    FLOW      -1
60          RC   .080    .030    .080    9104   .0214
61          RX      0     1.5   201.5   202.5   207.5   208.5   408.5   410.0
62          RY    100    98.5    98.5    97.5    97.5    98.5    98.5     100
            *

63          KK    20S
64          KM   Sub-Basin    20S
65          KM
```

```
 66          KM      The S-Graph #18 is used for this basin.
 67          KM      The following parameters are used for this basin:
 68          KM          L=      3.7  Lca=      1.2   S=  115.9  Kn= .055  LAG=  56.6
 69          KM
 70          BA   1.170
 71          LG    0.16    0.37    5.30    0.29    0.87
 72          UI     153     207     444     481     552     515     480     435     414     381
 73          UI     365     322     308     285     269     249     228     214     195     189
 74          UI     166     158     148     139     131     116     110     101      93      88
 75          UI      82      77      74      61      61      58      49      49      49      41
 76          UI      36      36      36      36      29      23      23      23      23      23
 77          UI      23      23      14       8       8       8       8       8       8       8
 78          UI       8       8       8       8       8       8       8       8       8       8
 79          UI       8       8       8       8       0       0       0       0       0       0
 80          UI       0       0       0       0       0       0       0       0       0       0
             *

 81          KK    25C
 82          KM   COMBINE HYDROGRAPHS 16R AND 20S
 83          HC       2
             *

 84          KK    30S
 85          KM   Sub-Basin    30S
 86          KM
 87          KM      The S-Graph #18 is used for this basin.
 88          KM      The following parameters are used for this basin:
 89          KM          L=      4.5  Lca=      2.6   S=  219.2  Kn= .055  LAG=  72.4
 90          KM
 91          BA   1.460
 92          LG    0.17    0.39    6.20    0.22    2.97
 93          UI     149     180     307     438     466     537     530     475     471     428
```



```
LINE         ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

 94          UI     406     392     363     357     318     305     290     276     262     247
 95          UI     238     212     208     192     185     177     159     154     148     139
 96          UI     131     128     114     113      99      98      90      86      86      75
 97          UI      75      75      60      60      60      57      48      48      48      48
 98          UI      40      35      35      35      35      35      34      22      22      22
 99          UI      22      22      22      22      22      22      22       9       8       8
100          UI       8       8       8       8       8       8       8       8       8       8
101          UI       8       8       8       8       8       8       8       8       8       8
102          UI       8       8       8       8       8       0       0       0       0       0
103          UI       0       0       0       0       0       0       0       0       0       0
             *

104          KK    35C
105          KM   COMBINE HYDROGRAPHS 25C AND 30S
106          HC       2
             *
107          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

LINE (V) ROUTING (---->) DIVERSION OR PUMP FLOW

NO. (.) CONNECTOR (<----) RETURN OF DIVERTED OR PUMPED FLOW

```
  8          5S
              V
              V
 32          6R
              .
              .
 38           .          10S
              .           .
              .           .
 54         15C.............
              V
              V
 57         16R
              .
              .
 63           .          20S
              .           .
              .           .
 81         25C.............
              .
              .
 84           .          30S
              .           .
              .           .
104         35C.............

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              MAY   1991               *
*            VERSION 4.0.1E             *
*                                       *
*  RUN DATE  03/18/94  TIME  14:48:26   *
*                                       *
*****************************************

*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************

                     RIO VERDE NORTH FIS
                     TEST RUN USING Kn = 0.055
                     FILE:TESTK1_A.IH1
                     MG

  7 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1   0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2   0  ENDING DATE
                     NDTIME       0055  ENDING TIME
                     ICENT         19  CENTURY MARK
```

COMPUTATION INTERVAL 0.08 HOURS
TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

DRAINAGE AREA	SQUARE MILES
PRECIPITATION DEPTH	INCHES
LENGTH, ELEVATION	FEET
FLOW	CUBIC FEET PER SECOND
STORAGE VOLUME	ACRE-FEET
SURFACE AREA	ACRES
TEMPERATURE	DEGREES FAHRENHEIT

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	5S	655.	4.25	147.	37.	35.	1.27		
ROUTED TO	6R	616.	4.58	147.	37.	35.	1.27	99.21	4.58
HYDROGRAPH AT	10S	314.	4.25	77.	20.	19.	0.60		
2 COMBINED AT	15C	900.	4.50	224.	56.	54.	1.87		
ROUTED TO	16R	773.	5.33	223.	56.	54.	1.87	99.25	5.33
HYDROGRAPH AT	20S	449.	4.42	130.	33.	32.	1.17		
2 COMBINED AT	25C	1007.	5.25	353.	89.	86.	3.04		
HYDROGRAPH AT	30S	510.	4.50	179.	46.	44.	1.46		
2 COMBINED AT	35C	1352.	5.25	532.	135.	130.	4.50		

*** NORMAL END OF HEC-1 ***

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             MAY   1991                *
*          VERSION 4.0.1E               *
*                                       *
*  RUN DATE  03/18/94  TIME  14:49:33   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************
```

```
X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX           XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
  LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

    1           ID   RIO VERDE NORTH FIS
    2           ID   TEST RUN USING Kn = 0.020
    3           ID   FILE:TESTK4_A.IH1
    4           ID   MG
    5           ID
    6           IT       5                   300
    7           IO       5
                *DIAGRAM
                *

    8           KK     5S
    9           KM   Sub-Basin     5S
   10           KM
   11           KM      The S-Graph #18 is used for this basin.
   12           KM      The following parameters are used for this basin:
   13           KM          L=      2.5  Lca=      1.0   S=  311.4  Kn= .020  LAG=  13.7
   14           KM
   15           BA   1.270
   16           IN      15
   17           KM   RAINFALL DEPTH OF 3.40 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
   18           KM   AN AREAL REDUCTION COEFFICIENT OF .929 WAS USED
   19           PB    3.16
```

```
   69        25C.....
               .
               .
   72          .        30S
               .          .
               .          .
   86        35C.....

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               MAY   1991              *
*            VERSION 4.0.1E             *
*                                       *
*  RUN DATE  03/18/94  TIME  14:49:33   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************
```

RIO VERDE NORTH FIS
TEST RUN USING Kn = 0.020
FILE:TESTK4_A.IH1
MG

IO OUTPUT CONTROL VARIABLES

IPRNT	5	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA

NMIN		5	MINUTES IN COMPUTATION INTERVAL
IDATE	1	0	STARTING DATE
ITIME		0000	STARTING TIME
NQ		300	NUMBER OF HYDROGRAPH ORDINATES
NDDATE	2	0	ENDING DATE
NDTIME		0055	ENDING TIME
ICENT		19	CENTURY MARK

COMPUTATION INTERVAL 0.08 HOURS
TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

DRAINAGE AREA	SQUARE MILES
PRECIPITATION DEPTH	INCHES
LENGTH, ELEVATION	FEET
FLOW	CUBIC FEET PER SECOND
STORAGE VOLUME	ACRE-FEET
SURFACE AREA	ACRES
TEMPERATURE	DEGREES FAHRENHEIT

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	PEAK	TIME OF	AVERAGE FLOW FOR MAXIMUM PERIOD	BASIN	MAXIMUM	TIME OF

```
66          UI     254     211     168     136     110      98      69      63      63      24
67          UI      22      22      22      22      22      22      22       0       0       0
68          UI       0       0       0       0       0       0       0       0       0       0
            *

69          KK    25C
70          KM   COMBINE HYDROGRAPHS 16R AND 20S
71          HC       2
            *

72          KK    30S
73          KM   Sub-Basin    30S
74          KM
75          KM      The S-Graph #18 is used for this basin.
76          KM      The following parameters are used for this basin:
77          KM          L=      4.5  Lca=      2.6   S=  219.2  Kn= .020  LAG=  26.3
78          KM
79          BA   1.460
80          LG    0.17    0.39    6.20    0.22    2.97
81          UI     527    1280    1390    1189    1027     855     745     632     539     460
82          UI     399     338     285     244     212     175     153     133     108      96
83          UI      85      61      61      61      37      22      22      22      22      22
84          UI      22      22      22      22       0       0       0       0       0       0
85          UI       0       0       0       0       0       0       0       0       0       0
            *
1                                          HEC-1 INPUT                                    PAGE  3

       LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

86          KK    35C
87          KM   COMBINE HYDROGRAPHS 25C AND 30S
88          HC       2
            *
89          ZZ
1
            SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
 LINE      (V) ROUTING          (---->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    8         5S
              V
              V
   28         6R
              .
              .
   34         .          10S
              .            .
              .            .
   47        15C.............
              V
              V
              16R
              .
              .
   56         .          20S
              .            .
              .            .
```

```
20          KM   THE FOLLOWING PC RECORD USED A 6-HOUR RAINFALL WITH PATTERN NO. 2.91
21          PC    .000    .014    .020    .030    .047    .061    .074    .087    .101    .115
22          PC    .131    .147    .170    .217    .299    .470    .672    .800    .871    .914
23          PC    .946    .960    .973    .987   1.000
24          LG   0.16    0.40    6.00    0.24    0.75
25          UI   1471    2192    1623    1209     878     657     479     361     256     193
26          UI    147     103      82      36      36      36      36      36       0       0
27          UI      0       0       0       0       0       0       0       0       0       0
            *

28          KK     6R
29          KM   ROUTE FLOW FROM SUBAREA 5S TO SUBAREA 10S OUTLET
30          RS      3    FLOW      -1
31          RC   .070    .030    .070    2786    .0126
32          RX      0     1.5   201.5   202.5   207.5   208.5   408.5   410.0
33          RY    100    98.5    98.5    97.5    97.5    98.5    98.5     100
            *

34          KK    10S
35          KM   Sub-Basin    10S
36          KM
37          KM      The S-Graph #18 is used for this basin.
38          KM      The following parameters are used for this basin:
39          KM         L=      2.1  Lca=      0.8   S=  106.0  Kn= .020  LAG=  14.5
40          KM
41          BA   0.600
42          LG    0.17    0.39    6.20    0.24    7.34
43          UI     634    1004     755     568     425     319     240     179     135     102
44          UI      73      55      46      28      16      16      16      16      16       0
45          UI       0       0       0       0       0       0       0       0       0       0
46          UI       0       0       0       0       0       0       0       0       0       0
            *
1                                        HEC-1 INPUT                                        PAGE  2

LINE        ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

47          KK    15C
48          KM   COMBINE HYDROGRAPHS 6R AND 10S
49          HC      2
            *

50          KK    16R
51          KM   ROUTE FLOW FROM CP 15 TO SUBAREA 20 OUTLET
52          RS     10    FLOW      -1
53          RC   .080    .030    .080    9104    .0214
54          RX      0     1.5   201.5   202.5   207.5   208.5   408.5   410.0
55          RY    100    98.5    98.5    97.5    97.5    98.5    98.5     100
            *

56          KK    20S
57          KM   Sub-Basin    20S
58          KM
59          KM      The S-Graph #18 is used for this basin.
60          KM      The following parameters are used for this basin:
61          KM         L=      3.7  Lca=      1.2   S=  115.9  Kn= .020  LAG=  20.6
62          KM
63          BA   1.170
64          LG    0.16    0.37    5.30    0.29    0.87
65          UI     690    1415    1267    1055     845     709     563     466     385     309
```

	OPERATION	STATION	FLOW	PEAK	6-HOUR	24-HOUR	72-HOUR	AREA	STAGE	MAX STAGE
	HYDROGRAPH AT	5S	1088.	4.00	148.	37.	36.	1.27		
	ROUTED TO	6R	994.	4.25	148.	37.	36.	1.27		
									99.46	4.25
	HYDROGRAPH AT	10S	522.	4.08	78.	20.	19.	0.60		
	2 COMBINED AT	15C	1454.	4.25	225.	56.	54.	1.87		
	ROUTED TO	16R	1183.	4.92	225.	56.	54.	1.87		
									99.48	4.92
	HYDROGRAPH AT	20S	822.	4.08	131.	33.	32.	1.17		
	2 COMBINED AT	25C	1394.	4.92	356.	89.	86.	3.04		
	HYDROGRAPH AT	30S	967.	4.17	184.	46.	44.	1.46		
	2 COMBINED AT	35C	1817.	4.83	539.	135.	130.	4.50		

*** NORMAL END OF HEC-1 ***

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             MAY   1991                *
*           VERSION 4.0.1E              *
*                                       *
*  RUN DATE  03/18/94  TIME  14:50:06   *
*                                       *
*****************************************
```

```
*************************************
*                                   *
*    U.S. ARMY CORPS OF ENGINEERS   *
*    HYDROLOGIC ENGINEERING CENTER  *
*         609 SECOND STREET         *
*       DAVIS, CALIFORNIA 95616     *
*           (916) 551-1748          *
*                                   *
*************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X       XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

   1          ID   RIL VERDE NORTH FIS
   2          ID   TEST RUN USING Kn = 0.015
   3          ID   FILE:TESTK5_A.IH1
   4          ID   MG
   5          ID
   6          IT       5                   300
   7          IO       5
              *DIAGRAM
              *

   8          KK      5S
   9          KM   Sub-Basin     5S
  10          KM
  11          KM      The S-Graph #18 is used for this basin.
  12          KM      The following parameters are used for this basin:
  13          KM          L=      2.5  Lca=      1.0   S=  311.4  Kn= .015  LAG=  10.3
  14          KM
  15          BA   1.270
  16          IN      15
  17          KM   RAINFALL DEPTH OF 3.40 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
  18          KM   AN AREAL REDUCTION COEFFICIENT OF .929 WAS USED
  19          PB    3.16
```

```
20          KM   THE FOLLOWING PC RECORD USED A 6-HOUR RAINFALL WITH PATTERN NO. 2.91
21          PC    .000    .014    .020    .030    .047    .061    .074    .087    .101    .115
22          PC    .131    .147    .170    .217    .299    .470    .672    .800    .871    .914
23          PC    .946    .960    .973    .987   1.000
24          LG   0.16    0.40    6.00    0.24    0.75
25          UI   2287    2521    1686    1116     753     504     330     226     143      94
26          UI     48      48      48       0       0       0       0       0       0       0
27          UI      0       0       0       0       0       0       0       0       0       0
            *

28          KK     6R
29          KM   ROUTE FLOW FROM SUBAREA 5S TO SUBAREA 10S OUTLET
30          RS      3    FLOW      -1
31          RC   .070    .030    .070    2786   .0126
32          RX      0     1.5   201.5   202.5   207.5   208.5   408.5   410.0
33          RY    100    98.5    98.5    97.5    97.5    98.5    98.5     100
            *

34          KK    10S
35          KM   Sub-Basin    10S
36          KM
37          KM      The S-Graph #18 is used for this basin.
38          KM      The following parameters are used for this basin:
39          KM          L=      2.1  Lca=      0.8   S=  106.0  Kn= .015  LAG=  10.8
40          KM
41          BA   0.600
42          LG    0.17    0.39    6.20    0.24    7.34
43          UI    1003    1162     795     541     371     250     171     116      79      61
44          UI      23      22      22      22       0       0       0       0       0       0
45          UI       0       0       0       0       0       0       0       0       0       0
            *
```



```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

46          KK    15C
47          KM   COMBINE HYDROGRAPHS 6R AND 10S
48          HC      2
            *

49          KK    16R
50          KM   ROUTE FLOW FROM CP 15 TO SUBAREA 20 OUTLET
51          RS     10    FLOW      -1
52          RC   .080    .030    .080    9104   .0214
53          RX      0     1.5   201.5   202.5   207.5   208.5   408.5   410.0
54          RY    100    98.5    98.5    97.5    97.5    98.5    98.5     100
            *

55          KK    20S
56          KM   Sub-Basin    20S
57          KM
58          KM      The S-Graph #18 is used for this basin.
59          KM      The following parameters are used for this basin:
60          KM          L=      3.7  Lca=      1.2   S=  115.9  Kn= .015  LAG=  15.4
61          KM
62          BA   1.170
63          LG    0.16    0.37    5.30    0.29    0.87
64          UI    1106    1880    1441    1096     846     640     496     372     292     214
65          UI     168     131      90      84      45      29      29      29      29      29
```

```
66          UI      0      0      0      0      0      0      0      0      0      0
67          UI      0      0      0      0      0      0      0      0      0      0
            *

68          KK    25C
69          KM   COMBINE HYDROGRAPHS 16R AND 20S
70          HC      2
            *

71          KK    30S
72          KM   Sub-Basin    30S
73          KM
74          KM      The S-Graph #18 is used for this basin.
75          KM      The following parameters are used for this basin:
76          KM          L=      4.5  Lca=      2.6   S=  219.2  Kn= .015  LAG=  19.8
77          KM
78          BA   1.460
79          LG    0.17    0.39    6.20    0.22    2.97
80          UI     925    1845    1616    1327    1065     867     708     563     465     371
81          UI     301     245     197     164     127     106      82      82      44      29
82          UI      29      29      29      29      29      29       0       0       0       0
83          UI       0       0       0       0       0       0       0       0       0       0
            *

84          KK    35C
85          KM   COMBINE HYDROGRAPHS 25C AND 30S
86          HC      2
            *
87          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

 NO.       (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  8          5S
              V
              V
 28          6R
              .
              .
 34           .         10S
              .           .
              .           .
 46         15C.....
              V
              V
 49         16R
              .
              .
 55           .         20S
              .           .
              .           .
 68         25C.....
              .
              .
 71           .         30S
              .           .
              .           .
```

84 35C.....

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1**********************************************
*                                            *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)        *
*              MAY   1991                    *
*           VERSION 4.0.1E                   *
*                                            *
*  RUN DATE  03/18/94  TIME  14:50:06        *
*                                            *
**********************************************
```

```
**********************************************
*                                            *
*    U.S. ARMY CORPS OF ENGINEERS            *
*    HYDROLOGIC ENGINEERING CENTER           *
*          609 SECOND STREET                 *
*       DAVIS, CALIFORNIA 95616              *
*           (916) 551-1748                   *
*                                            *
**********************************************
```

RIL VERDE NORTH FIS
TEST RUN USING Kn = 0.015
FILE:TESTK5_A.IH1
MG

7 IO OUTPUT CONTROL VARIABLES

IPRNT	5	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA

NMIN		5	MINUTES IN COMPUTATION INTERVAL
IDATE	1	0	STARTING DATE
ITIME		0000	STARTING TIME
NQ		300	NUMBER OF HYDROGRAPH ORDINATES
NDDATE	2	0	ENDING DATE
NDTIME		0055	ENDING TIME
ICENT		19	CENTURY MARK

COMPUTATION INTERVAL 0.08 HOURS
TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

DRAINAGE AREA	SQUARE MILES
PRECIPITATION DEPTH	INCHES
LENGTH, ELEVATION	FEET
FLOW	CUBIC FEET PER SECOND
STORAGE VOLUME	ACRE-FEET
SURFACE AREA	ACRES
TEMPERATURE	DEGREES FAHRENHEIT

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT									
+	5S	1230.	4.00	147.	37.	35.	1.27		

	ROUTED TO								
+		6R	1091.	4.25	147.	37.	35.	1.27	
+								99.52	4.25
	HYDROGRAPH AT								
+		10S	587.	4.00	78.	20.	19.	0.60	
	2 COMBINED AT								
+		15C	1561.	4.17	225.	56.	54.	1.87	
	ROUTED TO								
+		16R	1270.	4.83	224.	56.	54.	1.87	
+								99.52	4.83
	HYDROGRAPH AT								
+		20S	939.	4.08	131.	33.	32.	1.17	
	2 COMBINED AT								
+		25C	1450.	4.83	355.	89.	86.	3.04	
	HYDROGRAPH AT								
+		30S	1125.	4.08	184.	46.	44.	1.46	
	2 COMBINED AT								
+		35C	2095.	4.08	539.	135.	130.	4.50	

*** NORMAL END OF HEC-1 ***

SECTION 1: General Documentation and Correspondence

1.2 Contact (Telephone) Reports

MKE

McLaughlin Kmetty Engineers, Ltd.

TELEPHONE COMMUNICATION REPORT

DATE: 12-9-03 TIME: 9 AM JOB NO. R.> Wash Ln, St

TO: Frank Brown LOCATION:

FROM: Leanne Cumberland LOCATION:

SUBJECT/DISCUSSION:

Contract amendment written Dec 09 ATP

will follow in writing

SUMMARY/ACTION ITEMS:

COPY TO:

MKE

McLaughlin Kmetty Engineers, Ltd.

TELEPHONE COMMUNICATION REPORT

DATE: 12-20-93 TIME: 2:45 PM JOB NO. Rio Vista Estates

TO: File LOCATION:

FROM: MKE F. Brown LOCATION:

SUBJECT/DISCUSSION: Invited to Kick-off meeting 1:30 PM Jan 4th
GVS (George will try, May, invite Terri.
ARC - Richard Cook will go.
New recon today. Mylar mapping 12-21-93
I prepare drawing and on Mylar
to GVS Control and Bk. Parkway

Told him I thought ALS out in Tuscany some time,
waiting for BoM to finish more BM comps.

GCA Lori Spring 2:10 PM
wants to change Survey from what County has.
to keep from running thru piers.
will research + send to us to pass thru to
County. Comm from La Mesa.

Item
B+N wants add'l coverage routing path. Tc Jeff Foley
has Flow Line Load track on this. Add'l Cable Locates.
Lori

SUMMARY/ACTION ITEMS:

COPY TO:

MKE

McLaughlin Kmetty Engineers, Ltd.

TELEPHONE COMMUNICATION REPORT

DATE: 12-30-93 TIME: 1:45PM msg JOB NO. RKS

TO: Lori Spire LOCATION:

FROM: LOCATION:

SUBJECT/DISCUSSION:

1. Send memo to me on Fm Hills + RVS GIS specs. + new specs affecting RVS.

2. What was his data needs for USGS Raster vector Scan

3. Schedule - I should list areas at date what is length of time needed? Tweak each?

SUMMARY/ACTION ITEMS:

COPY TO:

MKE

McLaughlin Kmetty Engineers, Ltd.

TELEPHONE COMMUNICATION REPORT

DATE: 3-8-98 TIME: 10:30 AM JOB NO. RVS
TO: F. Brown LOCATION: MKE
FROM: Ash Patel LOCATION: Wood Patel

SUBJECT/DISCUSSION:

Russ Cuffy has hydro comments - for in-house use
new S graph prepared by George - will get GVS
results next week.
George has requested copy of Scottsdale Alluvial
Fan Study - see also packet @ meeting GVS, GK, Russ
(see reference in Ash's packet.
has not yet done flow splits calcs. has done
field work on flow splits.
Sandy will finish review this week.

SUMMARY/ACTION ITEMS:

1. wait for GVS review of Patel's Hydrology early next week.
2. Schedule our field trip as soon, when schedule allows.

COPY TO:

MKE

McLaughlin Kmetty Engineers, Ltd.

TELEPHONE COMMUNICATION REPORT

RVS

DATE: 5/2/94 TIME: 2:00 PM JOB NO. 89-407.003

TO: LOCATION:

FROM: LOCATION:

Notes/ Questions

SUBJECT/DISCUSSION: (OK per Richard Cook) per MKE contract, Task 3.4, the topo mapping is missing: 1) 1" contour interval on Rio Verde Drive (or spot elevations) 2) Section corners 3) Quarter corners 2+3 = Task 3.5 B+N 4) Corporate boundaries and Indian boundary? no, could get from BLM, easy to get on. 5) I need list of ERMI's - have any been set? Going now 6) When will I/we get photo-mylars? Task 7.9.3 later - near end.

Concerning GPS data in files: 1. What is PT elev (vs Panel Elev) 2. What is RLS # on Topo we will find? 18436 Topo # Blair M. 3. What are coords on QC X-S 2 also they plotted on mapping somewhere? 4. Any elevation equations? 5. What are coords eq. for PT = to S-to Plan coords on map? 6. What are coordsys / QC cross sections A, B, C etc so we can plot on maps - pull name X-S & verify. 7. What are coords of target land corners?

File: Office X-S

Richard Cook 2 PM Tom got 3 (heading RV North from Richard mailed on Friday.

ANC can't use our data just want x, y, z data.

Call Blair Mozzett 252-535-3337 will fax Pagano. Tony Culler

2nd call to Richard where is Verde River - on Scott's Indian limits?

Blair Mozzett 2:40 PM

will plot QC X-S on road maps, plus Indian Corr.

SUMMARY/ACTION ITEMS: work in on ERMI's has two ERMI's & TPS. on Bevel Circuit must travel work 1 day has made 3 copies - 1 for MKE - will send in Tues. Collier on road - use Low Impact Mod.

Russ Cook will work on this weekend, coming in from Ariz. then talk to him on Fri. for RV North only. in-field Mark may also in Tues if FED.

COPY TO:

Tom Loomis 9:30 AM MON 5/2/94 RVS

RVS "Rio GUS horse. not available. 16.3 hands

horses? 1 short could get 1 from Char from Yuma. FG on King. Do vet today

CWR attend? not on horseback being ridden in desert here.

need:

1. Section Cor Coords
   Solidus tied in
2. Need descriptions & list in field, mount GPS on
3. & Tom needs coord points. mail today.

Can we do it w/ 1 horse?

FG ride King for Wash II? while TRL does s.t. else?

on Thursday

5-10-94

Tom Loomis Rio Verde Foothills 3:15 PM

Still needs to read GPS notebook

Payson Time on Thursday.

Field work next week? Marysvale

May 19 Tech Proposal due ADMS GVS can't do org mtg this Thursday, May 12th

How to Proceed: Mapping out of date

Detention in golf course shows reduced Q but grading plans shows no flow into golf course lakes

whatever we do is wrong off mapping!

What does FCO show us doing? What does FCO want? - include det. plans into new map

Schedule mtg before we go to field

Maybe May 20 mtg Field May 23rd

probably May 23 or May 24

CWR + Sandy

CONCLUSION:

1. need mtg w/ FCO prior to field work
   a. discuss sub basin delineation
   b. discuss recent earth moving operations.

6-2-98

Mtg w/ Erich 10:30 am to 3 PM

for GVS – must get Q from GVS

1. on Wash 10 sheet & need Q U/S and D/S of confluence.

Tom – Q's @ riverbend core points only.

Wash 11 U/S + D/S

Wash 10 + 11 confluence area. – yes OK.

2. Flow Splits – use same method GVS & MKE to do flow splits,

a. Conveyance method – split by area at some WSEL. see Chow proportional $(Slope)^{1/2}$.

b. Run HEC-2 island analysis (only if returns)

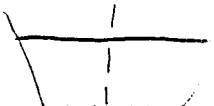
c. Weir flow approach

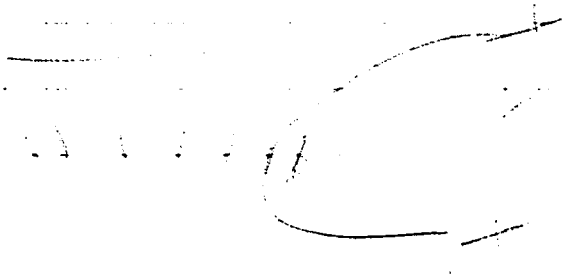
use same rating curve in HEC-2 or could manually input (less elegant)

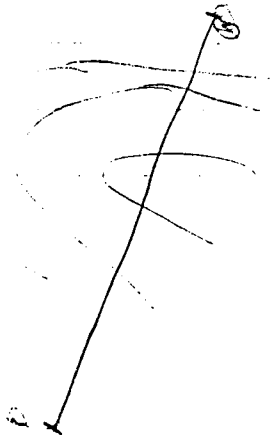
Erich out this weekend, look up culvert locations. Report back Monday

3:40 PM 6-2-98

Tom will do an vertical wall in between will use HEC-2 + flow distribution. get CWSEL the same.







Lori Spire 3:55PM 6-2-94 RLS

- ISG base mapping ~~incorrectly~~ rotated S-P 27 to NAD83 State Plane
  63 m. shift

Tom has the new disk. will give to me on Fri June 3

off 0.1 inches @ 1"=200' (200' off)

Has full double precision capacity Now.

not req'd by County.

Has not received $1500.00 his money. Needs it now.

mtg on week of June 20 re-obligation

- will be converting base map to Arc-Info. thru B+N

Get copy so we can use Arc View.

Call B+N.

Pro\254Sec10.EM

RVS
Data Needs

1/8/94

D/S (last pg)

1. Distance of riprap from new culvert work in near F. Rd.

~~Furnish to CWR~~ CWR 7/15/94 2 PM

2. Bump up n value for earth channel? prob ok for planting. CWR to call Dave Ritchie

3. On SC routing, add some debris blockage.

~~QQ~~ — 2 n values ROB — for block wall for 2X length from culvert

~~XHB — n OH — 0.057 seems high~~

~~XE~~ if out of bank use 0.030 for temp LOB + ROB put on calc sheet + on report.

Make sure set up Rpt for CWR FAX last fall. CWR will send to me.

Cathy Forester 7/20/94 4:30 PM

Form 37
only difference is digital Specs in App

App 6, + Dig Specs added. She will send me
the charges she will look over / Sandy
for TRL: on Friday.
Some time for G-H mapping + coord transform.
3-4 subbasins? big? she does not believe his
some has were for time study apart on coord transformation. $1000 charge. I told her
give me From # on Monday. for cost of CO #

She wants to wait for Tonto Verde are they all done?
If more claimed charges, she will wait for new mapping
Do the calcs for n value study. G-H was in
error for not doing it.
I asked for 60 days time extension.

P.

RVS telecon
Tom Loomis 7/25/1954 9AM

1 day Tom 1 day Tech

4 12 4
TRL Tech Secy

If Q does not change, NO no effect
paper change only.
So take out hydrology ok per Tom
will EQO get picky on basin change?
if not leave as is.

put GVS in for 4 hrs coord time position.

Lori Spice 8-18-94 Noon. RVS

Arc Cad vs GCA autocad

GCA used the | MKE used this ~~IS have conflicts~~

~~Lod for.~~ will send us revised autocad layers.
we tell him if there is conflict.
will send us letter transmitted of what he sent & Tom
will send us invoice for the billing cycle.

Cathy Pegeter Wed 8/24/94

expecting S.t. by end of month.

VDC will be calling next week – west of Tonto Verde →
Wash 11 & to the north. Tonto Vista – crossing Verde River
how much time to pipe-line this
ph II

VDC wants to use GVS hydro data.

Can we release next week – will have S.S.
review & approve – DO wants to say
it's here & in review & will release.

C.O. released so go do it.

MKE

McLaughlin Kmetty Engineers, Ltd.

TELEPHONE COMMUNICATION REPORT

DATE: 8/25/94 TIME: 11:30 Am JOB NO. RVS

TO: Frank Brown LOCATION: MKE

FROM: Larry Cadler LOCATION: B+N

SUBJECT/DISCUSSION:

Tom map breakout @ Forest Rd + Rio Verde Drive.
affects BTN

new 210 cfs breakout from Work A
Sheet 4 SW cor of study area north of Rio Verde Drive.

will send letter + map.

Flow split not in HEC-1 model 16% of flow.
+ not planned for.

Tony Rugis doing hydrology for Wood Patel
OK for Tom to call Tony.

Fri 8/26/94 8:45 AM
I told Tom to add to model later.

SUMMARY/ACTION ITEMS:

COPY TO:

Larry Caller 9:40 AM 9-15-94

HEC-1 flow split

HEC-2 flow split

Magnus called - are they holding us up?

Wood Patel Transmitted rec 8-24-94
HEC-1 Divert 165 OR

Tom's been waiting for HEC-1 hydrograph from DT. 200 cfs
we have split that affects them
Tom's rep knows
Tom rep.

No letter Wait & see if Tom & Larry agree.
agree on phone, then act.

9:30 mtg w/ Larry Caller

9:30AM Larry - Wood Patel will model it 200 cfs
N + provide hydrograph.
then Tom to provide

MKE

McLaughlin Kmetty Engineers, Ltd.

TELEPHONE COMMUNICATION REPORT

DATE: TIME: JOB NO. 9[illegible]

TO: LOCATION:

FROM: LOCATION:

SUBJECT/DISCUSSION:

Tom has revised ST.

Due Friday Oct 7. Oct 10 Lupdo and LFQ.

OK words to read.

Fri 9:15 mm

R.O Lands

Send Tom:

Dates on sheet 8

FEMA will not approve Dmg

on land a maintenance criteria (written

agreement / signed) (

will hold plans

We must meeting:

Existing use QIS

Dmg Lands -

not may DC lic each work in HBC -

by Dr Lic or S.S. makes changes

SUMMARY/ACTION ITEMS:

COPY TO:

RVS

7/13 TRL OCT 98

Hydrology Exhibits

next redmarks and revision for Lower

in the W/S Wash 17. Affects Wash 10 R.

will need new Table.

MKE

McLaughlin Kmetty Engineers, Ltd.

TELEPHONE COMMUNICATION REPORT

DATE: 2 Nov 94 TIME: JOB NO.

TO: LOCATION:

FROM: LOCATION:

SUBJECT/DISCUSSION:

Talk to Wade recent events

throw out new mapping — they lowered channel to make HEC-2 work.

could do wash 11 & new culvert.

no change orders per Pedro. delete RM's on wash 11.

retype R/S for Wash 11 — TRL lower than Franks — Use the higher ones per FCD direction

SUMMARY/ACTION ITEMS:

COPY TO:

MKE McLaughlin Kmetty Engineers, Ltd.

TELEPHONE COMMUNICATION REPORT

DATE: 6 Dec 94 TIME: JOB NO. N/A

TO: LOCATION:

FROM: LOCATION:

SUBJECT/DISCUSSION:

1. C543L b133 SM 487 cfs add Straight, 300 cfs add HEC-1 Will this be added to Phase II?
2. When decide on Phase II? in December, 1st week of year.
3. Hydro Report on Thursday OK.
4. Any person reassignments if reorganization? See below.
5. Enlarge FIRM 10 times to 1"=200'? NO.

Updated FIRM? Has it on G.I.S. ArcCad and Auto Cad will send to me.

#1 Dan Sagramoso Ed Raleigh Engineering

4. No effect on MKE if reorganization Nick Pinizzotto, Chief Walter Engra, Tim Reidy Nina Cotti, Craig Stapisa Watershed & Flood Control Projects & Joint Federal Regulatory Matters Dan Reimer maybe family. → still Rio Verde Hydrologist. Podesta Land "Industries"

Str. Engrg Mike Lopez Charles Wainright

SUMMARY/ACTION ITEMS:

Interested Alfonso (Alfonso Ryan) Ahouraiyan.

will take 3 people Kevin Cora Bernadine Edgar Marvin.

SUMMARY

Cathy will call on Autocadd of FIRM Map.

COPY TO:

MKE

McLaughlin Knetty Engineers, Ltd.

TELEPHONE COMMUNICATION REPORT

DATE: 2 Feb 95 TIME: 9:25 Am JOB NO. RVS

TO: C. Reeste LOCATION:

FROM: E. Brown LOCATION:

SUBJECT/DISCUSSION:

Erickson believes no hotel - will call Roger Nelson

ph. II - will send map

call CWR Ste I talk w/ Reza on mtgs w/ fp. problem

SUMMARY/ACTION ITEMS: 1. She will call me after talk w/ Nelson (UBC)

2. Will mail me the Scope Phase II and the maps

3. FG to talk w/ Gk + call CWR

COPY TO:

1. ET
2. 70% GCA

MKE

McLaughlin Kmetty Engineers, Ltd.

TELEPHONE COMMUNICATION REPORT

ET HEC-2 problem

DATE: 2 Feb 95 TIME: JOB NO. RVS

TO: LOCATION:

FROM: LOCATION:

SUBJECT/DISCUSSION:

Richard Cook says to call David Aust.

on 70% Hydrology work / GCA - would be happy

to run through files - but contact Larry Rikofski

Richard 11:30 AM Fri 3 Feb 95

Level like that 70% billed

doesn't know of a Count

Uncertain is - in the work 100% done - no drawings

Get work done by getting EOG files back from District

GCA still has all existing

SUMMARY/ACTION ITEMS:

COPY TO:

MKE

McLaughlin Kmetty Engineers, Ltd.

TELEPHONE COMMUNICATION REPORT

DATE: 6 Feb 95 TIME: 8:15 AM JOB NO. RVS

TO: F Brown LOCATION:

FROM: C. Register LOCATION: FCOMC

SUBJECT/DISCUSSION:

called Roger Wilson this A.M.

UOC has not finished report will get forwarded 1995 PTZ
1996 built

will do fip. mapping - will get us S.T. for Phase II and will get us an answer today in Wash II.

Results 3:25 PM MAN
may have to work over a little 0.4' @ RM 1.933
to get AMC X-S more accurate.

has as-built design plans (I have one)

no [illegible] here - on the [illegible]

So do Study in Sec 36.

SUMMARY/ACTION ITEMS:

1. will put in letter for Phase II
   + will send maps
2. will send FIS excerpts + mail to us. Will send it by end of week.

COPY TO:

MKE

McLaughlin Knetty Engineers, Ltd.

TELEPHONE COMMUNICATION REPORT

DATE: 14 FEB 95 TIME: Am JOB NO. R1/5

TO: FB LOCATION:

FROM: CWR LOCATION:

SUBJECT/DISCUSSION:

Phase I must be specific on milepost - road title only.

Personal preference is 4 mil. Call to find out what set.

SUMMARY/ACTION ITEMS:

COPY TO:

SECTION 1: General Documentation and Correspondence

1.3 Meeting Minutes or Reports

FCD 93-07
RIO VERDE SOUTH
FLOODPLAIN DELINEATION STUDY
KICKOFF MEETING

January 4, 1994
1:30 P.M. Office of McLaughlin Kmetty Engineers

AGENDA

1. Personnel Assignments
2. Month Report
3. Billing Procedure/Estimated Quarterly Billings
4. Newspaper Ad
5. Right of Entry Letter
6. Publications
7. FEMA Checklist
8. Project Schedule
9. Surveying and Mapping
10. Public Meeting No. 1, January 19, 1994
11. Phase II
12. Evaluation Forms
13. Data Collection
14. Other

FIS PUBLICATIONS

DISTRICT PUBLICATIONS

Drainage Design Manual for Maricopa County, Arizona: Volume I - Hydrology, June 1, 1992

Drainage Design Manual for Maricopa County, Arizona: Volume II - Hydraulics, September 1, 1992

Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona, April 1991

Data Delivery Specifications: The Hydrologic Information System (HIS), Revision 01.1, as revised to include only Rio Verde South Scope of Work Tasks 3.6.3.1 and 3.6.3.3

FEMA PUBLICATIONS

FEMA Document 37, Flood Insurance Study Guidelines and Specifications for Study Contractors, March 1993

FIA Document 12, Appeals, Revisions, and Amendments to Flood Insurance Maps, January 1990

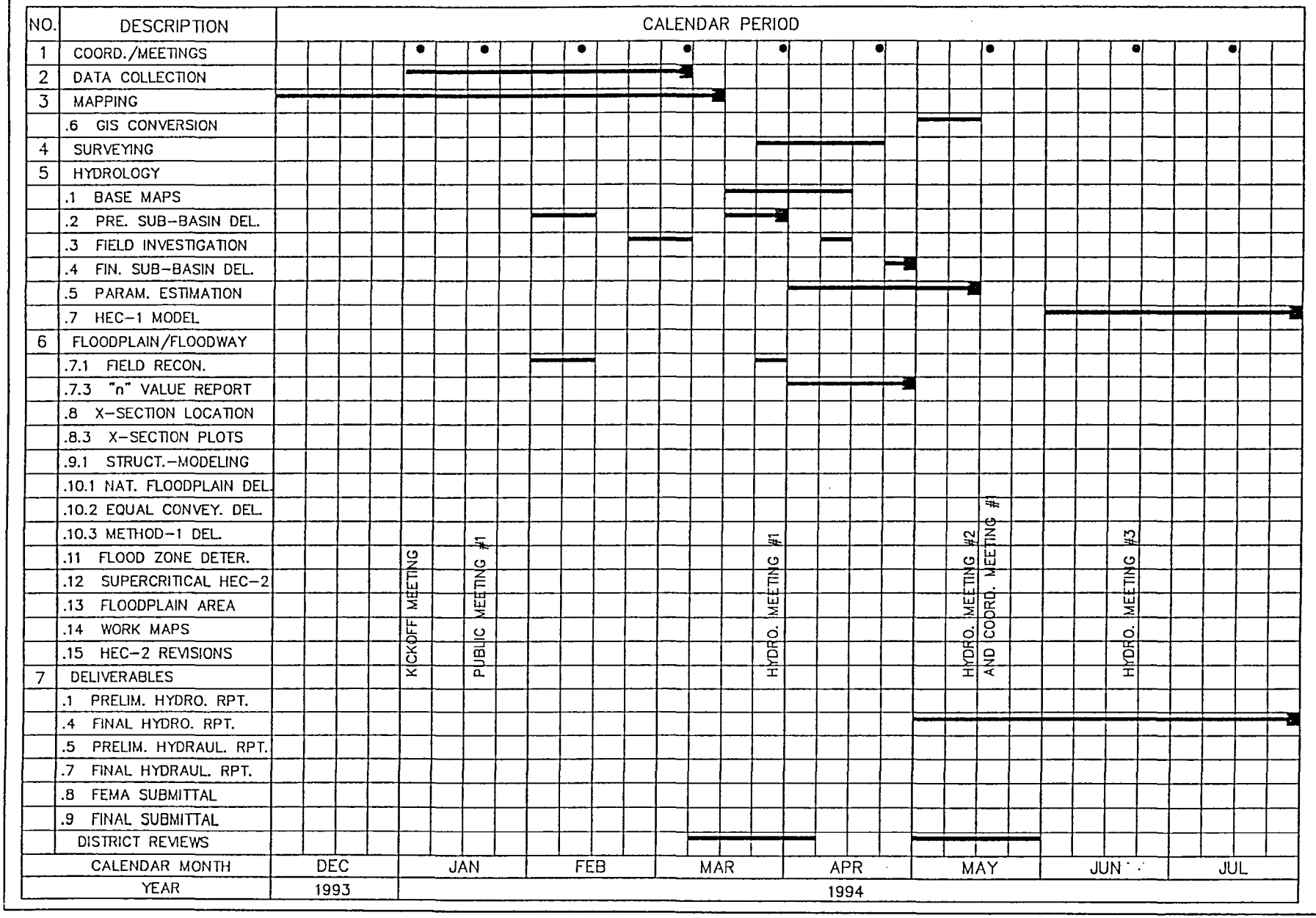
ADWR PUBLICATIONS

State Standard Attachment 1-90, Instructions for Organizing and Submitting Technical Documentation for Flood Studies, September 1991

PROJECT SCHEDULE

LEGEND
PROPOSED — MEETINGS ●
ACTUAL ▨ SUBMITTAL ■

PROJECT PHASE I RIO VERDE SOUTH LOCATION FCD 93-07 DATE 12/30/93 p.1 of 2

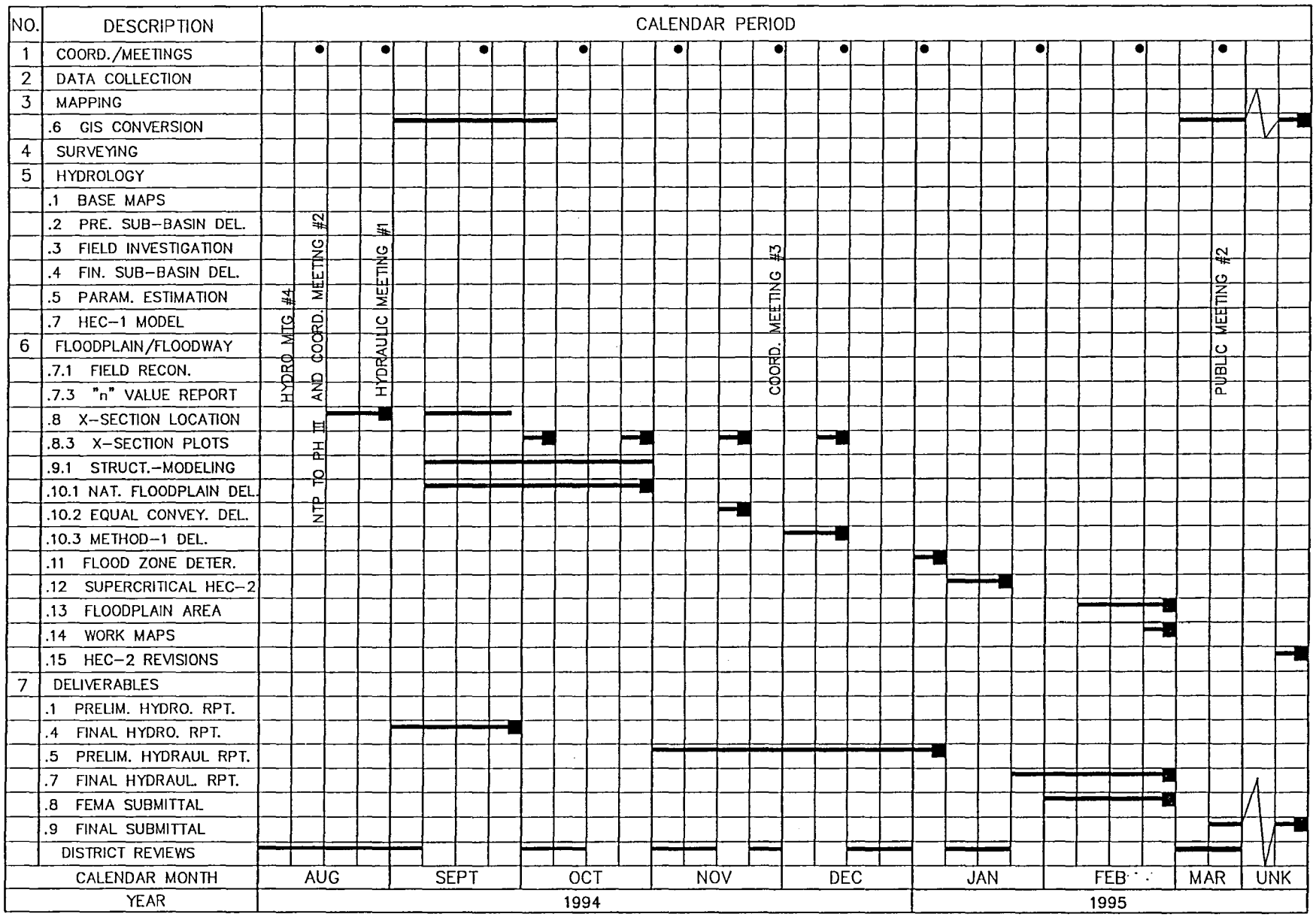


Dwg Name: \ACAD\PROMO\93-52.dwg
Date: REV. JAN. 03, 1994 04:45pm

PROJECT SCHEDULE

LEGEND
PROPOSED — ACTUAL ▨ MEETINGS ● SUBMITTAL ■

PROJECT PHASE I RIO VERDE SOUTH LOCATION FCD 93-07 DATE 12/30/93 p.2 of 2



Dwg Name: \ACAD\PROMO\93-53.dwg
Date: REV. JAN. 04, 1994 11:55am

MEETING MINUTES

RECEIVED APR 0 5 1994

DATE: March 29, 1994

TIME: 9:00 a.m.

LOCATION: Guadalupe Room, FCDMC

PROJECT NO.: 93031.00

PROJECT NAME: Rio Verde - North and Rio Verde - South Floodplain Delineation Study, Hydrology

SUBJECT: Preliminary Hydrology Coordination Review

ATTENDEES:

Burgess & Niple:
Russ Cruff, P.E.
Larry D. Culler, P.E.
Larry J. Woodlan., P.E.

FCDMC:
Sandy Story

George V. Sabol Consulting Engineers, Inc.
George Sabol, PhD, P.E.
Tom Loomis, P.E.

McLaughlin Kmetty Engineers, Ltd.
Frank Brown, P.E.

Wood/Patel:
Ash Patel, P.E.
Tony Regis, Hydrologist AJR

ITEMS DISCUSSED:

1. Mr. Sabol stated that in his research, he found that the combination of S-graph # 18 (which he researched for FCDMC) and a Kn value of 0.020 may be applicable to the conditions found in this watershed. He stated that this may be preferable in lieu of using other S-graphs or the Clark unit hydrograph. Mr. Sabol suggested that while the Clark unit hydrograph is appropriate for many watersheds, it may be unsuitable for sub-basins in which the time of concentration is significantly greater than the duration of rainfall excess. In those cases, an S-graph may be more appropriate.

2. Mr. Sabol acknowledged that the results of the test HEC-1 model by Wood/Patel that uses the Phoenix Valley S-graph unit hydrograph and a Kn value of 0.055 agrees fairly well with the S-graph # 18 model with a Kn value of 0.020.

3. Preliminary HEC-1 results by Wood/Patel indicate that the Clark unit hydrograph does indeed produce flows lower than those produced using the S-graphs. This is often the case, and the Clark method may be more appropriate for smaller (and urban) sub-basins.

4. FCDMC may prefer to use a District-approved unit hydrograph rather than the S-graph # 18. Sandy will discuss this issue with Amir Motamedi, Pedro Calza, and Joe Tram within the next day to decide whether to recommend the alternate S-graph # 18.

5. Burgess & Niple, Wood/Patel, McLaughlin Kmetty, George Sabol, and FCDMC all concur on the proposed south watershed boundary of the Rio Verde - North hydrology study. Further analysis and inspection of detailed topographic maps may require minor changes due to flow breakouts.

6. SCS soil survey data is not available adjacent to the Verde River. Mr. Loomis stated that it is possible to estimate soil groups using aerial photographs. He suggested meeting soon with SCS to determine soil groups in those areas.

7. Mr. Sabol suggested that we consider eliminating channel routing when lengths are less than a minimum value, say 800 or 1000 feet. This will be addressed as the study progresses.

8. Mr. Loomis stated that it would be appropriate to model routing reaches using a composite cross section representing one or several channels, since routed flows may be contained in more than one wash.

9. Topographic mapping is expected to be completed by April 18 for the Rio Verde - North study area, and by April 30 for the south study area.

cc: All Attendees
Magnus Jolayemi, FCDMC
Cathy Regester, FCDMC

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

COORDINATION MEETING NO. 1
MEETING NO. 3*

TO: **Distribution**

FROM: **Frank Edward Brown** Frank Edward Brown
McLaughlin Kmetty Engineers, Ltd. (MKE)

DATE: **May 31, 1994**

SUBJECT: **Subbasin Delineation**
Rio Verde Area South Floodplain Delineation Study
Contract FCD 93-07

Hydrology Meeting No. 1 was held at the office of Flood Control District at 1:30 p.m. on May 31, 1994. The following attended the meeting:

Ms. Cathy Regester, Flood Control District of Maricopa County, (FCDMC)
Ms. Sandy Story, FCDMC
Mr. Tom Loomis, George V. Sabol Consulting Engineers, (GVSCE)
Mr. Frank Brown, McLaughlin Kmetty Engineers, (MKE)

The following presents our understanding of discussion items.

1. **Background:** The aerial mapping was received on April 20, 1994. Work is proceeding on subbasin delineation. The purpose of this meeting is to discuss the subbasin delineation, flow splits and other pertinent items. Subbasin review is critical to maintaining the schedule for this project. Field reconnaissance is expected to begin on June 6th. Ms. Regester is expected to join MKE and GVSCE in the field June 10th.

2. **Subbasin Maps:** On May 27, Mr. Loomis submitted subbasin delineation maps and the colored originals. A colored acetate plotted on the 1 inch = 1000 feet USGS base map was loaned to FCDMC on May 31st, and presents the subbasins and flow splits outside of the detailed mapping areas. The proposed subbasin delineation was presented and thoroughly discussed.

   a. The naming convention for subbasins and routing reaches is not uniform between Rio Verde North and South, and this is acceptable to the District.

* Meetings with FCDMC are numbered consecutively as well as per category of meeting defined in the Scope of Work. Meeting No. 1 was the January 4, 1994 Kickoff Meeting. Meeting No. 2 was the March 29, 1994 Joint Hydrology Meeting with Burgess and Niple.

ASPEN, CO (303) 925-1920 | TULSA, OK (918) 582-6800 | DENVER, CO (303) 458-5550 | SUMMIT COUNTY, CO (303) 468-2141

3. **Flow Splits:** The field reconnaissance of flow splits (and Subbasin boundaries) is expected to begin on June 6th, using Global Positioning Systems (GPS). The Rio Verde North (Burgess and Niple) flow split methodology was discussed. Due to complexity, that project assumed a percentage flow split in certain areas. This approach may be needed in Rio Verde South.

   a. At complex or important flow splits, four cross-sections may be needed, otherwise one cross-section may suffice.

4. **Hydrology Exhibits:** The CADD work for subbasins, landuse, T_c path and Routing path is expected to begin next week. A soils map will be prepared for the one area lacking current soils maps. Mr. Loomis is working with Mr. Bill Johnson of SCS to prepare those maps. In critical areas, soil samples will be taken and classified by the SCS.

5. **New Flow Diversions:** The new flow diversions in the Tonto Verde Subdivision need to be shown on the subbasin maps.

6. **Recent Earth Moving Projects:** The area north of the existing Rio Verde community is currently undergoing earth moving operations that are changing subbasin boundaries and floodplain flow paths. Affected washes are washes north of, and including, Wash 11. In some areas, the recent (flight date 12-22-93) aerial mapping is almost outdated. Ms. Regester will consider how to proceed.

   a. Ms. Cora Hernandez, FCDMC, has recently received plans for a new subdivision covering one land section within the project limits.

7. **Concerns:** Ms. Story has no subbasin or flow split concerns at this time and is awaiting the results of the field reconnaissance.

8. **Aerial Photographs:** Marked aerial photographs depicting subbasins and flow paths were loaned to the District.

9. **Hydrology Results:** The first working HEC-1 model is expected about the middle of July.

The meeting adjourned at approximately 2:30 P.M.

ACTION ITEMS:

1. FCDMC to instruct MKE on how to proceed in areas of recent earthmoving projects.

Distribution: All Attendees

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

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TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

COORDINATION MEETING NO. 2 MINUTES
MEETING NO. 4*
January 23, 1995 at 10:00 a.m.
Flood Control District of Maricopa County
2801 West Durango St., Phoenix

SUBJECT: **Phase I HEC-2 Review and Phase II Scope of Work**
Rio Verde Area South Floodplain Delineation Study
Contract FCD 93-07

Attendees:

Ms. Cathy Regester, Flood Control District of Maricopa County, (FCDMC)
Ms. Sandy Story, FCDMC
Mr. Frank Brown, McLaughlin Kmetty Engineers, (MKE) Frank Edward Brown

The following presents our understanding of discussion items:

1. **Floodplain Mapping:** The District Review comments on the draft and preliminary HEC-2 analysis were presented. The draft HEC-2 technical appendix-type report was also reviewed.

   a. Any Zone A floodplain less than one foot deep should be called a Zone X.

   b. Supercritical HEC-2 runs are needed, but only for supercritical reaches (rather than the entire wash).

   c. The number of Zone A's should be limited; try for Zone X or Zone AE.

   d. For the starting water surface on Wash 10, present calculations according to FEMA 37 Page 5-6 on coincident peaks at the Wash 10 and 11 confluence.

   e. The starting water surface on Wash 9 should be at critical depth, not at the Verde River.

   f. The starting water surface on Wash 11 should be reviewed: Start at normal depth, not the Verde River, show FEMA 37 Page 5-6 calculations, or state both methods attempted.

   g. The Verde River cross sections (Page 10 of Draft Report) should be shown, if used.

* Meetings with FCDMC are numbered consecutively as well as per category of meeting defined in the Scope of Work.

ASPEN, CO (303) 925-1920 | TULSA, OK (918) 582-6800 | DENVER, CO (303) 458-5550 | SUMMIT COUNTY, CO (303) 468-2141

h. Weir flow coefficients should be justified and the surface type stated (road, desert island).

i. The analysis at weirs and split flows at islands can be reduced: If the cross-section has less than 1 foot depth, drop the analysis. Ms. Regester will provide excerpts from other flood studies on this topic.

2. **Floodplain Base Maps:** On 16 December, Mr. Brown submitted floodplain base maps showing HEC-2 cross sections and labels, overlaid on the topographic mapping. Some work is needed to correct line weights and line styles. District review comments (redmarked prints) were returned.

3. **Phase II Scope of Work:** Phase II should analyze up to 4 river miles for washes that have more than 500 cfs.

   a. Ms. Regester presented maps showing about one (1) river mile of new floodplain mapping requested on two separate washes.

   b. Ms. Regester is to review the HEC-2 analysis submitted last November on Wash 11, just upstream of the Phase I boundary (Cross sections 1.910, 1.933, 1.946). Mr. Brown is to check with Mr. Kmetty on how to handle the recent grade change in this area that does not significantly affect the mapped floodplain. FEMA would probably allow a common sense approach here.

   c. Expanding the floodplain analysis for Wash 11 in Section 36 was discussed: Due to the on-going development in Section 36, it may not be worthwhile to delineate floodplains. Mr. Jeff Erickson (Development Engineering, Inc.) will telephone Ms. Regester to confirm subdivision timing. As a result, it was decided to confirm the Phase II Scope of Work in the near future.

4. **ARCInfo Translation:** MKE has the option of using the newest HIS specifications, which are to be published shortly.

5. **Hydrology:** The Preliminary Hydrology Report and computations are acceptable to the District, and a memo to that effect presented. The Final Report should not be published until the HEC-2 analysis is complete.

The meeting adjourned at approximately 11:00 a.m.

ACTION ITEMS:

FCDMC:

1. Ms. Regester to provide:

   a. Floodplain Delineation Study excerpts on split flows at islands.

   b. Review comments on HEC-2 Analysis Near Wash 11 River Mile 1.91 to 1.95.

   c. Maps showing the Phase II floodplain limits, and written authorization to begin Phase II.

MKE:

1. Mr. Brown is to:

   a. Address all review comments on the HEC-2 analysis, as noted above and the redmarked copy of the Draft HEC-2 Report.

   b. Revise the floodplain base maps for line styles and weights.

   c. Provide supercritical HEC-2 analysis, as appropriate.

   d. Discuss with Mr. Kmetty the floodplain analysis near River Mile 1.9.

Distribution: All Attendees

MKE McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

COORDINATION MEETING NO. 1

TO: **Distribution**

FROM: **Frank Edward Brown**
McLaughlin Kmetty Engineers, Ltd. (MKE)

DATE: **24 January 1995**

SUBJECT: **GIS Coordination meeting**
Rio Verde Area South Floodplain Delineation Study
Contract FCD 93-07

Coordination Meeting No. 1 was held at the office of Aerial Mapping Company at 3:00 p.m. on 24 January 1995. The meeting was informal in nature and is not required per the Scope of Work with FCDMC. The following attended the meeting:

Mr. Richard Cook, Aerial Mapping Company (AMC)
Mr. Bob Parks, AMC
Mr. Mike Mester, AMC
Mr. Frank Brown, McLaughlin Kmetty Engineers, (MKE)
Mr. Larry Blilie, MKE

GIS Consultants of Arizona (GCA) has essentially closed its doors, and MKE will be doing the required GIS work in-house. However, the District's double precision requirement means that MKE will need to utilize AMC's Unix workstation. Once ArcCad II is released, a Unix work station would not be required. The ArcCad II release is about 1 year overdue, and there are no indications for its release date.

The following presents our understanding of discussion items.

1. **Letter of Agreement:** A letter from Mr. Blilie (attached) detailing the arrangement and charges for an AMC operator and a Unix workstation was hand-delivered.

2. **Submittal to FCDMC:** If required to submit tapes, hand deliver and get the tape back, due to $30 per tape cost. On occasion, Eric Feldman has rigorously applied the HIS specifications.

3. **Submittal to AMC:** Large files should be submitted on QIC 80 tapes, which will be returned to MKE.

4. **File Translation:** When working with dBase attribute tables in Quatro Pro, be careful not to let the Quatro Pro default setting change the table structures. Mr. Parks may be able to assist in this.

4. **File Translation:** When working with dBase attribute tables in Quatro Pro, be careful not to let the Quatro Pro default setting change the table structures. Mr. Parks may be able to assist in this.

5. **Digitized USGS Quad Maps:** A scan of a quad map is not accurate, and is not registered properly. Mr. Parks should double check certain items. Digitized maps prepared by the USGS should be obtained, are not presently available for most areas and, given enough time, will be available for all of Arizona. Digital Line Graph (DLG) format should be requested.

6. **ERM's:** Burgess & Niple should tell MKE what order of survey (third order?) was used for the ERM's that they prepared for Rio Verde South.

7. **Translation Problems:** AMC agrees to stop work if problems are encountered with MKE's submittal. MKE should submit clean data to avoid problems. A small submittal should be made early to allow AMC to check the data and save MKE expensive rework. AMC will not change MKE's raw data.

8. **Split Flows:** At split flows and island flows, MKE should work closely with AMC on cross section length, when one cross section is shared for two washes.

9. **Phase II Floodplain Mapping:** FCDMC has authorized 1 mile for Phase II floodplain, yet has not completed discussion on the Scope of Work, and AMC will be given a work assignment at the approprite time.

10. **Aerial Mapping:** MKE has requested ArcInfo coverages from AMC for the Rio Verde South topographic mapping, to assist MKE in their translation work. This will be done once AMC's translation is complete.

The meeting adjourned at approximately 5:30 p.m.

Distribution: All Attendees

Job file 89.407.003

MKE
McLaughlin Kmetty Engineers, Ltd.

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GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

COORDINATION MEETING NO. 3* MINUTES
MEETING NO. 5*
July 12, 1995 at 9:00 a.m.
Flood Control District of Maricopa County
2801 West Durango St., Phoenix

SUBJECT: Phase II Wash 12 Floodplain Delineation Interim Submittal
Rio Verde Area South Floodplain Delineation Study
Contract FCD 93-07

Attendees:

Pedro Calza, Flood Control District of Maricopa County (FCDMC)	506-7346
Hasan Mushtaq, FCDMC	506-1501
Geza E. Kmetty, McLaughlin Kmetty Engineers, Ltd. (MKE)	248-7702
Frank Edward Brown, MKE	248-7702

Frank Edward Brown

After interim submittal of the Wash 12 Floodplain delineation, an interim Field Review Meeting was held on 27 June 1995 (please see separate memorandum summarizing field review). Today's meeting was held to decide on a course of action. The following presents our understanding of discussion items:

1. **Wash 12 Future Floodplain:** In all likelihood, this portion of Wash 12 will be channelized. Brooks Hersey is the engineering company working for the landowner. The NRCS (National Resource Conservation Service, formerly the Soil Conservation Service) has agreed to provide bank stabilization along the Verde River at the Box Bar Ranch (under same ownership), and we assume that the landowner will have no problem obtaining the necessary approvals for Wash 12 channelization.

2. **Floodplain near River Mile 0.49 to 0.74**: The options presented in the 27 June memo were discussed. The photographs taken by Mr. Brown were viewed. One set of original photographs and the handwritten photo key was given to the District.

   A. It was decided to present the floodplain as shown in the previous submittal, after addressing District review comments in a forthcoming review letter.

3. **Floodplain Violation:** Mr. Calza reports that the landowner has been cited for a floodplain violation due to the dumping of materials in the floodplain (see May 31 1995 Memorandum.) Mr. Brown reiterates that he thought the debris would cause higher flood levels, since the materials were in the floodplain. Mr. Brown reports that the debris has been cleaned up in one area and rearranged in another.

* Meetings with FCDMC are numbered consecutively as well as per category of meeting defined in the Scope of Work. Other coordination meetings have occurred with the District without meeting minutes prepared.

4. **Floodplain at Forest Road:** Mr. Brown explained that the reason for the Zone A at Forest Road has to do with upstream split flows and the geometry of this street crossing. The District asks that this be fully described in the Report.

5. **Submittals:** Mr. Calza expects to send the results of this study to FEMA in August and has informed others of this time frame.

ACTION ITEMS:

The District is to:

1. Provide written review comments on the Wash 12 Floodplain Submittal.

MKE is to:

1. Address forthcoming Wash 12 review comments.

2. Along with the next floodplain submittal, resubmit the first floodplain submittal given to Cathy Regester.

3. Describe in the report text the flow situation at Forest Road.

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

INTERIM FIELD REVIEW MEETING

TO: **Distribution**

FROM: **Frank Edward Brown**
McLaughlin Kmetty Engineers, Ltd. (MKE)

DATE: **27 June 1995**

SUBJECT: **Floodplain Delineation for Wash 12**
Rio Verde Area South Floodplain Delineation Study
Contract FCD 93-07

An Interim Field Review meeting was held at the site to discuss the recent submittal of the HEC-2 output, cross section plots, stream profile plot, and floodplain delineation maps for Wash 12. The following attended the meeting:

Attendees: Mr. Hasan Mushtaq, Flood Control District of Maricopa County
Mr. Frank Edward Brown, McLaughlin Kmetty Engineers, Ltd.
Mr. Charles L. Joy, McLaughlin Kmetty Engineers, Ltd.
Mr. Ahmad Osman, McLaughlin Kmetty Engineers, Ltd.

The purpose of these meeting notes is to present a summary of the field review and to propose a course of action for floodplain delineation at the following locations.

1. **Left Bank Area:** Between River Mile 0.49 and River Mile 0.74 along the left bank of Wash 12, a natural embankment was inspected in the field. This embankment is well vegetated, and has the appearance of being naturally formed. The top width varies from about 10 feet wide to one foot wide. The embankment is between 1.5 feet and 4.0 feet high above the adjacent thalweg. There is evidence of flows recently in this channel, and in some places the channel side slopes are eroded to near vertical with evidence of sloughing. Mr. Brown took several photographs in this area. The channel between the above referenced river miles was walked, including a good portion of the proposed Zone A. The Box Bar Ranch lies due east of this area.

a. Computations show that the left bank is overtopped between River Mile 0.569 and River Mile 0.661.

b. As briefly discussed with Mr. Mushtaq in the field, the proposed course of action is to map

ASPEN,CO (303) 925-1920 | TULSA, OK (918) 582-6800 | DENVER, CO (303) 458-5550 | SUMMIT COUNTY, CO (303) 468-2141

the floodplain under two scenarios. The first is to map the floodplain on the stream side of the embankment with the embankment in place. This yields the maximum water surface, in the event the embankment stays in place during a 100 year event. The second is to map the nonstream side using the entire channel cross section, assuming runoff cuts through the embankment This yields the maximum lateral floodplain extent. Split flows and island flow situations are expected. These approaches should be discussed before we proceed. Generally, water deposited sediment has fairly good compaction. However, MKE lacks the geotechnical expertise to state for certain whether the embankment would remain in place or not during a 100 year flood. We recommend that a qualified geotechnical professional be hired to examine and test this area. We would supply flow rate, flow depth, velocity, and any other data available to us.

1. If flow cuts through the embankment, a portion of Wash 12 would flow through the Box Bar Ranch. The analysis could end with a standard "Limit of Detailed Study" note. If the detailed study area were continued through the Box Bar Ranch, approximately 0.5 stream miles would be added to the study, which is outside the present Scope Of Work.

2. **Right Bank Area:** What appears to be a manmade earthen levee is found along the Wash 12 right bank between River Mile 0.36 and River Mile 0.48 and was inspected in the field. Fill material is comprised of undetermined local material, small landscaping rock with plastic sheet remains, and other "junk" type fill. The top width is generally about 1.0 foot. It is generally well-vegetated, except for the more rocky portions.

a. This levee is overtopped and the floodplain is mapped as if the levee is completely gone.

3. **Right Bank Levee Construction Plans:** During Data Collection, MKE did not locate any construction or compaction or freeboard drawings, nor any reference to such drawings. The District will again search the files for construction details.

4. **Wash 12 at Forest Road:** The flow situation at Forest Road was examined. The true low point is south of the main thalweg, and occurs where runoff from Subbasin 500K (0.10 square miles) crosses Forest Road. The main thalweg occurs north of the Subbasin 500K crossing, where runoff from 7.5 square miles crosses the road.

a. The main thalweg should remain as shown on the flood maps.

b. The likely situation is that west of Forest Road, runoff in the main thalweg splits off to the south in several locations , thus most of the flow ends up at the true low point. Since this is outside of the floodplain study area, the exact nature of the split flows is not known. Since runoff flowing between the main thalweg and Rio Verde Drive to the north has momentum and the potential to cross Forest Road in a perpendicular fashion, a Zone A is delineated here since the exact flow rate cannot be determined.

5. **General field reconnaissance:** Several Study Wash locations were reviewed in the field, as follows (listed in viewing order):

a. Wash 11 at Agua Verde Drive.
b. Wash 10 between golf course and Forest Road.
c. Wash 11 near west end of Section 31. A new road is being constructed at this location. The concrete roll curb ends before the low water crossing.
d. Wash 11 in Section 36. The concrete levee diversion structure was viewed.
e. Wash 9 at Forest Road, at Via Hermosa, at Vado Court, and at Quail Haven Road.
f. Wash 10 at Avenida Del Ray.

Distribution: All Attendees
Pedro Calza, Flood Control District of Maricopa County

SECTION 1: General Documentation and Correspondence

1.4 General Correspondence

RECEIVED DEC 29 1993

BURGESS & NIPLE
ENGINEERS
ARCHITECTS

Burgess & Niple, Inc.
5025 East Washington Street
Suite 212
Phoenix, AZ 85034
602 244-8100
Fax 602 244-1915

LETTER OF TRANSMITTAL

DATE December 29, 1993	JOB NO. 15183
RE: Rio Verde South	

TO Mr. Frank Brown
McLaughlin Kinetty Engineers, Ltd.
3501 N. 16th Street
Phoenix AZ 85016

WE ARE SENDING YOU: ☒ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1 ea.			Aerial mapping contact prints, Rio Verde South watershed.

THESE ARE TRANSMITTED:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☒ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☐ As requested ☐ Returned for correction ☐ Return _____ corrected prints
☐ For review and comment ☐ _____

REMARKS

Rec'd ~~1:72~~ 1:7200 mapping contact prints
and 1:12,000 recon plotting of entire watershed.

T. Brown
MKE 12-29-93

COPY TO Ms. Cathy Regester
Mr. Magnus Jolayemi.

SIGNED James E Nisehler

If enclosures are not as noted, kindly notify us at once.

WOOD/PATEL
ASSOCIATES
Civil Engineers
Hydrologists
Land Surveyors

DATE 1/20/94
TIME 2:50 pm.

COMPANY: McLAUGHLIN KNETTY ENGINEERS
ATTENTION: FRANK BROWN
FAX NO.: (602) 248-7851

FROM: TONY REGIS FAX NO.(602)234-1322
PROJECT: RIO VERDE NORTH F.I.S. JOB NO. 93031.00
SUBJECT: SOUTH WATERSHED BOUNDARY

COMMENTS:

HERE IS OUR PRELIMINARY WATERSHED DELINEATION, BASED ON FIELD OBSERVATION, AND INSPECTION OF AERIAL PHOTOS AND TOPO MAPS ALONG THE SOUTHERN BOUNDARY. I HAVE INDICATED WITH ARROWS POSSIBLE FLOW BREAKOUTS ENTERING YOUR STUDY AREA AS WELL AS LOCATIONS WHERE FLOW FROM THE SOUTH MAY ENTER OUR STUDY AREA. PLEASE REVIEW THIS BOUNDARY AND LET US KNOW ANY COMMENTS OR QUESTIONS YOU MAY HAVE. THANK YOU.

Tony

CC: JIM MISCHLER, BURGESS & NIPLE

AERIAL MAPPING COMPANY, INC.
3141 W. Clarendon Avenue
PHOENIX, AZ 85017-4588

TEL (602) 263-5728
FAX (602) 263-0165

LETTER OF TRANSMITTAL

89-407 C.2

DATE	JOB NO.
1-20-94	93-168

ATTENTION: FRANK BROWN

RE: RIOVERDE South Quad Data.

RECEIVED JAN 21 1994

TO MKE
3501 N. 16th ST Suite B
Phoenix AZ 85016

WE ARE SENDING YOU ☐ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ AutoCAD DRAWING for Riverdale

COPIES	DATE	NO.	DESCRIPTION
1	1-20-94		RIOVERDE QUAD DATA IN AutoCAD R12 DXF FORMAT ZIPPED AND DOS BACKUP TO (2) DISKS RESTORE TO C:\

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☐ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☐ As requested ☐ Returned for corrections ☐ Return _____ corrected prints
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 19____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS STREAMS ARE INTERMITTANT FROM SUB. CONTOURS HAVE NO Z value. Questions call Larry Blilie 263-5794

COPY TO Tom Loomis
Flood Control District - Cathy Rejdak

SIGNED: Larry Blilie

If enclosures are not as noted, kindly notify us at once.

MKE

LETTER OF TRANSMITTAL

McLaughlin Kmetty Engineers, Ltd.
35[illegible] North 16th Street, Phoenix AZ 85016-6419
248-7702 FAX 248-7851

TO GVSCE

Scottsdale

DATE 2-22-94 | JOB NO 89-407.003

ATTENTION Dr. George Sabol

RE: Rio Verde South

GENTLEMEN:

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via deliver the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	DESCRIPTION
1ea	—	Data Collection file from FCDMC in accordian folder
1ea	—	MKE Data Collection data in manilla folder

REMARKS

COPY TO

SIGNED: Frank Edward Brown

If enclosures are not as noted, kindly notify us at once

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

March 16, 1994

Mr. David Ritchie
Rio Verde Services
P.O. Box 31001
Rio Verde, Arizona 85263

Re: Right of entry for surveying purposes:

Dear Property Owner:

The Flood Control District of Maricopa County has contracted with McLaughlin Kmetty Consulting Engineers, Ltd. (MKE), and their subcontractor George V. Sabol Consulting Engineers, Inc. (GVSCE), to perform a Flood Delineation Study for the southern portion of the Rio Verde Area and surrounding vicinity. The purpose of this study is to determine flood related hazard zones and delineate areas that may be subject to inundation during a "100-year flood" event. According to records at the Maricopa County Assessor's office, you own one or more parcels of land within the limits of the study area.

The intent of this letter is to notify you of the commencement of surveying activities in support of the above mentioned study. In order to perform these surveys it may be necessary to enter your property. This activity should not result in any inconvenience or damage to property. If you have any objections to the entry onto your property, you must notify Ms. Cathy Regester of the Flood Control District at 506-1501. Otherwise it will be assumed that you consent to the entry onto your property.

The study and resulting maps will be used for floodplain management purposes and submitted to the Federal Emergency Management Agency for flood insurance information and revisions of Flood Insurance Rate Maps. This study should be available to the public in about 12 to 15 months.

The Flood Control District and its representatives appreciate your help in assuring the accuracy of this study by allowing access to your property for the surveyors and by providing any information you may have regarding past flooding or related problems.

If you have any questions regarding this study or the right of entry, please contact Ms. Cathy Regester of the Flood Control District, Mr. Frank Brown of McLaughlin Kmetty Engineers or Mr. Tom Loomis of George V. Sabol Consulting Engineers.

Ms. Cathy Regester, Hydrologist, Flood Control District, (602) 506-1501.
Mr. Frank Brown, Project Engineer, McLaughlin Kmetty Engineers, Ltd. (602) 248-7702.
Mr. Tom Loomis, Project Engineer, George V. Sabol Consulting Engineers, Inc. (602) 483-3368

Very truly yours,

Geza E. Kmetty, P.E.
Project Manager

89407-00\Entry.003

RIO VERDE SOUTH FLOODPLAIN DELINEATION STUDY

RIGHT OF ENTRY FOR SURVEYING PURPOSES

List of Property Owners Notified

Mr. Robert Malone, Chrm., Streets Committee
Rio Verde Community Association
P.O. Box 32012
Rio Verde, Arizona 85263-2012

Mr. Robert Haack, President
Rio Verde Country Club
P.O. Box 31432
Rio Verde, Arizona 85263

Mr. Bob Anderson, Chairman
Rio Verde Greens and Grounds Committee
P.O. Box 31432
Rio Verde, Arizona 85263

Mr. David Ritchie
Rio Verde Services
P.O. Box 31001
Rio Verde, Arizona 85263

Mr. David Ritchie, President
Tonto Verde Subdivision
P.O. Box 31001
Rio Verde, Arizona 85263

Mr. David Ritchie
Tonto Vista Development
P.O. Box 31001
Rio Verde, Arizona 85263

Mr. David Ritchie
West 36 Development
P.O. Box 31001
Rio Verde, Arizona 85263

Mr. David Ritchie
Rio Verde Development
P.O. Box 31001
Rio Verde, Arizona 85263

RIO VERDE SOUTH FLOODPLAIN DELINEATION STUDY

RIGHT OF ENTRY FOR SURVEYING PURPOSES

List of Property Owners Notified

James Young
U.S. Forest Service
P.O. Box 5348
Phoenix, AZ 85010

Louie Hood, Planning Coordinator
Fort McDowell Indian Community
P.O. Box 17779
Fountain Hills, AZ 85269

Robert and Barbara Nelson 7328 E. Krall Scottsdale, AZ 85252	5N-6E, Sec. 25 219-38-17 - 18 and 20 - 34
Rio Verde Partnership 7137 North 7th Avenue Phoenix, AZ 85021	5N-6E, Sec. 25 219-38-16
Billie Nelson P.O. Box 32012 Rio Verde, AZ 85255	5N-6E, Sec. 36 219-38-38C
Western Rio Verde, Inc. 23150 North Pima Road Scottsdale, AZ 85255	5N-6E, Sec. 36 219-38-38H, 38J, 38P, 38R, 38S, 43, 44 & 45
Second Arizona Rio Verde Co. P.O. Box 1 Rio Verde, AZ 85255	5N-6E, Sec. 36 219-38-38X & 38Y 5N-7E, Sec. 32 219-14-1F, 1G, & 1L
Jane Mooty 300 Roanoke Bldg. Minneapolis, MN 55402	5N-7E, Sec. 31 219-14-2F, 2L

RIO VERDE SOUTH FLOODPLAIN DELINEATION STUDY

RIGHT OF ENTRY FOR SURVEYING PURPOSES

List of Property Owners Notified

Rio Verde Land, Inc. P.O. Box 1 Rio Verde, AZ 85255	5N-7E, Sec. 31 219-14-2H & 2M
Tonto at Verde Co. P.O. Box 1 Rio Verde, AZ 85255	5N-7E, Sec. 31 210-14-2K
Traverse, Inc. 5605 Woodcrest Drive Edina, MN 55424	5N-7E, Sec. 31 219-14-2Q
Joanne Hilty 2218 East State Street Fremont, OH 43420	5N-7E, Sec. 31 219-14-4
McCullough Properties, Inc. P.O. Box 17795 Fountain Hills, AZ 85268	5N-7E, Sec. 32 219-14-1D
Rio Verde Box-Bar Ranch 3400 City Center Minneapolis, MN 55402	5N-7E, Sec. 32 219-14-1J & 1K
Rio Verde Utilities, Inc. 18815 Four Peaks Blvd. Rio Verde, Arizona 85255	5N-7E, Sec. 32 219-14-1M & 1N

RIO VERDE SOUTH FLOODPLAIN DELINEATION STUDY

RIGHT OF ENTRY FOR SURVEYING PURPOSES

List of Property Owners Notified
*Revised 4/1/94**

Mr. Robert Malone, Chairman
Streets Committee
Rio Verde Community Association
P.O. Box 32012
Rio Verde, Arizona 85263-2012

Mr. Robert Haack, President
Rio Verde Country Club
18731 East Four Peaks Road
P.O. Box 31432
Rio Verde, Arizona 85263

Mr. Bob Anderson, Chairman
Rio Verde Greens and Grounds Committee
18731 East Four Peaks Road
P.O. Box 31432
Rio Verde, Arizona 85263

Mr. David Ritchie
Rio Verde Services
P.O. Box 31001
Rio Verde, Arizona 85263

Mr. David Ritchie, President
Tonto Verde Subdivision
P.O. Box 31001
Rio Verde, Arizona 85263

Mr. David Ritchie
Tonto Vista Development
P.O. Box 31001
Rio Verde, Arizona 85263

West Thirty-Six Company, Ltd.
25609 Danny Lane
Rio Verde, Arizona 85263

5N-6E, Sec. 36
219-38-38H, 38J, 38P, 38R, 38S,
43, 44 & 45
(from Western Rio Verde, Inc.)

RIO VERDE SOUTH FLOODPLAIN DELINEATION STUDY

RIGHT OF ENTRY FOR SURVEYING PURPOSES

List of Property Owners Notified
*Revised 4/1/94**

Mr. David Ritchie
Rio Verde Development
P.O. Box 31001
Rio Verde, Arizona 85263

James Young
U.S. Forest Service
2324 East McDowell Road
P.O. Box 5348
Phoenix, AZ 85010

Louie Hood, Planning Coordinator
Fort McDowell Indian Community
P.O. Box 17779
Fountain Hills, AZ 85269

Robert and Barbara Nelson
7328 E. Krall
Scottsdale, AZ 85252

5N-6E, Sec. 25
219-38-17 - 18 and 20 - 34

Rio Verde Partnership
2200 E. Camelback Road, #221
Phoenix, Arizona 85016

5N-6E, Sec. 25
219-38-16,

Billie Nelson
P.O. Box 32012
Rio Verde, AZ 85255

5N-6E, Sec. 36
219-38-38C

Second Arizona Rio Verde Co.
P.O. Box 1
Rio Verde, AZ 85255

5N-6E, Sec. 36
219-38-38X & 38Y
5N-7E, Sec. 32
219-14-1F, 1G, & 1L

Rio Verde Land, Inc.
P.O. Box 1
Rio Verde, AZ 85255

5N-7E, Sec. 31
219-14-2H & 2M

* *Italics = Revised Items*

RIO VERDE SOUTH FLOODPLAIN DELINEATION STUDY

RIGHT OF ENTRY FOR SURVEYING PURPOSES

List of Property Owners Notified
*Revised 4/1/94**

Tonto at Verde Co. P.O. Box 1 Rio Verde, AZ 85255	5N-7E, Sec. 31 210-14-2K *219-14-2F, 2L (from Jane Mooty)*
Traverse, Inc. 5605 Woodcrest Drive Edina, MN 55424	5N-7E, Sec. 31 219-14-2Q
Joanne Hilty 2218 East State Street Fremont, OH 43420	5N-7E, Sec. 31 219-14-4
McCullough Properties, Inc. P.O. Box 17795 Fountain Hills, AZ 85268	5N-7E, Sec. 32 219-14-1D
Rio Verde Box-Bar Ranch 3400 City Center Minneapolis, MN 55402	5N-7E, Sec. 32 219-14-1J & 1K
Rio Verde Utilities, Inc. 18815 Four Peaks Blvd. Rio Verde, Arizona 85255	5N-7E, Sec. 32 219-14-1M & 1N
Bob Brethower, Ranch Superintendent ? ? ?	

MKE
McLaughlin Knietty Engineers, Ltd.
3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

VOB

LETTER OF TRANSMITTAL

Date: 3-29-98	Job No.: 89-907.003
To: GVSCE	Attention: Mr. Tom Loomis
	Re: Rio Verde South
Scottsdale	

WE ARE SENDING YOU X ATTACHED ___ VIA deliver

Original:	Copies	Date	Description
	1	3-27-98	FCD Transmittal, Calcs + drawing

Remarks: Tom,
this is on the new diversion structure
in Tonto Verde

COPY TO ___

SIGNED Frank Edward Brown

WOOD/PATEL
ASSOCIATES
Civil Engineers
Hydrologists
Land Surveyors

Darrel E. Wood, P.E., R.L.S.
Ashok C. Patel, P.E., R.L.S.
James S. Campbell, P.E.
Jay N. Vaughn, R.L.S.
Gordon Wark, P.E.
Jeffrey J. Holzmeister, P.E.

COMMUNICATION RECORD

DATE: April 1, 1994

PROJECT NO: 93031.00

PROJECT NAME: Rio Verde - North Floodplain Delineation Study, Hydrology

SUBJECT: Hydrology Method, Input

Input Received from Sandy Story

Wood/Patel - Burgess & Niple, have submitted preliminary results of hydrology using various methods. The district has received the data submitted and concluded that the Phoenix Valley S-graph be utilized for the subject study.

CC:

Burgess & Niple:
Russ Cruff, P.E.
Larry D. Culler, P.E.
Larry J. Woodlan, P.E.

FCDMC:
Sandy Story
Magnus Jolayemi
Cathy Regester

George V. Sabol Consulting Engineers, Inc.
George Sabol, PhD, P.E.
Tom Loomis, P.E.

McLaughlin Kmetty Engineers, Ltd.
Frank Brown, P.E.

GENCOR\93031-00.404

MKE

McLaughlin Kuetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

	Date: 04-14-94 Job No.: 89-407.003
To: George V. Sabol Consulting Engineers, Inc.	Attention: Dr. George V. Sabol, P.E.
7950 East Acoma Drive	Re: Rio Verde South
Suite 211	
Scottsdale, Arizona 85260-6962	

WE ARE SENDING YOU ___ ATTACHED ___ VIA Hand Delivery

Original:	Copies	Date	Description
	1		Rio Verde Binder and Accordian File.
	1		Tonto Verde Binder and Accordian File.
	1		FEMA Binder and Accordian File.
	1		Data Collection Binder, including Summary Report for Phase I, Task 2 Data Collection dated 3-9-94.

Remarks:

COPY TO_____

SIGNED Barbara A. Larrieu
for Frank Brown, P.E.

BURGESS & NIPLE
ENGINEERS
ARCHITECTS

Burgess & Niple, Inc.
5025 East Washington Street
Suite 212
Phoenix, AZ 85034
602 244-8100
Fax 602 244-1915

RECEIVED APR 2 0 1994

LETTER OF TRANSMITTAL

DATE 4/19/94	JOB NO.
RE: Rio Verde South - Floodplain Delineation Study	

TO Gena Knuettel
W. Franklin Knuettel Engineers, Ltd.
3501 North 16th Street
Phoenix, AZ 85016

WE ARE SENDING YOU: ☑ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☑ Mapping and Auto CADD Files

COPIES	DATE	NO.	DESCRIPTION
1		2-8	Original Mylars of topographic work maps for Rio Verde South
1		1-5	Auto CADD digital files of topographic work maps for Rio Verde South
1		1-2	Digital files of centerline data for Rio Verde South

THESE ARE TRANSMITTED:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☑ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☐ As requested ☐ Returned for correction ☐ Return _____ corrected prints
☐ For review and comment ☐ _____

REMARKS _____

COPY TO Magnus Jolayemi
Cathy Rogerson
Larry Woodham

SIGNED Larry D. Cullaw

If enclosures are not as noted, kindly notify us at once.

MKE
McLaughlin Kmetty Engineers, Ltd.
3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 4/26/94 Job No.: 89-407.003

To: G.V.S.C.E.

Attention: Tom Loomis

Re:

WE ARE SENDING YOU ___ ATTACHED X VIA Hand Delivery

Original:	Copies	Date	Description
	1	–	24x36 Showing Blue Stream lines, red boundary + yellow flow splits.
	1		Exhibit 1 Floodplain Delineation Mapping Options 24x36
	1	12-16-92	2-303x33 Aerial photographs 1"=400' red + yellow stream lines & blue dots are known culverts). Photo dated 12-16-92

Remarks:

COPY TO

SIGNED Brant Edward Brown

BURGESS & NIPLE
ENGINEERS
ARCHITECTS

Burgess & Niple, Inc.
1106 North Beeline Highway
Payson, AZ 85541
602 474-5313
Fax 602 474-3511

LETTER OF TRANSMITTAL

DATE 5-3-94	JOB NO. 15183
RE: RIO VERDE FLOOD DELINEATION STUDY	

TO FRANK BROWN
MCLAUGHLIN KMETTY ENGINEERS

WE ARE SENDING YOU: ☑ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1			AERIAL CONTROL MAP W/PT#'S ON QUAD. MAP
1			" " LIST W/PT#'S, DESCRIPTION, POINT ELEV. & PANEL ELEV'S (ON USGS DATUM)
1			FIELD BOOKS - VERTICAL RUNS - (UNCONVERTED TO USGS DATUM)
1			GPS CONTROL DESCRIPTION SHEETS FOR HZ. CONTROL
1			ON-SITE QUALITY CONTROL SECTION PRINTOUT (ON USGS DATUM)
1			AERIAL MAPS - REDLINED W/AERIAL CONTROL, X-SEC'S, ERM'S & SECTION LINES

THESE ARE TRANSMITTED:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☑ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☐ As requested ☐ Returned for correction ☐ Return _____ corrected prints
☑ For review and comment ☐ _____

REMARKS _____

COPY TO P FILE
L. CULLER

SIGNED B. C. Maggett

If enclosures are not as noted, kindly notify us at once.

MKE McLaughlin Kinetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 5/2/94 Job No.: 89-907.003

To: George V. Sabol Consulting Engrs

Attention: Mr. Tom Loomis

Re: Rio Verde South

WE ARE SENDING YOU X ATTACHED ___ VIA 1st class mail

Original:	Copies	Date	Description
	1 ea	April 94	B+M coordinate data OFFSITE x-Sections
	1 ea	April 94	B+M Coordinate data GPS control, QC X-Sections

Remarks: Tom, this is as I received it. No other instructions / explanation was included.

Y TO _____

SIGNED Frank Edward Brown

89-407.003

TRANSMITTAL

TO: MKE
Attn: Mr. Frank Brown, P.E.

FROM: George V. Sabol Consulting Engineers, Inc.
7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

DATE: May 2, 1994

PROJECT No./Name: 46 Rio Verde

SUBJECT: Hydraulic Base Maps

ENCLOSED ARE THE FOLLOWING

1- Set of 200 scale base maps (prints)

REMARKS

Frank: I have outlined the flowlines of FEMA washes 9, 10 & 11 on the enclosed maps. I have not tried to select a HEC-2 100-year thalweg.

COPIES

SIGNED Tom Loomis

BURGESS & NIPLE
ENGINEERS
ARCHITECTS

Burgess & Niple, Inc.
5025 East Washington Street
Suite 212
Phoenix, AZ 85034
602 244-8100
Fax 602 244-1915

RECEIVED MAY 0 9 1994

LETTER OF TRANSMITTAL

DATE 5/9/94	JOB NO.
RE: Rio Verde South - Floodplain Delineation Study	

TO Diego Knowlton
McLaughlin Knowlton Engineering, Inc.
3501 North 16th Street
Phoenix, AZ 85016

WE ARE SENDING YOU: ☑ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☑ Photo transparencies

COPIES	DATE	NO.	DESCRIPTION
1		2-8	Original Mylars of photo transparencies of the Rio Verde South

THESE ARE TRANSMITTED:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☑ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☐ As requested ☐ Returned for correction ☐ Return _____ corrected prints
☐ For review and comment ☐ _____

REMARKS _____

COPY TO Magnus Jolayemi
C. Kathy Riegbates
Larry Wahlberg

SIGNED Larry D. Cullen

If enclosures are not as noted, kindly notify us at once.

MKE
McLaughlin Kuetty Engineers, Ltd.
3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

JOB
Rio Verde

LETTER OF TRANSMITTAL

To: GVSCE Inc	Date: 5-12-94 / Job No.: 89-407.003
	Attention: Mr. Tom Loomis
	Re: Rio Verde South

WE ARE SENDING YOU X ATTACHED ___ VIA pick-up

Original:	Copies	Date	Description
	1 ea	approx Dec 1993	7 sheets of Semi-rectified aerial photos, 200' Scale.

Remarks:

CC TO:

SIGNED Frank Edward Brown

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

Date 5-27-94

Page 1 of 3
INCL. this page

From Frank Brown

Transmitted to Fax Number 483-3990

To & Mr. Tom Loomis

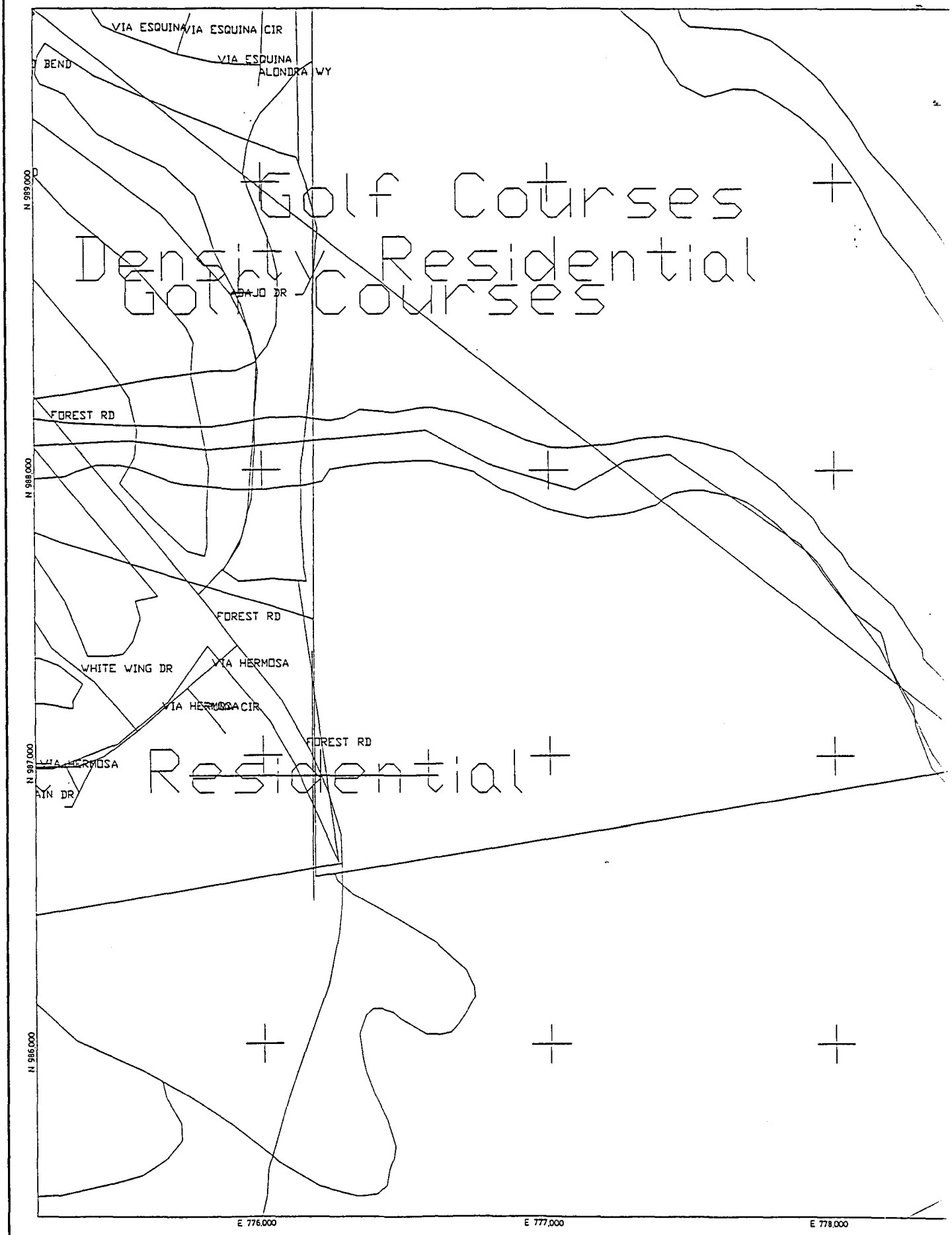
Company GVSCE Inc

Comments Tom, please review + comment.
On the right half of sheet 2 can you tell what the land use is? Do we need to transfer # labels, and where from?
Call us Tuesday morning.
Frank

Job # 89-407.003

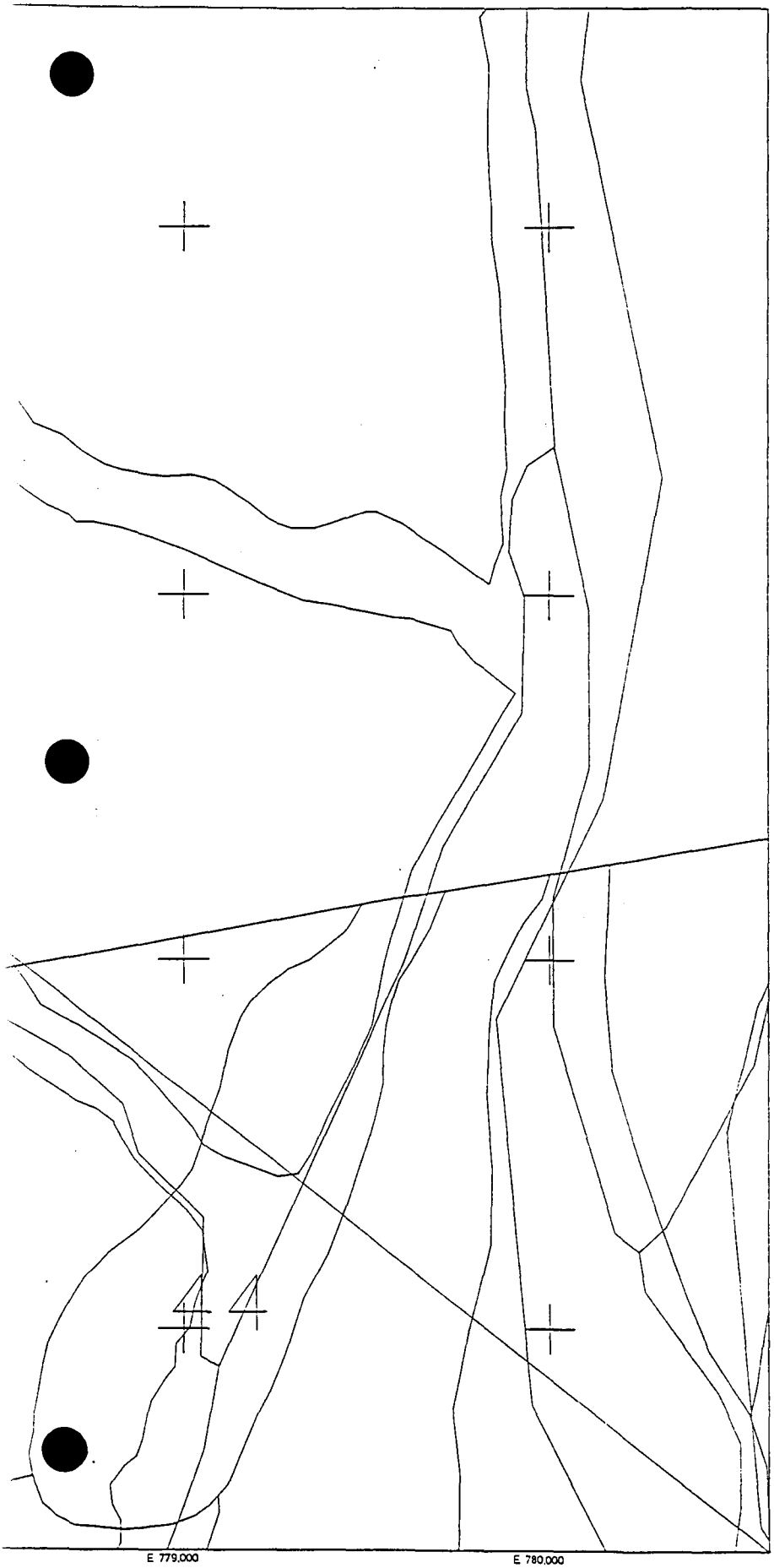
NOTE: If this transmission is incomplete, please call
(602) 248-7702

Admin\FaxForm.000



AERIAL MAPPING COMPANY, INC.
SURVEYING AND PHOTOGRAMMETRY
FLIGHT DATE: 12-22-1993

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STA...
1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS AND BASED ON GROUND CONTROL ...
DATA PROVIDED BY PROJECT ENGINEERING AND AERIAL MAPPING COMPANY, INC.



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF

RIO VERDE SOUTH

F.C.D. CONTRACT NO. 93-07

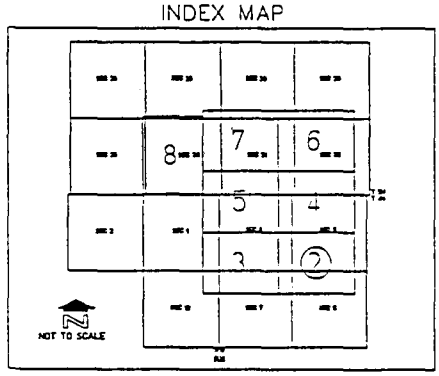
ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION

NOTES

INDEX MAP



200 0' 200 400

SCALE: 1"= 200'

CONTOUR INTERVAL = 2' FEET

HYDROLOGY EXHIBIT

LAND USE MAP

McLAUGHLIN KMETTY ENGINEERS

	BY	DATE
DESIGN	F.C.D.M.C.	1993
DESIGN CHK.	TRL	6/94
PLANS	BKE	5/94
PLANS CHK.	TRL	6/94
SUBMITTED BY:		DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE

APPROVED BY: DATE

CHIEF ENGINEER AND GENERAL MANAGER

SHEET OF

MKE
McLaughlin Kmetty Engineers, Ltd.
3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 5/31/94 Job No.: 89-407.003

To: George V. Sabol Consulting

Attention: Mr. Tom Loomis

Re: Rio Verde South

WE ARE SENDING YOU X ATTACHED ___ VIA deliver via G.K.

Original:	Copies	Date	Description
1		5/31/94	Original Mylars- Land Use Maps

Remarks: Tom,
layers are as requested - 4 layers (zero, PLSS, Landuse and Streets as dashed lines). ~~Hope~~ Hope it meets your needs. 1000' Scale map forthcoming.

COPY TO ___

SIGNED Frank Edward Brown

JCB

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 6-1-94	Job No.: 89-407.003
To: George V. Sabol Consulting Engrs	Attention: Mr. Tom Loomis
	Re: Rio Verde South

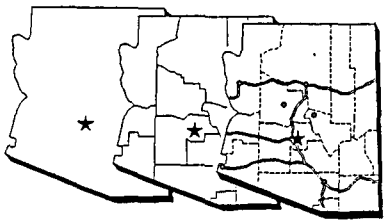
WE ARE SENDING YOU X ATTACHED — VIA pick-up

Original:	Copies	Date	Description
		6-1-94	Original Mylar, 1000' Land Use Map.

Remarks: Tom,
as requested.

COPY TO

SIGNED Frank Edward Brown



GIS Consultants of Arizona, Ltd.

June 8, 1994

Mr. Frank Brown
McLaughlin Kmetty
3501 N. 16th Street, Suite B
Phoenix, Arizona 85016

RE: RIO VERDE SOUTH - FCDMC FLOODPLAIN DELINEATION STUDIES
Letter of Transmittal - Revised FMDMC & USGS 7.5' study base maps

Dear Mr. Brown:

Please find attached the Revised digital Topographic base maps and FCDMC Coverages for Rio Verde South - This data is on a Arizona State Plain, NAD 83 shifted for local adjustment in the coordinate system to match the project mapping based on USGS Published local adjustment.

The adjusted stream lines are included (as continuous polylines) for your project watershed study area. A copy of the stream data (only) is being delivered to Tom Loomis at G.V. Sabol Engineers. They have already received the balance of the adjusted data under separate cover.

Please contact me should you have any questions or comments

Sincerely,

GIS Consultants of Arizona, Ltd.

L. Don Spire, RLS
President

cc: Tom Loomis, G.V. Sabol Engineers

3141 West Clarendon Ave., Phoenix, AZ 85017 (602) 263-5794 Fax (602) 263-0165

JOB

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 6-15-94 Job No.: 89-407.003

To: George V. Sabol Consulting Engineers

Attention: Mr. Tom Loomis

Re: Rio Verde South

WE ARE SENDING YOU X ATTACHED ___ VIA certified courier

Original:	Copies	Date	Description
1		—	1" = 1000' redmark vellum
1		—	1" = 200' original redmark bluelines
1			Bond p/n ÷ 1" = 1000'
1			Bond p/n ÷ 1" = 200'

Remarks: Tom,

as requested, here are the newly generated Subbasin maps.

COPY TO _____

SIGNED Frank Edward Green

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

Date 6/21/94

From Frank Brown

Transmitted to Fax Number 483-3990

To Tom Loomis

Company GVSCE, Inc

Comments State Plane coords for requested points 2, 3, 21, +23.

Here is the Legend for B+M maps:

◇ = Quality Control Check sections

○ = vertical only control

△ = Horizontal + Vertical Control

□ = Land Corner

Job # Frank

Rio Verde South

89-407.003

NOTE: If this transmission is incomplete, please call
(602) 248-7702

Translated Coords for AMC
Fieldbook 6/20/94 CPM

168466	770889.756	988395.476	1650.689
168467	770888.409	988796.727	1649.013
168468	773298.229	987990.729	1600.670
168469	773336.512	988487.214	1601.185
168470	774399.777	992516.875	1589.011
168471	774365.906	997416.628	1587.095
168472	772189.477	992767.457	1632.793
168473	772581.275	991905.364	1626.089
168475	766285.788	993222.341	1803.817
168476	766311.438	993922.651	1782.003
168477	765973.112	995635.917	1791.734
168478	765883.506	996665.762	1794.998
168479	765786.465	1001291.453	1807.150
168480	765872.684	998304.476	1799.557
168481	765914.947	998038.858	1797.077
168482	773925.872	1000172.955	1590.723
168483	773951.173	999839.180	1595.339

FRANK

These are the ANALYTICAL Values FOR the points you Requested. ← this is from Bob Parks, AMC dated 6/17/94.

LAST TWO DIGITS are B/N POINT #s

per R. Cook 11:30 AM 6-21-94

Point 21 Horiz + Ctrl.

765829.830 994779.816 1793.336

point 23 VRT obs - analytic values

771114.672 992167.140 1653.42 (appx ground elev)

point 3 AMC pt + 303 Analytic

771100.985 997447.302 1654.13 point elev.

Bad Point (E/C)

target 1657.375 1" I. Pipe End

point 1655.995

+ 69 B+N + 2.67 AMC has 1' dif. received.

pt 2 Analytic B+M Brass Cap

776380.178 997457.937 target 1542.26

point 1542.58

MKE
McLaughlin I netty Engineers, Ltd.
3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 6/23/94	Job No.: 89-407.003
To: Rural Metro Fire Station Rio Verde, AZ	Attention: Mr. Dick Reed
	Re: Rio Verde South

WE ARE SENDING YOU X ATTACHED ___ VIA deliver

Original:	Copies	Date	Description
	1	12-22-93	Aerial Photographs + Topo Map, blueline, 1"=200'

Remarks: Dick,
as you requested. The aerial photos for Rio Verde North (North of Rio Verde Drive) will be sent to you ~~soon~~. (they are being printed now).

COPY TO Cathy Regester FCDMC

SIGNED Frank Edward Brown

BURGESS & NIPLE
ENGINEERS
ARCHITECTS

Burgess & Niple, Inc.
5025 East Washington Street
Suite 212
Phoenix, AZ 85034
602 244-8100
Fax 602 244-1915

RECEIVED JUN 2 4 1994

LETTER OF TRANSMITTAL

DATE 6/23/94	JOB NO. 89-407.002
RE: Rio Verde Floodplain Delineation Study	

TO Frank Brown
McLaughlin Kmetty Engineers
3501 North 16th Street
Phoenix, AZ 85016

WE ARE SENDING YOU: ☑ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☑ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1		2-6	Prints of photo transparencies for Rio Verde North

THESE ARE TRANSMITTED:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☐ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☑ As requested ☐ Returned for correction ☐ Return _____ corrected prints
☐ For review and comment ☐ _____

REMARKS You requested these for the fire department.

COPY TO _____ **SIGNED** Larry D. Cullen

If enclosures are not as noted, kindly notify us at once.

89-407.003

BURGESS & NIPLE
ENGINEERS
ARCHITECTS

Burgess & Niple, Inc.
5025 East Washington Street
Suite 212
Phoenix, AZ 85034
602 244-8100
Fax 602 244-1915

LETTER OF TRANSMITTAL

DATE 6/27/94	JOB NO.
RE: Rio Verde South Floodplain Dedineation Study	

TO Frank Brown
Mc Laughlin Knuetty Engineers
3501 North 16th Street
Phoenix, AZ 85016

WE ARE SENDING YOU: ☑ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☑ Mapping

COPIES	DATE	NO.	DESCRIPTION
1		2-8	Revised original Mylars of topographic maps for Rio Verde South

THESE ARE TRANSMITTED:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☑ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☐ As requested ☐ Returned for correction ☐ Return _____ corrected prints
☐ For review and comment ☐ _____

REMARKS These have been revised to correct the statement in the bottom, center margin concerning surveying and to correct the spelling of Mc Laughlin in the title block.
These should supersede the original maps sent for you on April 19, 1994.

COPY TO _____ **SIGNED** Larry D. Cullers

If enclosures are not as noted, kindly notify us at once.

JOB

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 6/27/94 | Job No.: 89-407.003

To: George V. Sabol Consulting Engineers, Inc

Attention: Mr. Tom Loomis

Re: Rio Verde South

WE ARE SENDING YOU ☒ ATTACHED ☐ VIA Pick-up

Original:	Copies	Date	Description
1 ea		6/27/94	3 sheets 500' Hydrology Exhibits >
1 ea		"	7 sheets 200' " " & Bond Plots
1 ea		—	redmarks being returned to you.

Remarks: Tom,

please & let us know when you have the final redmarks on those & we'll schedule the CADD drafting for them.

COPY TO _____

SIGNED Frank Edward Kmetty

RECEIVED JUN 2 8 1994

89-407.003

BURGESS & NIPLE
ENGINEERS
ARCHITECTS

Burgess & Niple, Inc.
5025 East Washington Street
Suite 212
Phoenix, AZ 85034
602 244-8100
Fax 602 244-1915

LETTER OF TRANSMITTAL

DATE 6/27/94	JOB NO.
RE: Rio Verde Floodplain Delineation Study	

TO Maggie Johansen
FCD of Maricopa County
2801 West Durango
Phoenix, AZ 85009

WE ARE SENDING YOU: ☑ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☑ Cross Sections

COPIES	DATE	NO.	DESCRIPTION
1			Mapping Revisions, Sections 1 through 3 and 5 through 10 for Rio Verde North and South C

THESE ARE TRANSMITTED:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☐ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☑ As requested ☐ Returned for correction ☐ Return _____ corrected prints
☐ For review and comment ☐ _____

REMARKS _____

COPY TO Cathy Reposten
Frank Brown
Kenny Woodson

SIGNED Kenny D. Cullum

If enclosures are not as noted, kindly notify us at once.

89-407.003

TRANSMITTAL

RECEIVED JUN 2 8 1994

TO: MKE
Attn: Frank Brown

FROM: George V. Sabol Consulting Engineers, Inc.
7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

DATE: June 27, 1994

PROJECT No./Name: 46 Rio Verde

SUBJECT: Landuse Map

ENCLOSED ARE THE FOLLOWING

1- set of redlines of landuse exhibit.

REMARKS

Call Mike or me with any questions.

*** The landuse map needs to be translated 40' north in relation to B+N's topography + horizontal control.

COPIES

SIGNED Tom Loomis

89-417-2C3

RECEIVED JUN 29 1994

BURGESS & NIPLE
ENGINEERS
ARCHITECTS

Burgess & Niple, Inc.
5025 East Washington Street
Suite 212
Phoenix, AZ 85034
602 244-8100
Fax 602 244-1915

LETTER OF TRANSMITTAL

DATE 6/28/94	JOB NO.
RE: Rio Verde South Floodplain Delineation Study.	

TO Frank Brown
McLaughlin Kmetty Engineers
3501 V North 16th Street
Phoenix, AZ 85016

WE ARE SENDING YOU: ☑ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☑ Cross sections

COPIES	DATE	NO.	DESCRIPTION
1			Mapping Quality Control. Sections 1 through 3 and 5 through 7 for Rio Verde South

THESE ARE TRANSMITTED:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☑ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☐ As requested ☐ Returned for correction ☐ Return _____ corrected prints
☐ For review and comment ☐ _____

REMARKS These sections were reviewed with Magnus Jolayemi yesterday. Magnus is providing copies to Cathy Regester.

COPY TO Magnus Jolayemi
Cathy Regester
Larry Woodson

SIGNED Larry D Cullom

If enclosures are not as noted, kindly notify us at once.

Hand Delivered

89-407.003

RECEIVED JUL 0 7 1994

TRANSMITTAL

TO: MKE
Attn: Frank Brown

FROM: *George V. Sabol Consulting Engineers, Inc.*
7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

DATE: July 6, 1994

PROJECT No./Name: 46 Rio Verde

SUBJECT: Exhibits "D" & "E"

ENCLOSED ARE THE FOLLOWING

1- Redlines of 500 scale Exhibit D
1- " " 200 Scale " E

REMARKS

For CADD.

COPIES

SIGNED Thomas R. Loomis

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

50-403.003

LETTER OF TRANSMITTAL

Date: 7/11/94	Job No.: 93-404-001
To: George V. Sabol Consulting Engrs	Attention: Tom Loomis
	Re: Rio Verde South

WE ARE SENDING YOU ___ ATTACHED ___ VIA_____

Original:	Copies	Date	Description
1		June 1994	1"=200' I.C.I. Colored topo Map - Tonto Verde

Remarks: Tom,

will hydrology to attached by
1 1 1

what we know today about new contours
2 0

as with II?

COPY TO_____

SIGNED Frank Edward Brown

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 07-15-94	Job No.: 89-407.003
To: George V. Sabol Consulting Enginerrs, Inc. 7950 East Acoma Drive Suite 211 Scottsdale, AZ 85260-6962	Attention: Tom Loomis Re: Rio Verde South

WE ARE SENDING YOU ___ ATTACHED X VIA Hand Delivery

Original:	Copies	Date	Description
	1		Redlined Hydrology Exhibits.

Remarks:

COPY TO

SIGNED Frank Edward Kmetty

RECEIVED JUL 15 1994

TRANSMITTAL

TO: FRANK BROWN @ MKE

FROM: *George V. Sabol Consulting Engineers, Inc.*
7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

DATE: 14 JULY 94

PROJECT No./Name: 46 / RIO VERDE SOUTH FES

SUBJECT:

ENCLOSED ARE THE FOLLOWING

Red lined Landuse Exhibit
Red lined Soils Exhibit

REMARKS

Please make changes in CAD and return.

COPIES

SIGNED DTP

Office
89-407.003

RECEIVED JUL 19 1994

TRANSMITTAL

TO: MIKE

ATTN: FRANK BROWN

3501 N 16th Street

PHOENIX AZ 85016

FROM: *George V. Sabol Consulting Engineers, Inc.*

7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

DATE: 19 JULY 94

PROJECT No./Name: 46- Rio Verde South FIS

SUBJECT: HYDROLOGY EXHIBITS D and E

ENCLOSED ARE THE FOLLOWING

Red lined set of Exhibit D

Red lined set of Exhibit E

REMARKS

Pleas make changes and return ASAP

Let us know if you have any questions or concerns.

COPIES

SIGNED DTP

MKE
McLaughlin Kmetty Engineers, Ltd.
3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 7/25/94 Job No.: 89-407.003

To: George V. Sabol Consulting Engrs

Attention: Mr. Tom Loomis

Re: Rio Verde South

WE ARE SENDING YOU X ATTACHED ___ VIA deliver

Original:	Copies	Date	Description
	1	7/22/94	Rio Verde South n value report.
1 ea			RUS Hydrology Maps - Bond Plots
1 ea			RUS Hydrology Red Marks
1		March 93	FEMA 37

Remarks: Tom, please return the n value report when finished, and I can reuse it for Final Report. Let me know when you make your submittal to FCDMC, via "copy to" on the transmittal letter.

COPY TO ___

SIGNED Frank Edward Brown

RECEIVED AUG 0 2 1994

TRANSMITTAL

89-407.003

TO: GCA
Attn: Lari Spire

FROM: *George V. Sabol Consulting Engineers, Inc.*
7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

DATE: August 1, 1994

PROJECT No./Name: 46 Rio Verde FIS FCD 93-07

SUBJECT: Hydrology

ENCLOSED ARE THE FOLLOWING

1- Exhibits B, C, D + E

REMARKS

COPIES Frank Brown, MKE (including exhibits)

SIGNED Thomas R. Loomis

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

15

Date 8-[illegible]-94

From Frank Brown

Transmitted to Fax Number 483-3990

To Mr. Tom Loomis

Company GVSCE.

Comments Re: Rio Verde South.

I received these comments on Hydrology Review by Sandy Story late last week. Please review + comment.

Sandy is at an Arc-Info seminar/training for 2 weeks. Kindly stay by your phone 8-15-94 Monday during lunch hour and Sandy will call you. Thanks.

Job #

Rio Verde South 89-407.003

NOTE: If this transmission is incomplete, please call
(602) 248-7702

ASPEN, CO (303) 925-1920 | TULSA, OK (918) 582-6800 | DENVER, CO (303) 458-5550 | SUMMIT COUNTY, CO (303) 468-2141

FLOOD CONTROL DISTRICT of Maricopa County

Interoffice Memorandum

CMT. NO.	SUBJECT: RIO VERDE SOUTH FDS	☐ FILE ☐ DESTROY

TO: CWR FROM: SS DATE: 8/11/94

* I have previously reviewed Exhibits B & C and forwarded those comments to Tom.

* I have completed my review of ~~exhibit~~ "D" and the combination and routing logic of the HEC-1 and have the following comments:

1. It is hard to determine exactly where CP531 & CP580 are on the map "exhibit D".
2. The routing arrows are backwards for 565566 & 566567.
3. CP563 is shown on the map but is not in the HEC-1 model.
4. CP503 should be shown as a diversion on the map, not a CP.
5. CP509 is shown as a diversion on the map, but is not according to the HEC-1 model.

* Also - the 100yr-6hr value of 3.25 inches differs from the 100yr-6hr value of 3.40 inches given in the Rio Verde North study.

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

08-17-94

LETTER OF TRANSMITTAL

Date: ~~07-11-94~~	Job No.: 89-407.003
To: George V. Sabol Consulting Engineers, Inc	Attention: Mr. Tom Loomis, P.E.
7950 East Acoma Drive	Re: Rio Verde South
Suite 211	
Scottsdale, AZ 85260-6962	

WE ARE SENDING YOU X ATTACHED ___ VIA Pick Up or Deliver

Original:	Copies	Date	Description
1		12-10-92	Photo dated 12-10-92; Sections 3-4-9-10 T4N R6E Aerial photograph, mounted on plastic film.

Remarks: Tom

We received this in conjunction with our Rio Verde South proposal about June, 1993. This is within our Study Area, so I am giving it to you. Please return this at the end of the project.

COPY TO _____

SIGNED Frank Edward Brown

Frank Edward Brown, P.E.

JOB

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 8-19-98 | Job No.: 89-407,003

To: Aerial Mapping Company

Attention: Mr. Richard Cook

Re: Rio Verde South
MKE Task 6.8.1

WE ARE SENDING YOU X ATTACHED ___ VIA hand-deliver via certified courier

Original:	Copies	Date	Description
1		6/23/98	Original Mylar Sheet 5 of 8
	1	8-19-98	Redlined blue lines sheets 2 → 7 with HEC-2 X-S
	1	8-19-98	Photogrammetric Cross-Sections List & Instructions
1		July 22, 1998	Hydrology Exhibit E with green high light.
	1	8-19-98	Disk with thalweg as "HEC-2" layer.

Remarks: Richard,

Please read enclosed List & Instructions.

This is not a step-by-step instruction sheet so please call with any & all questions.

COPY TO _____

SIGNED Frank Edward Brown

MKE McLaughlin Kmetty Engineers, Ltd.

Project Title Rio Verde South Project No. 89-407,003 Date 8-19-94

Subject Task 6.8.1 Designed TC Page 1/1

Photogrammetric Cross-Section List & Instructions

1. Digitize the cross-sections noted in red,
   a. digitize a point at every P.I. and every purple tick mark and every green thalweg.
2. Provide X1 & GR data in Standard HEC-2 format.

   Code with GR Station @ the green thalweg (use the disk provided with thalweg) using Station 10,000 at the thalweg.
3. Color code of cross-sections on sheet 2 not strictly adhered to.

Wash 11 Photogrammetric Cross-Sections = 20

Cross-Section #	
1	11
2	12
3	13
4	14
5	15
6	16
7	17
8	18
9	19
10	20 (also a QC Section, but it not in 10,000 station format)

Wash 10 Photogram x-s = 16

Cross-Section #		
5	12	19
6	13	20
7	14	
8	15	
9	16	
10	17	
11	18	

Wash 9 Photogram x-s = 25

Cross-Section #				
1	6	18	24	29
2	7	19	25	34
3	8 < 13	20 < 21	26	39 (also a QC Section not in 10,000 Sta. format)
4	16	22	27	
5	17	23	28	

WOOD, PATEL & ASSOC. INC.

Civil Engineers, Hydrologists, Land Surveyors

1550 East Missouri, Suite 203
Phoenix, AZ 85014
(602) 234-1344 • FAX 234-1322

RECEIVED AUG 2 4 1994

LETTER OF TRANSMITTAL

MKE on 89-407.003

DATE: August 24, 1994	JOB NO. 93031.00
ATTENTION: Tom Loomis, P.E.	
RE: Rio Verde - North FPDS hydrology coordination	

TO:

George V. Sabol Consulting Engineers, Inc.
7950 E. Acoma Dr. Suite 211
Scottsdale, AZ 85260-6962

WE ARE SENDING YOU ■ Attached □ Under separate cover via PICK-UP the following items:

□ Shop drawings □ Prints □ Plans □ Samples □ Specifications
□ Copy of letter □ Change Order ■ Other (Files)

COPIES	DATE	NO.	DESCRIPTION
1	8/24/94		11"x17" copy of portion of drainage map and HEC-1 schematic
1	8/24/94		One 5 1/4" diskette containing TAPE21 files for divert operation 165DR for 6-hour and 24-hour storms

THESE ARE TRANSMITTED as checked below:

□ For approval ■ Approved as submitted □ Approved as noted
■ For your use ■ As requested □ For review and comment

REMARKS:

Note that the NMIN value for both files is 5 minutes.

Stored on MKE computer as:

C:\P\RIOVERDE\HEC1\RIONORTH file names TAPE21.06H
TAPE21.24H

A. Regis 8/24/94

COPY TO: Larry Culler, P.E., Burgess & Niple

SIGNED: Anthony J. Regis, P.E.

FORMS\TRANSMIT.GEN

MKE
McLaughlin Kretty Engineers, Ltd.
3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

JSB

LETTER OF TRANSMITTAL

Date: 8/24/94 Job No.: 89-407.00

To: George V. Sabol Consulting Engrs

Attention: Mr. Tom Loomis

Re: Rio Verde South

WE ARE SENDING YOU X ATTACHED ___ VIA pick-up

Original:	Copies	Date	Description
	1	unk	Disk containing AutoCadd file needed to generate the Hydrology Maps.

Remarks:

Tom,

Please note that the recent revisions necessary per Lori Spire's work are not incorporated into these drawings. Lori expects to send the disks to us on 8/25/94.

COPY TO ___

SIGNED Frank Edward Brown

89-407.003

BURGESS & NIPLE

ENGINEERS

ARCHITECTS

RECEIVED AUG 2 5 1994

Mr. Frank Brown
McLaughlin Kmetty Engineers, Ltd.
3501 North 16th Street
Phoenix, AZ 85016

Re: Rio Verde North
Floodplain Delineation Study

August 25, 1994

Dear Mr. Brown:

Burgess & Niple, Inc.
5025 East Washington Street
Suite 212
Phoenix, AZ 85034
602 244-8100
Fax 602 244-1915

During a phone conversation, this date, we discussed a flow breakout included in the HEC-2 model for Rio Verde North. The breakout occurs at Section 2.494 of Wash A and discharges 210 cfs to Rio Verde South.

Enclosed is a print of Sheet 5 of the maps for Rio Verde North, which shows the location of the flow breakout.

Very truly yours,

Larry D. Culler

Larry D. Culler, PE

copy: Magnus Jolayemi
Cathy Regester
Sandy Story

Jackpile
89-407.003

8/26/94

TO FRANK BROWN

To Richard Alcocer Ref Rio Verde

Need to Level between 168540A Pt. ½" Pipe which was targeted this Time and PT 168542 original pt which is 17'± More West. Original Pt was set by B&N Pt. Targeted is probably center of Section or Break-Hersey Point.

I have No coordinate Value for Richards pt #1, but Assuming, it is on line between 470 & 471, which it probably isn't perfect yet straight line, ± Calculate a value that is about 1'x1' from our Jury rigged model set up.

CONTENT OF GROUND MEMORY (COMPLETE COORDINATES) DATE 1994. 9.25.10 10

	POINT	NS	EW	EL	REGISTER
New Pt	138040	772581.118	994507.201	1632.603 ±	1
	r168470	774999.777	992516.875	1589.011	2
	r169472	772189.477	992767.457	1632.793	3
	168542 A	773335.341	994804.752	1610.772	4
	r168552	773316.250	994433.675	1612.194	5

old pt 542 773317.6

Elev Based on wrong Pt 542
Used as BM

COORDINATE FILE: MY LENGTH = 208 POINTS; TIME ON FILE: 0 . 10.00
RIO VERDE JUNK BTL. ***** JOB #94134

xxxxxxxxxxxxx COGO xxxxxxxxxxxxx

FROM TYPE	BEARING	DISTANCE	TO	NORTHING	EASTING	ELEVATION
ENTER & ADDLGN						
			70	992,516.87530	774,399.77748	168470
			71	997,416.62050	774,385.98610	168471
			2	774,[illegible]	[illegible] TR PT 2	
			3	774,[illegible]	[illegible] TR PT 3	
START			3	772,[illegible]	[illegible] TR PT 3	
3	INV NE	86 41 27.06	1104.1900	2	772,[illegible]	[illegible] TR PT 2
2	TRAV SE	64 30 19.94	782.7000	1	776,[illegible]	[illegible] TR PT 1
START				71	997,416.62050	774,385.98610 168471
71	INV SE	86 41 27.06	4584.3725	70	992,516.87530	774,399.77748 168470
70	TRAV NW	0 00 42.94	1667.5705	1	994,184.45062	774,[illegible] TR PT 1
1	TRAV NW	64 30 19.94	782.7000	2	994,[illegible]	773,760.70852 TR PT 2
2	TRAV SW	86 41 27.06	1104.1900	3	994,423.19649	772,658.43192 TR PT 3
START				2	994,[illegible]	773,760.70852 TR PT 3
2	INV SW	86 41 27.06	1104.1900	3	994,423.19649	772,658.43192 TR PT 3
3	TRAV NW	00 18 35.74	208.0200	4	994,[illegible]	772,[illegible] NEW PT
LIST						
			1	994,184.45062	774,[illegible] TR PT 1	
			2	994,[illegible]	773,760.70852 TR PT 2	
			3	994,423.19649	772,[illegible] TR PT 3	
			4	994,[illegible]	772,[illegible] NEW PT	
			70	992,516.87530	774,399.77748 168470	
			71	997,416.62050	774,385.98610 168471	

TIMES ON THIS RUN: 0 . 14 12.33; TOTAL TIME ON FILE: 0 . 14 12.33
COORDINATES STORED

Approx ±

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 9-1-94 | Job No.: 89-907.003

To: George V. Sabol Consulting Engrs

Attention: Mr. Tom Loomis

Re: Rio Verde South

WE ARE SENDING YOU X ATTACHED ___ VIA mail

Original:	Copies	Date	Description
	1	Sealed 30 AUG 94	Sheets 5 + 7 new mapping

Remarks: Tom,

this is the new mapping as a result of Change Order #1. As we previously agreed, this new mapping will not affect your hydrology; thus I am simply keeping you updated on this project.

COPY TO ___

Thanks much,

SIGNED Frank Edward Brown

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

Date 8/26/94

From Frank Brown

Transmitted to Fax Number 263-0165

To Mr. Richard Cook

Company Aerial Mapping Company

Comments Richard, here are Richard Alcocer's (pages 47-50) field notes on Additional Aerial Panel. Will you review them to resolve coordinate problem? Richard Alcocer will call me about 10:30 or 11 AM today - so please tell me by then what you need Richard Alcocer to do to fix the problem. Frank Brown

Job # Rio Verde South 89-407.003

NOTE: If this transmission is incomplete, please call
(602) 248-7702

Admin\FaxForm.000

TO: Frank Brown & Richard Alcocer

28-407.003

RECEIVED AUG 2 9 1994

RECEIVED AUG 2 9 1994

COORDINATE FILE:MKE LENGTH = 200 POINTS; TIME ON FILE: 0 14 12.53
RIO VERDE JUNK STUFF ***** JOB #94130

********** COGO **********

FROM	TYPE	BEARING	DISTANCE	TO	NORTHING	EASTING	ELEVATION

LIST

1	994,184.45862	774,395.05644	TR PT 1
2	994,486.91746	773,760.78052	TR PT 2
3	994,423.19049	772,658.43102	TR PT 3
4	994,505.91335	772,382.54617	NEW PT
70	992,516.87530	774,399.77740	168470
71	997,416.62850	774,385.90610	168471

TIME FOR THIS RUN: 0 00 52.12; TOTAL TIME ON FILE: 0 15 04.65
COORDINATES STORED

COORDINATE FILE:MKE LENGTH = 200 POINTS; TIME ON FILE: 0 15 04.65
RIO VERDE JUNK STUFF ***** JOB #94130

********** ROTATION **********

ROTATE LINE 70TO 1 ABOUT 70 NW 0 09 43.94 1662.5900
TO NW 0 12 43.94
A ROTATION OF- 0 03 00.00 ← Per R. Alcocer

SCALE 1.0000000
TRANSLATE TO: 70 992,516.87530 774,399.77740

FROM	BEARING	DISTANCE	TO	NORTHING	EASTING
			1	994,184.45386	774,393.60119
1	NW 64 33 19.94	702.7000	2	994,486.35907	773,759.06156
2	SW 86 38 29.06	1104.1900	3	994,421.67014	772,656.76809
3	NW 73 21 31.94	288.0200	4	994,504.15221	772,380.81116

TIME FOR THIS RUN: 0 00 56.72
TOTAL TIME ON FILE: 0 16 01.37
COORDINATES STORED

COORDINATE FILE:MKE LENGTH = 200 POINTS; TIME ON FILE: 0 16 01.37
RIO VERDE JUNK STUFF ***** JOB #94130

********** COGO **********

FROM	TYPE	BEARING	DISTANCE	TO	NORTHING	EASTING	ELEVATION

LIST

1	994,184.45386	774,393.60119	TR PT 1
2	994,486.35907	773,759.06156	TR PT 2
3	994,421.67014	772,656.76809	TR PT 3
4	994,504.15221	772,380.81116	NEW PT

Revised Per R. Alcocer

MKE
McLaughlin Kmetty Engineers, Ltd.
3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 8/29/94 Job No.: 89-407.003

To: George V. Sabol Consulting Engineers

Attention: Mr. Tom Loomis

Re: Rio Verde South

WE ARE SENDING YOU X ATTACHED ___ VIA pick-up

Original:	Copies	Date	Description
	1	25AUG94	Letter from Larry Culler (B+N) to Frank Brown (MKE)
			Concerning 210 cfs breakout
	1	RECD 25AUG94	Sheet 5 of Rio Verde North.

Remarks: Tom,

please review this breakout + advise me about its effect on ~~the~~ your HEC-1 model. Larry tells me this breakout is not in Rio Verde North HEC-1 model.

COPY TO ___

SIGNED Frank Edward Brown

BURGESS & NIPLE

ENGINEERS
ARCHITECTS

RECEIVED AUG 25 1994

Mr. Frank Brown
McLaughlin Kmetty Engineers, Ltd.
3501 North 16th Street
Phoenix, AZ 85016

Re: Rio Verde North
Floodplain Delineation Study

August 25, 1994

Dear Mr. Brown:

Burgess & Niple, Inc.
5025 East Washington Street
Suite 212
Phoenix, AZ 85034
602 244-8100
Fax 602 244-1915

During a phone conversation, this date, we discussed a flow breakout included in the HEC-2 model for Rio Verde North. The breakout occurs at Section 2.494 of Wash A and discharges 210 cfs to Rio Verde South.

Enclosed is a print of Sheet 5 of the maps for Rio Verde North, which shows the location of the flow breakout.

Very truly yours,

Larry D. Culler

Larry D. Culler, PE

copy: Magnus Jolayemi
Cathy Regester
Sandy Story

AERIAL MAPPING COMPA[illegible], INC.
3141 W. Clarendon Avenue
PHOENIX, AZ 85017-4588

TEL (602) 263-5728
FAX (602) 263-0165

LETTER OF TRANSMITTAL

RECEIVED AUG 3 1 1994

DATE	JOB NO.
8-31-94	94138

ATTENTION

RE: Rio Verde South CO

TO McLaughlin Kinetty ENG

WE ARE SENDING YOU ☐ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1 ea.	8/30/94	5&7	Topographic Maps w/ New CADD Data
1 ea.	8/22/94	1-3	Spots 1&10560 Contours
1 ea.	8/22/94	1(1-3)	1:7200 Mapping Contours
1 ea.	8/22/94	5&7	Photo Mylar Transparencys
1 ea.	5/2/94	1&2&3	Descriptives for Scanning by FCD

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit_____copies for approval
☐ For your use ☐ Approved as noted ☐ Submit_____copies for distribution
☑ As requested ☐ Returned for corrections ☐ Return_____corrected prints
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 19_____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS _____

COPY TO File

SIGNED: [signature]

If enclosures are not as noted, kindly notify us at once.

Gaspé

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 9-1-94 Job No.: 89-407.003

To: Aerial Mapping Company

Attention: Mr. Richard D. Cook

Re: Rio Verde South

WE ARE SENDING YOU X ATTACHED ___ VIA ~~deliver~~ pick-up

Original:	Copies	Date	Description
1 ea		Sealed 30 AUG 94	Sheets 5 and 7 original mylars.
1 ea		8/31/94	3½" Disks with NEW 5 + 7. ZIP files
1 ea		4/18/94	Previous submittal Bluelines - as a Sample of how crisp + clear line weights were before.
1 ea		9-1-94	Sheets 5 + 7 labeled "HEC-2 9-1-94"
1		Revised 9-1-94	Photogram. Cross-Section List + Instructions.

Remarks: Richard:

1. Please verify flight date in lower left hand corner.
2. Please revise the line weight on the following contours (they are washed out compared to previous submittal) (highlighted in green on HEC-
   A. Sheet 5: 1580 → 1600, 1610 (South half only!) 1620 → 1700
   B. Sheet 7: 1570 → 1690 except South ⅓ of 1620, 1650 → 1670 are OK!
3. Please add 11 cross sections to your HEC-2 GR records See enclosed List + Instructions + see enclosed redlines.
4. What does "-------" mean (see sheet 5)? Provide any legend you have readily available.
5. Please increase line weight on houses/Bldgs to match previous maps.
6. Please review streets line weight - I liked previous better (was thicker).
7. Please replot these 2 sheets, since I must submit mylars with info only to the District. Consider adding Alcoa Land Surv. to Gr. Control No. For the next job would you consider placing sheet #'s in "sheet ___ of ___" area? Don't do it now or line styles/fonts must match our ink-on-mylar.

COPY TO ___

Thanks for your attention to all these details.

SIGNED Frank Edward Brown

MKE McLaughlin Kmetty Engineers, Ltd.

Revised 9-1-94

Project Title Rio Vista South Project No. 89-407,003 Date 8-19-94

Subject Task 6.8.1 Designed DTL Page 1/1

Photogrammetric Cross-Section List + Instructions

1. Digitize the cross-sections noted in red,
   a. digitize a point at every P.I. and every purple tick mark and every green thalweg.
2. Provide X1 + GR data in Standard HEC-2 format.

   Code with GR Station @ the green thalweg (use the disk provided with thalweg) using Station 10,000 at the Thalweg.
3. Color code of cross-sections on sheet 2 not strictly adhered to.

Wash 11 Photogrammetric Cross-Sections = 20 +8

Cross-Section #			
1	11	21	28
2	12	22 } Culvert already taken	29
3	13	23	30
4	14	24	31
5	15	25	32 Cont. Section
6	16	26	
7	17	27	33
8	18		
9	19		
10	20 (also a QC Section, but not in 10,000 station format)		

Wash 10 Photogram X-S = 16 +3

Cross-Section #			
5	12	19	1
6	13	20	2 (Terrestrial Survey)
7	14		3
8	15		4
9	16		
10	17		
11	18		

Wash 9 Photogram X-S = 25

Cross-Section #				
1	6	18	24	29
2	7	19	25	34
3	8 < 13	20 < 21	26	39 (also a QC Section, not in 10,000 St. Format)
4	16	22	27	
5	17	23	28	

AERIAL MAPPING COMPA' ', INC.
3141 W. Clarendon Avenue
PHOENIX, AZ 85017-4588

TEL (602) 263-5728
FAX (602) 263-0165

RECEIVED SEP 07 1994

LETTER OF TRANSMITTAL

TO MIKE

DATE 9-7-94	JOB NO 9413B R3.16E
ATTENTION FRANK	
RE: Rio Verde	

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☒ HSC II Disk w/ Sections

COPIES	DATE	NO.	DESCRIPTION

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☐ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☐ As requested ☐ Returned for corrections ☐ Return _____ corrected prints
☐ For review and comment ☒ All Stuff from last Transmittal Returned
☐ FOR BIDS DUE _____ 19____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS Richard says he is still investigating the problem with Sheet 5+ 7 plots - has sent it to ACAD for review - so he is returning old mylars.

COPY TO Felix

SIGNED: [signature]

If enclosures are not as noted, kindly notify us at once.

Qk fill

AERIAL MAPPING COMPANY, INC.
3141 W. Clarendon Avenue
PHOENIX, AZ 85017-4588

TEL (602) 263-5728
FAX (602) 263-0165

RECEIVED SEP 14 1994

LETTER OF TRANSMITTAL

89-407.003

DATE	JOB NO.
9-14-94	94138

ATTENTION: FRANK BROWN

RE: Rio Verde South

TO MKE

WE ARE SENDING YOU ☐ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1 ea	8/31/94	5 of 7	Revised Topographic Maps (Line Weights Corrected)
1	9/13/94	1 of 1	ASCII Format XSec END Pts * See Note

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit_____copies for approval
☐ For your use ☐ Approved as noted ☐ Submit_____copies for distribution
☒ As requested ☐ Returned for corrections ☐ Return_____corrected prints
☐ For review and comment ☒ Returned ORIG, SHEET 5
☐ FOR BIDS DUE _____ 19_____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS * Note Water Surface Slope Wave BLOCK Added to this Disc See Attached

COPY TO File

SIGNED: [signature]

If enclosures are not as noted, kindly notify us at once.

To: Frank Brown
MKE

Re: Sinewave Pattern for FEMA Sheets

Frank:

We have made a block called SINE200 that is one cycle of the pattern needed for the FEMA waterline.

It can be INSERTed into a 1"=200' drawing without scaling, then used to pattern a line with the MEASURE command in AutoCAD. The distance increment will be 14.8' (200 * .074).

To complete the cycles down the line, the straight line needs to extend past the actual endpoints of the line. Then pattern with the MEASURE command and explode the block segmenets that cross the real endpoints of the line. Then TRIM both the exploded blocks and excess line past the endpoints.

The straight line needs to be on one layer, and the sinewave pattern on a different layer for conversion into ARC/INFO.

This is not an elegant solution, but it works for now. We are trying to modify our treeline patterning command to pattern on opposites sides of the line every other symbol, which would automate the procedure.

Good luck,

Bob Parks
Aerial Mapping Company, Inc.

.044"
one cycle
.074"

WOOD, PATEL & ASSOC., C. LETTER OF RANSMITTAL

Civil Engineers, Hydrologists, Land Surveyors

1550 East Missouri, Suite 203

Phoenix, AZ 85014

(602) 234-1344 • FAX 234-1322

DATE: September 15, 1994	JOB NO. 93031.00
ATTENTION: Tom Loomis, P.E.	
RE: Rio Verde - North FPDS hydrology coordination	

TO:

George V. Sabol Consulting Engineers, Inc.

7950 E. Acoma Dr. Suite 211

Scottsdale, AZ 85260-6962

WE ARE SENDING YOU ■ Attached □ Under separate cover via PICK-UP the following items:

□ Shop drawings □ Prints ■ Plans □ Samples □ Specifications
□ Copy of letter □ Change Order ■ Other (Files)

COPIES	DATE	NO.	DESCRIPTION
1	9/15/94		11" x 17" copy of portion of drainage map and HEC-1 schematic
1	9/15/94		One 5 1/4" diskette containing output hydrographs for divert operation
			171D for 6-hour and 24-hour storms

THESE ARE TRANSMITTED as checked below:

□ For approval □ Approved as submitted □ Approved as noted
■ For your use □ As requested □ For review and comment

REMARKS:

Tom, this divert operation represents the flow breakout from Burgess & Niple's HEC-2 model. Note that the NMIN value for both models is 5 minutes. From inspection of an aerial photo, it appears that a portion of this flow lost from the north watershed may re-enter the north watershed at a point about 3800 or 4000 feet east of the diverted flow, as shown on the sketch. If this is indeed the case, please forward these hydrographs to us, along with those for any other inflows into the north watershed. If you have any questions, please call. Thank you!

Note: This was the wrong HEC-1 operation. Received correct files from Tom by modem 3:30 p.m. 9/19/94
TRL

COPY TO: Larry Culler (B&N)
Sandy Story (FCDMC)

SIGNED: Anthony J. Regis, P.E.

FORMS\TRANSMIT.GEN

JOB

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 9-16-94 | Job No.: 89-407.003

To: George V. Sabol Consulting Engineers

Attention: Mr. Tom Loomis

Re: Rio Verde South

Change Older #1

WE ARE SENDING YOU X ATTACHED ___ VIA pick-up or deliver

Original:	Copies	Date	Description
	1	8-22-94	Sheets 5 + 7 Revised: New Contour Map New Semi-Rectified Aerials
	1	8-22-94	9 x 9 Contact print photo copy.

Remarks:

The 9 x 9 photocopy shows diversion structure — Do you need to see original photograph? We have 1:10,560 and 1:7200 aerial photos of new channel 10, channel 11 and Diversion Str. Area — taken on 8/22/94. Do you need to borrow these? As before, just keeping you informed.

COPY TO _____

SIGNED Frank Edward Brown

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 09-20-94 | Job No.: 89-407.003

To: George V. Sabol Consulting Engineers, Inc.
7950 East Acoma Drive
Suite 211
Scottsdale, AZ 85260-6962

Attention: Mr. Tom Loomis, P.E.

Re: FCD 93-07
Rio Verde South FDS

WE ARE SENDING YOU ___ ATTACHED X VIA Pick Up

Original:	Copies	Date	Description
	1	09-13-94	No. 10 Tonto Verde Unit One Grading Plans - Record Drawings
			received by MKE 09-19-94.

Remarks: FCDMC letter of transmittal is included.

COPY TO _____

SIGNED Frank Edward Brown

Frank Edward Brown, P.E.

89-407.003

TRANSMITTAL

RECEIVED NOV 0 1 1994

: FRANK BROWN

FROM: *George V. Sabol Consulting Engineers, Inc.*
7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

DATE: 10/31/94

PROJECT No./Name: 46 / RIO VERDE SOUTH FIS

SUBJECT: HYDROLOGY

ENCLOSED ARE THE FOLLOWING

TABLES F-3 : 100 YR, 6 & 24 HR PEAK DISCHARGES
F-1 : 100 YR 6 HR STORM RESULTS
F-5 : 100 YR, 6 & 24 HR PEAK DISCHARGES W/O LEVEE

REMARKS

COPIES

SIGNED

RECEIVED NOV 0 7 1994

Archive
89-407.00

TRANSMITTAL

TO: MKE

Attn: Frank Brown

FROM: George V. Sabol Consulting Engineers, Inc.
7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

DATE: 1 Nov. 7 1994

PROJECT No./Name: 46 Rio Verde

SUBJECT: Time Cards

ENCLOSED ARE THE FOLLOWING

Time Cards For Period- 10/10/94 — 11/6/94
1- 500 Scale Hydrology Exhibit redlines for CADD
1- 200 " " " " " " "

REMARKS

COPIES

SIGNED Dana R. Sabol

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 18 Nov 97 | Job No.: 89-407.003

To: George V. Sabol Consulting Engrs

Attention: Mr. Tom Loomis

Re: Rio Verde South

WE ARE SENDING YOU X ATTACHED ___ VIA delivery

Original:	Copies	Date	Description
1 ea			2 of 8 to 8 of 8 Hydrology Exhibits
1 ea			1 of 3 to 3 of 3 "
	1 ea		Red marks of same.

Remarks: Tom,

Please back check. I have made 1 copy of each final map.

As previously agreed, please supply us with 1 copy of your preliminary Hydrology Report and TDR, we will review & then submit to FCDMC.

COPY TO ___

SIGNED Frank Edward Brown

RECEIVED NOV 2 9 1994

TRANSMITTAL

TO: Frank Brown

FROM: *George V. Sabol Consulting Engineers, Inc.*
7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

DATE: 29 Nov

PROJECT No./Name: Rio Verde

SUBJECT:

ENCLOSED ARE THE FOLLOWING

Report, including diskette of Word files

REMARKS

COPIES

My instructions are to read ASAP + comment, so can submit to FCDMC

F. Brown

SIGNED Joyce

TABLE 2
SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	HYDROLOGIC CONCENTRATION POINTS	DRAINAGE AREA (S. M.)	100-YEAR (cfs)	
Wash 9				
At confluence with Verde River	C570	5.43	1140	
Near Indian Reservation Boundary at River Mile 0.265	C569	5.09	1010	
At Forest Road near McDowell Mountain Road	C568	4.99	1010	
At Forest Road above White Wing Drive	C567	4.88	960	
About 0.1 mile above Danny Lane	C566	2.36	760	
At Vado Court	C565	2.28	660	
Wash 10				
Above confluence with Wash 11	C545R	13.91	1910	*
Above Forest Road near El Parado	C543	13.73	1890	*
At Avenue Del Rey	C542	7.40	1430	
About 0.23 miles above Avenue Del Ray	C540	7.28	1420	
Wash 11				
At Confluence with Verde River	C546	20.82	2100	*
After confluence with Wash 10	C545	20.47	2010	*
Above confluence with Wash 10	C545L	6.56	740	
At Forest Road	C536	6.52	740	
About 0.2 miles above R6E/R7E Boundary	C575	6.36	740	

* Maximum flow, with or without Section 36 levee, whichever produces maximum flow.

Post-it™ brand fax transmittal memo 7671 | # of pages ▸ 1

To Tom Kennedy | From Phil Richardson

Co. GVSCAF | Co. MKE

Dept. 12/5/94 | Phone # 294-7705

Fax # 463-3790 | Fax # 294-7751

Tom,
Here is what my table from about 1 month ago.
Thanks

JDB

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix. Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

ETTER OF TRANSMITTAL

Date: 8 DEC 98 | Job No.: 89-407.003

GVSCE, Inc

Attention: Mr. Tom Loomis

Re: Rio Verde South

Task 7.1 Prelim Hydrology Rpt

ARE SENDING YOU X ATTACHED ___ VIA deliver

Original:	Copies	Date	Description
1 ea		July 7 July 22	Exhibit B redmarks
1 ea		June 30 July 22	Exhibit C redmarks
1		7 Dec 98	Full Size Exhibit A
1		7 Dec 98	Full Size Exhibit B
1		7 Dec 98	Full Size Exhibit C
1 ea		7 Dec	11 X 17 Exhibits A, B & C.
1 ea		17 Nov	11 X 17 Exhibits D & E.

emarks:

Tom,

these are for your submittal on 8 Dec 98 (today)

Please submit today, even if you have redmarks already

OPY TO ___

SIGNED Frank Edward Brown

MKE
McLaughlin Kmetty Engineers, Ltd.
3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 01-25-95	Job No.: 89-407.003
To: George V. Sabol Consulting Engineers, Inc.	Attention: Tom Loomis
7950 East Acoma Drive, Suite 211	Re: Rio Verde South FDS
Scottsdale, AZ 85260-6962	

WE ARE SENDING YOU X ATTACHED ___ VIA ___

Original:	Copies	Date	Description
	1	01-11-95	FCDMC Interoffice Memo Re: Technical Data Notebook
			(Draft Hydrology).

Remarks: Tom

the Hydrology Report is approved. Do not print as Final Report until I get Hec-2 approval.

COPY TO ___

SIGNED Frank Edward Brown

Frank Edward Brown, P.E.

Job file 94-407.00

RECEIVED MAY 3 1995

TRANSMITTAL

TO: Frank Brown

FROM: *George V. Sabol Consulting Engineers, Inc.*
7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

DATE: 2 May

PROJECT No./Name: Rio Verde

SUBJECT:

ENCLOSED ARE THE FOLLOWING

Flow Split Calculations from Appendix B
for CS35 & CS44

and Disk - "Rio Verde, Flow Split CS34, HEC-1" (3½)

REMARKS

Per your request

COPIES

SIGNED

Table D-9
Flow split at C535

Stage	Discharge, in cfs		
	Left	Right	Total
---	0	0	0
---	15	85	100
---	30	170	200
---	90	510	600
---	150	850	1000
---	225	1275	1500

Based on field reconnaissance and aerial photographs, a 15 / 85 split was used.

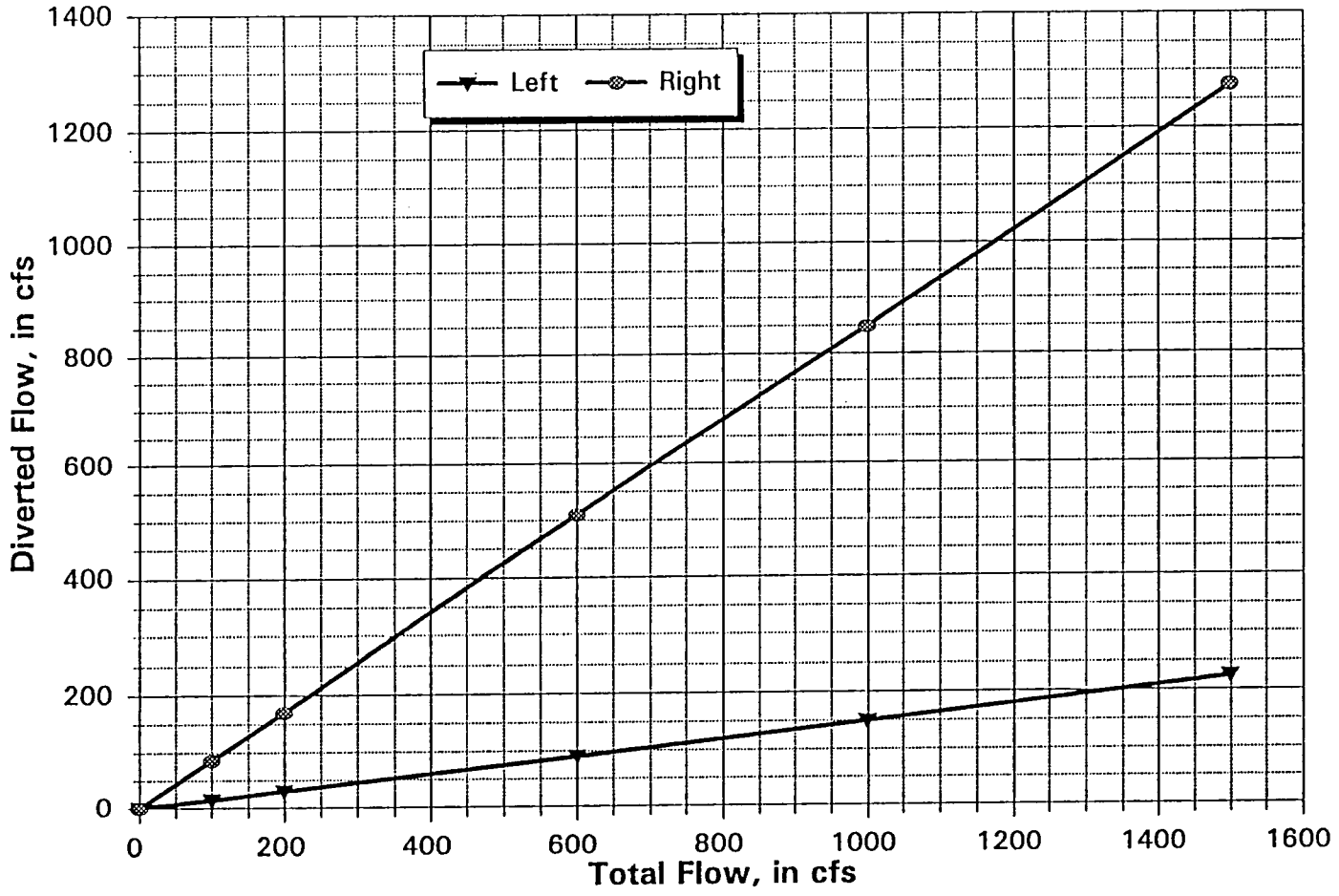


Figure D-9

Flow split at C535

Table D-19
Flow split at C574

Stage	Discharge, in cfs		
	Left	Right	Total
1777.8	0	0	0
1778.0	20	0	20
1778.2	25	0	25
1778.4	30	0	30
1778.6	45	0	45
1778.8	70	20	90
1779.0	110	25	135
1779.2	175	30	205
1779.4	250	50	300
1779.6	350	80	430
1779.8	485	140	625
1780.0	660	200	860
1780.2	875	290	1165
1780.4	1150	400	1550
1780.6	1470	490	1960
1780.8	1825	700	2525
1781.0	2200	900	3100
1781.2	2600	1140	3740

Split developed from 200 scale mapping (sheet 8)

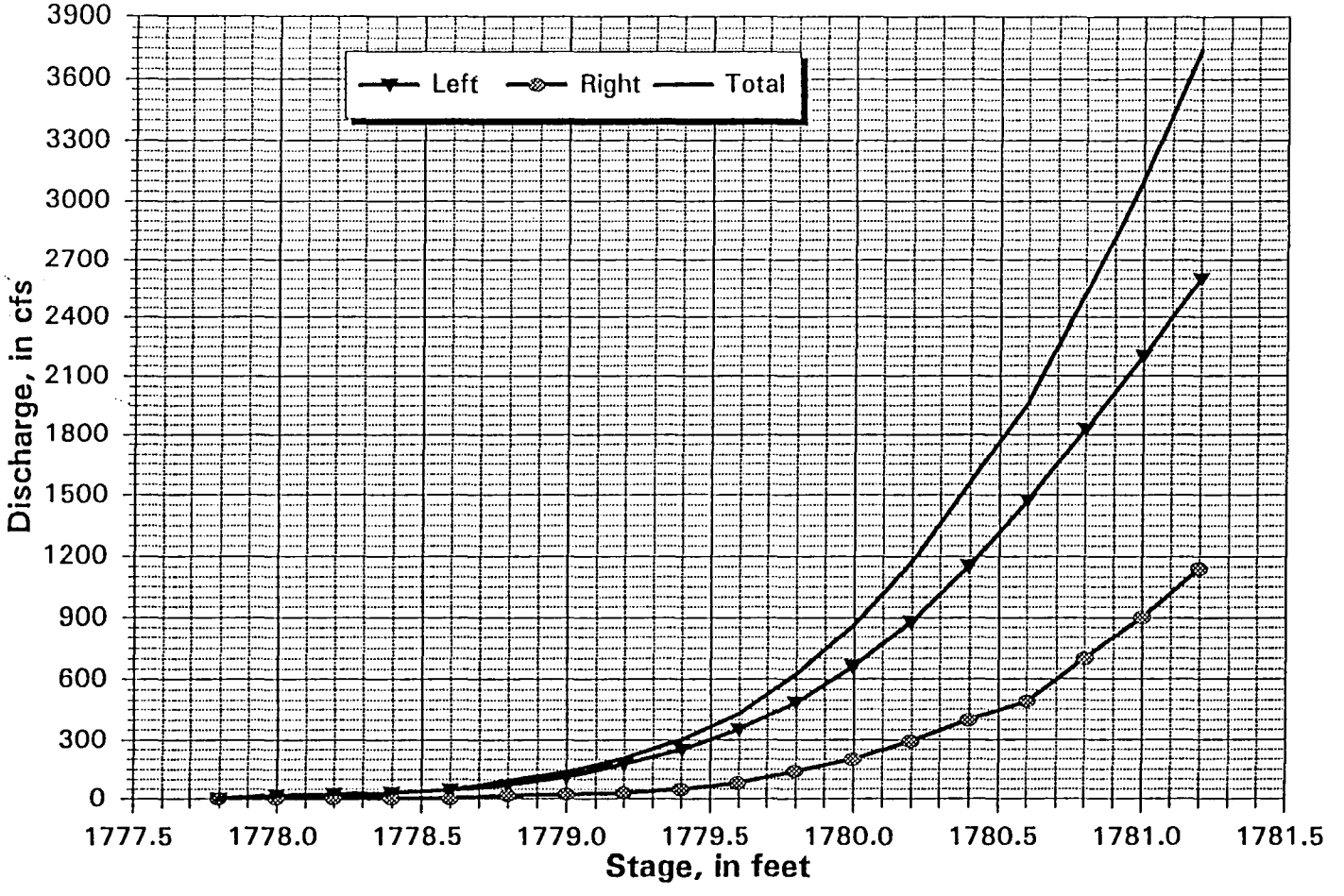


Figure D-19

Flow split at C574

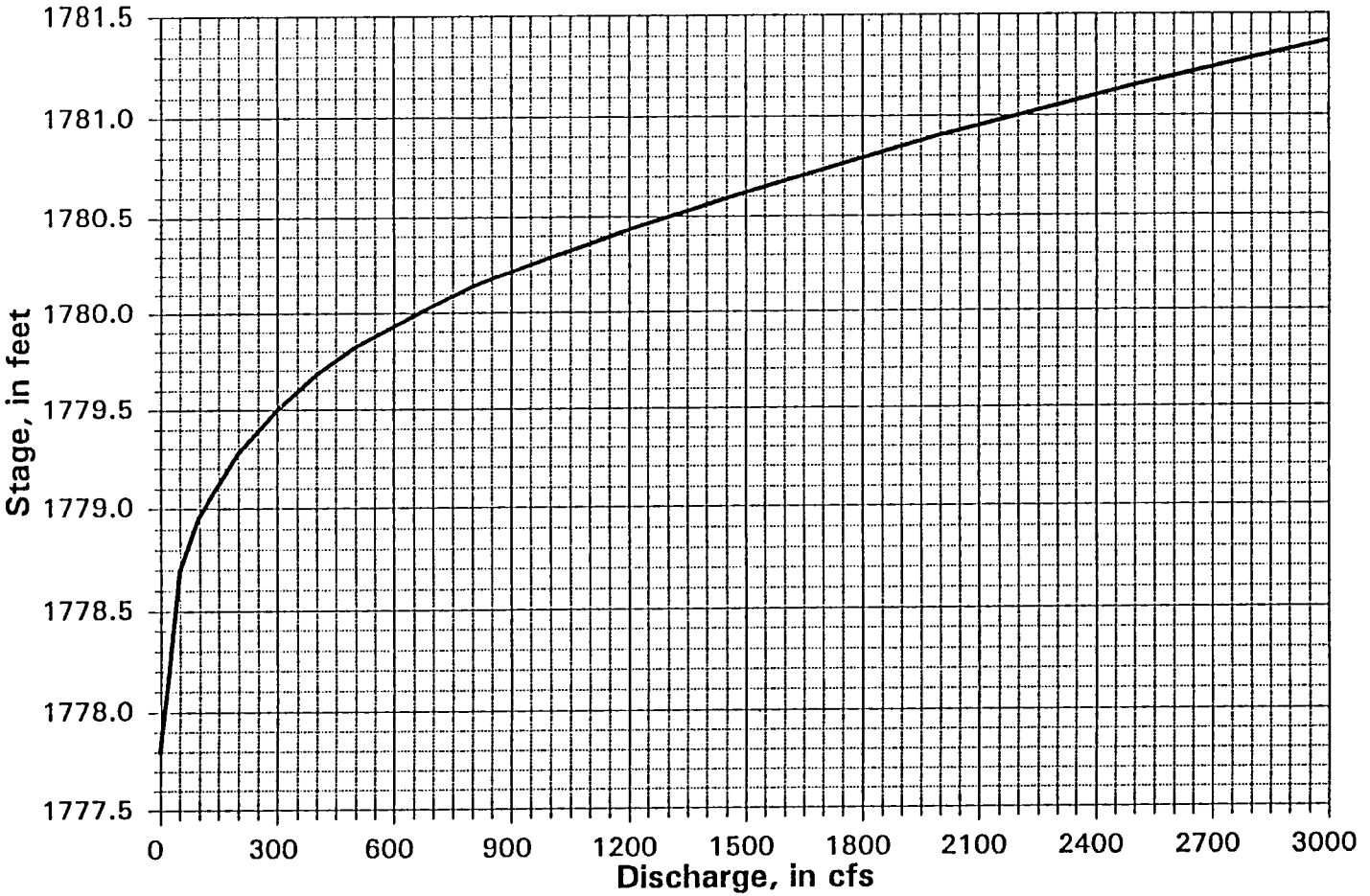


Figure D-19a

C574 Split Left

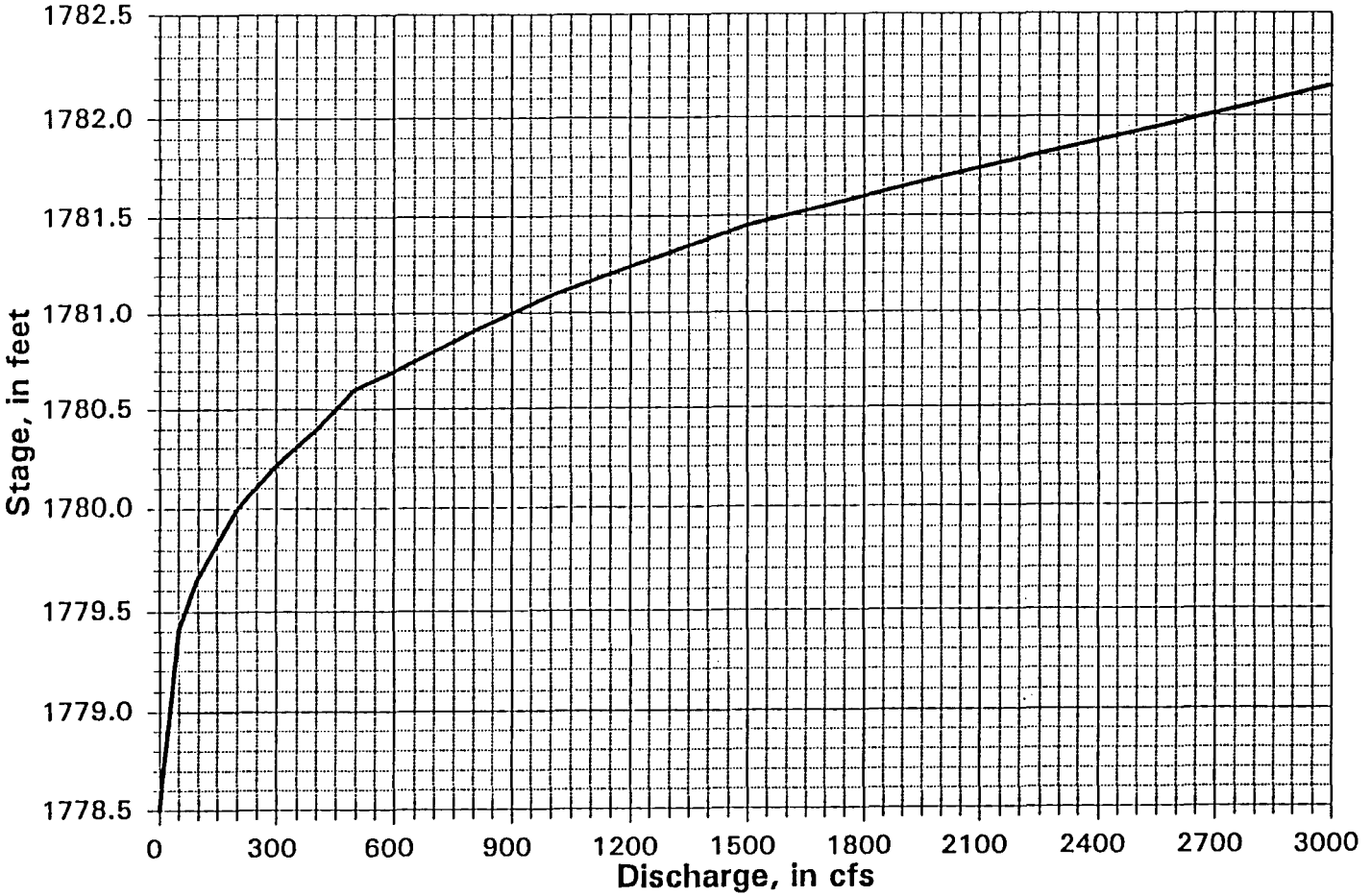


Figure D-19b

C574 Split Right

```
1*****************************************
*  HEC-2 WATER SURFACE PROFILES           *
*                                         *
*  Version   4.6.2;  May 1991             *
*                                         *
*  RUN DATE    22JUN94    TIME   13:08:17  *
*****************************************
```

```
*****************************************
*  U.S. ARMY CORPS OF ENGINEERS           *
*  HYDROLOGIC ENGINEERING CENTER          *
*  609 SECOND STREET, SUITE D             *
*  DAVIS, CALIFORNIA 95616-4687           *
*        (916) 756-1104                   *
*****************************************
```

```
X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X           X     X
X     X  X        X                       X
XXXXXXX  XXXX     X          XXXXX    XXXXX
X     X  X        X                  X
X     X  X        X     X            X
X     X  XXXXXXX   XXXXX             XXXXXXX
```

1

THIS RUN EXECUTED 22JUN94 13:08:17

```
*************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
*************************************
```

```
T1      FLOOD CONTROL DISTRICT OF MARICOPA COUNTY:  FCD#93-07
T2      RIO VERDE SOUTH FIS STUDY by GVSCE for MKE
T3      574 Left                                    FILE:     C574L.IH2
T4                                                  DATE:     06-22-94  dtp
T4
T5              This model is used to develop a flow split rating curve
T6              for the split that occurs at hydrologic concentration point 574
T6                SPLIT  LEFT
T7
T8      Single X-Section Run
                  Ditch slope =   0.0167 ft/ft  From 200 Scale Mapping

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

                2                         0.0167

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

      1                 -1                                      -1

    SECNO       Q    CWSEL    DEPTH     VCH    CRIWS      EG       HL    SLOPE   KRATIO

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     38         43         1          8         26         2          3         11         5         58

J5  LPRNT     NUMSEC                    ********REQUESTED SECTION NUMBERS********

    -10       -10


NC    0.075      0.075      0.035       .1         .3
QT      .14         50        100        200        300         400         500         600         800        1000
QT     1200       1500       2000       2500       3000

NH        4      0.075       1090      0.035       1125       0.075       1300       0.01        1301
        X-Section #1
X1        1         15       1090       1125          0           0           0
GR     1783        999       1781       1000       1780        1030        1778       1065      1779.5        1080
GR     1778       1090     1777.8       1095       1778        1100        1780       1125        1780        1160
GR     1779       1200       1780       1255     1778.2        1280        1779       1300        1785        1301
```

1


```
X1        2                                    .2          .2          .2

X1        3                                    .2          .2          .2

X1        4                                    .2          .2          .2

X1        5                                    .2          .2          .2

X1        6                                    .2          .2          .2
```

1


```
T3            Q2

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

                3                         0.0167

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE
```

2 -1 -1

1
22JUN94 13:08:17 PAGE 4

T3 Q3
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
4 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE
3 -1 -1

1
22JUN94 13:08:17 PAGE 5

T3 Q4
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
5 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE
4 -1 -1

1
22JUN94 13:08:17 PAGE 6

T3 Q5
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
6 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE
5 -1 -1

1
22JUN94 13:08:17 PAGE 7

T3 Q6
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
7 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE
6 -1 -1

1
22JUN94 13:08:17 PAGE 8

T3 Q7
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
8 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE
7 -1 -1

1
22JUN94 13:08:17 PAGE 9

T3 Q8
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
9 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE
8 -1 -1

1
22JUN94 13:08:17 PAGE 10

T3 Q9
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
10 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE

9 -1 -1

1 22JUN94 13:08:17 PAGE 11

T3 Q10
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
11 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE
10 -1 -1

1 22JUN94 13:08:17 PAGE 12

T3 Q11
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
12 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE
11 -1 -1

1 22JUN94 13:08:17 PAGE 13

T3 Q12
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
13 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE
12 -1 -1

1 22JUN94 13:08:17 PAGE 14

T3 Q13
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
14 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE
13 -1 -1

1 22JUN94 13:08:17 PAGE 15

T3 Q14
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
15 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE
14 -1 -1

1 22JUN94 13:08:17 PAGE 16

THIS RUN EXECUTED 22JUN94 13:08:37

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2: May 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

574 Left

SUMMARY PRINTOUT

SECNO Q CWSEL DEPTH VCH CRIWS EG HL 10*KS KRATIO

1.000	50.00	1778.65	.85	3.73	1778.62	1778.82	.00	167.99	.00
1.000	100.00	1778.91	1.11	4.36	1778.87	1779.11	.00	166.04	.00
1.000	200.00	1779.23	1.43	5.09	1779.18	1779.48	.00	167.40	.00
1.000	300.00	1779.45	1.65	5.56	1779.39	1779.73	.00	168.14	.00
1.000	400.00	1779.62	1.82	5.89	1779.56	1779.92	.00	168.19	.00
1.000	500.00	1779.76	1.96	6.14	1779.69	1780.07	.00	167.50	.00
1.000	600.00	1779.88	2.08	6.37	1779.80	1780.21	.00	167.20	.00
1.000	800.00	1780.09	2.29	6.81	1780.02	1780.45	.00	164.63	.00
1.000	1000.00	1780.23	2.43	7.37	1780.16	1780.64	.00	168.82	.00
1.000	1200.00	1780.38	2.58	7.78	1780.29	1780.82	.00	167.23	.00
1.000	1500.00	1780.57	2.77	8.34	1780.46	1781.06	.00	166.91	.00
1.000	2000.00	1780.85	3.05	9.15	1780.73	1781.42	.00	166.75	.00
1.000	2500.00	1781.09	3.29	9.83	1780.95	1781.74	.00	166.68	.00
1.000	3000.00	1781.32	3.52	10.44	1781.16	1782.04	.00	166.80	.00
2.000	50.00	1778.65	.85	3.70	1778.62	1778.82	.00	164.52	1.01
2.000	100.00	1778.91	1.11	4.34	1778.86	1779.12	.00	163.45	1.01
2.000	200.00	1779.23	1.43	5.07	1779.19	1779.48	.00	165.26	1.01
2.000	300.00	1779.45	1.65	5.53	1779.40	1779.73	.00	166.16	1.01
2.000	400.00	1779.62	1.82	5.86	1779.57	1779.92	.00	166.33	1.01
2.000	500.00	1779.76	1.96	6.12	1779.71	1780.08	.00	165.84	1.00
2.000	600.00	1779.89	2.09	6.34	1779.84	1780.22	.00	165.64	1.00
2.000	800.00	1780.09	2.29	6.79	1780.02	1780.45	.00	163.00	1.00
2.000	1000.00	1780.24	2.44	7.34	1780.18	1780.64	.00	167.25	1.00
2.000	1200.00	1780.38	2.58	7.75	1780.29	1780.82	.00	165.86	1.00
2.000	1500.00	1780.57	2.77	8.32	1780.46	1781.06	.00	165.69	1.00
2.000	2000.00	1780.85	3.05	9.13	1780.71	1781.42	.00	165.70	1.00
2.000	2500.00	1781.10	3.30	9.81	1780.95	1781.74	.00	165.75	1.00
2.000	3000.00	1781.32	3.52	10.42	1781.15	1782.04	.00	165.95	1.00

1

SECNO	Q	CWSEL	DEPTH	VCH	CRIWS	EG	HL	10*KS	KRATIO
3.000	50.00	1778.66	.86	3.64	1778.62	1778.82	.00	158.31	1.02
3.000	100.00	1778.92	1.12	4.29	1778.86	1779.12	.00	158.61	1.02
3.000	200.00	1779.24	1.44	5.02	1779.19	1779.49	.00	161.14	1.01
3.000	300.00	1779.46	1.66	5.48	1779.40	1779.73	.00	162.47	1.01
3.000	400.00	1779.63	1.83	5.81	1779.58	1779.92	.00	162.86	1.01
3.000	500.00	1779.77	1.97	6.07	1779.69	1780.08	.00	162.64	1.01
3.000	600.00	1779.90	2.10	6.30	1779.85	1780.22	.00	162.75	1.01
3.000	800.00	1780.10	2.30	6.74	1780.02	1780.45	.00	159.77	1.01
3.000	1000.00	1780.25	2.45	7.30	1780.16	1780.65	.00	164.27	1.01
3.000	1200.00	1780.39	2.59	7.71	1780.29	1780.83	.00	163.21	1.01
3.000	1500.00	1780.58	2.78	8.28	1780.46	1781.07	.00	163.42	1.01
3.000	2000.00	1780.86	3.06	9.09	1780.71	1781.43	.00	163.79	1.01
3.000	2500.00	1781.11	3.31	9.78	1780.95	1781.75	.00	164.04	1.01
3.000	3000.00	1781.33	3.53	10.38	1781.15	1782.04	.00	164.37	1.00
4.000	50.00	1778.67	.87	3.57	1778.62	1778.83	.00	150.05	1.03
4.000	100.00	1778.93	1.13	4.22	1778.87	1779.13	.00	152.18	1.02
4.000	200.00	1779.25	1.45	4.95	1779.18	1779.49	.00	155.52	1.02
4.000	300.00	1779.47	1.67	5.41	1779.40	1779.74	.00	157.42	1.02
4.000	400.00	1779.64	1.84	5.74	1779.56	1779.93	.00	158.04	1.02
4.000	500.00	1779.79	1.99	6.01	1779.69	1780.09	.00	158.29	1.01
4.000	600.00	1779.91	2.11	6.24	1779.85	1780.22	.00	158.77	1.01
4.000	800.00	1780.11	2.31	6.68	1780.01	1780.46	.00	155.45	1.01
4.000	1000.00	1780.26	2.46	7.24	1780.16	1780.65	.00	160.18	1.01
4.000	1200.00	1780.40	2.60	7.65	1780.29	1780.83	.00	159.60	1.01
4.000	1500.00	1780.59	2.79	8.23	1780.46	1781.07	.00	160.28	1.01
4.000	2000.00	1780.87	3.07	9.04	1780.71	1781.43	.00	161.12	1.01
4.000	2500.00	1781.12	3.32	9.73	1780.95	1781.75	.00	161.64	1.01
4.000	3000.00	1781.34	3.54	10.34	1781.15	1782.05	.00	162.20	1.01
5.000	50.00	1778.69	.89	3.48	1778.62	1778.83	.00	140.86	1.03
5.000	100.00	1778.95	1.15	4.14	1778.87	1779.13	.00	144.90	1.02
5.000	200.00	1779.27	1.47	4.86	1779.18	1779.50	.00	148.85	1.02
5.000	300.00	1779.49	1.69	5.33	1779.40	1779.74	.00	151.40	1.02
5.000	400.00	1779.66	1.86	5.62	1779.56	1779.93	.00	149.87	1.03
5.000	500.00	1779.80	2.00	5.93	1779.69	1780.09	.00	153.13	1.02
5.000	600.00	1779.92	2.12	6.16	1779.83	1780.23	.00	154.06	1.02
5.000	800.00	1780.13	2.33	6.60	1780.01	1780.46	.00	150.34	1.02
5.000	1000.00	1780.27	2.47	7.16	1780.15	1780.66	.00	155.25	1.02
5.000	1200.00	1780.42	2.61	7.58	1780.35	1780.83	.00	155.30	1.01
5.000	1500.00	1780.60	2.80	8.16	1780.46	1781.08	.00	156.50	1.01
5.000	2000.00	1780.88	3.08	8.98	1780.71	1781.44	.00	157.88	1.01
5.000	2500.00	1781.13	3.33	9.67	1780.95	1781.76	.00	158.77	1.01
5.000	3000.00	1781.36	3.56	10.28	1781.15	1782.05	.00	159.59	1.01

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SECNO	Q	CWSEL	DEPTH	VCH	CRIWS	EG	HL	10*KS	KRATIO
6.000	50.00	1778.70	.90	3.40	1778.62	1778.83	.00	131.75	1.03
6.000	100.00	1778.96	1.16	4.06	1778.87	1779.13	.00	137.49	1.03
6.000	200.00	1779.28	1.48	4.73	1779.18	1779.50	.00	138.97	1.03
6.000	300.00	1779.50	1.70	5.20	1779.39	1779.75	.00	142.35	1.03
6.000	400.00	1779.68	1.88	5.50	1779.56	1779.94	.00	141.76	1.03
6.000	500.00	1779.82	2.02	5.81	1779.69	1780.09	.00	145.35	1.03
6.000	600.00	1779.93	2.13	6.08	1779.83	1780.23	.00	148.95	1.02
6.000	800.00	1780.14	2.34	6.48	1780.01	1780.47	.00	142.81	1.03
6.000	1000.00	1780.29	2.49	7.04	1780.22	1780.66	.00	147.79	1.02
6.000	1200.00	1780.43	2.63	7.47	1780.35	1780.84	.00	148.66	1.02
6.000	1500.00	1780.62	2.82	8.06	1780.48	1781.08	.00	150.67	1.02
6.000	2000.00	1780.90	3.10	8.88	1780.71	1781.44	.00	152.90	1.02
6.000	2500.00	1781.15	3.35	9.58	1780.95	1781.76	.00	154.28	1.01
6.000	3000.00	1781.37	3.57	10.22	1781.15	1782.06	.00	156.72	1.01

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SUMMARY OF ERRORS AND SPECIAL NOTES

```
1*****************************************
*  HEC-2 WATER SURFACE PROFILES           *
*                                         *
*  Version   4.6.2;  May 1991             *
*                                         *
*  RUN DATE    22JUN94    TIME   13:09:48  *
*****************************************
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*****************************************
*  U.S. ARMY CORPS OF ENGINEERS           *
*  HYDROLOGIC ENGINEERING CENTER          *
*  609 SECOND STREET, SUITE D             *
*  DAVIS, CALIFORNIA 95616-4687           *
*        (916) 756-1104                   *
*****************************************
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X     X  XXXXXXX   XXXXX             XXXXX
X     X  X        X     X           X     X
X     X  X        X                 X     X
XXXXXXX  XXXX     X          XXXXX    XXXXX
X     X  X        X                 X
X     X  X        X     X           X
X     X  XXXXXXX   XXXXX             XXXXXXX
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THIS RUN EXECUTED 22JUN94 13:09:48

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*************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
*************************************
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```
T1      FLOOD CONTROL DISTRICT OF MARICOPA COUNTY:  FCD#93-07
T2      RIO VERDE SOUTH FIS STUDY by GVSCE for MKE
T3      574 Right                                   FILE:     C574R.IH2
T4                                                  DATE:     06-22-94  dtp
T4
T5              This model is used to develop a flow split rating curve
T6              for the split that occurs at hydrologic concentration point 574
T6                SPLIT  RIGHT
T7
T8      Single X-Section Run
                Ditch slope =   0.0167 ft/ft  From 200 Scale Mapping

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

                2                           0.0167

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

      1                 -1                                      -1

    SECNO       Q   CWSEL   DEPTH     VCH   CRIWS      EG       HL   SLOPE  KRATIO

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     38         43          1          8         26          2          3         11          5         58

J5  LPRNT     NUMSEC                  ********REQUESTED SECTION NUMBERS********

     -10       -10


NC    0.075     0.075     0.035       .1        .3
QT       14        50       100       200       300       400       500       600       800      1000
QT     1200      1500      2000      2500      3000

NH        4     0.01      1000     0.075      1020     0.035      1050     0.075      1380
        X-Section #1
X1        1        12      1020      1050         0         0         0
GR     1785       999      1779      1000    1778.5      1020      1780      1050    1780.5      1070
GR     1780      1120      1779      1150      1780      1165      1781      1200      1780      1250
GR     1782      1350      1790      1380
```

1


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X1        2                                   .2        .2        .2

X1        3                                   .2        .2        .2

X1        4                                   .2        .2        .2

X1        5                                   .2        .2        .2

X1        6                                   .2        .2        .2
```

1


```
T3            Q2
J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

                3                           0.0167

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE
```

2 -1 -1

1
22JUN94 13:09:48 PAGE 4

T3 Q3
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
4 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE
3 -1 -1

1
22JUN94 13:09:48 PAGE 5

T3 Q4
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
5 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE
4 -1 -1

1
22JUN94 13:09:48 PAGE 6

T3 Q5
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
6 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE
5 -1 -1

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22JUN94 13:09:48 PAGE 7

T3 Q6
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
7 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE
6 -1 -1

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22JUN94 13:09:48 PAGE 8

T3 Q7
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
8 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE
7 -1 -1

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22JUN94 13:09:48 PAGE 9

T3 Q8
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
9 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE
8 -1 -1

1
22JUN94 13:09:48 PAGE 10

T3 Q9
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
10 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE

9 -1 -1

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22JUN94 13:09:48 PAGE 11

T3 Q10
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
11 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE
10 -1 -1

1
22JUN94 13:09:48 PAGE 12

T3 Q11
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
12 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE
11 -1 -1

1
22JUN94 13:09:48 PAGE 13

T3 Q12
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
13 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE
12 -1 -1

1
22JUN94 13:09:48 PAGE 14

T3 Q13
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
14 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE
13 -1 -1

1
22JUN94 13:09:48 PAGE 15

T3 Q14
J1 ICHECK INQ NINV IDIR STRT METRIC HVINS Q WSEL FQ
15 0.0167
J2 NPROF IPLOT PRFVS XSECV XSECH FN ALLDC IBW CHNIM ITRACE
14 -1 -1

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22JUN94 13:09:48 PAGE 16

THIS RUN EXECUTED 22JUN94 13:10:06

****
HEC-2 WATER SURFACE PROFILES
Version 4.6.2; May 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

574 Right
SUMMARY PRINTOUT

SECNO Q CWSEL DEPTH VCH CRIWS EG HL 10*KS KRATIO

	1.000	50.00	1779.37	.87	3.15	1779.25	1779.47	.00	165.94	.00
	1.000	100.00	1779.63	1.13	3.75	1779.48	1779.77	.00	166.61	.00
	1.000	200.00	1779.96	1.46	4.47	1779.79	1780.17	.00	168.27	.00
	1.000	300.00	1780.17	1.67	5.22	1780.02	1780.44	.00	168.24	.00
	1.000	400.00	1780.34	1.84	5.80	1780.23	1780.65	.00	166.87	.00
	1.000	500.00	1780.48	1.98	6.28	1780.41	1780.83	.00	166.71	.00
	1.000	600.00	1780.59	2.09	6.66	1780.56	1780.97	.00	166.72	.00
*	1.000	800.00	1780.80	2.30	7.18	1780.80	1781.22	.00	159.23	.00
	1.000	1000.00	1780.95	2.45	7.81	1780.94	1781.42	.00	166.80	.00
*	1.000	1200.00	1781.10	2.60	8.22	1781.10	1781.60	.00	165.29	.00
*	1.000	1500.00	1781.29	2.79	8.75	1781.29	1781.83	.00	164.08	.00
	1.000	2000.00	1781.56	3.06	9.63	1781.53	1782.18	.00	168.62	.00
	1.000	2500.00	1781.80	3.30	10.29	1781.73	1782.48	.00	168.56	.00
	1.000	3000.00	1782.03	3.53	10.83	1781.97	1782.76	.00	166.79	.00
	2.000	50.00	1779.38	.88	3.12	1779.25	1779.48	.00	162.61	1.01
	2.000	100.00	1779.64	1.14	3.72	1779.48	1779.78	.00	164.04	1.01
	2.000	200.00	1779.97	1.47	4.45	1779.79	1780.17	.00	166.20	1.01
	2.000	300.00	1780.18	1.68	5.20	1780.02	1780.44	.00	166.14	1.01
	2.000	400.00	1780.35	1.85	5.78	1780.23	1780.66	.00	165.02	1.01
	2.000	500.00	1780.48	1.98	6.25	1780.40	1780.83	.00	164.97	1.01
	2.000	600.00	1780.60	2.10	6.64	1780.55	1780.98	.00	165.02	1.01
	2.000	800.00	1780.81	2.31	7.15	1780.78	1781.22	.00	157.83	1.00
	2.000	1000.00	1780.96	2.46	7.79	1780.93	1781.42	.00	165.40	1.00
	2.000	1200.00	1781.11	2.61	8.19	1781.08	1781.60	.00	163.96	1.00
	2.000	1500.00	1781.30	2.80	8.73	1781.25	1781.84	.00	162.89	1.00
	2.000	2000.00	1781.57	3.07	9.60	1781.50	1782.18	.00	167.51	1.00
	2.000	2500.00	1781.81	3.31	10.27	1781.77	1782.49	.00	167.56	1.00
	2.000	3000.00	1782.04	3.54	10.81	1781.95	1782.76	.00	165.89	1.00

1

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SECNO	Q	CWSEL	DEPTH	VCH	CRIWS	EG	HL	10*KS	KRATIO
3.000	50.00	1779.39	.89	3.09	1779.25	1779.48	.00	157.81	1.02
3.000	100.00	1779.64	1.14	3.69	1779.48	1779.78	.00	160.22	1.01
3.000	200.00	1779.98	1.48	4.42	1779.79	1780.17	.00	163.00	1.01
3.000	300.00	1780.19	1.69	5.17	1780.02	1780.45	.00	162.69	1.01
3.000	400.00	1780.35	1.85	5.75	1780.23	1780.66	.00	161.73	1.01
3.000	500.00	1780.49	1.99	6.21	1780.40	1780.84	.00	161.67	1.01
3.000	600.00	1780.61	2.11	6.59	1780.56	1780.98	.00	161.63	1.01
3.000	800.00	1780.82	2.32	7.11	1780.79	1781.22	.00	155.13	1.01
3.000	1000.00	1780.97	2.47	7.74	1780.93	1781.43	.00	162.52	1.01
3.000	1200.00	1781.12	2.62	8.15	1781.07	1781.60	.00	161.19	1.01
3.000	1500.00	1781.31	2.81	8.69	1781.24	1781.84	.00	160.54	1.01
3.000	2000.00	1781.58	3.08	9.56	1781.49	1782.18	.00	165.32	1.01
3.000	2500.00	1781.82	3.32	10.23	1781.77	1782.49	.00	165.60	1.01
3.000	3000.00	1782.05	3.55	10.77	1781.97	1782.77	.00	164.09	1.01
4.000	50.00	1779.39	.89	3.05	1779.25	1779.48	.00	152.62	1.02
4.000	100.00	1779.65	1.15	3.65	1779.48	1779.78	.00	155.80	1.01
4.000	200.00	1779.98	1.48	4.38	1779.80	1780.18	.00	159.24	1.01
4.000	300.00	1780.20	1.70	5.13	1780.02	1780.45	.00	158.40	1.01
4.000	400.00	1780.36	1.86	5.70	1780.23	1780.67	.00	157.27	1.01
4.000	500.00	1780.50	2.00	6.15	1780.40	1780.84	.00	157.10	1.01
4.000	600.00	1780.62	2.12	6.52	1780.56	1780.98	.00	156.66	1.02
4.000	800.00	1780.83	2.33	7.05	1780.79	1781.23	.00	151.16	1.01
4.000	1000.00	1781.02	2.52	7.39	1780.93	1781.44	.00	142.26	1.07
4.000	1200.00	1781.22	2.72	7.42	1781.07	1781.62	.00	123.60	1.14
4.000	1500.00	1781.36	2.86	8.40	1781.29	1781.85	.00	146.08	1.05
4.000	2000.00	1781.61	3.11	9.40	1781.55	1782.19	.00	157.45	1.02
4.000	2500.00	1781.83	3.33	10.17	1781.78	1782.49	.00	162.78	1.01
4.000	3000.00	1782.07	3.57	10.65	1781.97	1782.77	.00	158.84	1.02
5.000	50.00	1779.40	.90	3.01	1779.25	1779.49	.00	147.63	1.02
5.000	100.00	1779.65	1.15	3.61	1779.48	1779.79	.00	151.36	1.01
5.000	200.00	1779.99	1.49	4.34	1779.79	1780.18	.00	155.38	1.01
5.000	300.00	1780.20	1.70	5.08	1780.02	1780.45	.00	153.76	1.01
5.000	400.00	1780.38	1.88	5.64	1780.23	1780.67	.00	152.21	1.02
5.000	500.00	1780.52	2.02	6.05	1780.40	1780.84	.00	149.09	1.03
5.000	600.00	1780.68	2.18	6.09	1780.57	1780.99	.00	128.45	1.10
5.000	800.00	1780.89	2.39	6.63	1780.80	1781.23	.00	126.39	1.09
5.000	1000.00	1781.08	2.58	6.97	1780.94	1781.44	.00	120.56	1.09
5.000	1200.00	1781.23	2.73	7.39	1781.10	1781.62	.00	122.26	1.01
5.000	1500.00	1781.45	2.95	7.75	1781.25	1781.86	.00	116.13	1.12
5.000	2000.00	1781.68	3.18	8.92	1781.53	1782.20	.00	135.79	1.08
5.000	2500.00	1781.91	3.41	9.66	1781.78	1782.51	.00	140.79	1.08
5.000	3000.00	1782.14	3.64	10.20	1781.97	1782.78	.00	140.66	1.06

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SECNO	Q	CWSEL	DEPTH	VCH	CRIWS	EG	HL	10*KS	KRATIO
6.000	50.00	1779.40	.90	2.98	1779.25	1779.49	.00	142.83	1.02
6.000	100.00	1779.66	1.16	3.57	1779.48	1779.79	.00	147.14	1.01
6.000	200.00	1780.00	1.50	4.30	1779.79	1780.18	.00	151.50	1.01
6.000	300.00	1780.21	1.71	5.03	1780.02	1780.46	.00	148.96	1.02
6.000	400.00	1780.39	1.89	5.57	1780.23	1780.67	.00	146.80	1.02
6.000	500.00	1780.60	2.10	5.46	1780.41	1780.85	.00	110.40	1.16
6.000	600.00	1780.69	2.19	6.04	1780.56	1781.00	.00	125.46	1.01
6.000	800.00	1780.90	2.40	6.58	1780.79	1781.24	.00	124.16	1.01
6.000	1000.00	1781.09	2.59	6.93	1780.93	1781.45	.00	118.61	1.01
6.000	1200.00	1781.24	2.74	7.35	1781.10	1781.62	.00	120.63	1.01
6.000	1500.00	1781.45	2.95	7.78	1781.28	1781.86	.00	117.38	.99
6.000	2000.00	1781.69	3.19	8.88	1781.51	1782.20	.00	133.98	1.01
6.000	2500.00	1781.92	3.42	9.62	1781.72	1782.51	.00	139.07	1.01
6.000	3000.00	1782.15	3.65	10.15	1781.97	1782.79	.00	138.75	1.01

1

22JUN94 13:09:48 PAGE 19

SUMMARY OF ERRORS AND SPECIAL NOTES

CAUTION SECNO= 1.000 PROFILE= 8 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 10 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 11 CRITICAL DEPTH ASSUMED

MKE

JOL

McLaughlin K ietty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 3 Aug 95	Job No.: 89-407.003
To: GVSCE	Attention: Ms. Joyce Sabol
	Re: RVS

WE ARE SENDING YOU X ATTACHED ___ VIA deliver

Original:	Copies	Date	Description
1		—	Color Photos p. 3-38
1	10	—	Originals for p. 3-38 report copies

Remarks:

COPY TO ___

SIGNED Frank Edward Brown

Job file
89-407.003

TRANSMITTAL

TO: Frank REC'D 3 AUG 95

FROM: *George V. Sabol Consulting Engineers, Inc.*
7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

DATE: 2 Aug 95

PROJECT No./Name: Rio Verde

SUBJECT: Hydrology Report

ENCLOSED ARE THE FOLLOWING

p 3-38 For MKE to Scan + produce original preface
p 3-60 – Figure 3-5 } for your information

REMARKS

COPIES

SIGNED Joyce

SECTION 1: GENERAL DOCUMENTATION AND CORRESPONDENCE

1.4 GENERAL CORRESPONDENCE

1.4.1 Community

SECTION 1: GENERAL DOCUMENTATION AND CORRESPONDENCE

1.4 GENERAL CORRESPONDENCE

1.4.2 State Coordinator

SECTION 1: GENERAL DOCUMENTATION AND CORRESPONDENCE

1.4 GENERAL CORRESPONDENCE

1.4.3 Other Agencies

Fax Cover Sheet

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

2801 West Durango Street
Phoenix, Arizona 85009
Telephone (602)506-1501
Fax (602)506-7346
TDD (602)506-5897

FLOODPLAIN MANAGEMENT BRANCH

To: TOM LOOMIS

Company or Department: GEORGE V. SABOL CONSULTING

Fax Number: 483-3990

From: CATHY REGESTER

Number of pages being sent including cover sheet: 3

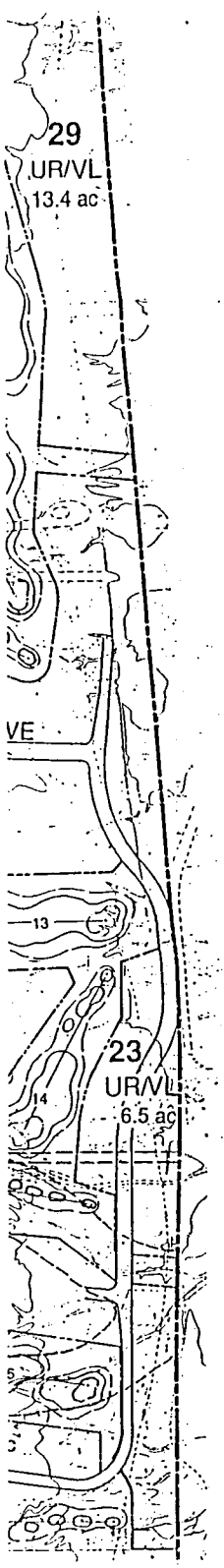
If there are any problems or questions, please call (602)506-1501

Comments: LAND USE CATEGORY (ZONING) VS. LAND USE TYPE TABLE FROM 7/16/92 DEVELOPMENT MASTER PLAN.

DEVELOPMENT MASTER PLAN

Tonto Verde

MARICOPA COUNTY, ARIZONA



LAND USE SUMMARY TABLE

Parcel No.	Land Use Category	Type of Land Use	Gross Acres	Gross Density
1	MNC	Commercial	8.5	-
2	UR/M	Townhouse	13.1	7.6
3	UR/VL	Single Family	17.5	2.0
4	UR/M	Townhouse	13.5	7.6
5	UR/VL	Single Family	16.5	2.0
6	UR/VL	Single Family	20.9	2.0
7	UR/VL	Single Family	17.8	2.0
8	UR/VL	Single Family	14.0	2.0
9	UR/VL	Single Family	13.8	2.0
10	UR/VL	Single Family	13.9	2.0
11	UR/VL	Single Family	2.2	2.0
12	UR/VL	Single Family	7.5	2.0
13	UR/VL	Single Family	11.7	2.0
14	UR/VL	Single Family	24.0	2.0
15	UR/VL	Single Family	8.5	2.0
16	UR/M	Townhouse	10.4	7.6
17	UR/VL	Single Family	5.0	2.0
18	UR/VL	Single Family	3.5	2.0
19	OS	Maintenance	5.4	-
20	UR/VL	Single Family	7.4	2.0
21	UR/VL	Single Family	2.4	2.0
22	UR/VL	Single Family	13.5	2.0
23	UR/VL	Single Family	6.5	2.0
24	UR/VL	Single Family	16.3	2.0
25	UR/VL	Single Family	31.5	2.0
26	UR/M	Townhouse	11.4	7.6
27	UR/M	Townhouse	7.7	7.6
28	UR/VL	Single Family	13.8	2.0
29	UR/VL	Single Family	13.4	2.0
30	UR/VL	Single Family	13.5	2.0
	OS	Golf Course	281.9	-
	OS	Community Center	9.5	-
	OS	Drainage/Open Space	18.4	-

Land Use Category	Total Gross Acres	Average Gross Density
MNC	8.5	-
UR/VL	295.1	2.0
UR/M	56.1	7.6
OS	315.2	-

Total Area for Development: 674.9
Average Density for Residential Parcels: 1.51 DU/ac*

*Density calculation includes area of all uses in the Open Space category.

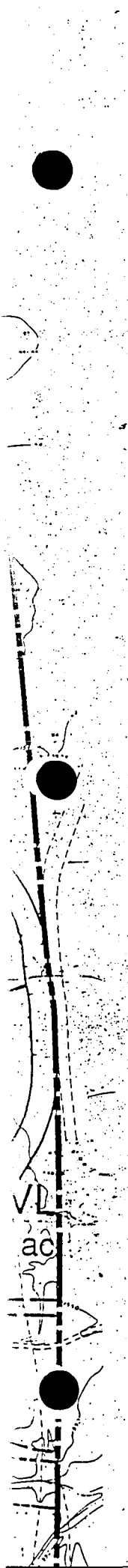
Prepared for:
RIO VERDE SERVICES, INC

July 16, 1992

LAND USE SUMMARY TABLE

Parcel No.	Land Use Category	Type of Land Use	Gross Acres	Gross Density
1	MNC	Commercial	8.5	-
2	UR/M	Townhouse	13.1	7.6
3	UR/VL	Single Family	17.5	2.0
4	UR/M	Townhouse	13.5	7.6
5	UR/VL	Single Family	16.5	2.0
6	UR/VL	Single Family	20.9	2.0
7	UR/VL	Single Familly	17.8	2.0
8	UR/VL	Single Family	14.0	2.0
9	UR/VL	Single Family	13.8	2.0
10	UR/VL	Single Family	13.9	2.0
11	UR/VL	Single Family	2.2	2.0
12	UR/VL	Single Family	7.5	2.0
13	UR/VL	Single Family	11.7	2.0
14	UR/VL	Single Family	24.0	2.0
15	UR/VL	Single Family	8.5	2.0
16	UR/M	Townhouse	10.4	7.6
17	UR/VL	Single Family	5.0	2.0
18	UR/VL	Single Family	3.5	2.0
19	OS	Maintenance	5.4	-
20	UR/VL	Single Family	7.4	2.0
21	UR/VL	Single Family	2.4	2.0
22	UR/VL	Single Family	13.5	2.0
23	UR/VL	Single Family	6.5	2.0
24	UR/VL	Single Family	16.3	2.0
25	UR/VL	Single Family	31.5	2.0
26	UR/M	Townhouse	11.4	7.6
27	UR/M	Townhouse	7.7	7.6
28	UR/VL	Single Family	13.8	2.0
29	UR/VL	Single Family	13.4	2.0
30	UR/VL	Single Family	13.5	2.0
-	OS	Golf Course	281.9	-
-	OS	Community Center	9.5	-
-	OS	Drainage/Open Space	18.4	-

Land Use Category	Total Gross Acres	Average Gross Density
MNC	8.5	-
UR/VL	295.1	2.0
UR/M	56.1	7.6
OS	315.2	-



Fax Cover Sheet

FLOOD CONTROL DISTRICT
Of
Maricopa County

2801 West Durango Street ■ Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TDD (602) 506-5897

To: GEZA KMETTY

Company or Dept: McLAUGLIN KMETTY Fax # 248-7851

From: CATHY REGESTER

Number of Pages Being Sent Including Cover Sheet: 5

If there are any problems, please call (602) 506-1501.

Comments: PLEASE FIND ATTACHED, A COPY OF THE PROPOSAL WHICH WE HAVE RECEIVED FROM SHB AGRA TO DO THE GEOTECHNICAL EVALUATION OF THE EXISTING DIVERSION STRUCTURE ON WASH 10 JUST UPSTREAM OF THE RIO VERDE SUBDIVISION. PLEASE TAKE A QUICK LOOK AND LET ME KNOW IF THIS WILL MEET YOUR NEEDS IN YOUR HYDRAULIC STUDY. THANK YOU!

SHB AGRA, INC.
Engineering & Environmental Services

3232 West Virginia Avenue
Phoenix, Arizona 85009
Phone: 602-272-6848
Fax: 602-272-7239

October 6, 1993

Maricopa County
Flood Control District
2801 West Durango Street
Phoenix, Arizona 85009

SHB Proposal No. PA93-10-4

Attention: Warren Rosebraugh, P.E.

Re: Rio Verde Dike Evaluation

Gentlemen:

In response to the request of Warren Rosebraugh, P.E., of the Maricopa County Flood Control District (MCFCD), our proposal for the performance of a geotechnical site investigation at the above referenced project is herewith submitted. The purpose of the investigation will be to evaluate the integrity of the existing 300-foot dike and to examine the adequacy of the riprap protection. The information will then be used to develop recommendations concerning the dike and/or the riprap protection.

Our understanding of the details of the project, upon which this proposal is based, the proposed scope of work, fees, other contractual items and schedule are submitted in the following sections.

1. Project Description

Details of the project were provided to us by Warren Rosebraugh, P.E., of MCFCD. It is understood that an earthen dike, approximately 300 feet long with riprap protection on the stream side, currently diverts runoff from a small arroyo into an adjacent larger arroyo. The smaller arroyo apparently once flowed into an area that is now a residential

development. It is our understanding that the dike shows signs of erosion and vegetative growth which may compromise the effectiveness of this structure for the intended flood control. MCFCD has requested that SHG AGRA, Inc. (SHB) evaluate the condition of the dike and protective riprap.

It is understood that the site is not easily accessible and that it will be necessary to cut through a barbed wire fence to drive to the site. The fence will be mended upon completion of the field work, however, it is understood that MCFCD will obtain permission from the appropriate parties prior to cutting the fence.

2. Scope of Work

2.1 Field Investigation

We plan to mobilize and demobilize our field engineer, an engineering aide and a vehicle to the site. A backhoe and operator will be subcontracted and mobilized to the site.

Two test pits will be excavated to depths of about 5 to 10 feet, or to refusal on rock, strongly cemented materials or other obstructions, using a rubber-tired backhoe. We will perform in situ density tests in the upper 5 feet of the trench. Soil samples also will be collected for subsequent laboratory testing.

Based on our knowledge of conditions in the general area, we believe that this field program will provide sufficient information for us to provide recommendations. However, should the investigation reveal unexpected conditions, recommendations for any additional work required will be presented verbally upon review of the data by our project engineer.

2.2 Laboratory Analysis

Laboratory tests will be performed as considered necessary for engineering analysis. Tests which may be performed include grain-size distribution, Atterberg limits and moisture-density relationship.

2.3 Engineering Analysis & Report

The information gathered in the field and the data collected in the laboratory will be analyzed and results presented. Based on the results, recommendations will be provided for treatment of the dike and/or riprap. We will submit three copies of the geotechnical investigation report, which will include the following:

A. Logs of test pits, a site plan showing their locations and a description of procedures and equipment used in the test pit program.

B. Results of laboratory testing and a description of test methods.

C. Discussion of the condition and adequacy of the existing dike and riprap protection.

D. Recommendations for treatment and restoration of the dike and riprap.

E. Guide specifications for site grading.

F. Recommended cut and fill slopes.

3. Fees

Charges for the work, as described in Section 2, will be accrued in accordance with unit prices established in our contract with the Maricopa County Flood Control District, Contract No. FCD92-10. The estimated budget is given as follows:

Item		Estimated Cost
Field Investigation		$1,650.00
Laboratory Testing		$ 650.00
Analysis & Report		$1,550.00
	Total	**$3,850.00**

Should you have any questions concerning this proposal, we would appreciate the opportunity to review and clarify. We certainly appreciate your consideration of our firm for the geotechnical engineering services required for this project.

Respectfully submitted,
SHB AGRA, Inc.

By _____
Norman H. Wetz, P.E.

Copies: Addressee (2)

njf/P2-93/10-5-93

Flood study hearing set

1/12/94

A public meeting to inform Rio Verde residents of floodplain delineation studies now being conducted by the Maricopa County Flood Control District will be held Wednesday, Jan. 19, at the Oasis from 7 to 9 p.m.

The study is being performed on about 14 linear miles of desert washes which flow through Rio Verde.

The public is being invited to share experiences and observations of local flooding and hear details about the study by Flood Control District representatives.

Those details will include how the study is conducted, what kind of information is being gathered and how the information will be used.

Mapping floodplains involves developing detailed topographic maps to determine where water goes and studying rainfall patterns to determine typical amounts of runoff.

The studies and resulting maps will be used to better manage the floodplains so as to reduce or prevent flood damage and maintain the integrity of the floodplains.

Extensive surveying and aerial mapping is involved in the studies, but other factors influencing drainage also must be considered, including soil composition, slope and vegetation, and land use.

The Rio Verde studies are expected to take 15 months of work. A second public hearing will be held when the study is complete to inform residents of the results.

The engineering firms on contract with the Flood Control District to perform the studies are Burgess & Niple, Inc., and McLaughlin Kmetty Engineers, Ltd., both of Phoenix.

Questions or additional information about the studies can be obtained by calling or writing Cathy Regester, Jim Phipps or Magnus Jolayemi of the Flood Control District of Maricopa County, 2801 W. Durango St., Phoenix, Ariz., 85009. The telephone is 506-1501.

Accessibility for persons with disabilities will be provided upon request. Those requests should be telephoned to Phipps at 506-1501 so arrangements can be made. Seventy-two hours advance notice is needed to obtain sign language interpreters and alternate materials for persons who have visual disabilities.

AERIAL MAPPING COMPANY, INC.
3141 W. Clarendon Avenue
PHOENIX, AZ 85017-4588

TEL (602) 263-5728
FAX (602) 263-0165

LETTER OF TRANSMITTAL

89-407 CC 2

DATE	JOB NO.
1-20-94	93-168

ATTENTION: FRANK BROWN

RE: RIOVERDE South Quad Data.

RECEIVED JAN 21 1994

TO MIKE
3501 N. 16th ST Suite B
Phoenix AZ 85016

WE ARE SENDING YOU ☐ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ AutoCAD DRAWING for Riverde

COPIES	DATE	NO.	DESCRIPTION
1	1-20-94		RIOVERDE QUAD DATA IN AutoCAD R:12, DWG-FORMAT ZIPPED AND DOS BACKUP TO (2) DISCS RESTORE TO C:\

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit_____copies for approval
☐ For your use ☐ Approved as noted ☐ Submit_____copies for distribution
☐ As requested ☐ Returned for corrections ☐ Return_____corrected prints
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 19_____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS STREAMS ARE INTERMITTANT FROM SUB. CONTOURS HAVE NO Z value Questions call Larry BLilic 263-5794

COPY TO Tom Loomis
Flood Control District - Cathy Register

SIGNED: Larry Blilic

If enclosures are not as noted, kindly notify us at once.

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

February 3, 1994

GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

Ms. Cathy Regester, Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Rio Verde South Floodplain Delineation Study
Contract FCD 93-07, MKE Job No. 89-407.003
Monthly Progress Report No. 1

Dear Ms. Regester:

The following progress is reported for the period December 9, 1993 to January 25, 1994:

TASK 1 - COORDINATION
- a. Verbal Notice to Proceed on December 9, 1993.
- b. Kick-off Meeting held on January 4, 1994.
- c. Project Schedule and Estimated Quarterly Billings submitted on January 4, 1994.
- d. Public Meeting #1 held on January 19, 1994.
- e. Placement of legal advertisement in the Arizona Republic and the Times of Fountain Hills. Submitted original affidavit from Arizona Republic.

TASK 2 - DATA COLLECTION
- a. Received FEMA data obtained by FCDMC.

TASK 3 - TOPOGRAPHIC MAPPING
- a. Coordination meeting with Burgess & Niple (Rio Verde North) and Aerial Mapping Company on December 10, 1993.

TASK 4 - FIELD SURVEY
- a. Supplied location of verification check sections to Burgess & Niple.

TASK 5 - HYDROLOGY
- a. Received major basin map with possible split flow locations from Wood-Patel, hydrology subconsultant for Rio Verde North. Acceptance reserved until field reconnaissance and split analysis is completed.

TASK 6 - FLOODPLAIN DELINEATION
- a. No activity.

TASK 7 - DELIVERABLES
- a. No activity.

BILLINGS\FEB-94.GEK

The estimated completion by Tasks are:

Task No.	Percentage Complete
1	2
2	1
3	1
4	1
5	1
6	0
7	0
OVERALL	2

During the month of February, we plan to meet with the GIS subconsultant, obtain the USGS topographic map in digital form and prepare for field reconnaissance work and data collection in March.

If you have any questions or require additional information please call me.

Very truly yours,

McLAUGHLIN KMETTY ENGINEERS, Ltd.

Géza E. Kmetty

Géza E. Kmetty, P.E.
Principal

BILLINGS\FEB-94.GEK

MKE

McLaughlin K. .etty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 03-10-94	Job No.: 89-407.003
To: Flood Control District of Maricopa County 2801 West Durango Street Phoenix, Arizona 85009	Attention: Ms. Cathy Regester Re: FCD Contract No. 93-07 Rio Verde South

WE ARE SENDING YOU X ATTACHED ___ VIA Hand Deliver

Original:	Copies	Date	Description
1	1	03-09-94	Summary Report for Phase I, Task 2 Data Collection.

Remarks:

COPY TO George V. Sabol (including report)

SIGNED Frank Edward Brown

Frank Edward Brown, P.E.

FLOOD INSURANCE STUDY
for
RIO VERDE SOUTH
FCD CONTRACT NO. 93-07

SUMMARY REPORT FOR
PHASE I, TASK 2 DATA COLLECTION

March 9, 1994

As part of the Scope of Work for the Flood Insurance Study for Rio Verde South, data collection was performed. Several reference sources were consulted in order to obtain the results of previous studies and other pertinent data to support development of this study. The following is a brief summary of that information.

Summary of Data Collection

1. FEMA/Michael Baker Jr., Inc.:

   a. A report entitle "Floodplain Study of Rio Verde, Arizona", dated May 20, 1988, by Wiley & Associates.

   b. Sheet 1 through 3 of topographic maps entitled "Rio Verde Flood Study", dated May 20, 1988, by Wiley & Associates. Scale: 1"=40'. Shows HEC-2 cross-section locations.

   c. A blueprint of an aerial photograph entitled "Rio Verde Flood Study", showing the Rio Verde Subdivision limits and channel locations, dated February, 1987, by Wiley & Associates. Scale: 1"=410'±.

   d. A drainage map entitled "Tonto Verde, Master Drainage Map", dated November, 1986, Sealed 11/7/86, it is the map for Item 1-e.

   e. A drainage map entitled "A Map for Drainage Study, Rio Verde", showing floodplain boundary delineations, dated February, 1987. Scale: 1"=150'. (Not sealed, it is the original drainage study for Rio Verde.)

f. A report entitled "Preliminary Drainage Report, November 1986, Tonto Verde Master Plan", dated November 1986, by Wiley & Associates. For associated map see Item 1-d.

g. A topographic map entitled "McDowell Mountain Park Channel", dated July 1987, by Wiley & Associates. (This is the diversion dike on Wash 10.)

2. Newspaper Articles/Clippings:

a. The Times/Rio Verde

Dates:
- June 9, 1993
- June 16, 1993
- July 21, 1993
- December 15, 1993
- December 22, 1993

3. Development Master Plan for Tonto Vista Contour Map with Golf Course Layout. Scale: 1"=300'. By A. Wayne Smith & Associates dated December 1982.

4. Revised Drainage Master Plan for Tonto Verde. Scale: 1"=300' by Brooks, Hersey & Assoc. dated June 22, 1993, showing Drainage Basin Number, D.A. Boundaries, Detention/Detention Basins.

5. Rio Verde Sales Brochure, including:

a. Resale Home - Asking Prices 6/23/93.

b. Alexander Homes - Model Price List 4/7/93.

c. Rio Verde Country Club Membership - Fees and Dues 4/1/93.

d. Resale Lots - Prices 6/24/93.

6. Rio Verde Unit Six. Re-Plat of Lot 491 dated December 23, 1993. The lot is adjacent to Wash 10.

7. Rio Verde Unit 11 from FCD file S38-39.

   a. Final Drainage Report by Wiley & Associates dated April 21, 1988.

   b. Three 11" x 17" portions of the Final Plat (unsigned, not stamped), by Wiley & Associates.

   c. Paving, Grading, Drainage and Sewer Collection Plans - Sheets 1, 2, 3, 4, 5, 6, and 7 of 44 by Wiley & Associates dated April 22, 1988, signed and stamped.

8. Rio Verde Unit One (also labelled as Phase One) from FCd file S93-03.

   a. Final Plat Review, Comments and Responses by Brooks, Hersey & Assoc. dated September 28, 1993.

   b. Letter from Rio Verde Services, Inc., President David S. Ritchie to Felicia Terry, Flood Control District of Maricopa County (FCDMC) dated June 1, 1993 regarding Tonto Verde, Phase 1 Plat.

   c. FCDMC Inter-Office Memo from C.W. Regester to P.A. Calza dated June 8, 1993 regarding Tonto Verde Floodplain Delineation, includes HEC-2 printouts and input data.

   d. FCDMC Inter-Office Memo from C.W. Regester to F. Terry dated July 8, 1993, regarding Tonto Verde Preliminary Plat Results of Discussions with Mr. O'Neill of Brooks, Hersey. Subject: HEC-2 Study of FIRM submitted June 25, 1993.

   e. FCDMC Inter-Office Memo from S. Story to F. Terry dated July 8, 1993 regarding Tonto Verde Hydrology Final Review Comments.

   f. FCDMC Inter-Office Memo from C.S. Regester to F. Terry dated April 19, 1993 regarding Tonto Verde Phase One Preliminary Plat Review Comments. Comments on FIRM Wash 10, FIRM Wash 11.

g. FCDMC Memo to Richard Turner, Director of Planning, from Edward Raleigh, Engineering Division Manager, dated July 13, 1993 regarding Tonto Verde Master Drainage Plan and Preliminary Plat Review.

h. FCDMC Memo to Richard Turner, Director of Planning, from Edward Raleigh, Engineering Division Manager, undated, regarding Tonto Verde - Final Plat.

i. FCDMC Inter-Office Memo from C.W. Regester to C.G. Fernandez dated September 20, 1993 regarding Tonto Verde - Grading and Drainage Plans. Review of Plans and HEC-2 Computations.

j. Scour Calculations and HEC-2 runs for Diversion Structure West of Tonto Verde dated December 8, 1993 from Brooks, Hersey & Assoc. to Cora Fernandez, FCDMC. (Partial Copy. Two pages only.) A complete copy of the engineer's design file has been requested; currently under construction, As-Builts will be sent.

k. Letter to Steve Tucker, FCDMC, from Brooks, Hersey & Assoc. dated December 16, 1993 regarding Tonto Verde, Unit, Temporary Club House, Sales Office Site Plan.

l. Final Drainage Report for Tonto Verde Unit I dated September 2, 1993 by Brooks, Hersey & Associates. (Complete Copy.)

m. Memo to Richard Tucker from Edward Raleigh dated October 1, 1993 regarding Tonto Verde Final Plat.

n. FAX-cover to Brooks, Hersey & Assoc. from Cora Fernandez, FCDMC, not dated regarding requesting Calculations for the design and stability of the diversion structure. See Item 8-j.

o. Letter to Steve Tucker from Brooks, Hersey & Assoc dated December 6, 1993 regarding Tonto Verde, Unit 1, Lots 53, 54 and 55 Certification.

p. FAX - Cover Sheet - to Cora Fernandez from Brooks, Hersey & Assoc. dated January 13, 1994 regarding Diversion Structure Details. See Item 8-j

9. Rio Verde Unit 4 from FCD file S78-84.

a. Vicinity Map - No Scale.

10. Rio Verde Units 5 and 5A from FCD file S75-11.

a. Unit 5A - Two partial prints of Plat - 11" x 17" - Title and Vicinity Map.

11. Rio Verde Units 6 and 7 from FCD file S76-16A.

a. Letter from Leslie Bond, FCDMC Chief Hydrologist, to Don McDaniel, FCDMC Planning Department Director, dated May 10, 1978 regarding Final Plat Review for S76-16.

b. Letter from Herb Donald, FCDMC Chief Engineer, to Earle Slider of Wiley & Associates dated July 7, 1977 regarding Unit 6 Paving Plans Review Comments.

c. Unit 7 Partial Plat - 11" x 17" - Title and Vicinity Maps.

d. Unit 6 Paving Plan Title Sheet - 11" x 17" - and Vicinity Map.

12. Rio Verde Unit 8 from FCD file S80-30.

a. Preliminary Plat - Reduced to 11" x 17".

b. Paving and Grading Plan. (Partial)

c. Vicinity Map - No Scale.

d. Typical Channel Section.

e. Sixth Fairway Drainage Study Cross-Sections (11" x 17").

f. Vicinity Map - No Scale.

g. Vicinity Map - No Scale (Contour Map).

h. Drainage Report dated June, 1981 (6 pages).

13. Rio Verde Unit 2 from FCD file S79-1.

a. Vicinity Map (11" x 17").

b. Narrative dated February 24, 1979 describing drainage of Unit 2 (4 pages).

14. Rio Verde Unit 7 from FCD file S76-16B.

a. Memo from Nick Karan, FCDMC Engineering Division Chief, to Buck Orahood, MCHD Permits Division, dated November 20, 1989 regarding Drainage Easement Abandonment for Lots 633, 634, 635 and 636.

b. Legal Description for Drainage Easement Abandonments, by Wiley & Associates, regarding Lots 633, 634, 635 and 636 (6 pages, including map).

15. Rio Verde Unit 9 and 9A from FCD file S82-21.

a. Preliminary Plat - Partial (11" x 17").

b. Typical Parking - 11" x 17".

c. Letter from Doug Plasencia, FCDMC Hydrologist to Wiley & Associates dated August 13, 1985 regarding Paving, Grading and Drainage Plan revision requests.

d. Final Plat and Vicinity Map (11" x 17") - 2 sheets.

e. Final Drainage Report - Unit 9A dated June 1985 by Wiley & Associates. (Partial Copy, 33 pages).

16. Rio Verde Unit 10 from FCD file S85-40

a. Final Drainage Report dated April, 1986 by Wiley & Associates. (Complete Copy, 59 pages and map.)

17. Rio Verde Unit 12 from FCD file S89-5.

a. Preliminary Drainage Report dated May, 1989 by Wiley & Associates (Partial Copy, 11 pages).

b. Letter from Wiley & Associates to Tim Murphy, FCDMC, dated April 23, 1990 regarding Minutes of April 4, 1990 Meeting on FCD drainage comments..

c. Revised Master Development Plan dated August 18, 1989 by Wiley & Associates (Partial Copy, 2 pages).

18. Rio Verde Country Club

a. Letter to C. Regester, FCDMC, from Wiley & Associates dated May 20, 1993 regarding Fairway 6, (Wash 10) HEC-2 Analysis showing highwater elevations vs. finished floor elevations.

19. Rio Verde Commercial Park from FCD file S80-32

a. Report to the Planning & Zoning Commission dated July 2, 1981. 2 pages (11" x 17").

b. Portions of Reduced Plat (3)

20. Rio Verde Washes - Flood Insurance Study

a. Final Drainage Report (Partial Copy) dated February, 1990 regarding Unit 12 by Wiley & Associates. Includes:
   D.A.'s 1 through 8
   FIRM Wash 10
   Cultural Resources Survey
   Rainfall Intensity Letter
   References
   Preliminary Drainage Map

b. Tonto Verde Development Master Plan dated July 16, 1992 by Cornoyer-Hedrick, Architects, (Complete Copy).

c. FCDMC Inter-Office Memo from C.W. Regester to C.G. Fernandez dated February 23, 1993 regarding Tonto Verde Final Drainage Report Review Comments.

d. FCDMC Inter-Office Memo from AMM to PAC dated February 16, 1993 regarding explanation of discrepancy in Peak Q estimate at Wash 10.

e. Letter from Joe Tram, FCDMC, to Brad Gordon, Wiley & Associates, dated August 6, 1990 regarding FIRM Wash 10 Channelization Review Comments.

f. FCDMC Inter-Office Memo from Joe Tram to Tim Murphy dated March 16, 1990 regarding nine items of concern about FIRM Channel, Wash 10.

g. Floodplain Study by Wiley & Associates dated May 20, 1988 (Partial Copy, 2 pages, including map).

h. FCDMC Inter-Office Memo from C.W. Regester to C.G. Fernandez dated February 23, 1993, regarding Tonto Verde Final Drainage Report Review Comments.

i. Letter from John Matticks, FEMA, to Fred Koory, Maricopa Board of Supervisors, dated October 3, 1989 regarding Washes 9 and 10 floodplain boundary approval.

j. Letter from John Matticks, FEMA, to Tom Freestone, Maricopa Board of Supervisors, dated December 18, 1988 regarding additional data requests on Washes 9 and 10.

k. Letter from John Matticks, FEMA, to Tom Freestone, Maricopa Board of Supervisors, dated October 14, 1988 regarding acknowledgement of reviewing Wiley & Associates submittal on Washes 9 and 10.

l. Letter from Wiley & Associates to John Matticks, FEMA dated September 8, 1988 regarding explanation of Wash 10 diversion impacts in Wash 11.

m. Letter from Jan Farmer, FCDMC, to Wiley & Associates dated August 29, 1988 regarding Rio Verde FEMA Map Revision Request for Information.

n. Letter from John Matticks, FEMA, to Tom Freestone, Maricopa Board of Supervisors, dated August 8, 1988 regarding Washes 9 and 10, responses to Wiley & Associates submittal.

o. Drainage Report for Rio Verde Unit 3 dated December 17, 1973 by Bellante, Clauss, Miller & Nolan (Partial Copy, 27 pages).

p. Tonto Verde Master Plan Drainage by Wiley & Associates dated August 30, 1986 prepared in 1978, submitted to FCDMC for Sec. 36,31.

q. Revised Master Drainage Plan Tonto Verde dated May, 1993, by Brooks, Hersey & Assoc., including FCDMC review comments by S. Story to F. Terry (Complete Copy).

21. Tonto Verde Development Master Plan dated July 16, 1992, revised August 20, 1992.

22. Tonto Verde from FCDMC file MP 92-02.

a. Letter from David Ritchie, Rio Verde Services to Richard Turner, Maricopa County Planning and Development, dated May 27, 1993 regarding Tonto Verde Development Master Plan, Stipulation "K", wash banks Re-vegetation Plan.

b Conference Report dated April 8, 1993 by Gregg Kent, Brooks, Hershey & Associates, regarding discussion of Drainage Concerns of Tonto Verde Development with the FCDMC.

c. Letter from David Ritchie, Rio Verde Services, to Richard Turner, Maricopa County Planning and Development dated June 1, 1993 regarding Stipulation "K" FIRM 11 Wash - Re-vegetation Plan.

d. Letter from Tim Dunham, Rio Verde Landscaping to Richard Turner, Maricopa County Planning and Development, dated May 27, 1993 regarding Stipulation "K", wash banks Re-vegetation Plan.

e. Preliminary Drainage Report Tonto Verde Phase I dated April 1993 by Brooks, Hersey & Assoc. (Complete Copy).

f. Revised Drainage Plan and HEC-2 Sections dated May 26, 1993 by Brooks, Hersey & Assoc. (Transmittal letter only from Brooks, Hersey & Assoc. to FCDMC.)

g. Project Memos

1. From Jerry Wensloff, Brooks, Hersey & Assoc., dated April 5, 1993 regarding conversation with C. Regester, FCDMC.

2. Drainage Investigation from Brooks, Hersey & Assoc., to G.K., V.W. (Agency unknown) regarding visual analysis of flow splits dated April 4, 1993.

3. From Jerry Wensloff, Brooks, Hersey & Assoc., dated March 30, 1993 regarding conversation with Lenny Gostinski, Wiley and Associates, about flow splits on Wash 10.

h. Letter from F. Terry, FCDMC, to David Ritchie, Rio Verde Services, dated June 8, 1993 regarding Tonto Verde - Phase I Plat. (Prohibits obstruction in drainage easements.)

i. Letter from David Ritchie, Rio Verde Services, to F. Terry, FCDMC, dated June 1, 1993 regarding Phase I Plat.

j. Letter from Ron Nevitt, FCDMC, to David Ritchie, Rio Verde Services, dated April 23, 1993 regarding staff report on floodplain use permit.

k. Letter from Ed Raleigh, FCDMC to David Ritchie, Rio Verde Services, dated March 3, 1993 regarding request for information to issue drainage clearance.

l. Tonto Verde Master Plan Final Drainage Report dated August 1992 by Wiley & Associates (Cover Only) superseded by May, 1993 Report by Brooks, Hersey & Assoc.

23 Tonto Verde from FCD file MP 90-2.

a. Transmittal Letter dated February 8, 1994 from Brooks, Hersey & Assoc. to FCDMC. Items:

1. Set of semi-rectified aerial photos of new Tonto Verde Golf Course. Scale: 1"=100'.
2. Grading Plan - As Built.
3. Site Plan - Golf Course.

b. Rio Verde Drainage Report dated January, 1974 by Bellante, Clauss regarding Section 6, Township 4 North, Range 7 East D.A.'s P through Z, AA, BB and CC. (Partial Copy, 1 page).

c. Tonto Verde - Existing Zoning Map - 1"=1200' Reduced prepared by A. Wayne Smith for Rio Verde Services, March 15, 1990.

d. Tonto Verde Development Master Plan dated July 2, 1990, (Partial Copy, 7 Pages). (Superseded by August 20, 1992 Cornoyer-Hedrick Report).

24. Tonto Verde from FCD Accordion file

a. Letter of Transmittal from Brooks, Hersey to FCDMC dated June 24, 1993 - Tonto Verde. Items:

1. Preliminary Plat
2. Golf Course Drainage Plan
3. Revised Master Drainage Plan
4. Roadway Calculations

b. Final Drainage Report dated August, 1992 by Wiley & Associates regarding Tonto Verde Master Plan. (Partial Copy, 9 pages).

1. Memo from Ed Raleigh, FCDMC, to Dennis Zwagerman, Maricopa County Planning and Development, dated September 18, 1992 by Wiley & Associates regarding Tonto Verde Master Plan Approval Conditions.

2. Six pages of Drainage Report (See above title)

c. FCDMC Inter-Office Memo from A.M.M. to P.A.C. & C.W.R. dated February 16, 1993 regarding explanation of discrepancies in peak Q's in Wash 10 between Rio Verde and Tonto Verde Projects.

d. FCDMC Inter-Office Memo from C.W.R. to P.A.C. dated June 8, 1993 regarding Tonto Verde Floodplain Delineation for FIRM Washes 10 and 11 - Review Comments.

e. List of HEC-2 file names and culvert calculations for FIRM 11 Crossing, roadway name not specified.

f. Revised Master Drainage Plan Tonto Verde dated May, 1993 by Brooks, Hersey & Assoc. Complete copy of text, no calculations.

1. FIRM 10 Existing Channel 100-year Q, W.S. Elevations.

2. FIRM 10 Developed Conditions W.S. Elevations.

3. Tonto Verde Unit One W.S. Elevations.

4. FIRM 11 - HEC-2 Results.

5. Master Drainage Area Map for Tonto Verde (2 pages).

25. Tonto Verde 18 hole golf course layout.

26. Sample of Kenney Aerial Maps (2 - 11" x 17") covering Rio Verde and Tonto Verde.

27. Drainage Area Map of Tonto Verde Development dated March 26, 1993 by Brooks, Hersey & Assoc., Wiley & Associates and Cornoyer-Hedrick.

28. Re-Plat of Lot 491, Rio Verde Unit 6 dated December 6, 1993 by Wiley & Associates.

29. Tonto Verde Unit One Improvements Grading Plans dated October 14, 1993 by Brooks, Hersey & Assoc. (Sheet 6 and 7 of 10.)

30. Rio Verde Fairway Six, Grading and Drainage dated April 8, 1993 by Wiley & Associates. (Sheets 1 and 2 of 2.)

31. Tonto Verde Phase One Preliminary Plat dated May 5, 1993 by Brooks, Hersey & Assoc. (Sheets 1 and 2 of 2.)

32. Rio Verde Unit 12 - Offsite Grading from Channel to Inlet dated June 28, 1990 by Wiley & Associates.

33. Final Drainage Map - Rio Verde United 12 dated February 25, 1990 by Wiley & Associates.

34. Tonto Verde Unit One Improvements Grading Plans dated October 14, 1993 by Brooks, Hersey & Assoc. (Sheets 6 and 7 of 10.)

35. Kenney Aerial Maps - Full Size (2 copies) - Golf Course without any other development.

36. Geotechnical Investigation Report, Rio Verde Dike Evaluation, Maricopa County, Arizona, dated January 14, 1994 by SHB Agra Inc., prepared for FCDMC.. Discusses geotechnical concerns on Wash 10 dike located within the McDowell Mountain Park.

MKE
McLaughlin Kuetty Engineers, Ltd.
3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

To: Flood Control District of Maricopa County	Date: 3-17-98 Job No.: 89-907.003
	Attention: Ms. Cathy Regester
	Re: Rio Verde South
	FCD 93-07

WE ARE SENDING YOU X ATTACHED ___ VIA mail

Original:	Copies	Date	Description
	1	3-16-98	Right of Entry Letter to Mr. David Ritchie
	1	—	List of Property Owners Notified

Remarks: Cathy,
here is one sample letter, plus the
Complete list of who we sent Right of Entry letters to.

COPY TO Richard Alcocer, ALS, incl. enclosures
Tom Loomis, GUSCE, incl. enclosures

SIGNED Frank Edward Brown

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TDD (602) 506-5897

Neil S. Erwin, P.E., Chief Engineer and General Manager

March 21, 1994

Frank Brown, P.E.
McLaughlin Kmetty Engineers, Ltd.
3501 N. 16th Street
Phoenix, Arizona 85016-6419

SUBJECT: Rio Verde South FDS (FCD # 93-07)
Tonto Verde Off-site Diversion Structure

Dear Mr. Brown:

Please find enclosed two (2) copies of the design drawing sheet and the HEC-2 runs for the subject diversion structure. This information was obtained from Mr. Mike O'Neill of Brooks, Hersey & Associates, Inc. In addition, I have attached a copy of a design sheet obtained from Cora Fernandez of the District's Drainage Branch regarding re-bar size and spacing.

The off-site diversion is currently under construction. I will forward a set the as-built drawings to you when they become available.

If you have any questions or require additional information, please feel free to call me at (602) 506-4770.

Sincerely,

Catherine W. Regester

Catherine W. Regester
Hydrologist

Enclosure (28 sheets)

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

March 22, 1994

GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

Ms. Cathy Regester, Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Rio Verde South Floodplain Delineation Study
Contract FCD 93-07, MKE Job No. 89-407.003
Monthly Progress Report No. 2

Dear Ms. Regester:

The following progress is reported for the period January 26, 1993 to February 25, 1994:

TASK 1 - COORDINATION
a. Submitted original affidavit from The Times of Fountain Hills and Rio Verde, newspaper.

TASK 2 - DATA COLLECTION
a. No activity other than in-house.

TASK 3 - TOPOGRAPHIC MAPPING
a. Coordination meeting with GCA on February 2, 1994. Recieved USGS mapping in digital form, plus soils, landuse FCD floodplains, streams PLSS and roads.
b. No other activity other than normal coordination with FCDMC and subconsultants.

TASK 4 - FIELD SURVEY
a. No activity.

TASK 5 - HYDROLOGY
a. Coordination meeting with Wood, Patel and Associates and Burgess and Niple, Inc. concerning unit hydrograph paramaters.

TASK 6 - FLOODPLAIN DELINEATION
a. No activity.

TASK 7 - DELIVERABLES
a. No activity.

The estimated completion by Tasks are:

Task No.	Percentage Complete
1	3
2	1
3	1
4	1
5	2
6	0
7	0
OVERALL	3

During the month of March, we plan to prepare the Data Collection Summary Report.

If you have any questions or require additional information please call me.

Very truly yours,

McLAUGHLIN KMETTY ENGINEERS, Ltd.

Frank Edward Brown

for Geza E. Kmetty, P.E.
Principal

MKE
McLaughlin Koetty Engineers, Ltd.
3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

J 015

LETTER OF TRANSMITTAL

To: FCDMC	Date: 3-29-94 Job No.: 89-407.003
	Attention: Cathy Regester
	Re: Rio Verde South

WE ARE SENDING YOU X ATTACHED ___ VIA deliver

Original:	Copies	Date	Description
	1	8 —	3 returned Right of Entry letters — U.S Postal Service unable to deliver

Remarks:

COPY TO_____

SIGNED Frank Edward Brom

Fax Cover Sheet

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

2801 West Durango Street
Phoenix, Arizona 85009
Telephone (602)506-1501
Fax (602)506-7346
TDD (602)506-5897

FLOODPLAIN MANAGEMENT BRANCH

To: FRANK BROWN

Company or Department: MKE

Fax Number: 248-7851

From: CATHY REGESTER

Number of pages being sent including cover sheet: 2

If there are any problems or questions, please call (602)506-1501

Comments: FRANK,
I CHECKED INTO THE ADDRESSES FOR THE 3 RETURNED RIGHT-OF-ENTRY LETTERS AND THE ATTACHED MEMO STATES WHAT I FOUND. I WOULD LIKE FOR YOU TO SEND A LETTER TO BOTH RIO VERDE PARTNERSHIP AND WEST THIRTY-SIX COMPANY, LTD. IF THIS IS A PROBLEM, PLEASE LET ME KNOW. THANK YOU,
CATHY

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Interoffice Memorandum

Subject: Rio Verde South
Right-of-Entry Letters

File: 93-07

To: Frank Brown **From:** CWRegester CWR **Date:** 3/29/94

I have checked into the addresses for the property owners for which the Right-of-Entry letters were returned and found the following:

- Ms. Jane Mooty is no longer the owner of parcels 219-14-2F, 2L. Tonto at Verde Co. now owns these parcels. Since a Right-of-Entry letter has already been sent to this company in regard to parcel 219-14-2K, I see no reason to send an additional letter.

- The address for Rio Verde Partnership has been changed to:

  Rio Verde Partnership
  2200 E Camelback Road
  #221
  Phoenix, AZ 85016

- The owner of the parcels previously identified with Western Rio Verde, Inc. are now shown to be owned by:

  West Thirty-Six Company, Ltd.
  25609 Danny Lane
  Rio Verde, AZ 85263

WOOD/PATEL
ASSOCIATES
Civil Engineers
Hydrologists
Land Surveyors

Darrel E. Wood, P.E., R.L.S.
Ashok C. Patel, P.E., R.L.S.
James S. Campbell, P.E.
Jay N. Vaughn, R.L.S.
Gordon Wark, P.E.
Jeffrey J. Holzmeister, P.E.

COMMUNICATION RECORD

DATE: April 1, 1994

PROJECT NO: 93031.00

PROJECT NAME: Rio Verde - North Floodplain Delineation Study, Hydrology

SUBJECT: Hydrology Method, Input

Input Received from Sandy Story

Wood/Patel - Burgess & Niple, have submitted preliminary results of hydrology using various methods. The district has received the data submitted and concluded that the Phoenix Valley S-graph be utilized for the subject study.

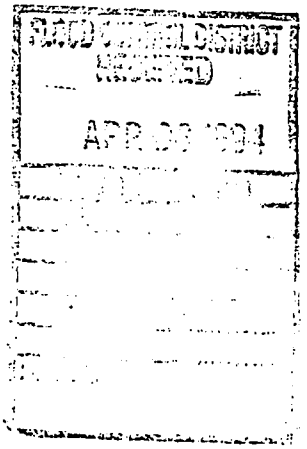
CC:

Burgess & Niple:
Russ Cruff, P.E.
Larry D. Culler, P.E.
Larry J. Woodlan, P.E.

FCDMC:
Sandy Story
Magnus Jolayemi
Cathy Regester

George V. Sabol Consulting Engineers, Inc.
George Sabol, PhD, P.E.
Tom Loomis, P.E.

McLaughlin Kmetty Engineers, Ltd.
Frank Brown, P.E.



GENCOR\93031-00.404

Original

MKE LETTER OF TRANSMITTAL

McLaughlin Kmetty Engineers, Ltd.
3[illegible] North 16th Street, Phoenix AZ 85016-6419
248-7702 FAX 248-7851

TO Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

DATE	JOB NO
4-1-94	89-407.003

ATTENTION: Ms. Cathy Regester

RE: FCD Contract 93-07
Rio Verde

GENTLEMEN:

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	DESCRIPTION
1	04-01-94	List of Property Owners Notified, Revised 4/1/94.

REMARKS In response to your memo of 3/29/94, written notices requesting right of entry were mailed as indicated on the Revised List of Property Owners Notified.

COPY TO _____

SIGNED: Frank Edward Brown
Frank Edward Brown, P.E.

If enclosures are not as noted, kindly notify us at once.

RIO VERDE SOUTH FLOODPLAIN DELINEATION STUDY

RIGHT OF ENTRY FOR SURVEYING PURPOSES

List of Property Owners Notified
*Revised 4/1/94**

Mr. Robert Malone, Chairman
Streets Committee
Rio Verde Community Association
P.O. Box 32012
Rio Verde, Arizona 85263-2012

Mr. Robert Haack, President
Rio Verde Country Club
18731 East Four Peaks Road
P.O. Box 31432
Rio Verde, Arizona 85263

Mr. Bob Anderson, Chairman
Rio Verde Greens and Grounds Committee
18731 East Four Peaks Road
P.O. Box 31432
Rio Verde, Arizona 85263

Mr. David Ritchie
Rio Verde Services
P.O. Box 31001
Rio Verde, Arizona 85263

Mr. David Ritchie, President
Tonto Verde Subdivision
P.O. Box 31001
Rio Verde, Arizona 85263

Mr. David Ritchie
Tonto Vista Development
P.O. Box 31001
Rio Verde, Arizona 85263

West Thirty-Six Company, Ltd.
25609 Danny Lane
Rio Verde, Arizona 85263

5N-6E, Sec. 36
219-38-38H, 38J, 38P, 38R, 38S,
43, 44 & 45
(from Western Rio Verde, Inc.)

RIO VERDE SOUTH FLOODPLAIN DELINEATION STUDY

RIGHT OF ENTRY FOR SURVEYING PURPOSES

List of Property Owners Notified
*Revised 4/1/94**

Mr. David Ritchie
Rio Verde Development
P.O. Box 31001
Rio Verde, Arizona 85263

James Young
U.S. Forest Service
2324 East McDowell Road
P.O. Box 5348
Phoenix, AZ 85010

Louie Hood, Planning Coordinator
Fort McDowell Indian Community
P.O. Box 17779
Fountain Hills, AZ 85269

Robert and Barbara Nelson 7328 E. Krall Scottsdale, AZ 85252	5N-6E, Sec. 25 219-38-17 - 18 and 20 - 34
Rio Verde Partnership *2200 E. Camelback Road, #221* *Phoenix, Arizona 85016*	5N-6E, Sec. 25 219-38-16,
Billie Nelson P.O. Box 32012 Rio Verde, AZ 85255	5N-6E, Sec. 36 219-38-38C
Second Arizona Rio Verde Co. P.O. Box 1 Rio Verde, AZ 85255	5N-6E, Sec. 36 219-38-38X & 38Y 5N-7E, Sec. 32 219-14-1F, 1G, & 1L
Rio Verde Land, Inc. P.O. Box 1 Rio Verde, AZ 85255	5N-7E, Sec. 31 219-14-2H & 2M

* *Italics = Revised Items*

RIO VERDE SOUTH FLOODPLAIN DELINEATION STUDY

RIGHT OF ENTRY FOR SURVEYING PURPOSES

List of Property Owners Notified
*Revised 4/1/94**

Tonto at Verde Co. P.O. Box 1 Rio Verde, AZ 85255	5N-7E, Sec. 31 210-14-2K *219-14-2F, 2L (from Jane Mooty)*
Traverse, Inc. 5605 Woodcrest Drive Edina, MN 55424	5N-7E, Sec. 31 219-14-2Q
Joanne Hilty 2218 East State Street Fremont, OH 43420	5N-7E, Sec. 31 219-14-4
McCullough Properties, Inc. P.O. Box 17795 Fountain Hills, AZ 85268	5N-7E, Sec. 32 219-14-1D
Rio Verde Box-Bar Ranch 3400 City Center Minneapolis, MN 55402	5N-7E, Sec. 32 219-14-1J & 1K
Rio Verde Utilities, Inc. 18815 Four Peaks Blvd. Rio Verde, Arizona 85255	5N-7E, Sec. 32 219-14-1M & 1N
Bob Brethower, Ranch Superintendent ? ? ?	

FLOOD CONTROL DISTRICT of Maricopa County

Interoffice Memorandum

CMT. NO.	SUBJECT: RIO VERDE SOUTH FDS DRAWINGS - COVER SHEET	☐ FILE ☐ DESTROY

TO: FRANK BROWN FROM: CATHY REGESTER DATE: 4/13/94

PLEASE FIND ENCLOSED THE STANDARD COVER SHEET DRAWING AS CONTAINED IN THE DISTRICT'S AUTOCADD FILES. AS YOU CAN SEE, IT IS GEARED TOWARD CONSTRUCTION PROJECTS.

I HAVE ALSO ENCLOSED TWO SAMPLE COVER SHEETS FROM RECENTLY APPROVED FLOODPLAIN DELINEATION STUDIES (STAR WASH & POWERLINE/TANK WASHES). THE STAR WASH SHOWS THE COVER SHEET AS SHEET 1A. PLEASE AVOID USING LETTER DESIGNATIONS AFTER THE SHEET NUMBER. OTHER THAN THIS ITEM, THE SAMPLE COVER SHEETS SERVE AS GOOD EXAMPLES OF WHAT IS EXPECTED ON THE COVER SHEET.

PLEASE LOOK OVER THE ENCLOSED ITEMS AND LET ME KNOW IF YOU FORSEE ANY PROBLEMS OR IF YOU HAVE QUESTIONS. IF YOU THINK THE DISTRICT'S STANDARD COVER SHEET WOULD BE USEFUL TO YOU, PLEASE LET ME KNOW AND I WILL GET IT FOR YOU ON DISKETTE. AS WE DISCUSSED EARLIER, IT CAN BE SUPPLIED EITHER IN AUTOCADD OR MICROSTATION.

MKE

McLaughlin Kmetty Engineers, Ltd.

April 19, 1994 3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

Ms. Cathy Regester, Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

Re: Rio Verde South Floodplain Delineation Study
Contract FCD 93-07, MKE Job No. 89-407.003
Monthly Progress Report No. 3

Dear Ms. Regester:

The following progress is reported for the period February 26, 1994 to March 25, 1994:

TASK 1 - COORDINATION

a. Normal coordination consisting of telephone conversations and information exchange between involved parties.
b. Right of Entry for Surveying Purposes Letters were sent to appropriate individuals and companies. The List of Property Owners Notified was mailed to FCDMC on March 17, 1994.

TASK 2 - DATA COLLECTION

a. Collection and review of available data. Submitted Data Collection Summary Report on March 10, 1994.
b. A subscription to the newspaper "The Times of Fountain Hills and Rio Verde, Arizona" was obtained to keep abreast of developments and problems in the community.
c. Design information was received from Brooks, Hersey & Associates, Inc. via FCDMC concerning a diversion structure in Tonto Verde Subdivision, which is currently under construction.

TASK 3 - TOPOGRAPHIC MAPPING

a. Aerial Mapping Company, under contract to Burgess & Niple, Rio Verde North consultant, is currently preparing the topographic mapping and anticipates completion for Rio Verde South on May 2, 1994.

TASK 4 - FIELD SURVEY

a. No activity.

TASK 5 - HYDROLOGY

a. Reviewed preliminary hydrologic analysis prepared by Wood, Patel and Associates concerning unit hydrograph parameters.
b. Prepared March 21, 1994 memorandum comparing and contrasting peak discharges for various unit hydrographs and hydrologic parameters.

TASK 6 - FLOODPLAIN DELINEATION

a. No activity.

TASK 7 - DELIVERABLES

a. Activity consisted of above referenced submittals and documents.

The estimated completion by Tasks are:

Task No.	Percentage Complete
1	5
2	75
3	5
4	5
5	8
6	0
7	5
OVERALL	5

During the month of April, we plan to further analyze the Data Collection maps, calculations and report and begin hydrologic analyses. A meeting is planned on March 29, 1995 to discuss unit hydrographs and hydrologic parameters. Planning to prepare for hydrologic and hydraulic field reconnaissance is anticipated to occur.

If you have any questions or require additional information please call me.

Very truly yours,

McLAUGHLIN KMETTY ENGINEERS, Ltd.

Geza E. Kmetty, P.E.
Principal

FLOOD CONTROL DISTRICT of Maricopa County

Interoffice Memorandum

RECEIVED APR 2 1 1994

CMT. NO.	SUBJECT: RIO VERDE SOUTH STANDARD COVER SHEET	☐ FILE ☐ DESTROY

TO: FRANK BROWN FROM: CATHY REGESTER DATE: 4/20/94

PLEASE FIND ENCLOSED A DISKETTE FROM OUR GIS GROUP CONTAINING THE SUBJECT COVER SHEET. THE FILE SHOULD BE IN AUTOCADD FORMAT.

IF YOU HAVE ANY PROBLEMS, PLEASE CALL ME.

6910-007 3-90

BURGESS & NIPLE
ENGINEERS
ARCHITECTS

Burgess & Nipie, Inc.
5025 East Washington Street
Suite 212
Phoenix, AZ 85034
602 244-8100
Fax 602 244-1915

LETTER OF TRANSMITTAL

DATE 4/20/94	JOB NO.
RE: Rio Verde North & South — Floodplain Delineation Study	

TO Cathy Regester
Flood Control District of Maricopa County
2801 West Durango
Phoenix, AZ 85009

WE ARE SENDING YOU: ☑ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☑ Mapping and Auto CAD files

COPIES	DATE	NO.	DESCRIPTION
1		2-8	Prints of topographic work maps for Rio Verde South
1		1-5	Auto CAD digital files of topographic work maps for Rio Verde South
1		1-2	Digital files of breakline data for Rio Verde South
1		2-6	Prints of topographic work maps for Rio Verde North

THESE ARE TRANSMITTED:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☑ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☐ As requested ☐ Returned for correction ☐ Return _____ corrected prints
☐ For review and comment ☐ _____

REMARKS _____

COPY TO Magnus Jolayemi
Lesa Kmetty
Larry Woodham

SIGNED Larry D. Cullen

If enclosures are not as noted, kindly notify us at once.

BURGESS & NIPLE
ENGINEERS
ARCHITECTS

Burgess & Niple, Inc.
5025 East Washington Street
Suite 212
Phoenix, AZ 85034
602 244-8100
Fax 602 244-1915

LETTER OF TRANSMITTAL

DATE 4/20/94	JOB NO.
RE: Rio Verde North & South - Floodplain Delineation Study	

TO Maggnus Jolayemi
Flood Control District of Maricopa County
2801 West Durango
Phoenix, AZ 85009

WE ARE SENDING YOU: ☑ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☑ Mapping and Auto CAD Files

COPIES	DATE	NO.	DESCRIPTION
1		2-6	Prints of topographic work maps for Rio Verde North
1		1-4	Auto CAD digital files of topographic work maps for Rio Verde North
1		1-2	Digital files of breakline data for Rio Verde North
1		2-8	Prints of topographic work maps for Rio Verde South

THESE ARE TRANSMITTED:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☑ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☐ As requested ☐ Returned for correction ☐ Return _____ corrected prints
☐ For review and comment ☐ _____

REMARKS _____

✓ Cathy Rogerson

COPY TO Gayle Knotts
Larry Woodman

SIGNED Larry D. Cullers

If enclosures are not as noted, kindly notify us at once.

FLOOD CONTROL DISTRICT of Maricopa County

Interoffice Memorandum

CMT. NO.	SUBJECT: RIO VERDE SOUTH	☐ FILE _____ ☐ DESTROY

TO: FRANK BROWN FROM: CATHY REGESTER DATE: 4/26/94

POSTER BOARDS, AS DESCRIBED ON ATTACHED SHEET, BEING RETURNED AS REQUESTED.

THANK YOU FOR LETTING ME BORROW THEM.

LETTER OF TRANSMITTAL

McLaughlin Kmetty Engineers, Ltd.
3501 North 16th Street, Phoenix AZ 85016-6419
248-7702 FAX 248-7851

TO Flood Control District of Maricopa County

DATE 12-20-93 JOB NO 89-402003

ATTENTION Cathy Regester

RE: Rio Verde South

GENTLEMEN:

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via pick-up the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☒ Paster Boards as described:

COPIES	DATE	DESCRIPTION
1 ✓	—	24×36 Showing blue stream lines, red boundary and yellow flow splits.
1 ✓	—	Exhibit 1 Floodplain & Mapping Options - 24×36
10	12-16-92	2-30×33 Aerial Photographs 1"=400' red & yellow Stream lines (blue dots are known culverts). Photo Date Dec 16 92.

REMARKS Cathy,
we have Exhibit 1 in our Computer so we could revise it to ~~show~~ delete option B mapping, etc. Let me know.

COPY TO

SIGNED: Frank Edward Brown

BURGESS & NIPLE
ENGINEERS
ARCHITECTS

Burgess & Niple, Inc.
1106 North Beeline Highway
Payson, AZ 85541
602 474-5313
Fax 602 474-3511

LETTER OF TRANSMITTAL

DATE 5-3-94	JOB NO. 15183
RE: RIO VEROE FLOOD DELINEATION STUDY	

TO FRANK BROWN
MCLAUGHLIN KMETTY ENGINEERS

WE ARE SENDING YOU: ☑ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1			AERIAL CONTROL MAP W/PT#'S ON QUAD. MAP
1			" " LIST W/PT#'S, DESCRIPTION, POINT ELEV.
			& PANEL ELEV'S (ON USGS DATUM)
1			FIELD BOOKS - VERTICAL RUNS - (UNCONVERTED TO USGS DATUM)
1			GPS CONTROL DESCRIPTION SHEETS FOR HZ. CONTROL
1			ON-SITE QUALITY CONTROL SECTION PRINTOUT
			(ON USGS DATUM)
1			AERIAL MAPS - REDLINED W/AERIAL CONTROL, X-SEC'S, ERM'S

*SECTION LINES

THESE ARE TRANSMITTED:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☑ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☐ As requested ☐ Returned for correction ☐ Return _____ corrected prints
☑ For review and comment ☐ _____

REMARKS _____

COPY TO P FILE
L. CULLER
Magnus Jolayemi
Cathy Regester
Larky Woodlan

SIGNED _____

If enclosures are not as noted, kindly notify us at once.

BURGESS & NIPLE
ENGINEERS
ARCHITECTS

Burgess & Niple, Inc.
5025 East Washington Street
Suite 212
Phoenix, AZ 85034
602 244-8100
Fax 602 244-1915

LETTER OF TRANSMITTAL

DATE 5/9/94	JOB NO.
RE: Rio Verde South - Floodplain Delineation Study	

TO Gregg Kmetty
McLaughlin Kmetty Engineers, Ltd.
3501 North 16th Street
Phoenix, AZ 85016

WE ARE SENDING YOU: ☑ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☑ Photo transparencys

COPIES	DATE	NO.	DESCRIPTION
1		2-3	Original Mylars of photo transparencys for Rio Verde South

THESE ARE TRANSMITTED:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☑ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☐ As requested ☐ Returned for correction ☐ Return _____ corrected prints
☐ For review and comment ☐ _____

REMARKS

MAY 11 '94

CHENG	P & PM
DEP	HYDRO
ADMIN	LMGT
FINANCE	FILE
C & D	CWR
ENGR	
REMARKS	

COPY TO Magnus Jolayemi
Cynthia Reposteri
Larry Walker

SIGNED Larry D. Cullen

If enclosures are not as noted, kindly notify us at once.

MKE
McLaughlin Knetty Engineers, Ltd.
3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

JOE

LETTER OF TRANSMITTAL

Date: 5-27-94	Job No.: 89-407.003
To: Flood Control District of Maricopa County	Attention: Cathy Regester
	Re: Rio Verde South

WE ARE SENDING YOU X ATTACHED ___ VIA deliver

Original:	Copies	Date	Description
1		5-27-94	Colored Original of Subbasin Map (Preliminary)
	1	5-27-94	Photo copy of above (1"= 200')
	2	5-27-94	1"= 1000 feet USGS subbasin map

Remarks: Cathy,

please convey these maps to Sandy Story.

The photo copy set is yours for review comments. The colored original is for ease of use & should be returned to us when you are through.

COPY TO Tom Loomis, GVSCE

SIGNED Frank Edward Brown

FLOOD CONTROL DISTRICT of Maricopa County

89-407.003

Interoffice Memorandum

RECEIVED JUN 13 1994

CMT. NO.	SUBJECT: RIO VERDE SOUTH	☐ FILE ☐ DESTROY

TO: TOM LOOMIS FROM: CATHY REGESTER DATE: 6/3/94

PLEASE FIND ATTACHED A COPY OF THE PRE-LIM. DRAINAGE REPORT FOR TONTO VERDE UNIT 3, FOR YOUR INFORMATION.

PRELIMINARY DRAINAGE REPORT

TONTO VERDE UNIT 3

Prepared For:

RIO VERDE SERVICES, INC.
P. O. Box 31001
Rio Verde, AZ 85263
(602)471-7247

Prepared By:

BROOKS, HERSEY & ASSOCIATES, INC.
4602 E. Elwood Street, #16
Phoenix, AZ 85040
(602)437-3733

May 1994

89-407.402

Fax Cover Sheet

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

2801 West Durango Street
Phoenix, Arizona 85009
Telephone (602)506-1501
Fax (602)506-7346
TDD (602)506-5897

FLOODPLAIN MANAGEMENT BRANCH

To: FRANK BROWN

Company or Department: MKE

Fax Number: 248-7851

From: CATHY REGESTER

Number of pages being sent including cover sheet:

If there are any problems or questions, please call (602)506-1501

Comments: THIS IS WHAT I RECEIVED FROM BROOKS - HERSEY REGARDING CONTROL FOR THEIR NEW MAPPING.
PLEASE CALL ME AFTER YOU HAVE REVIEWED.

N 11236.85
E 5394.91
EL. 1681.46

EL. 1646.51

EL. 1617.70

N 11242.9
E 9500.72
EL. 1586.7

N 9469.72
E 5396.84
EL. 1680.54

EL. 1653.82

EL. 1618.76

N 9524.27
E 9502.89
EL. 1585.1

N 7702.87
E 5398.77
EL. 1684.58

N 7585.77
E 6226.41
EL. 1665.80

EL. 1626.15

N 7769.42
E 9504.38
EL. 1586.77

EL. 1665.67

N 6057.08
E 5411.75
EL. 1673.62

N 6000.00
E 6218.91
EL. 1653.29

SW COR. SEC. 31
T-5-N, R-7-E

BROOKS, HERSEY AND ASSOCIATES
ENGINEERS/SURVEYORS

TONTO VERDE
AERIAL CONTROL

A.C.A. 03/23/94

Sec 36 T5N R6E

Point statistics:
Starting point number: 1
Max point number used: 121
Min point number used: 1
Current point number: 116

Point	Northing	Easting	Elevation	Description
25	8623.9757	937.4950	.	W 1/4
27	5982.5002	937.7446	.	SW COR
28	5991.3759	3577.5712	.	S 1/4
31	11264.0881	938.7984	.	NW COR

Points:

BURGESS & NIPLE
ENGINEERS
ARCHITECTS

Burgess & Niple, Inc.
5025 East Washington Street
Suite 212
Phoenix, AZ 85034
602 244-8100
Fax 602 244-1915

LETTER OF TRANSMITTAL

DATE 6/17/94 | JOB NO.

RE: Rio Verde Floodplain Delineation Study

TO Gregg Knetter
McLaughlin Knetter Engineering
3501 North 16th Street
Phoenix, AZ 85016

WE ARE SENDING YOU: ☑ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☑ Field Survey Notes

COPIES	DATE	NO.	DESCRIPTION
1			Field Books 169, 170, 171 and 172

THESE ARE TRANSMITTED:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☑ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☐ As requested ☐ Returned for correction ☐ Return _____ corrected prints
☐ For review and comment ☐ _____

REMARKS Please call if you have any questions. These notes cover the North Rio Verde and South.

COPY TO Maggie Jolyeman
Cindy Eggesten
Larry Woodman

SIGNED Larry D. Cullen

If enclosures are not as noted, kindly notify us at once.

6-22-94

Fax Cover Sheet

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

2801 West Durango Street
Phoenix, Arizona 85009
Telephone (602)506-1501
Fax (602)506-7346
TDD (602)506-5897

FLOODPLAIN MANAGEMENT BRANCH

To: FRANK BROWN

Company or Department: MKE

Fax Number: 248-7851

From: CATHY REGESTER

Number of pages being sent including cover sheet: 5

If there are any problems or questions, please call (602)506-1501

Comments: TONTO VERDE MAPPING INFO AS RECEIVED FROM BROOKS-HERSEY 6/22/94

MESSAGE CONFIRMATION

06/27/94 10:56
ID=FLOODPLAIN MANAGEMENT

NO.	MODE	BOX	GROUP
851	TX		

DATE/TIME	TIME	DISTANT STATION ID	PAGES	RESULT	ERROR PAGES	S.CODE
06/27 10:54	02'24"	602 483 3990	003/003	OK		0000

George V. Sabol Consulting Engineers, Inc.
7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

TELECOPY TRANSMITTAL

Date: June 27, 1994 **Time:** _____

Send To: **FAX No.** 506-4601

Attn: Sandy Story

From: Tom Loomis

Project No./Name: 46 Rio Verde FCD 93-07

Remarks: Sandy: These are new parameter spreadsheets that are simpler than those used for Fountain Hills. They are for a different job so the data is not specific to Rio Verde. Please review the format and calculation procedure. I want to use this format for Rio Verde.

Total number pages including this Transmittal: 5

Copy: To Frank Brown at MKE

RECEIVED BY CWR 6/29/94

TABLE 3-4

Worksheet

Soils, Vegetation Cover, and RTIMP for rainfall losses by Green & Ampt method for each subbasin

1H

Soil Class	...	53	536	550	570	584	0	0	0	0	0	0	0
Sub-Area (acres)	...	237.4	1405	313.0	552.3	115.2	---	---	---	---	---	---	---
XKSAT (bare ground)	...	0.25	0.40	0.40	0.25	0.25	---	---	---	---	---	---	---
RTIMP (rock)	...	0%	0%	0%	0%	0%	---	---	---	---	---	---	---
Vegetation Cover	...	15%	50%	45%	55%	48%	---	---	---	---	---	---	---
IA (natural only)	...	0.35	0.20	0.30	0.25	0.25	---	---	---	---	---	---	---

XKSAT log avg (bare ground) = 0.34
PSIF = 4.30
DTHETA (Dry) = 0.35
DTHETA (Normal) = 0.25
RTIMP avg. = 0.00 %
Veg. Cover avg. = 47.20 %
IA avg. = 0.24

Total Sub Basin Area in sq. miles = 4.0990

1I

Soil Class	...	53	536	550	570	0	0	0	0	0	0	0	0
Sub-Area (acres)	...	44.2	206.7	25.6	65.3	---	---	---	---	---	---	---	---
XKSAT (bare ground)	...	0.25	0.40	0.40	0.25	---	---	---	---	---	---	---	---
RTIMP (rock)	...	0%	0%	0%	0%	---	---	---	---	---	---	---	---
Vegetation Cover	...	15%	50%	45%	55%	---	---	---	---	---	---	---	---
IA (natural only)	...	0.35	0.20	0.30	0.25	---	---	---	---	---	---	---	---

XKSAT log avg (bare ground) = 0.34
PSIF = 4.30
DTHETA (Dry) = 0.35
DTHETA (Normal) = 0.25
RTIMP avg. = 0.00 %
Veg. Cover avg. = 46.06 %
IA avg. = 0.24

Total Sub Basin Area in sq. miles = 0.5340

2

Soil Class	...	53	536	537	550	565	578	582	584	585	586	0	0
Sub-Area (acres)	...	375.7	1839	177.9	237.4	3.2	143.4	496.6	26.9	32.6	30.1	---	---
XKSAT (bare ground)	...	0.25	0.40	0.40	0.40	0.25	0.09	0.19	0.25	0.25	0.25	---	---
RTIMP (rock)	...	0%	0%	15%	0%	0%	0%	0%	0%	0%	0%	---	---
Vegetation Cover	...	15%	50%	52%	45%	65%	45%	50%	48%	42%	55%	---	---
IA (natural only)	...	0.35	0.20	0.20	0.30	0.25	0.20	0.20	0.25	0.25	0.25	---	---

XKSAT log avg (bare ground) = 0.31
PSIF = 4.45
DTHETA (Dry) = 0.35
DTHETA (Normal) = 0.25

} Fig. 3-3 of the Manual

RTIMP avg. = 0.78 %
Veg. Cover avg. = 45.60 %
IA avg. = 0.23

} area avg.

Total Sub Basin Area in sq. miles = 5.2550

TABLE 3-5

Worksheet

Land-Use characteristics for rainfall losses for each subbasin

Pre - Development Condition

1H

Land-Use Class ..	LDR	UNDE	0	0	0	0	0	0	0	0	0	0
Natural or Developed ..	D	N	---	---	---		---	---	---	---	---	---
Sub-Area (acres) ..	87.0	2536	---	---	---	---	---	---	---	---	---	---
RTIMP (Developed) ..	20%	---	---	---	---	---	---	---	---	---	---	---
Veg. Cover (Developed) ..	40%	---	---	---	---	---	---	---	---	---	---	---
IA (Developed) ..	0.17	---	---	---	---	---	---	---	---	---	---	---

Natural Area	96.68	%
Developed Area	3.32	%
RTIMP (Dev.) avg.	0.66	%
Veg Cover (Dev.) avg.	1.33	%
IA (Dev.) avg.	0.01	

Total Sub Basin Area in sq. miles = 4.0990

1I

Land-Use Class ..	LDR	UNDE	0	0	0	0	0	0	0	0	0	0
Natural or Developed ..	D	N	---	---	---	---	---	---	---	---	---	---
Sub-Area (acres) ..	19.8	321.9	---	---	---	---	---	---	---	---	---	---
RTIMP (Developed) ..	20%	---	---	---	---	---	---	---	---	---	---	---
Veg. Cover (Developed) ..	40%	---	---	---	---	---	---	---	---	---	---	---
IA (Developed) ..	0.17	---	---	---	---	---	---	---	---	---	---	---

Natural Area	94.19	%
Developed Area	5.81	%
RTIMP (Dev.) avg.	1.16	%
Veg Cover (Dev.) avg.	2.32	%
IA (Dev.) avg.	0.01	

Total Sub Basin Area in sq. miles = 0.5340

2

Land-Use Class ..	LDR	UNDE	0	0	0	0	0	0	0	0	0	0
Natural or Developed ..	D	N	---	---	---	---	---	---	---	---	---	---
Sub-Area (acres) ..	147.8	3215	---	---	---	---	---	---	---	---	---	---
RTIMP (Developed) ..	20%	---	---	---	---	---	---	---	---	---	---	---
Veg. Cover (Developed) ..	40%	---	---	---	---	---	---	---	---	---	---	---
IA (Developed) ..	0.17	---	---	---	---	---	---	---	---	---	---	---

Natural Area	95.60	%
Developed Area	4.40	%
RTIMP (Dev.) avg.	0.88	% = 20% x 4.40 %
Veg Cover (Dev.) avg.	1.76	% = 40% x 4.40 %
IA (Dev.) avg.	0.01	.17 x 4.40 %

Total Sub Basin Area in sq. miles = 6.2550

TABLE 3-6

Worksheet

Land-Use characteristics for rainfall losses for each subbasin

Post - Development Condition

1H

Land-Use Class ..	LDR	UNDE	0	0	0	0	0	0	0	0	0	0
Natural or Developed ..	D	N	---	---	---	---	---	---	---	---	---	---
Sub-Area (acres) ..	87.0	****	---	---	---	---	---	---	---	---	---	---
RTIMP (Developed) ..	20%	---	---	---	---	---	---	---	---	---	---	---
Veg. Cover (Developed) ..	40%	---	---	---	---	---	---	---	---	---	---	---
IA (Developed) ..	0.17	---	---	---	---	---	---	---	---	---	---	---

Natural Area	96.68	%
Developed Area	3.32	%
RTIMP (Dev.) avg.	0.66	%
Veg Cover (Dev.) avg.	1.33	%
IA (Dev.) avg.	0.01	

Total Sub Basin Area in sq. miles = 4.0990

1I

Land-Use Class ..	LDR	VLDR	RURAL	UNDE	0	0	0	0	0	0	0	0
Natural or Developed ..	D	D	D	N	---	---	---	---	---	---	---	---
Sub-Area (acres) ..	19.8	101.1	53.1	167.7	---	---	---	---	---	---	---	---
RTIMP (Developed) ..	20%	30%	10%	---	---	---	---	---	---	---	---	---
Veg. Cover (Developed) ..	40%	39%	41%	---	---	---	---	---	---	---	---	---
IA (Developed) ..	0.17	0.16	0.23	---	---	---	---	---	---	---	---	---

Natural Area	49.06	%
Developed Area	50.94	%
RTIMP (Dev.) avg.	11.59	%
Veg Cover (Dev.) avg.	20.01	%
IA (Dev.) avg.	0.09	

Total Sub Basin Area in sq. miles = 0.5340

(2)

Land-Use Class ..	LDR	VLDR	UNDE	0	0	0	0	0	0	0	0	0
Natural or Developed ..	D	D	N	---	---	---	---	---	---	---	---	---
Sub-Area (acres) ..	147.8	5.8	3210	---	Σ = 3363.6							
RTIMP (Developed) ..	20%	30%	---	---	---	---	---	---	---	---	---	---
Veg. Cover (Developed) ..	40%	39%	---	---	---	---	---	---	---	---	---	---
IA (Developed) ..	0.17	0.16	---	---	---	---	---	---	---	---	---	---

Natural Area	95.43	%
Developed Area	4.57	%
RTIMP (Dev.) avg.	0.93	%
Veg Cover (Dev.) avg.	1.62	%
IA (Dev.) avg.	0.01	

$(20\% \times 147.8 + 30\% \times 5.8)/3363.6$

$(40\% \times 147.8 + 39\% \times 5.8)/3363.6$

$(.17 \times 147.8 + .16 \times 5.8)/3363.6$

Total Sub Basin Area in sq. miles = 5.2550

TABLE 3-7

Rainfall loss parameters for Green & Ampt method for each subbasin
Pre - Development Condition

Sub Basin ID (1)	Area Total sq. mi. (2)	Area Natural % (3)	Area Urban % (4)	IA, in inches Natural (5)	IA, in inches Urban (6)	IA, in inches Composite (7)	RTIMP, in % Natural (8)	RTIMP, in % Urban (9)	RTIMP, in % Total (10)	Vegetation Cover, in % Natural (11)	Vegetation Cover, in % Urban (12)	Vegetation Cover, in % Composite (13)	XKSAT Bare Ground in/hr (14)	PSIF inches (15)	DTHETA Natural dry (16)	DTHETA Urban normal (17)	DTHETA Composite (18)	XKSAT Corrected for Veg. in/hr (19)
1	4.6330	96.4	3.6	0.24	0.01	0.24	0.00	0.72	0.72	47.07	1.44	46.81	0.34	4.30	0.35	0.25	0.35	0.48
1A	0.0110	100.0	0.0	0.20	0.00	0.20	0.00	0.00	0.00	50.00	0.00	50.00	0.40	3.95	0.35	0.25	0.35	0.58
1B	0.0320	100.0	0.0	0.22	0.00	0.22	0.00	0.00	0.00	48.91	0.00	48.91	0.40	3.95	0.35	0.25	0.35	0.57
1C	0.0220	100.0	0.0	0.23	0.00	0.23	0.00	0.00	0.00	48.41	0.00	48.41	0.40	4.00	0.35	0.25	0.35	0.57
1C-1	0.0090	100.0	0.0	0.20	0.00	0.20	0.00	0.00	0.00	50.00	0.00	50.00	0.40	3.95	0.35	0.25	0.35	0.58
1D	0.0200	100.0	0.0	0.25	0.00	0.25	0.00	0.00	0.00	47.75	0.00	47.75	0.40	3.95	0.35	0.25	0.35	0.57
1D-1	0.0140	100.0	0.0	0.24	0.00	0.24	0.00	0.00	0.00	48.21	0.00	48.21	0.40	3.95	0.35	0.25	0.35	0.57
1E	0.0230	100.0	0.0	0.25	0.00	0.25	0.00	0.00	0.00	46.52	0.00	46.52	0.39	4.00	0.35	0.25	0.35	0.55
1F	0.0840	100.0	0.0	0.23	0.00	0.23	0.00	0.00	0.00	45.42	0.00	45.42	0.38	4.10	0.35	0.25	0.35	0.53
1F-1	0.0560	100.0	0.0	0.23	0.00	0.23	0.00	0.00	0.00	47.50	0.00	47.50	0.39	4.00	0.35	0.25	0.35	0.56
1F-2	0.0280	100.0	0.0	0.24	0.00	0.24	0.00	0.00	0.00	41.25	0.00	41.25	0.36	4.25	0.35	0.25	0.35	0.48
1G	0.0430	100.0	0.0	0.23	0.00	0.23	0.00	0.00	0.00	42.56	0.00	42.56	0.36	4.20	0.35	0.25	0.35	0.49
1H	4.0990	96.7	3.3	0.24	0.01	0.24	0.00	0.66	0.66	47.20	1.33	46.96	0.34	4.30	0.35	0.25	0.35	0.48
1I	0.5340	94.2	5.8	0.24	0.01	0.23	0.00	1.16	1.16	46.06	2.32	45.71	0.34	4.30	0.35	0.25	0.34	0.48
2	5.2550	95.6	4.4	0.23	0.01	0.22	0.79	0.88	1.67	45.60	1.76	45.35	0.31	4.45	0.35	0.25	0.35	0.44

IA composite : (7) = (5)*(3)/100 + (6)

RTIMP total : (10) = (8) + (9)

Vegetation Cover composite : (13) = (11)*(3)/100 + (12)

DTHETA composite : (18) = (16)*(3)/100 + (17)*(4)/100

XKSAT Corrected : (19) = (14)*[(13)/100 * 1.111 + 0.889] where (13) > 10 and (14) < 1.2

BURGESS & NIPLE
ENGINEERS
ARCHITECTS

Burgess & Niple, Inc.
5025 East Washington Street
Suite 212
Phoenix, AZ 85034
602 244-8100
Fax 602 244-1915

LETTER OF TRANSMITTAL

DATE 6/27/94	JOB NO.
RE: Rio Verde, South Floodplain Delineation Study	

TO Frank Brown
McLaughlin Kmetty Engineers
3501 North 16th Street
Phoenix, AZ 85016

WE ARE SENDING YOU: ☑ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☑ Mapping

COPIES	DATE	NO.	DESCRIPTION
1		2-8	Revised original Mylars of topographic maps for Rio Verde South

THESE ARE TRANSMITTED:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☑ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☐ As requested ☐ Returned for correction ☐ Return _____ corrected prints
☐ For review and comment ☐ _____

REMARKS These have been revised to correct the alignment, locations, centers, margin conversions, surveying and to correct the spelling of McLaughlin in the title block.

These should supersede the original maps sent to you on April 19, 1994.

COPY TO _____ **SIGNED** Larry D. Cullers

If enclosures are not as noted, kindly notify us at once.

BURGESS & NIPLE
ENGINEERS
ARCHITECTS

Burgess & Niple, Inc.
5025 East Washington Street
Suite 212
Phoenix, AZ 85034
602 244-8100
Fax 602 244-1915

LETTER OF TRANSMITTAL

DATE 6/27/94	JOB NO.
RE: Rio Verde Floodplain Delineation Study	

TO Maricopa County
FCD & Maricopa County
2801 West Durango
Phoenix, AZ 85009

WE ARE SENDING YOU: ☑ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☑ Cross Sections

COPIES	DATE	NO.	DESCRIPTION
1			Mapping Quad City Contract, Sections 1 through 3 and 5 through 10 for Rio Verde North and South

THESE ARE TRANSMITTED:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☐ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☑ As requested ☐ Returned for correction ☐ Return _____ corrected prints
☐ For review and comment ☐ _____

REMARKS _____

COPY TO Cathy Riggenstein
Frank Brown
Kenny Woodson

SIGNED Kenny D. Cullom

If enclosures are not as noted, kindly notify us at once.

BURGESS & NIPLE
ENGINEERS
ARCHITECTS

Burgess & Niple, Inc.
5025 East Washington Street
Suite 212
Phoenix, AZ 85034
602 244-8100
Fax 602 244-1915

LETTER OF TRANSMITTAL

DATE 6/28/94	JOB NO.
RE: Rio Verde South Floodplain Delineation Study.	

TO Frank Brown
McLaughlin Kmetty Engineers
3501 North 16th Street
Phoenix, AZ 85016

WE ARE SENDING YOU: ☑ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☑ Cross Sections

COPIES	DATE	NO.	DESCRIPTION
1			Mapping Quality Control. Sections 1 through 3 and 5 through 7 for Rio Verde South

FLOOD CONTROL DISTRICT
RECEIVED
JUN 29 '94
CHENG
DEP
ADMIN
FINANCE
C&O
ENGR
REMARKS

THESE ARE TRANSMITTED:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☑ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☐ As requested ☐ Returned for correction ☐ Return _____ corrected prints
☐ For review and comment ☐ _____

REMARKS These sections were reviewed with Magnus Jolayemi yesterday. Magnus is providing hard copies to Cathy Regesteru.

COPY TO Magnus Jolayemi
Cathy Regesteru
Randy Woodson

SIGNED Lonny D Cullen

If enclosures are not as noted, kindly notify us at once.

Orig. file
089-407-03

FLOOD CONTROL DISTR
OF MARICOPA COUNTY
~~3335 West Durango Street~~
PHOENIX, ARIZONA 85009
506-
(602) ~~262~~-1501

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY
2801 W. Durango
PHOENIX, AZ 85009

LETTER OF TRANSMITTAL

RECEIVED JUN 2 9 1994

DATE	JOB NO.
6/29/94	FCD 93-07

ATTENTION: FRANK BROWN

RE: RIO VERDE SOUTH

TO McLAUGHLIN KMETTY
3501 N. 16th ST
PHOENIX, AZ 85016-6419

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via COURIER the following items:

☐ Shop drawings ☒ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☒ DISKETTES

COPIES	DATE	NO.	DESCRIPTION
2		1	TONTO VERDE TOPO MAPS (PRINTOUT OF DIGITAL FILE)
1	4/94	5	" " DIGITAL TOPO FILES (5 DISKETTES)
1		4	SURVEY/CONTROL INFORMATION

THESE ARE TRANSMITTED as checked below:

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☐ As requested ☐ Returned for corrections ☐ Return_____corrected prints
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 19_____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS FRANK,
PLEASE FIND ATTACHED THE INFO FOR TONTO VERDE WHICH I RECEIVED FROM BROOKS, HERSEY LAST WEEK. THE TOPO PRINT-OUT WAS GENERATED BY THE FCD FROM THE SUBMITTED DIGITAL FILES. PER MIKE O'NEILL OF BROOKS HERSEY, THE MAPPING WAS PERFORMED BY KENNEY AERIAL FROM A FLIGHT ON 3/10/94. MR O'NEILL EXPECTS TO HAVE AS-BUILTS ON THE BRIDGE, DIVERSION STRUCTURE, & WASH 10 IN A COUPLE OF WEEKS.

COPY TO FILE: FCD 93-07

SIGNED: Catherine W. Requarth

6910-009 3-90

If enclosures are not as noted, kindly notify us at once.

H-13

N 11236.85
E 5394.91
EL. 1681.46

V-15

EL. 1646.51

V-

EL. 1617.70

H-12

N 11242.99
E 9500.72
EL. 1586.73

H-14

N 9469.72
E 5396.84
EL. 1680.54

V-14

EL. 1653.82

V-13

EL. 1618.76

H-11

N 9524.27
E 9502.89
EL. 1585.11

H-15

N 7702.87
E 5398.77
EL. 1684.58

H-17

N 7585.77
E 6226.41
EL. 1665.80

V-12

EL. 1626.15

H-10

N 7769.42
E 9504.38
EL. 1586.77

V-11

EL. 1665.67

N 6057.08
E 5411.75
EL. 1673.62

H-9

H-16

N 6000.00
E 6218.91
EL. 1653.29

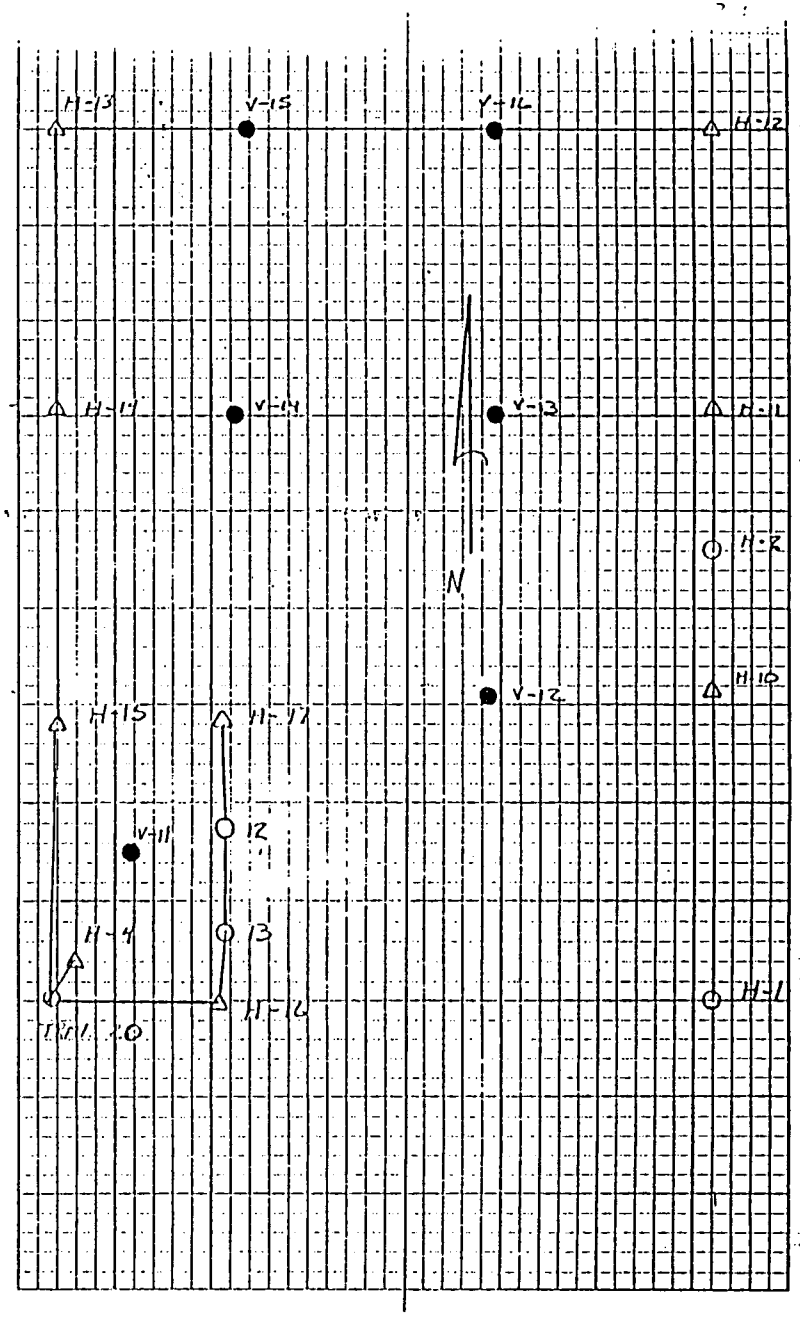
SW COR. SEC. 31
T-5-N, R-7-E

BROOKS, HERSEY AND ASSOCIATES, INC.
ENGINEERS/SURVEYORS
4402 East Elwood, Suite 16
Phoenix, Arizona 85040
(602) 437-8758

TONTO VERDE
AERIAL CONTROL

A.C.A. 03/23/94

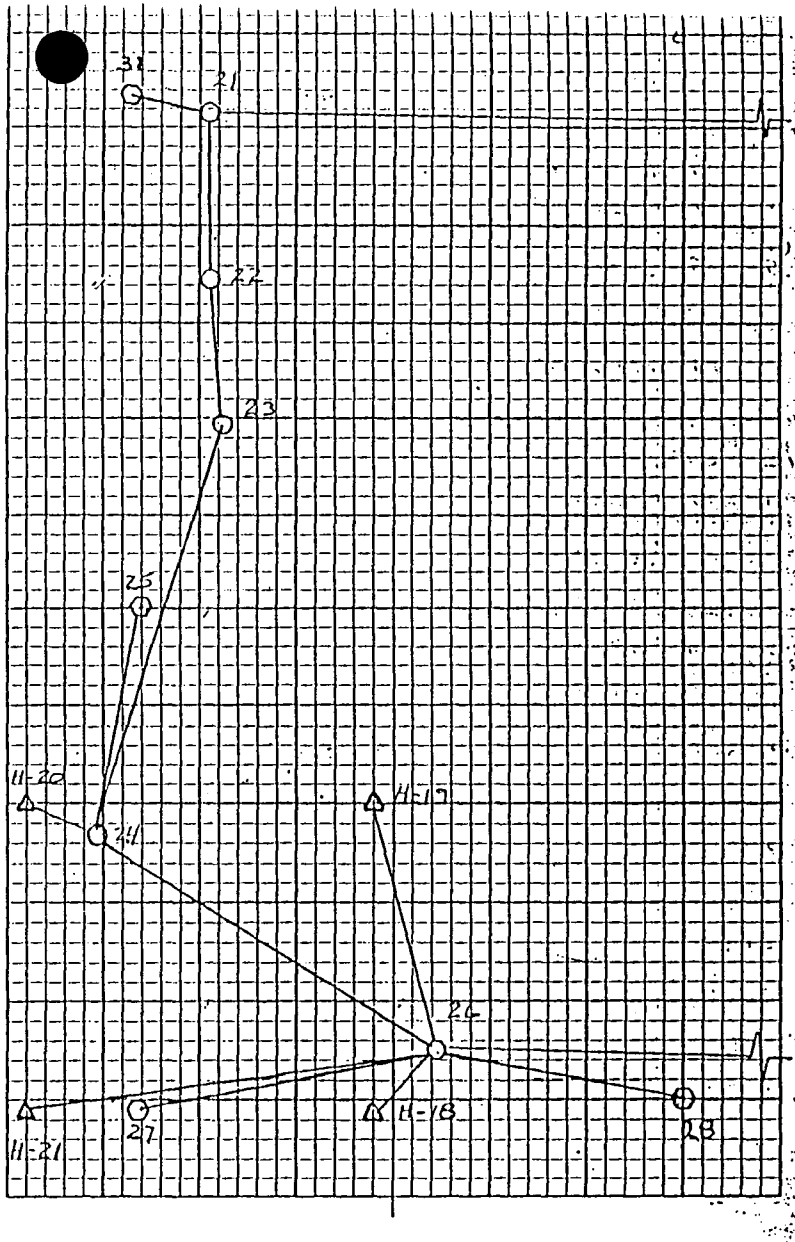
Pt. #	DESC.				
H-1	Fd PK	SEE PS #3			
H-2	Fd PK	SEE PS #3			
H-10	SET PK				
H-11	SET PK				
H-12	Fd PK w/PANNEL	1'X12' LEG'S			
H-13	SET PK				
H-14	SET 1/2" REBAR				
H-15	SET 1/2" REBAR				
20	SET 1/2" REBAR				
H-4	Fd NUB & TACK w/PANNEL	SEE PS #3			
H-16	Fd SEL COR 36 & 31	SEE PS #3. PT #5 F/ B.C.			
13	Fd 60 D NAIL	SEE PS 21			
12	Fd 60D NAIL	SEE PS 23			
11-17	Fd 1/2" REBAR	SEE PS 22 Pt 11			
	PANEL SUMMARY				
PANEL	ELEV.	LEGS	PANEL	ELEV.	LEGS
3 H-10	1586.77	1'X6'	V-11	1665.67	1'X6'
4 H-11	1585.11	1'X6'	V-12	1626.15	1'X6'
5 H-12	1586.73	1'X12'	V-13	1618.76	1'X6'
6 H-13	1681.46	1'X6'	V-14	1653.82	1'X6'
7 H-14	1680.54	1'X6'	V-15	1646.51	1'X6'
8 H-15	1684.58	1'X6'	V-16	1617.70	1'X6'
10 H-4	1673.62	1'X6'			
11 H-16	1653.29	1'X6'			
H-17	1665.80	1'X6'			

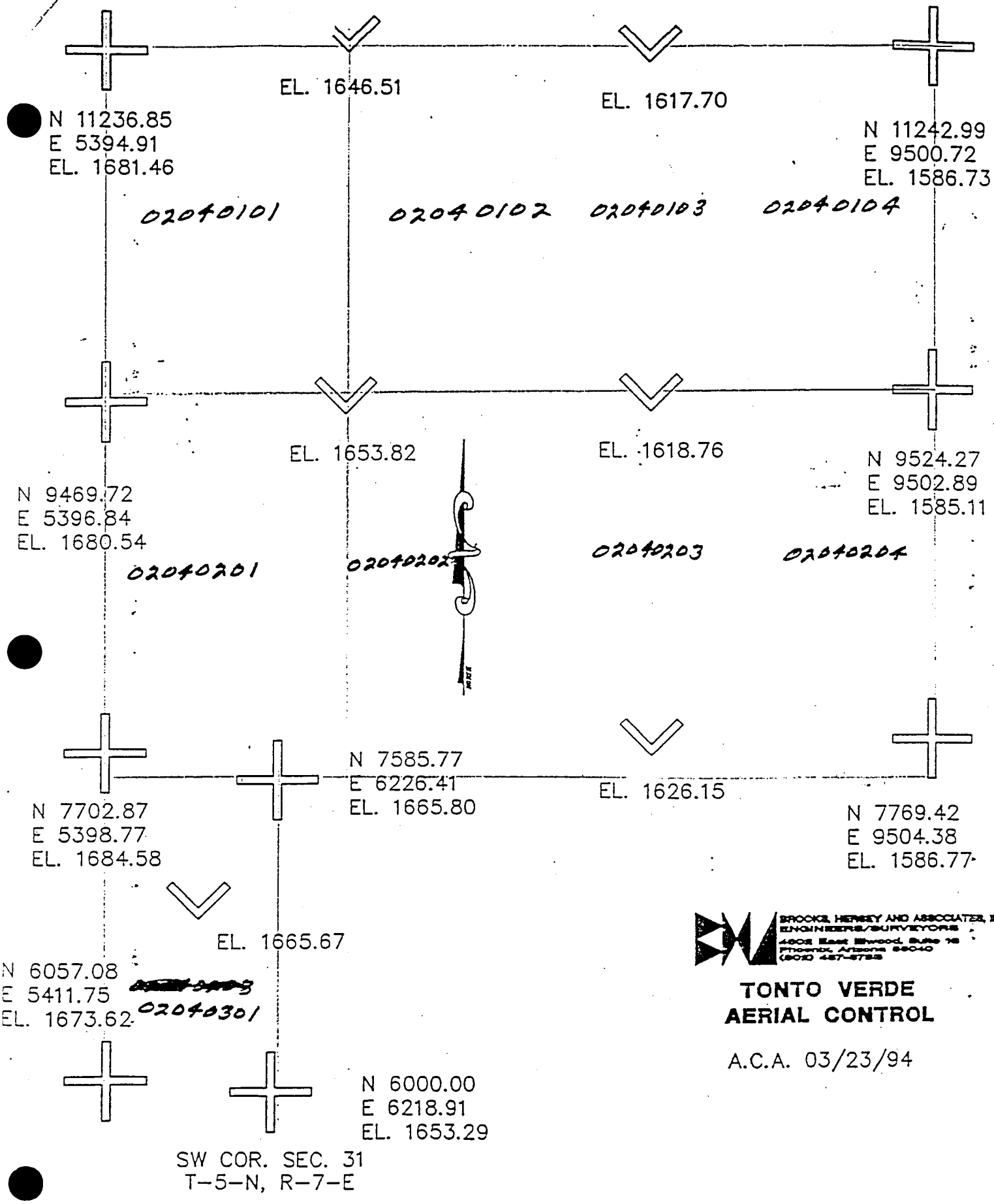


H-17	SEE BOOK 276 Pg 69	
21	SET ½" REBAR	
22	SET 60d NAIL	
23	SET 60d NAIL	
24	SET 60d NAIL	
25	Fd BLM BC. W/¼ COR SEC 36 T.5.N, R-6-E	
26	SET 60d NAIL	
27	Fd GLO B.C. S.L. COR SEC 36 T-5N, R-6-E	
28	Fd GLO BC. S ¼ COR SEC 36 T-5-N, R-6-E	
29	SET 60d NAIL	
H-15	SEE BOOK 276 Pg. 69	
H-18	SET	
H-19	SET	
H-20	SET	
H-21	SET	
30	Fd 1" PIPE N, E COR SEC 36	
31	Fd ½" REBAR W/CAP LS TABOR 19857 (N, W COR SEC 36)	

PANNEL Summary

	ELEV	LEG'S
H-18	1760.15	1' X 6'
H-19	1771.76	1' X 6'
H-20	1809.61	1' X 6'
H-21		1' X 6'





BROOKS, HERSEY AND ASSOCIATES, INC.
ENGINEERS/SURVEYORS
4605 East Elwood, Suite 16
Phoenix, Arizona 85040
(602) 437-8783

TONTO VERDE
AERIAL CONTROL

A.C.A. 03/23/94

FLOOD CONTROL DISTR.
OF MARICOPA COUNTY
~~3335 West Durango Street~~
PHOENIX, ARIZONA 85009
506-
(602) ~~262~~-1501

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY
2801 W. Durango
PHOENIX, AZ 85009

LETTER OF TRANSMITTAL

RECEIVED JUL 13 1994

DATE	JOB NO
7/12/94	93-07

ATTENTION: FRANK BROWN

RE: RIO VERDE SOUTH FDS

TO MCLAUGHLIN KMETTY ENGINEERS
3501 N. 16th ST
PHOENIX, AZ 85016-6419

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via MAIL the following items:

☐ Shop drawings ☒ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1	5/94		PRELIMINARY DRAINAGE REPORT, TONTO VERDE UNIT 3
1	6/13/94	3	TONTO VERDE UNIT THREE PRELIMINARY PLAT

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit_____copies for approval
☒ For your use ☐ Approved as noted ☐ Submit_____copies for distribution
☒ As requested ☐ Returned for corrections ☐ Return_____corrected prints
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 19_____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS FRANK,
COPY OF REPORT IS SAME ONE THAT WAS GIVEN TO TOM. I FOUND THIS REVISED PLAT IN DRAINAGE'S FILE (S 94-16) AND THOUGHT IT MAY BE OF SOME USE TO YOU OR TOM.

COPY TO FILE: FCD 93-07

SIGNED: Catherine L. Reath

6910-009 3-90

If enclosures are not as noted, kindly notify us at once.

89-417.002

FLOOD CONTROL DISTR.
OF MARICOPA COUNTY
~~3335 West Durango Street~~
PHOENIX, ARIZONA 85009
506-
(602) ~~262~~-1501

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY
2801 W. Durango
PHOENIX, AZ 85009

LETTER OF TRANSMITTAL

DATE 7/19/94 | JOB NO. FCD 93-07

ATTENTION FRANK BROWN

RE: RIO VERDE SOUTH FDS

RECEIVED JUL 19 1994

TO MCLAUGHLIN KMETTY
3501 NORTH 16TH STREET
PHOENIX, AZ 85016-6419

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via COURIER the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1	5/94	1	RIO VERDE NORTH FDS, 'n' VALUE REPORT "DRAFT"

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit_____copies for approval
☒ For your use ☐ Approved as noted ☐ Submit_____copies for distribution
☒ As requested ☐ Returned for corrections ☐ Return_____corrected prints
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 19_____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS FRANK,
MAGNUS ASKS THAT, WHEN REVIEWING THE ATTACHED, WE KEEP IN MIND THAT THIS IS ONLY A "DRAFT". PER MAGNUS, THERE ARE SOME ERRORS. HOWEVER, THE PICTURES MAY HELP WITH COMPARISON OF YOUR 'n' VALUES. UNFORTUNATELY, THE ACTUAL COMPUTATION OF EACH 'n' VALUE IS NOT INCLUDED WITH THIS "DRAFT" REPORT.
PLEASE RETURN THE REPORT TO ME WHEN YOU ARE FINISHED WITH IT.

COPY TO FCD 93-07

SIGNED: Catherine W. Reynolds

6910-009 3-90

If enclosures are not as noted, kindly notify us at once.

Report on Manning's "n" Values

RIO VERDE NORTH FLOODPLAIN DELINEATION STUDY

FCD 93-06

Wash A
Wash F
Wash I

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

Burgess & Niple, Inc.
5025 East Washington Street
Phoenix, Arizona 85034
(602) 244-8100

May 1994

Fax Cover Sheet

FLOOD CONTROL DISTRICT

OF
MARICOPA COUNTY

2801 West Durango Street
Phoenix, Arizona 85009
Telephone (602)506-1501
Fax (602)506-7346
TDD (602)506-5897

FLOODPLAIN MANAGEMENT BRANCH

To: FRANK BROWN

Company or Department: MKE

Fax Number: 248-7851

From: CATHY REGESTER (7/21/94)

Number of pages being sent including cover sheet: 7

If there are any problems or questions, please call (602)506-1501

Comments: I RECEIVED THIS INFO FROM DAVE RITCHIE TODAY. NO SPECIFICS ON WHEN HE WILL RECEIVE A RE-VEG PLAN BUT AT LEAST THIS SHOULD GIVE US A LITTLE BETTER IDEA.

MKE
McLaughlin Kmetty Engineers, Ltd.
3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 7/22/94	Job No.: 89-407.003
To: Flood Control District of Maricopa County	Attention: Cathy M. Regester
	Re: Rio Verde South

WE ARE SENDING YOU X ATTACHED ___ VIA hand-deliver

Original:	Copies	Date	Description
1		Sealed 7-20-94	Rio Verde North n value report - returning your copy
	1	7/22/94	Rio Verde South n value report
1		7/22/94	Sheets 2 through 7 with cross section locations.

Remarks: Cathy,

please review the n value report, and the cross-section locations. Please return the cross-sections maps with your comments.

I do not understand the seal date on the Burgess + Niple report - it contradicts the May 9 site visit.

COPY TO _____

SIGNED Frank Edward Gross

FLOOD CONTROL DISTR
OF MARICOPA COUNTY
~~3335 West Durango Street~~
PHOENIX, ARIZONA 85009
506-
(602) ~~262~~-1501

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY
2801 W. Durango
PHOENIX, AZ 85009

LETTER OF TRANSMITTAL

89-407-02

DATE 7/22/94 | JOB NO FCD 93-07

ATTENTION FRANK BROWN

RE: RIO VERDE SOUTH FDS

RECEIVED JUL 25 1994

McLAUGHLIN KMETTY
3501 N. 16th ST.
PHOENIX, AZ 85016-6419

ARE SENDING YOU ☒ Attached ☐ Under separate cover via MAIL the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

...IES	DATE	NO.	DESCRIPTION
	3/93		FEMA 37

...SE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit_____copies for approval
☒ For your use ☐ Approved as noted ☐ Submit_____copies for distribution
☒ As requested ☐ Returned for corrections ☐ Return_____corrected prints
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 19_____ ☐ PRINTS RETURNED AFTER LOAN TO US

...ARKS FRANK,
PLEASE NOTE THE SECTION REGARDING STARTING
...ATER SURFACE ELEVATIONS ON PAGES 5-5 TO 5-6.
...ONSIDER THIS MATERIAL FOR YOUR E STARTING
...SEL'S.

...Y TO FILE: FCD 93-07

SIGNED: Catherine W. Regester

...-009 3-90

If enclosures are not as noted, kindly notify us at once.

TRANSMITTAL

TO: Flood Control District of Maricopa Co.

Attn: Sandy Story

FROM: George V. Sabol Consulting Engineers, Inc.
7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

DATE: 25 July 1994

PROJECT No./Name: 46 Rio Verde FIS FCD 93-07

SUBJECT: Preliminary Hydrology

ENCLOSED ARE THE FOLLOWING

1- Hydrology Exhibits B and C
1- Draft HEC-1 routing diagram (under separate cover)
1- Prelim. HEC-1 Input Listing + HEC-1 diagram
1- Routing cross section plots.
1- Flow split rating curve tables + plots
1- 3½" diskette with HEC-1 Input File + Flow Split HEC-2 input and output files

REMARKS

Sandy: The HEC-1 file contains "Dummy" parameters. Check for combination + routing logic only. Please review exhibits B+C as soon as possible so we can send ACAD files to GCA for ArcInfo conversion + calculation of parameter areas.

COPIES Frank Brown, MKE

SIGNED Thomas R. Loomis

RECEIVED AUG 0 4 1994

89-407.rr

FLOOD CONTROL DISTR
OF MARICOPA COUNTY
~~3335 West Durango Street~~
PHOENIX, ARIZONA 85009
506-
(602) ~~262~~-1501

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY
2801 W. Durango
PHOENIX, AZ 85009

LETTER OF TRANSMITTAL

DATE	JOB NO
8/3/94	FCD 93-07

ATTENTION: FRANK BROWN, P.E.

RE: RIO VERDE SOUTH FDS

TO McLAUGHLIN KMETTY ENGINEERS
3501 N 16th ST.
PHOENIX, AZ 85016-6419

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via MAIL the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1	8/1/94 RECEIVED @ FCD		TYPICAL REVEGETATION PLAN FOR FIRM II & COVER LETTER FROM DAVE RITCHIE OF RIO VERDE SERVICES, INC.

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit_____copies for approval
☒ For your use ☐ Approved as noted ☐ Submit_____copies for distribution
☐ As requested ☐ Returned for corrections ☐ Return_____corrected prints
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 19_____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS _____

COPY TO FILE: FCD 93-07

SIGNED: Catherine M. Reynolds

6910-009 3-90

If enclosures are not as noted, kindly notify us at once.

MKE

McLaughlin Kinetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 8-10-94 Job No.: 89-507,003

To: Flood Control District of Maricopa County

Attention: Cathy Regester

Re:

WE ARE SENDING YOU X ATTACHED ___ VIA Deliver

Original:	Copies	Date	Description
1		Flight 12-92-93	Mylars of Semi - Rectified Aerial Photos

Remarks: As requested.

Cathy, please return these when done.

COPY TO ____

SIGNED Frank Edward Brown

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Interoffice Memorandum

RECEIVED AUG 1 1 1994

Subject: Rio Verde South FDS
Cross Section Location Plan and 'n' Value Report

File: 93-07

To: PACalza

From: CWRegester CWR

Date: 8/11/94

I have completed my review of the subject plan and report and have the following minor comments which I will pass on to the study consultant:

WASH 9

1. X-section 1: I am concerned with the depth of the channel being less than 2 ft when compared to the right side end station. May get a "cross section extended" message. May want to pivot section upstream (possibly at point where spacing with x-section 2 will be about 250 ft.)

2. X-section 4: Please note that the south approximately 160 ft is going downhill.

WASH 10/11 CONFLUENCE

1. X-section 14: Please note channel located on the north end of section (40 ft from north end or SSTA). Could there be a need to follow this channel down to x-section 7?

WASH 10

1. X-section 6: Doesn't appear perpendicular to flow and is skewed across the southern-most wash.

2. How is drop structure being included in the model? Doesn't appear that a x-section is proposed at this location.

3. X-section 9: Minor suggestion to southern end. See pencil line on plan.

4. X-section 16: Minor suggestion to alignment. See pencil line on plan view.

5. Please note heavy contour at x-section 9. Labeled as 1642. Should be 1640?

WASH 11

1. X-sections 15, 16, and 18 pick up the swale in a dirt road. Section 17 does not. May want to go ahead and get for 17 so sections are consistent.

GENERAL COMMENTS

1. For the HEC-2, please make sure that cross sections are numbered according to their river mile location.

2. The 'n' value report looks good. For the final, however, I would like more detail on how the starting WSEL was determined for Wash 10. I think it would be premature to try to write that now though. Let's see how the HEC-2 model comes out first. Also, I have made a couple minor corrections on page 1 of the report.

   Just for comparison, I looked at the 'n' values used in the Brooks-Hersey study of Wash 11 and the Wiley study of Wash 10 through the golf course. For Wash 11, Brooks-Hersey used a channel 'n' of 0.035 where we are using 0.030 and, an overbank 'n' of 0.050 where we will use 0.030 and 0.070. I think these show a favorable comparison. For Wash 10, Wiley used channel and overbank 'n' values of 0.025 where we will use 0.030. I think these, as well, compare favorably.

248-7702 26 pt

FLOOD CONTROL DISTR
OF MARICOPA COUNTY
~~3335 West Durango Street~~
PHOENIX, ARIZONA 85009
506-
(602) ~~262~~-1501

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY
2801 W. Durango
PHOENIX, AZ 85009

LETTER OF TRANSMITTAL

89-407.00

DATE 8/12/94 | JOB NO. 93-07

ATTENTION FRANK BROWN, P.E.

RE RIO VERDE SOUTH

RECEIVED AUG 15 1994

TO McLAUGHLIN KMETTY ENGINEERS, Ltd.
3501 N. 16th STREET
PHOENIX, AZ 85016-6419

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via COURIER the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☒ ORIGINAL MYLARS

COPIES	DATE	NO.	DESCRIPTION
1		7	SEMI-RECTIFIED AERIAL PHOTOS

THESE ARE TRANSMITTED as checked below:

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☐ For your use ☐ Approved as noted ☐ Submit_____copies for distribution
☐ As requested ☐ Returned for corrections ☐ Return_____corrected prints
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 19_____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS THANK YOU!

COPY TO FILE: FCD 93-07

SIGNED: Catherine W. Rogers

6910-009 3-90

If enclosures are not as noted, kindly notify us at once.

MKE
McLaughlin Kmetty Engineers, Ltd.
3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 8-15-94	Job No.: 89-407.003
To: Flood Control District of Maricopa County	Attention: Cathy Regester
	Re: Rio Verde South

WE ARE SENDING YOU X ATTACHED ___ VIA your pick-up

Original:	Copies	Date	Description
	1	6/23/94	Rio Verde South Topographic Maps sheets 2→8
	1	6/27/94	Burgess + Niple Letter of Transmittal to MKE dated 6/27/94

Remarks: Cathy,

the topo maps were revised to change the name of the company that performed the ground control survey. There were no other changes. The maps were re-sealed by Richard Cook on 6/23/94. Richard Cook will revise the contour label "1642" to "1640" on sheet 5.

COPY TO Larry Culler, B+N

SIGNED Frank Edward Brown

WOOD, PATEL & ASSOC., INC.

Civil Engineers, Hydrologists, Land Surveyors

1550 East Missouri, Suite 203
Phoenix, AZ 85014
(602) 234-1344 • FAX 234-1322

LETTER OF TRANSMITTAL

DATE: August 24, 1994 | JOB NO. 93031.00

ATTENTION: Tom Loomis, P.E.

RE: Rio Verde - North FPDS hydrology coordination

TO:

George V. Sabol Consulting Engineers, Inc.
7950 E. Acoma Dr. Suite 211
Scottsdale, AZ 85260-6962

WE ARE SENDING YOU ■ Attached □ Under separate cover via PICK-UP the following items:

□ Shop drawings □ Prints □ Plans □ Samples □ Specifications
□ Copy of letter □ Change Order ■ Other (Files)

COPIES	DATE	NO.	DESCRIPTION
1	8/24/94		11"x17" copy of portion of drainage map and HEC-1 schematic
1	8/24/94		One 5 1/4" diskette containing TAPE21 files for divert operation 165DR
			for 6-hour and 24-hour storms

THESE ARE TRANSMITTED as checked below:

□ For approval ■ Approved as submitted □ Approved as noted
■ For your use ■ As requested □ For review and comment

REMARKS:

Note that the NMIN value for both files is 5 minutes.

COPY TO: Larry Culler, P.E., Burgess & Niple

SIGNED: Anthony J. Regis, P.E.

FORMS\TRANSMIT.GBS

BURGESS & NIPLE

ENGINEERS

ARCHITECTS

Mr. Frank Brown
McLaughlin Kmetty Engineers, Ltd.
3501 North 16th Street
Phoenix, AZ 85016

Re: Rio Verde North
Floodplain Delineation Study

August 25, 1994

Dear Mr. Brown:

Burgess & Niple, Inc.
5025 East Washington Street
Suite 212
Phoenix, AZ 85034
602 244-8100
Fax 602 244-1915

During a phone conversation, this date, we discussed a flow breakout included in the HEC-2 model for Rio Verde North. The breakout occurs at Section 2.494 of Wash A and discharges 210 cfs to Rio Verde South.

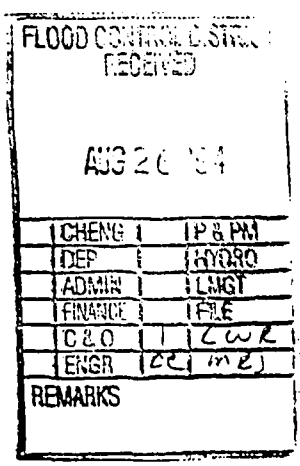
Enclosed is a print of Sheet 5 of the maps for Rio Verde North, which shows the location of the flow breakout.

Very truly yours,

Larry D. Culler

Larry D. Culler, PE

copy: Magnus Jolayemi
Cathy Regester
Sandy Story



84-407.003

RECEIVED SEP 0 1 1994

TRANSMITTAL

TO: Flood Control District of Maricopa County

Attn: Cathy Regester

FROM: George V. Sabol Consulting Engineers, Inc.
7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

DATE: 29 August 1994

PROJECT No./Name: 4e Rio Verde FIS FCD 93-07

SUBJECT: Hydrology

ENCLOSED ARE THE FOLLOWING

Preliminary HEC-1 Input files on 3½" diskette
Preliminary parameter spreadsheets
Preliminary results spreadsheets

REMARKS

Cathy: The HEC-1 models do not include transmission losses. The Watershed areas at concentration points downstream of flow diversions are not input yet. We are proceeding with the addition of transmission losses + areas. The next submittal will include the above and your review comments on this submittal.

COPIES Frank Brown

SIGNED James R Sabol

TRANSMITTAL

TO: Flood Control District of Maricopa County

Attn: Sandy Stacy

FROM: George V. Sabol Consulting Engineers, Inc.
7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

RECEIVED SEP 1 5 1994

DATE: 12 September 1994

PROJECT No./Name: 46 Rio Verde, FCD 93-07

SUBJECT: Hydrology Parameters

ENCLOSED ARE THE FOLLOWING

1- Revised Tables 5-1 through 5-9
1- Tables 3-3 and 3-4

REMARKS

Sandy: The 5-Tables will be in Appendix A. Tables 3-1 and 3-2 will be the same as 5-2 and 5-4 and will be in the main body of the report along with summary Tables 3-3 & 3-4.

COPIES Frank Brown, MKE

SIGNED Thomas R. Francis

WOOD, PATEL & ASSOC. NC.

Civil Engineers, Hydrologists, Land Surveyors

1550 East Missouri, Suite 203

Phoenix, AZ 85014

(602) 234-1344 • FAX 234-1322

LETTER OF RANSMITTAL

DATE: September 15, 1994 | JOB NO. 93031.00

ATTENTION: Tom Loomis, P.E.

RE: Rio Verde - North FPDS hydrology coordination

TO:

George V. Sabol Consulting Engineers, Inc.

7950 E. Acoma Dr. Suite 211

Scottsdale, AZ 85260-6962

RECEIVED
SEP 16 1994
BURGESS & NIPLE, INC.

WE ARE SENDING YOU ■ Attached □ Under separate cover via PICK-UP the following items:

□ Shop drawings □ Prints ■ Plans □ Samples □ Specifications
□ Copy of letter □ Change Order ■ Other_(Files)_____

COPIES	DATE	NO.	DESCRIPTION
1	9/15/94		11" x 17" copy of portion of drainage map and HEC-1 schematic
1	9/15/94		One 5 1/4" diskette containing output hydrographs for divert operation
			171D for 6-hour and 24-hour storms

THESE ARE TRANSMITTED as checked below:

□ For approval □ Approved as submitted □ Approved as noted
■ For your use □ As requested □ For review and comment

REMARKS:

Tom, this divert operation represents the flow breakout from Burgess & Niple's HEC-2 model. Note that the NMIN value for both models is 5 minutes. From inspection of an aerial photo, it appears that a portion of this flow lost from the north watershed may re-enter the north watershed at a point about 3800 or 4000 feet east of the diverted flow, as shown on the sketch. If this is indeed the case, please forward these hydrographs to us, along with those for any other inflows into the north watershed. If you have any questions, please call. Thank you!

COPY TO: Larry Culler (B&N)
Sandy Story (FCDMC)

SIGNED: Anthony J. Regis, P.E.

FORMS\TRANSMIT.GEN

JZB

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 9-16-94 | Job No.: 89-407.003

To: Flood Control District of Maricopa County

Attention: Cathy Regester

Re: Rio Verde South

Change Order #1

WE ARE SENDING YOU X ATTACHED ___ VIA deliver

Original:	Copies	Date	Description
	1ea	8-22-94	Revised sheet 5+7, Topographic (Contour) Maps and Semi-Rectified Aerial Photographs.
1ea	1	8-22-94	9"x9" film diapositives, 1:10,560, 1 sheet 1 of 3 and 2 of 3

Remarks:

COPY TO ___

SIGNED Frank Edward Brown

FLOOD CONTROL DISTRIC
OF MARICOPA COUNTY
~~3335 West Durango Street~~
PHOENIX, ARIZONA 85009
506-
(602) ~~262~~-1501

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY
2801 W. Durango
PHOENIX, AZ 85009

LETTER OF TRANSMITTAL

DATE 9/16/94	JOB NO 93-07
ATTENTION	FRANK BROWN, P.E
RE:	RIO VERDE SOUTH FDS

McLAUGHLIN KMETTY ENGINEERS, Ltd
3501 N. 16TH ST.
PHOENIX, AZ 85016-6419

RECEIVED SEP 19 1994

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via COURIER the following items:

☐ Shop drawings ☒ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1	9/13/94	10	TONTO VERDE UNIT ONE GRADING PLANS - RECORD DRAWINGS

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit_____copies for approval
☒ For your use ☐ Approved as noted ☐ Submit_____copies for distribution
☐ As requested ☐ Returned for corrections ☐ Return_____corrected prints
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 19_____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS FRANK,
PLEASE FIND ATTACHED THE AS-BUILT FOR THE OFF-SITE DIVERSION STRUCTURE FOR TONTO VERDE UNIT ONE. SO FAR, A DRAINAGE REPORT HAS NOT BEEN SUBMITTED FOR THE NEXT SECTION - UNIT THREE, BUT WE HAVE RECEIVED GRADING & PAVING PLANS. NO ADDITIONAL CULVERTS ARE SHOWN IN FIRM II - JUST AS BROOKS-HERSEY SAID THERE WOULD BE NONE.

COPY TO FILE: FCD 93-07

SIGNED: Catherine W. Regenter

6910-009 3-90

If enclosures are not as noted, kindly notify us at once.

89-407.00

RECEIVED SEP 2 6 1994

TRANSMITTAL

TO: Flood Control District of Maricopa County
2801 West Durango
Phoenix, AZ 85009
Attn: Cathy Regester

FROM: George V. Sabol Consulting Engineers, Inc.
7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

DATE: 23 September 1994

PROJECT No./Name: 46 Rio Verde FIS FCD 93-07

SUBJECT: Rio Verde Hydrology

ENCLOSED ARE THE FOLLOWING

1- Revised Tables S-2 through S-9
1- " " 3-3 and 3-4
1- Diskette with revised HEC-1 input files.
1- Revised Tables R-1 through R-3
1- Revised Tables F-1 through F-4

REMARKS

COPIES Frank E. Brown, MKE

SIGNED Thomas R. Sabol

WOOD, PATEL & ASSOC., C. LETTER OF RANSMITTAL

Civil Engineers, Hydrologists, Land Surveyors

1550 East Missouri, Suite 203

Phoenix, AZ 85014

(602) 234-1344 • FAX 234-1322

DATE: September 15, 1994	JOB NO. 93031.00
ATTENTION: Tom Loomis, P.E.	
RE: Rio Verde - North FPDS hydrology coordination	

TO:

George V. Sabol Consulting Engineers, Inc.

7950 E. Acoma Dr. Suite 211

Scottsdale, AZ 85260-6962

WE ARE SENDING YOU ■ Attached □ Under separate cover via PICK-UP the following items:

□ Shop drawings □ Prints ■ Plans □ Samples □ Specifications
□ Copy of letter □ Change Order ■ Other_(Files)_____

COPIES	DATE	NO.	DESCRIPTION
1	9/15/94		11" x 17" copy of portion of drainage map and HEC-1 schematic
1	9/15/94		One 5 1/4" diskette containing output hydrographs for divert operation
			171D for 6-hour and 24-hour storms

THESE ARE TRANSMITTED as checked below:

□ For approval □ Approved as submitted □ Approved as noted
■ For your use □ As requested □ For review and comment

REMARKS:

Tom, this divert operation represents the flow breakout from Burgess & Niple's HEC-2 model. Note that the NMIN value for both models is 5 minutes. From inspection of an aerial photo, it appears that a portion of this flow lost from the north watershed may re-enter the north watershed at a point about 3800 or 4000 feet east of the diverted flow, as shown on the sketch. If this is indeed the case, please forward these hydrographs to us, along with those for any other inflows into the north watershed. If you have any questions, please call. Thank you!

Note: This was the wrong HEC-1 operation. Received correct files from Tom by modem 3:30 p.m. 9/19/94
TRL

COPY TO: Larry Culler (B&N)
Sandy Story (FCDMC)

SIGNED: Anthony J. Regis, P.E.

FORMS\TRANSMIT.GEN

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

October 6, 1994

GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

Ms. Cathy Regester, Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Rio Verde South Floodplain Delineation Study
Contract FCD 93-07, MKE Job No. 89-407.003
Monthly Progress Report No. 7 for Invoice #7

Dear Ms. Regester:

The following progress is reported for the period June 26, 1994 to July 25, 1994:

TASK 1 - COORDINATION

a. Normal coordination consisting of telephone conversations and information exchange between involved parties.
b. The Preliminary Drainage Report and Preliminary Plat for Tonto Verde was given to the hydrology subconsultant, George V. Sabol Consulting Engineers.
c. The proposed ADWR-TDN (Arizona Department of Water Resources Technical Data Notebook) revisions by the District were received. Alphabetical cross-section labels are no longer required for Flood Delineation Studies.
d. Copies of the March 1993 version of FEMA 37 were received.

TASK 2 - DATA COLLECTION

a. Information was received, as listed herein, as Task Items 1.b., 1.d., 3.c., 6.a., and 6.b..

TASK 3 - TOPOGRAPHIC MAPPING

a. New original mylars of topographic maps were received from Burgess & Niple, Rio Verde North consultant. Some text was revised, the topographic information remains unchanged.
b. The mapping Quality Control Cross-Section plots were received from Burgess & Niple via the District. These cross-sections meet the mapping accuracy requirements for this project.
c. A portion of Wash 10 and Wash 11 was regraded by the Tonto Verde subdivision. New Tonto Verde topographic maps and survey notes were received from Brooks Hersey via the District. The information was analyzed for inclusion in the present District mapping.

TASK 4 - FIELD SURVEY

a. Surveys of the bridges and culverts were completed.

TASK 5 - HYDROLOGY

a. Revisions to the Hydrology Exhibits were made in AutoCAD.
b. Sample hydrology parameter spreadsheets were sent, requesting District approval.
c. The preliminary hydrology computations were submitted for District review. Included were the Hydrology Exhibits, routing cross-section plots, flow split rating curves and HEC-1 file. The HEC-1 file contained some dummy parameters until lengths and areas could be calculated.

TASK 6 - FLOODPLAIN DELINEATION

a. The preliminary Manning's Roughness Coefficients calculations were reviewed with the District on July 15, 1994. On July 19, 1994, the Rio Verde North Roughness Coefficient Report was compared to that of Rio Verde South. For similar washes, the n values compare favorably.
b. The Tonto Verde Development revegetation plan for the newly channelized Wash 11 was received from Rio Verde Services via the District. No revisions are necessary to the roughness coefficient report.
c. The Roughness Coefficient Report was submitted on July 22, 1994 for District approval.
d. The HEC-2 cross-section locations were submitted for District approval on July 22, 1994.

TASK 7 - DELIVERABLES

a. Activity consisted of above referenced submittals and documents.

The estimated completion by Tasks are:

Task No.	Percentage Complete
1	50
2	95
3	75
4	65
5	65
6	25
7	10
OVERALL	50

During the month of August, we plan to determine hydrology parameters from the Hydrology Exhibits, code the Special Culvert Routines and revise the cross-section locations as needed per District comments.

If you have any questions or require additional information please call me.

Very truly yours,

McLAUGHLIN KMETTY ENGINEERS, Ltd.

Géza E. Kmetty, P.E.
Principal

Billings\Sept-94.GEK

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

October 6, 1994

GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

Ms. Cathy Regester, Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Rio Verde South Floodplain Delineation Study
Contract FCD 93-07, MKE Job No. 89-407.003
Monthly Progress Report No. 8 for Invoice #8

Dear Ms. Regester:

The following progress is reported for the period July 26, 1994 to August 25, 1994:

TASK 1 - COORDINATION

a. Normal coordination consisting of telephone conversations and information exchange between involved parties.
b. Mylars of the semi-rectified aerial photographs (24" x 36") for flight date 22 December 1993 were loaned to the District and returned to MKE.

TASK 2 - DATA COLLECTION

a. Reviewed the newspaper, *The Times of Fountain Hills and Rio Verde, Arizona* for articles relating to rainfall, new development, and other information relating to the community.

TASK 3 - TOPOGRAPHIC MAPPING

a. Approximately 1.25 river miles of Wash 10 and Wash 11 have been channelized since preparation of mapping. Change Order No. 1 was processed to revise mapping in the affected area. The contract with the Rio Verde North consultant, who prepared the original mapping, was unaffected. The Brooks Hersey mapping was flown prior to channelization completion.
b. The revised mapping area was flown on 22 August 1994 and mapping computations commenced for Sheets 5 and 8 of 8.
c. Preliminary translation of the Hydrology Exhibits to ArcInfo coverages was made.

TASK 4 - FIELD SURVEY

a. Per Change Order No. 1, panel points were marked and one (1) new mapping control point was surveyed and marked.

TASK 5 - HYDROLOGY

a. Hydrology parameters, such as flow lengths and subbasin areas, were calculated or measured, and input to the HEC-1 model.

ASPEN, CO (303) 925-1920 | TULSA, OK (918) 582-6800 | DENVER, CO (303) 458-5550 | SUMMIT COUNTY, CO (303) 468-2141

b. No revisions are required to the HEC-1 model as a result of Change Order No. 1. The HEC-1 routing path was smoothed out to more closely agree with the channelized thalweg.
c. Hydrology review comments from the District were received.
d. Wood Patel and Associates, Rio Verde North Hydrology Subconsultant, submitted a map and HEC-1 information for a flow diversion at location 165DV that affects Rio Verde South.
e. Burgess & Niple submitted a map and letter show a breakout flow of 210 cfs at Wash A Section 2.494. This affects Rio Verde South and presently is not incorporated into the Rio Verde North HEC-1 model.

TASK 6 - FLOODPLAIN DELINEATION

a. A typical revegetation plan and letter for Wash 11 in the Tonto Verde Development was received from Rio Verde Services via the District.
b. The HEC-2 Special Culvert Routines were coded from the survey notes.
c. A meeting was held on 11 August 1994 to discuss the District's review comments on the Roughness Coefficient Report and the proposed HEC-2 cross-section locations.
d. The final cross-section locations were submitted to Aerial Mapping Company for photogrammetric cross-sections (GR record format).

TASK 7 - DELIVERABLES

a. Activity consisted of above referenced submittals and documents.
b. Preparation of the Preliminary Hydrology Report has begun.

The estimated completion by Tasks are:

Task No.	Percentage Complete
1	55
2	95
3	80
4	75
5	70
6	30
7	15
OVERALL	60

During the month of September, we plan to obtain the revised Change Order No. 1 mapping, receive the photogrammetric GR records, begin assembling the HEC-2 model and complete the hydrology parameters.

If you have any questions or require additional information please call me.

Very truly yours,

McLAUGHLIN KMETTY ENGINEERS, Ltd.

Géza E. Kmetty, P.E.
Principal

Billings\Sept-94.GEK

94-407.00

RECEIVED OCT 2 8 1994

TRANSMITTAL

Flood Control District of Maricopa County

Attn: Ms. Cathy Regester

FROM: George V. Sabol Consulting Engineers, Inc.
7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

DATE: 28 October 1994

PROJECT No./Name: 4e Rio Verde FIS FCD 93-07

SUBJECT: Rio Verde South Hydrology

ENCLOSED ARE THE FOLLOWING

- 3½" Diskette containing 6-hour and 24-hour hydrographs at C510 in "QT" format.

REMARKS

Cathy: The hydrographs are in the left branch of a diversion downstream from C510 that enters the Rio Verde North study area. These reflect the recent corrections to the HEC-1 models and should be the final results.

COPIES Frank Brown, MKE

SIGNED Thomas R. Sabol

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

October 31, 1994

Ms. Cathy Regester, Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

Re: Rio Verde South Floodplain Delineation Study
Contract FCD 93-07, MKE Job No. 89-407.003
Monthly Progress Report No. 9A for Invoice #9

Dear Ms. Regester:

Please note that Invoice #9 is for two months, and that individual monthly progress reports are prepared, noted as 9A and 9B.

The following progress is reported for the period August 26, 1994 to September 25, 1994:

TASK 1 - COORDINATION

a. Normal coordination consisting of telephone conversations and information exchange between involved parties.
b. Hydrology Meeting #3 - Preliminary HEC-1 Review Meeting was held on 31 August 1994 to discuss the 29 August Hydrology submittal.

TASK 2 - DATA COLLECTION

a. Tonto Verde Unit One Grading Plans (Record Drawings) were received from Brooks-Hersey via the District. These drawings depict the diversion structure on Wash 11. This diversion is incorporated into the HEC-1 model.
b. Tonto Verde Unit Three Grading and Paving Plans by Brooks-Hersey were received by the District.

TASK 3 - TOPOGRAPHIC MAPPING

a. The Change Order No. 1 Mapping for channelized Washes 10 and 11 was received and a copy sent to the District. One copy was sent to George V. Sabol Engineers as a formality, since the hydrology is unaffected by the channelization.

TASK 4 - FIELD SURVEY

a. The As-Built survey of structures is complete. Some field cross-sections will be needed, after the preliminary HEC-2 model is running.

TASK 5 - HYDROLOGY

a. Telephone discussions on the 210 cfs breakout flow at Wash A Section 2.494 yielded the following: the breakout will be modeled in Rio Verde North HEC-1 model and input into the Rio Verde South HEC-1 model.
b. Work is progressing on the 100-year existing conditions HEC-1 model:
   1. On 29 August, preliminary HEC-1 input files, parameter spreadsheets and results spreadsheets were sent to the District for review.
   2. On 12 September 1994, Preliminary Hydrology Tables S-1 through S-9 and Tables 3-3 and 3-4 were transmitted to the District. These tables depict rainfall loss parameters and include revisions made to the 29 August submittal.

ASPEN, CO (303) 925-1920 | TULSA, OK (918) 582-6800 | DENVER, CO (303) 458-5550 | SUMMIT COUNTY, CO (303) 468-2141

3. On 23 September 1994, revised Hydrology Tables S-2 through S-9, Tables 3-3 and 3-4, Tables R-1 through R-3, and Tables F-1 through F-4 were sent to the District for review. In addition, the HEC-1 input files were transmitted to Sandy Story.

c. Review of the diversion structure Record Drawings on Wash 11 yielded no change to the HEC-1 model, since the record drawings closely followed the previously received Grading Plans. It was agreed to model the watershed assuming the levee is there, and not there. The highest peak discharges will be reported.

TASK 6 - FLOODPLAIN DELINEATION

a. Final HEC-2 cross-sections were located within the Change Order No. 1 mapping area (11 cross-sections) and sent to Aerial Mapping Company for photogrammetric GR records.

b. Work was done on the Base Flood Elevation sinewave pattern. This line must be in AutoCAD as a straight line for ArcInfo to work correctly, but must plot on the AutoCAD Flood Delineation Maps as a sinewave pattern.

c. Photogrammetric GR records were received along with surveyed cross-sections, and assembled into the preliminary HEC-2 model.

d. ASCII format cross-section end points were placed into the Flood Delineation Maps.

e. A preliminary HEC-2 model was run using preliminary flowrates, and inspected for problem areas. A supercritical run was attempted for some washes.

TASK 7 - DELIVERABLES

a. Activity consisted of above referenced submittals and documents.

b. Work was done on the Preliminary Hydrology Report.

c. Change Order No. 1 revised topographic mapping and semi-rectified aerial photographs of Sheets 5 and 7 of 8 (prints) and were delivered to the District. In addition, 9" x 9" film diapositives (originals) for Change Order No. 1 mapping were sent.

The estimated completion by Tasks are:

Task No.	Percentage Complete
1	60
2	95
3	85
4	75
5	80
6	35
7	18
OVERALL	62

During the month of October, we plan to fine-tune the HEC-2 model using preliminary flowrates, analyze split flows at naturally-occurring islands, revise the HEC-1 model as needed per District comments, and continue work on the Preliminary Hydrology Report.

If you have any questions or require additional information please call me.

Very truly yours,
McLAUGHLIN KMETTY ENGINEERS, Ltd.

Geza E. Kmetty, P.E., Principal

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

October 31, 1994

Ms. Cathy Regester, Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

Re: Rio Verde South Floodplain Delineation Study
Contract FCD 93-07, MKE Job No. 89-407.003
Monthly Progress Report No. 9B for Invoice #9

Dear Ms. Regester:

Please note that Invoice #9 is for two months, and that individual monthly progress reports are prepared, noted as 9A and 9B.

The following progress is reported for the period September 26, 1994 to October 25, 1994:

TASK 1 - COORDINATION
- a. Normal coordination consisting of telephone conversations and information exchange between involved parties.

TASK 2 - DATA COLLECTION
- a. Reviewed the newspaper, *The Times of Fountain Hills and Rio Verde, Arizona*, for articles relating to rainfall, new development, and other information relating to the community, as it may affect floodplains, or floodplain management.

TASK 3 - TOPOGRAPHIC MAPPING
- a. No activity reported this month.

TASK 4 - FIELD SURVEY
- a. No activity reported this month.

TASK 5 - HYDROLOGY
- a. Additional minor computations on hydraulic flow splits.
- b. Calibration of 100-year existing conditions HEC-1 model.
- c. Work is proceeding on the written text and tables for the Preliminary Hydrology Report and Technical Data Notebook.
- d. Determination of HEC-1 problem with diversions and interpolation of hydrographs. The solution is presented in the attached HEC-1 problem report, which is a manual calculation of the interpolated hydrograph.

TASK 6 - FLOODPLAIN DELINEATION
- a. A preliminary HEC-2 model was run using preliminary flowrates, and inspected for problem areas. A supercritical run was completed for some reaches. A split flow/island analysis was completed using preliminary flow rates.

TASK 7 - DELIVERABLES
- a. Work was done on the Preliminary Hydrology Report.

ASPEN, CO (303) 925-1920 | TULSA, OK (918) 582-6800 | DENVER, CO (303) 458-5550 | SUMMIT COUNTY, CO (303) 468-2141

The estimated completion by Tasks are:

Task No.	Percentage Complete
1	60
2	95
3	85
4	75
5	89
6	45
7	20
OVERALL	70

During the month of November, we plan to continue work on the Preliminary Hydrology Report, fine-tune the HEC-2 model using final flowrates and submit the HEC-2 model results for preliminary District approval.

If you have any questions or require additional information please call me.

Very truly yours,
McLAUGHLIN KMETTY ENGINEERS, Ltd.

Geza E. Kmetty, P.E., Principal

Attachment:
HEC-1 Problem Report, 14 October 1994, George V. Sabol Consulting Engineers, Inc.

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix. Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 11-09-94	Job No.: 89-407.003
To: Flood Control District of Maricopa County	Attention: Ms. Cathy Regester
2801 West Durango Street	Re: FCD #93-07
Phoenix, AZ 85009	Rio Verde (South)
	Flood Delineation Study

WE ARE SENDING YOU X ATTACHED ___ VIA Mail

Original:	Copies	Date	Description
	1		Draft of Preliminary HEC-2 Report.
	1		3.5" Disk with Input Files.

Remarks: Cathy:

This report is our work to date on the Rio Verde South HEC-2 model. It is submitted as a Progress Report and is stamped "Draft" and "Preliminary". There are some inconsistencies and items that need to be checked. After this work was done, we received the final hydrology values, so already it needs to be re-worked. Please review and comment on methodology, plus any other items we need to look at, considering my above comments.

COPY TO_____

SIGNED Frank Edward Brown

Frank Edward Brown, P.E.

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
2801 West Durango Street
Phoenix, Arizona 85009

(602) 506-1501

LETTER OF TRANSMITTAL

89-407.00

TO MKE

DATE	JOB NO
12/2/94	FCD # 93-07

ATTENTION FRANK BROWN

RE RIO VERDE SOUTH FDS

RECEIVED DEC 0 5 1994

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via MAIL the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1	10/27/94		ADDENDUM #1 TO THE FINAL DRAINAGE REPORT OF TONTO VERDE UNIT 3

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit_____copies for approval

☒ For your use ☐ Approved as noted ☐ Submit_____copies for distribution

☒ As requested ☐ Returned for corrections ☐ Return_____corrected prints

☐ For review and comment ☐ _____

☐ FOR BIDS DUE _____ 19_____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS _____

COPY TO FCD # 93-07

SIGNED: Catherine W. Russell

6910-009 R8-93

If enclosures are not as noted, kindly notify us at once.

Hand-Delivered

TRANSMITTAL

Flood Control District of Maricopa Co.

Attn: Cathy Regester

FROM: George V. Sabol Consulting Engineers, Inc.
7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

DATE: 9 December 1994

PROJECT No./Name: 46 Rio Verde South FIS, FCD 93-07

SUBJECT: Draft TDN - Hydrology

ENCLOSED ARE THE FOLLOWING

1- Draft Technical Data Notebook - Hydrology
1- Exhibits A-E

REMARKS

Cathy: Appendices D, E, F & G are not included. Current HEC-1 input files are included on diskette in lieu of those appendices. We will proceed with reproduction of the final report if this submittal is approved, after any required revisions.

COPIES Frank Brown, PE

SIGNED Thomas R. Loomis

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

GEZA E. KMETTY
RONALD C. McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TORRES
TERRENCE P. KENYON

December 15, 1994

Ms. Cathy Regester, Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Rio Verde South Floodplain Delineation Study
Contract FCD 93-07, MKE Job No. 89-407.003
Monthly Progress Report No. 10 for Invoice #10

Dear Ms. Regester:

The following progress is reported for the period October 26, 1994 to November 25, 1994:

TASK 1 - COORDINATION
- a. Normal coordination consisting of telephone conversations and information exchange between involved parties.
- b. Coordination meeting on November 8 to discuss Phase II flowrates and Wash 11 floodplain at upstream end of Phase I.

TASK 2 - DATA COLLECTION
- a. Reviewed the newspaper, *The Times of Fountain Hills and Rio Verde, Arizona*, for articles relating to rainfall, new development, and other information relating to the community, as it may affect floodplains, or floodplain management.

TASK 3 - TOPOGRAPHIC MAPPING
- a. No activity reported this month.

TASK 4 - FIELD SURVEY
- a. No activity reported this month.

TASK 5 - HYDROLOGY
- a. Continued work oh the CADD drawings.
- b. Work is almost complete on the written text and tables for the Preliminary Hydrology Report and Technical Data Notebook.

TASK 6 - FLOODPLAIN DELINEATION
- a. On 9 November 1994, submitted Preliminary HEC-2 Report, stamped "DRAFT" and "PRELIMINARY". The HEC-2 used pre-preliminary flowrates, the report text only described the analysis and flow split methods.

TASK 7 - DELIVERABLES

a. Additional work was done on the Preliminary Hydrology Report.
b. The HEC-2 model results were submitted for methodology approval.

The estimated completion by Tasks are:

Task No.	Percentage Complete
1	60
2	95
3	85
4	75
5	96
6	50
7	20
OVERALL	75

During the month of December, we plan to submit the Preliminary Hydrology Report, and wait for methodology approval from the District on the HEC-2 model results.

If you have any questions or require additional information please call me.

Very truly yours,

McLAUGHLIN KMETTY ENGINEERS, Ltd.

Géza E. Kmetty, P.E.
Principal

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 16 Dec 98 | Job No.: 89-407.003

To: Flood Control District of Maricopa County

Attention: Cathy Regester

Re:

WE ARE SENDING YOU X ATTACHED ___ VIA best method

Original:	Copies	Date	Description
	1	15 Dec 98	Sheets 1 thru 7 of 8

Remarks: Cathy,

these maps show topo, thalweg, cross-sections and cross-section labels in river miles. This should aid in your current HEC-2 review even though these maps do not show any floodplains. These are submitted as progress prints, since I was not able to review them before sending them to you.

COPY TO ___

SIGNED Frank Edward Brown

FLOOD CONTROL DISTRI
OF MARICOPA COUNTY
2801 West Durango Street
Phoenix, Arizona 85009

(602) 506-1501

RECEIVED DEC 19 1994

LETTER OF TRANSMITTAL

59-407.02

TO MIKE

DATE	JOB NO
12/15/94	93-07

ATTENTION FRANK BROWN

RE: RIO VERDE SOUTH FDS

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via MAIL the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☒ DISKETTE

COPIES	DATE	NO.	DESCRIPTION
1	12/13/94		AUTO CAD FILE W/ VERDE RIVER, 3 WASHES 9, 10, & 11 FLOODPLAIN DELINEATIONS

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit____ copies for approval

☒ For your use ☐ Approved as noted ☐ Submit____ copies for distribution

☒ As requested ☐ Returned for corrections ☐ Return____ corrected prints

☐ For review and comment ☐ ____

☐ FOR BIDS DUE ____ 19____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS FRANK,
IF YOU HAVE ANY PROBLEMS WITH THE ATTACHED DISKETTE, PLEASE CALL ME.

COPY TO FILE

SIGNED: Catherine W. Rogers

6910-009 R8-93

If enclosures are not as noted, kindly notify us at once.

LETTER OF TRANSMITTAL

McLaughlin Kmelly Engineers, Ltd.
3501 North 16th Street, Phoenix AZ 85016-6419
248-7702 FAX 248-7851

TO Flood Control District of Maricopa County

DATE 12-20-93 JOB NO 99-407003

ATTENTION Cathy Regester

RE: Rio Verde South

GENTLEMEN:

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via pick-up the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☒ Paster Boards as described:

COPIES	DATE	DESCRIPTION
1✓	—	24×36 Showing blue stream lines, red boundary and yellow flow splits,
1✓	—	Exhibit 1 Floodplain + Mapping Options - 24×36
10✓	12-16-92	2-30×33 Aerial Photographs 1"=400' red + yellow stream lines (blue dots are known culverts). Photo date Dec 1692.

REMARKS Cathy, we have Exhibit 1 in our computer so we could revise it to ~~show~~ delete option B mapping, etc. Let me know.

COPY TO

SIGNED: Gerald Edward Brown

BURGESS & NIPLE
ENGINEERS
ARCHITECTS

Burgess & Niple, Inc.
5025 East Washington Street
Suite 212
Phoenix, AZ 85034
602 244-8100
Fax 602 244-1915

LETTER OF TRANSMITTAL

DATE December 29, 1993	JOB NO. 15183
RE: Rio Verde, North & South Aerial Mapping	

TO Mr. Magnus Jolayemi
Flood Control District of Maricopa County
2801 W. Durango
Phoenix AZ

WE ARE SENDING YOU: ☒ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1 ea.			Contact prints, Rio Verde north & south
1 ea.			Diapositives, Rio Verde north & south

THESE ARE TRANSMITTED:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☒ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☒ As requested ☐ Returned for correction ☐ Return _____ corrected prints
☐ For review and comment ☐ _____

REMARKS These items are submitted per scope of work items 6.1.1 and 6.1.4

COPY TO Ms. Cathy Rogester

SIGNED James E Mischler

If enclosures are not as noted, kindly notify us at once.

BURGESS & NIPLE
ENGINEERS
ARCHITECTS

Burgess & Niple, Inc.
5025 East Washington Street
Suite 212
Phoenix, AZ 85034
602 244-8100
Fax 602 244-1915

LETTER OF TRANSMITTAL

DATE December 29, 1993	JOB NO. 15183
RE: Rio Verde South	

TO Mr. Frank Brown
McLaughlin Kinetty Engineers, Ltd.
3501 N. 16th Street
Phoenix AZ 85016

WE ARE SENDING YOU: ☒ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1 ea.			Aerial mapping contact prints, Rio Verde South watershed.

THESE ARE TRANSMITTED:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☒ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☐ As requested ☐ Returned for correction ☐ Return _____ corrected prints
☐ For review and comment ☐ _____

REMARKS _____

COPY TO Ms. Cathy Regester
Mr. Magnus Jolayemi

SIGNED James E Mischler

If enclosures are not as noted, kindly notify us at once.

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

January 5, 1994

Ms. Cathy Regester, Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Rio Verde South Floodplain Delineation Study
Contract FCD 93-07, MKE Job No. 89-407.003
Monthly Progress Report No. 11 for Invoice #11

Dear Ms. Regester:

The following progress is reported for the period November 26, 1994 to December 25, 1994:

TASK 1 - COORDINATION
a. Normal coordination consisting of telephone conversations and information exchange between involved parties.

TASK 2 - DATA COLLECTION
a. Reviewed the newspaper, *The Times of Fountain Hills and Rio Verde, Arizona*, for articles relating to rainfall, new development, and other information relating to the community, as it may affect floodplains, or floodplain management.

TASK 3 - TOPOGRAPHIC MAPPING
a. No activity reported this month.

TASK 4 - FIELD SURVEY
a. No activity reported this month.

TASK 5 - HYDROLOGY
a. Submitted the Preliminary Hydrology Report and a complete set of Hydrology Maps on 9 December 1994.

TASK 6 - FLOODPLAIN DELINEATION
a. Check and revise stream stationing of HEC-2 cross-sections. The field surveyed cross-sections at culverts had to be added to the cross-section model obtained by photogrammetric methods.
b. Check and revise HEC-2 section lengths (as shown in plan view) at culverts.

ASPEN,CO (303) 925-1920 | TULSA, OK (918) 582-6800 | DENVER, CO (303) 458-5550 | SUMMIT COUNTY, CO (303) 468-2141

c. Prepare floodplain base maps to depict topography, HEC-2 Sections and section locations in river miles. These maps will be used to redline the floodplain for future submittal under Task 6.10.1, and were submitted to the District on 16 December 1994.
d. Prepared three tables for inclusion in the Preliminary Hydraulic Report.
e. Received from the District an AutoCAD file with the Verde River floodplain as depicted on the Flood Insurance Rate Map.
f. Received from the District a copy of Addendum #1 to the Final Drainage Report on Tonto Verde Unit 3.

TASK 7 - DELIVERABLES

a. Submitted the Preliminary Hydrology Report as previously noted.
b. Submitted floodplain base maps as previously noted.

The estimated completion by Tasks are:

Task No.	Percentage Complete
1	60
2	95
3	85
4	75
5	98
6	55
7	40
OVERALL	76

During the month of January, we plan to check the FEMA forms, if any can be filled out early, discuss Phase II limits, and wait for methodology approval from the District on the HEC-2 model results. Concerning the PHASE II - ADDITIONAL FLOODPLAIN MAPPING: The additional floodplain mapping could be handled in one of two ways; wait for Phase II approval and submit all floodplains at once, or complete the floodplains on Washes 9 and 10, plus Wash 11 up to the Phase I boundary. This will be discussed with the District in January.

If you have any questions or require additional information please call me.

Very truly yours,

McLAUGHLIN KMETTY ENGINEERS, Ltd.

Geza E. Kmetty, P.E.
Principal

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Interoffice Memorandum

RECEIVED JAN 2 3 1995

To: CWR CWR

From: SS

Subject: Rio Verde South FDS - Technical Data Notebook (Draft Hydrology)

Date: 1/11/95

I have found the submitted material to be acceptable. Please let me know if you have any questions.

Hand-Delivered
89-467-663

TRANSMITTAL

RECEIVED FEB 0 2 1995

: Flood Control District of Maricopa Co.

Attn: Cathy Regester

FROM: George V. Sabol Consulting Engineers, Inc.
7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

DATE: 9 December 1994

PROJECT No./Name: 46 Rio Verde South FIS, FCD 93-07

SUBJECT: Draft TDN - Hydrology

ENCLOSED ARE THE FOLLOWING

1- Draft Technical Data Notebook - Hydrology
1- Exhibits A-E

REMARKS

Cathy: Appendices D, E, F & G are not included. Current HEC-1 input files are included on diskette in lieu of those appendices. We will proceed with reproduction of the final report if this submittal is approved, after any required revisions.

COPIES Frank Brown, PE

IGNED Thomas R. Sabol

FLOOD CONTROL DISTRICT
of
Maricopa County
2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5859

February 14, 1995

Mr. Frank E. Brown, P.E.
McLaughlin Kmetty Engineers, Ltd.
3501 N 16th Street
Phoenix, Arizona 85016-6419

SUBJECT: Rio Verde South Floodplain Delineation Study
FCD #93-07
Phase II

Dear Mr. Brown:

Upon reviewing the results of the preliminary final hydrology, we have decided to delineate approximately 2.0 miles of floodplains under Phase II of this contract. The washes to be delineated are shown on topographic map sheets 6, 7, and 8 of 8. Please review the Phase II reach lengths and determine the actual miles proposed under Phase II. Upon verification of this mileage, I will prepare a written authorization to proceed.

I have attached some examples of small, end-of-section, breakouts which occurred on the Powerline/Tank and Star Washes floodplain delineation studies as we discussed. In addition, I have attached a page from the Star Wash Study which addresses the issue of coincidental/non-coincidental flows.

An updated (October 1994) copy of the FEMA forms is enclosed for your use. I would prefer to use these new forms for the FEMA submittal. If you feel that these forms are beyond your scope, please contact me so that we may discuss this matter in more detail.

If you have any questions or require additional information, please feel free to call me at (602) 506-1501.

Sincerely,

Catherine W. Regester

Catherine W. Regester
Hydrologist

Enclosures

PhaseIIA.NWP CWR 02/14/95

MKE
McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

February 17, 1995

Ms. Cathy Regester, Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Rio Verde South Floodplain Delineation Study
Contract FCD 93-07, MKE Job No. 89-407.003
Monthly Progress Report No. 12 for Invoice #12

Dear Ms. Regester:

The following progress is reported for the period December 26, 1994 to January 25, 1995:

TASK 1 - COORDINATION

a. Normal coordination consisting of telephone conversations and information exchange between involved parties.
b. Coordination occurred between MKE and Aerial Mapping Company (AMC). AMC is handling GCA's contracts. (See Task 3, Item a.)

TASK 2 - DATA COLLECTION

a. Reviewed the newspaper, *The Times of Fountain Hills and Rio Verde, Arizona*, for articles relating to rainfall, new development, and other information relating to the community, as it may affect floodplains, or floodplain management.

TASK 3 - TOPOGRAPHIC MAPPING

a. Mr. L. Don Spire has left the employ of GIS Consultants of Arizona (GCA). MKE prefers to do the GIS work in-house. For budgetary purposes, the remaining budget will remain under "GCA" on Sheet 3 of the monthly billing.

TASK 4 - FIELD SURVEY

a. No activity reported this month.

TASK 5 - HYDROLOGY

a. Received review comments on the Preliminary Hydrology Report and Hydrology Maps on 11 January 1995. MKE will not print the Final Hydrology Report until the floodplain delineation us substantially complete.

ASPEN,CO (303) 925-1920 | TULSA, OK (918) 582-6800 | DENVER, CO (303) 458-5550 | SUMMIT COUNTY, CO (303) 468-2141

TASK 6 - FLOODPLAIN DELINEATION

a. Coordination Meeting #2 was held on 23 January 1995 to discuss Phase I Hydrology Review, Phase I HEC-2 Review and Phase II Scope of Work. Meeting minutes were sent under separate cover.

TASK 7 - DELIVERABLES

a. No activity reported this month.

The estimated completion by Tasks are:

Task No.	Percentage Complete
1	61
2	95
3	86
4	75
5	98
6	55
7	40
OVERALL	76

During the month of February, we plan to fill-out the FEMA forms, except for data required after floodplain delineation, wait for the Final Scope of Work for Phase II, and begin revisions on the HEC-2 model, as necessary per in-house and District review comments.

If you have any questions or require additional information please call me.

Very truly yours,

McLAUGHLIN KMETTY ENGINEERS, Ltd.

Geza E. Kmetty, P.E.
Principal

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

Date 2-22-95

INCL. this page

From Frank Brown

Transmitted to Fax Number 506-7346

To Cathy Register

Company F.C.D.M.C.

Comments Re: Rio Verde South, Phase II
Study Limits

Job # 89-407.003

Hard copy to follow

NOTE: If this transmission is incomplete, please call
(602) 248-7702

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

February 22, 1995

GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TORRES
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

Ms. Cathy Regester
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

SUBJECT: Rio Verde South Floodplain Delineation Study
FCD #93-07
Phase II Study Limits

Dear Ms. Regester:

We have reviewed topographic map sheets 6, 7 and 8 showing the Phase II study Washes. The study wash lengths were measured to be 2.015 miles. Two different measurement methods were utilized, one directly from the computer model and the other using a map wheel (hand calculations enclosed).

According to our final Scope of Work, the Phase II contract amount would be $3,700 fixed cost plus $4,000 per mile, for a Phase II total cost of $11,760. Please prepare written authorization for McLaughlin Kmetty Engineers to proceed with this work.

One of the Phase II study washes is unnamed. Since it lies directly north of Wash 11, we propose to name it Wash 12. Such a naming scheme would be consistent with the study area. Are you aware of any locally-used name for this wash? If not, please authorize us to use "Wash 12" as the official wash name.

Very truly yours,

McLAUGHLIN KMETTY ENGINEERS, Ltd.

Frank Edward Brown

Frank Edward Brown, P.E.
Project Engineer

c: Geza Kmetty, MKE

89407-00\Ph2scope.003

JDB

MKE McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 14 AUG 95 | Job No.: 89-407.003

To: FCD of MC

Attention: Mr. Hasan Mushtaq

Re: Rio Verde South

WE ARE SENDING YOU X ATTACHED ___ VIA deliver

Original:	Copies	Date	Description
	1	14AUG95	Flood Map Sheet #8.
	1	11AUG95	Cross Sections for W10IS2FW.OH2
	1	11AUG95	Flood Profile - Wash 10 Island 2 (southern chan
	1	1994	Figure 3 and Figure 3A - see below *

Remarks: Hasan,

these items were left out of the 11 AUG 95 submittal. You already received the HEC-2 for W10IS2FW.IH2 on 11 Aug. This completes the Floodway method 4 submittal.

* Figure 3 and 3A should be placed in the map pocket in the notebook marked MKE 1st submittal.

COPY TO ___

SIGNED Frank Edward Brown, P.E.

Job file

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 08-17-95 | Job No.: 89-407.003

To: Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Attention: Mr. Hasan Mushtaq

Re: Rio Verde South

WE ARE SENDING YOU X ATTACHED ___ VIA Mail

Original:	Copies	Date	Description
	1	1994	Figure 3 and Figure 3A

Remarks: Please place in the map pocket in the notebook marked MKE 1st submittal.

COPY TO _____

SIGNED Jay P. Lee
for Frank Edward Brown, P.E.

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix. Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

Date 21 AUG 95

From Frank Brown

Transmitted to Fax Number 506-4601

To Hasan Mushtaq

Company FCD of MC

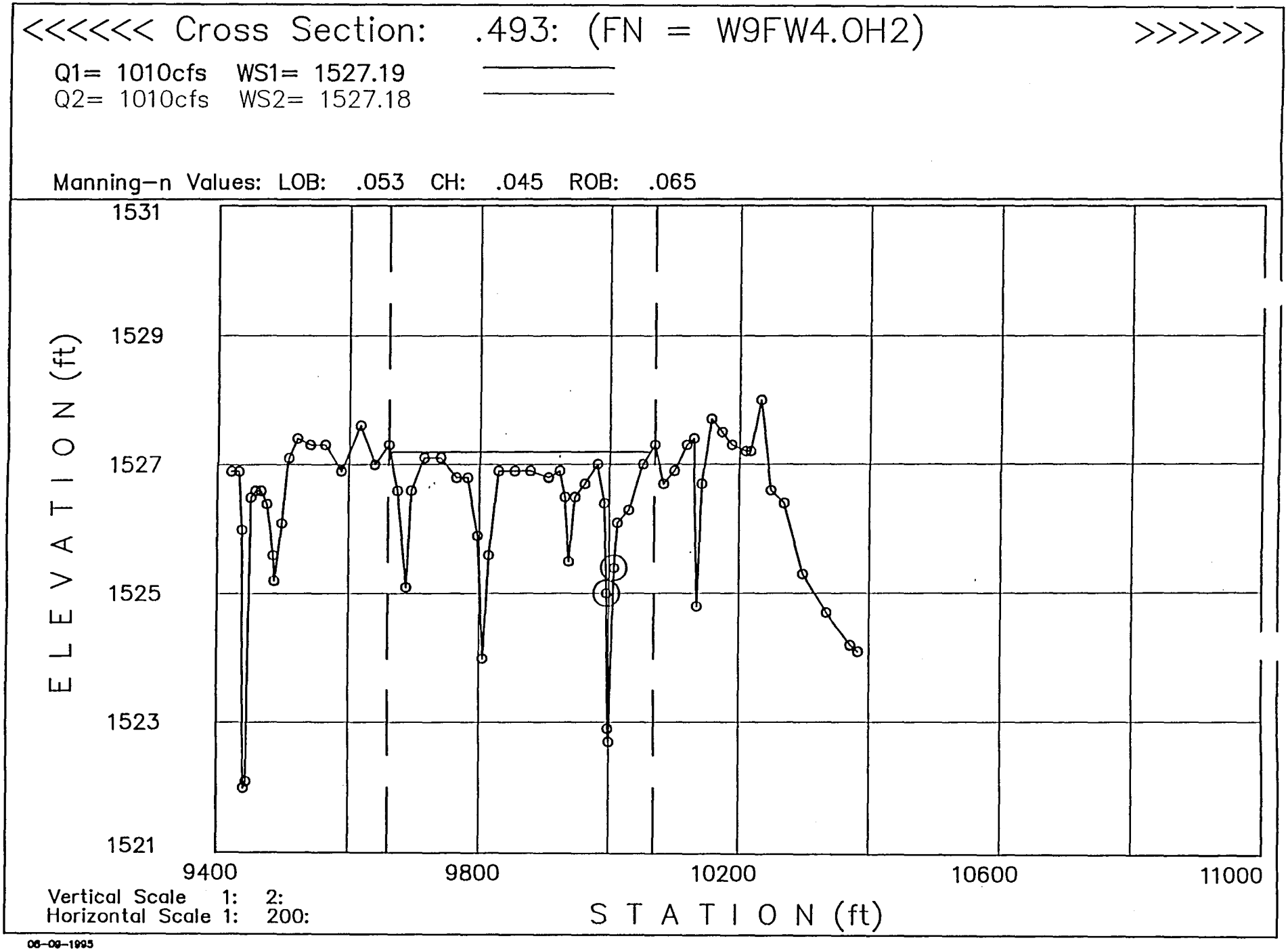
Comments Hasan,

Cross section 0.493 on Wash #9 was left ~~off~~ out of the recent Floodway Method 4 submittal package. Please include it.

Frank

Job # 89-407.003

NOTE: If this transmission is incomplete, please call (602) 248-7702


<<<<<< Cross Section: .493: (FN = W9FW4.0H2) >>>>>>
Q1= 1010cfs WS1= 1527.19
Q2= 1010cfs WS2= 1527.18
Manning-n Values: LOB: .053 CH: .045 ROB: .065
1531
1529
1527
1525
1523
1521
ELEVATION (ft)
9400
9800
10200
10600
11000
STATION (ft)
Vertical Scale 1: 2:
Horizontal Scale 1: 200:
06-09-1995

Job file

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 08-22-95 | Job No.: 89-407.003

To: Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009

Attention: Mr. Hasan Mushtaq

Re: Rio Verde South

WE ARE SENDING YOU X ATTACHED ___ VIA Deliver

Original:	Copies	Date	Description
	2	Aug 1995	Hydrology Report and TDN
			Volume 1 of 2 and Volume 2 of 2

Remarks: This submittal consists of the Final Hydrology Report to fulfill Task 7.8.3.1 of the Scope of Work.

COPY TO ___

SIGNED Frank Edward Brown
Frank Edward Brown. P.E.

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5859

August 25, 1995

Frank Brown
McLaughlin Kmetty Engineers, Ltd.
3501 N. 16th Street
Phoenix, Arizona 85016-6419

SUBJECT : Rio Verde South Floodplain Delineation Study - HEC-2 analysis (1).

Dear Mr. Brown :

Please find the following comments on the HEC-2 analysis of Wash -12 of the above mentioned project.

(1) The value of J2.1 should be 15 since it is the last profile.
(2) Explain Water Surface Elevations 1514.0 ft. and 1515.0 ft.
(3) n-values are not properly listed in the x-section plots.
(4) Eliminate surcharges greater than 1.0 ft. rotate per P. Calza.
(5) Please explain x-sections 0.207, 0.569, 0.661, 0.846, regarding the floodway limits.
(6) Attemp to eliminate the abrupt change in the mean velocities in the Floodway summary output table.
(7) Please explain why the Top width and floodway widths are not equal in the Floodway summary output table.

It is recommended that the above mentioned comments are incorporated in the HEC-2 modeling. Should you need further information, please do not hesitate to contact me at (602)-506-1501 (W).

Sincerely,

Hasan Mushtaq

JCD

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

September 5, 1995

GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

Mr. Hasan Mushtaq
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Rio Verde South FDS
Cross Section Location Plan and 'n' Value Report
Interoffice Memorandum dated 08/11/94
FCD No. 93-07
MKE Job No. 89-407.003

Dear Hasan:

This is a written response to an Interoffice Memorandum to P. A. Calza from C. W. Regester dated August 11, 1994. A copy of that memo is attached with this letter for ease of reference. Cross Sections are now double referenced according to the RM label and original cross section numbering scheme.

These comments were previously addressed and corrected. The file lacks documentation regarding these items, thus, the need for this letter.

WASH 9

Comment 1.: Cross Section at RM 0.170 (XS 1) was rotated, and is not in the floodplain mapping area since it is within the Fort McDowell Indian Reservation.

Comment 2.: Cross Section at RM 0.402 was rotated.

WASH 10/11 CONFLUENCE

Comment 1.: No, the floodplain at RM 0.894 (XS 14) does not extend laterally to this small channel, therefore, no need to follow to RM 0.458 (XS 7).

WASH 10

Comment 1.: Cross Section at RM 0.838 (XS 6) has been revised to be perpendicular to flow.

Comment 2.: A Cross Section was added in this area. Final Cross Section locations (see Comment 1. preceding) consist of RM 0.829 after the drop and RM 0.838 before the drop to model the elevation difference in channel thalweg.

Comment 3.: Cross Section at RM 1.002 (XS 9) alignment has been revised.

Comment 4.: Cross Section 1.247 (XS 16) alignment has been revised.

ASPEN,CO (303) 925-1920 | TULSA, OK (918) 582-6800 | DENVER, CO (303) 458-5550 | SUMMIT COUNTY, CO (303) 468-2141

Comment 5.: Contour label near RM 1.002 (XS 9) was incorrectly labeled and has been revised. Burgess & Niple and Aerial Mapping Company were notified of the revision.

WASH 11

Comment 1.: The Cross Section at RM 1.072 (XS 17) was extended to be consistent with Cross Sections at RM 0.985 (XS 15), RM 1.034 (XS 16) and RM 1.128 (XS 18).

GENERAL COMMENTS

Comment 1: River Miles are used as the final cross section labeling scheme.

Comment 2.: Please see final text in the Technical Data Notebook for more detail on the Wash 10 Starting Water Surface Elevation (WSEL). The comments made by C. W. Regester (in quotes) on Page 1 of the report (in bold) are as follows:

and a data request to FEMA via Flood Control District of Maricopa County (FCDMC) did not yield any water surface elevations.

"The info[rmation] on the Verde [River] was not requested. Since coincident peaks on the Verde and Wash 11 are not likely, I felt there was no need to request data on the Verde [River]."

For Wash 10, the HEC-2 analysis begins at the confluence with Wash 11.

"After we get into the HEC-2, I would like to have more detail on starting Wash 10. I think the confluence with Wash 11 is going to be somewhat of a modeling problem.

Sincerely,
McLaughlin Kmetty Engineers, Ltd.

Frank Edward Brown

Frank Edward Brown, P.E.
Project Engineer

Enclosure

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Interoffice Memorandum

RECEIVED AUG 1 1 1994

Subject: Rio Verde South FDS
Cross Section Location Plan and 'n' Value Report

File: 93-07

To: PACalza

From: CWRegester CWR

Date: 8/11/94

I have completed my review of the subject plan and report and have the following minor comments which I will pass on to the study consultant:

WASH 9

1. X-section 1: I am concerned with the depth of the channel being less than 2 ft when compared to the right side end station. May get a "cross section extended" message. May want to pivot section upstream (possibly at point where spacing with x-section 2 will be about 250 ft.)

2. X-section 4: Please note that the south approximately 160 ft is going downhill.

WASH 10/11 CONFLUENCE

1. X-section 14: Please note channel located on the north end of section (40 ft from north end or SSTA). Could there be a need to follow this channel down to x-section 7?

WASH 10

1. X-section 6: Doesn't appear perpendicular to flow and is skewed across the southern-most wash.

2. How is drop structure being included in the model? Doesn't appear that a x-section is proposed at this location.

3. X-section 9: Minor suggestion to southern end. See pencil line on plan.

4. X-section 16: Minor suggestion to alignment. See pencil line on plan view.

5. Please note heavy contour at x-section 9. Labeled as 1642. Should be 1640?

WASH 11

1. X-sections 15, 16, and 18 pick up the swale in a dirt road. Section 17 does not. May want to go ahead and get for 17 so sections are consistent.

GENERAL COMMENTS

1. For the HEC-2, please make sure that cross sections are numbered according to their river mile location.

2. The 'n' value report looks good. For the final, however, I would like more detail on how the starting WSEL was determined for Wash 10. I think it would be premature to try to write that now though. Let's see how the HEC-2 model comes out first. Also, I have made a couple minor corrections on page 1 of the report.

   Just for comparison, I looked at the 'n' values used in the Brooks-Hersey study of Wash 11 and the Wiley study of Wash 10 through the golf course. For Wash 11, Brooks-Hersey used a channel 'n' of 0.035 where we are using 0.030 and, an overbank 'n' of 0.050 where we will use 0.030 and 0.070. I think these show a favorable comparison. For Wash 10, Wiley used channel and overbank 'n' values of 0.025 where we will use 0.030. I think these, as well, compare favorably.

JOB

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

September 8, 1995

Mr. Hasan Mushtaq
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Rio Verde South Floodplain Delineation Study
Contract No. FCD 93-07, MKE Job No. 89-407.003

Dear Hasan:

We have addressed the District's review comments found in your 25 August 1995 review letter concerning Wash 12. Most of the comments were discussed in person during a meeting held in your conference room on 25 August 1995 at 1:30 p.m. Here are my responses to your comments, following the same numbering sequence:

1. The value of J2.1 is revised to 15.

2. The starting water surface elevation of 1514.0 for natural floodplain conditions is based upon a probable 100 year flood level in the Verde River. The starting elevation for the floodway run is one foot above that, at elevation 1515.0. A calculation sheet entitled "Starting Water Surface Elevations and Coincident Peak Considerations" will be added to each wash appendix, and was submitted to you on 7 September 1995. Starting water surfaces for all washes will be described in the report text.

3. The problem with n values not properly listed is due to the cross section plotting software we are using, which lists n values reported by HEC-2 in the output file. As discussed in our review meeting, the cross sections plots are acceptable to the District.

4. Floodway surcharges greater than 1.0 feet will be eliminated when we use Floodway Method 1.

5. The floodway limits shown on the cross section plots for sections 0.207, 0.569, 0.661, and 0.846 were due to a conflict between the X3 and ET records. This conflict will be resolved by truncating the cross section at the specified X3 record location, and deleting the X3 record. Full comment record documentation will be

ASPEN,CO (303) 925-1920 | TULSA, OK (918) 582-6800 | DENVER, CO (303) 458-5550 | SUMMIT COUNTY, CO (303) 468-2141

placed in the HEC-2 file. As agreed at our meeting, we will rotate the cross section at River Mile 0.207 to be perpendicular to the floodplain.

6. We will attempt to eliminate abrupt changes in the floodway mean velocity. However, the first cross section will have a low velocity because of the backwater effect from the Verde River.

7. The top width discrepancies between HEC-2 floodway tables is due to one table reporting the difference between stations and another table reporting the width of the actual water surface. The discrepancy is apparent when there is divided flow. We will present only Table 200 with the Floodway Method 1 submittal.

8. In addition to your written comments, we discussed the cross section plots and agreed that we would eliminate the circles around the GR data points.

As you recommended, we will incorporate these comments into the HEC-2 model for Wash 12, and will make similar modifications for the models on Washes 9, 10 and 11.

On 7 September 1995, we submitted the revised Wash 12 HEC-2 output, cross section plots and floodway/floodplain maps to you. This submittal includes these review comment responses and presents the final floodway computations based upon Method 1. On 8 September 1995, we sent the HEC-2 input and output files to you via modem. Please review and let us know when the Wash 12 analysis is acceptable to the District.

Sincerely,
McLAUGHLIN KMETTY ENGINEERS, Ltd.

Frank Edward Brown

Frank Edward Brown
Project Engineer

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix. Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TORES
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

Date 1 SEP 95

From Frank Brown

Transmitted to Fax Number 506-4601

To Mr. Hasan Mushtaq

Company FCD of MC

Comments Hassan, enclosed is an 11 x 17 showing the revised floodplain map @ Wash 10-11 confluence area. I think our 11 August 95 analysis is more complex than it needs to be. A simpler approach consisting of no island analysis and using Wash 11 cross sections across the full floodplain yields about the same results.

Job # Please review and comment. Frank
I can supply the HEC-2 and disk if you would like.

89-407.003

NOTE: If this transmission is incomplete, please call
(602) 248-7702

MKE McLaughlin Kmetty Engineers, Ltd.

Project Title RIO VERDE SOUTH Project No. 89-407-003 Date 17 FEB 95
CHECKED BY: DL 21 FEB 95
Subject _____ Designed _____ Page 1/1

PHASE II FLOODPLAIN LIMITS

Measure length of thalweg for Wash 12 (assumed name) and Wash 11 extended. Measurements made using Keuffel + Esser Map Wheel, model #62-0310, calibrated to 1/16th inch.

Sheet No.	Wash	Distance inches	Distance feet	Distance miles	
6	12 (assumed)	19 7/8			
7	12 (assumed)	4 1/4	____	____	
	TOTAL	24 1/8	4825.0	0.914	TOTAL WASH 12 (assumed name)
7	11 - Starting @ Phase I boundary	7			
8	11	22 1/16	____	____	
	TOTAL	29 1/16	5812.5	1.101	TOTAL WASH 11

PHASE II TOTAL: WASH 12 + WASH 11

0.914 + 1.101 = 2.015 miles TOTAL PHASE II

PHASE II Contract Amount:

$3,700.00 Lump Sum + $4,000.00/mile (2.015 mi) = $11760 TOTAL ADDITIONAL CONTRACT

LEGEND:
✓ = check in-house, OK.

NOTE: The computer distances match above mileage. Individual lengths vary a little but they add to 2.015 miles.

Original
188-HDR-005

Fax Cover Sheet

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

2801 West Durango Street
Phoenix, Arizona 85009
Telephone (602)506-1501
Fax (602)506-7346
TDD (602)506-5897

FLOODPLAIN MANAGEMENT BRANCH

To: FRANK BROWN

Company or Department: MKE

Fax Number: 248-7851

From: CATHY REGESTER 2/23/95

Number of pages being sent including cover sheet: 5

If there are any problems or questions, please call (602)506-1501

Comments: 2 SHEETS FROM AERIAL MAPPING.
2 IN-HOUSE MESSAGE DISPLAYS.

I HAVE SENT A MESSAGE TO MARTA ASKING IF ALL OF AERIAL MAPPING CO'S QUESTIONS HAVE BEEN ANSWERED & WILL LET YOU KNOW MARTA'S RESPONSE.

aerial mapping company, inc.

3141 West Clarendon Ave.
Phoenix, AZ 85017
(602) 263-5728

Fax (602) 263-0165

FAX COVER SHEET

Name: CATHY REGISTER Date: 2/15/95

Company: FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Fax Phone Number: 506-7346

We are transmitting 2 pages (including cover sheet).

From: MIKE MESTER & BOB PARKS

Notes:

If you do not receive all pages, please advise.

To: Cathy Register
Via: Richard Cook
Via: Bob Parks

From: Mike Mester

Subject: Rio Verde North (FCD 93-06) & Rio Verde South (FCD 93-07)

Before the final ARCINFO translation for the above projects can be completed a few matters need to be addressed:

1) Due to the altitude and scale at which the Rio Verde mapping was done, some of the planimetric mapping data compiled for the project is not conducive to transformation into a polygon coverage. For example: The retaining walls collected are not polygons, they are only multiple point linestrings. It is photogrammetrically incorrect to collect a double-line wall at 1" = 200' scale mapping.

2) Is there a place in your specs for building foundations?

3) Are sidewalks on golf courses considered as strtdtl?

4) Is there a place in your specs for existing riprap?

5) The topographic mapping ARCINFO conversion for Rio Verde North & South is being translated as one piece, the ARCINFO conversions for the hydrology are being done by different consultants, and are considered separate projects. What #'s should be used to properly fit into your database? I have approximately 4000 arcs in the topographic elv coverage.

Please address these questions and comments. If you have any questions or need further consultation, feel free to give me a call at 263-5728.

Sincerely,

Michael A. Mester
Digital Systems Specialist
Aerial Mapping Company, Inc.

MESSAGE DISPLAY FOR CATHY REGESTER

To: cwr

From: Marta Dent:TALOS
Postmark: 02/17/95 06:47AM
Status: Previously read

Host: TALOS
Delivered: 02/17/95 06:47AM

Subject: Rio Verde

Message:
Cathy, I received your memo and the last question requests the numbers to be assigned to this project. Mark is the Database Administrator and he has the book that assigns the numbers. He is off today and will be back tuesday, because of the holiday.
I'll talk to them over the phone to solve the other questions and the final report will go out tuesday when the numbers are assigned.
If you have any questions please give me a call.
Thanks

MESSAGE DISPLAY FOR CATHY REGESTER

To: Marta Dent
Cc: CWR

From: Mark Brewer:TALOS
Host: TALOS
Postmark: 02/21/95 09:38AM
Delivered: 02/21/95 09:38AM
Status: Previously read

Subject: Reply to: Rio Verde

Reply Text:
From: Mark Brewer:
Date: 02/21/95 09:38AM
The range of numbers for aerial mapping for Rio Verde North and South will be 871,000 thru 875,9999. This is for the mapping portion only.
The CNTRCT_LID for aerial mapping will be number 14.
A range of numbers will need to be assigned for the hydrology portion of the study.

Previous Comments:
From: Marta Dent
Date: 02/17/95 02:07PM
Mark the Rio Verde Study was divided into:

•Rio Verde North with FCD No. 93-06
•Rio Verde South with FCD No. 93-07

However the mapping was done as a whole by Aerial Mapping Company. They need a range of numbers. They have approx 4000 arcs in the elv coverage.

Maybe we should give them a contractor number for the mapping portion that would reflect who did the mapping, since they will deliver one single coverage.
The hydrology would be by 2 different companies: McLaughlin Kmetty and Burgess & Niple.

Please let me know the numbers for the contractors as well as the ranges so we can give them the info.

87-4-1003

Fax Cover Sheet

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

2801 West Durango Street
Phoenix, Arizona 85009
Telephone (602)506-1501
Fax (602)506-7346
TDD (602)506-5897

ENGINEERING DIVISION
HYDRAULICS BRANCH

To: FRANK BROWN

Company or Department: MKE

Fax Number: 248-7851

From: CATHY REGESTER

Number of pages being sent including cover sheet: 2

If there are any problems or questions, please call (602)506-1501

Comments: FRANK,

THESE ARE MARTA'S RESPONSES TO AERIAL MAPPING Co.'s QUESTIONS OF 2/15/95.

Cathy
3/7/95

March 3, 1995

To: Mike Mester
cc: Richard Cook
cc: Bob Parks

From: Marta Dent
cc: Cathy Register, Project Manager
cc: Mark Brewer, Database Administrator

Ref: **Rio Verde North (FCD 93-06) & Rio Verde South (FCD 93-07)**

The following items should take care of your questions regarding the FCD-HIS database:

1) Retaining Walls:

The structure coverage has been reviewed to contain only arc topology. Single lines are acceptable for retaining walls.

2) Building Foundations:

The structure coverage should have all outlines of structures that impact drainage. The look-up table for this coverage is strcttyp.lut. We will be adding 2 codes to that table: building foundations and rip-rap.
Please make sure that the building foundations that you are referring to, do not fit any of the existing categories.

3)Sidewalks:

They can be placed under street detail.

4)Rip-Rap:

Like with point 2, these feature should be located under the structure coverage and coded accordingly.

5) Numbers:

The range of numbers assigned to Rio Verde are:
871000 through 875999

If you have any questions, please give me a call at 506-8612. Mark will fax you a copy of the new strcttyp.lut with the new codes added to the look up table.

Marta Dent

Marta Dent
HIS Supervisor
Flood Control District of Maricopa County

FLOOD CONTROL DISTRICT
OF MARICOPA COUNT
2801 West Durango Street
Phoenix, Arizona 85009

(602) 506-1501

LETTER OF TRANSMITTAL

89-407.112

RECEIVED MAR 0 9 1995

DATE	JOB NO
3/7/95	FCD # 93-07

ATTENTION: FRANK BROWN

RE: RIO VERDE SOUTH

TO: McLAUGHLIN KMETTY ENGINEERS
3501 N. 16TH STREET
PHOENIX, AZ 85016-6419

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via MAIL the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☒ Specifications
☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1	5/94		DTM MAPPING DATA COLLECTION & DELIVERY SPECIFICATIONS, RELEASE 1.0

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit_____copies for approval
☒ For your use ☐ Approved as noted ☐ Submit_____copies for distribution
☒ As requested ☐ Returned for corrections ☐ Return_____corrected prints
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 19_____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS _____

COPY TO FILE; FCD # 93-07

SIGNED: Catherine W. Rogers

6910-009 R8-93

If enclosures are not as noted, kindly notify us at once.

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

March 14, 1995

Ms. Cathy Regester, Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Rio Verde South Floodplain Delineation Study
Contract FCD 93-07, MKE Job No. 89-407.003
Monthly Progress Report No. 13 for Invoice #13

Dear Ms. Regester:

The following progress is reported for the period January 26, 1995 to February 25, 1995:

TASK 1 - COORDINATION
- a. Normal coordination consisting of telephone conversations and information exchange between involved parties.
- b. Written Authorization was received for Phase II, which adds 2.015 river miles to the floodplain study.

TASK 2 - DATA COLLECTION
- a. Reviewed the newspaper, *The Times of Fountain Hills and Rio Verde, Arizona*, for articles relating to rainfall, new development, and other information relating to the community, as it may affect floodplains, or floodplain management.

TASK 3 - TOPOGRAPHIC MAPPING
- a. No activity reported this month.

TASK 4 - FIELD SURVEY
- a. No activity reported this month.

TASK 5 - HYDROLOGY
- a. No activity reported this month.

89407-00\PrgRpt13.003

TASK 6 - FLOODPLAIN DELINEATION

a. Revisions on the HEC-2 model and floodplain maps were begun.
b. The culvert analysis program HY-8 was run on the existing culverts.
c. The Phase II thalwegs were measured.
d. Preparatory work was done for the upcoming Phase II field reconnaissance work.

TASK 7 - DELIVERABLES

a. Some of the FEMA forms were filled out, using the forms dated October 1994.

The estimated completion by Tasks are:

Task No.	Percentage Complete
1	61
2	95
3	86
4	75
5	98
6	55
7	40
OVERALL	71 *

*NOTE: Overall percentage complete has been adjusted to reflect the addition of Phase II to the project.

During the month of March, we plan to fill-out the FEMA forms as filler work, conduct Phase II field reconnaissance and Phase II topographic survey work, layout Phase II HEC-2 cross sections, and continue HEC-2 model revisions.

If you have any questions or require additional information please call me.

Very truly yours,

McLAUGHLIN KMETTY ENGINEERS, Ltd.

Geza E. Kmetty, P.E.
Principal

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5859

February 28, 1995

McLaughlin Kmetty Engineers
3501 North 16th Street
Phoenix, Arizona 85016

Attention: Geza E. Kmetty

Subject: Contract Insurance Coverage

Reference: Contract FCD 93-07 Rio Verde South FDS

Dear Mr. Kmetty:

Our records indicate that your firm's insurance coverage on the subject contract expired on February 15, 1995. **The contract specifies that coverage shall remain in full force during the life of the contract and shall not expire, be cancelled, or materially changed without thirty (30) days written notice to the District.**

Within ten (10) days of receipt of this letter, we request that you furnish a current insurance certificate showing the appropriate coverage, and listing the Flood Control District of Maricopa County as an additional insured where applicable.

If you have any questions, call the undersigned or Dottie Klaahsen at telephone (602) 506-1501.

Sincerely

Leanna Cumberland

Leanna Cumberland
Chief, Contracting Branch

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5859

RECEIVED APR 17 1995

April 12, 1995

Mr. Geza E. Kmetty, P.E.
McLaughlin Kmetty Engineers, Ltd.
3501 N. 16th Street
Phoenix, Arizona 85016-6419

SUBJECT: Contract FCD 93-07 Rio Verde South

Dear Mr. Kmetty:

Our records show that we have not received a current insurance certificate from your firm to comply with Contract FCD 93-07, Section XVI - Indemnification and Insurance. Please furnish the Flood Control District with a Certificate of Insurance showing that insurance has been obtained with coverage as specified, and that the Flood Control District of Maricopa County is named as an additional insured. The contract states that coverage shall remain in full force during the life of the contract, and that the insurance cannot expire, be cancelled or materially changed to affect the coverage available without thirty (30) days written notice to the District.

Please submit a current insurance certificate within ten (10) days of receipt of this letter. Should you have any questions, please don't hesitate to call me at 506-1501.

Sincerely,

Dortha L. Klaahsen

Dortha L. Klaahsen
Contracts Assistant

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 4/17/95	Job No.: 89-407.003
To: Flood Control District of Maricopa County 2801 West Durango Street Phoenix, Arizona 85009	Attention: Dortha L. Klaahsen Re: Contract FCD 93-07 Rio Verde South

WE ARE SENDING YOU XX ATTACHED ___ VIA_____

Original:	Copies	Date	Description
	1	2/15/95	Copy of Certificate of Insurance

Remarks:

COPY TO_____

SIGNED Esther M. Kmetty

Esther M. Kmetty

Certificate of Insurance

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON YOU THE CERTIFICATE HOLDER. THIS CERTIFICATE IS NOT AN INSURANCE POLICY AND DOES NOT AMEND, EXTEND, OR ALTER THE COVERAGE AFFORDED BY THE POLICIES LISTED BELOW.

This is to Certify that

McLAUGHLIN WATER ENGINEERS
3501 N. 16TH STREET
PHOENIX AZ 85016-6419

Name and address of Insured

LIBERTY MUTUAL

is, at the issue date of this certificate, insured by the Company under the policy(ies) listed below. The insurance afforded by the listed policy(ies) is subject to all their terms, exclusions and conditions and is not altered by any requirement, term or condition of any contract or other document with respect to which this certificate may be issued.

TYPE OF POLICY	EXP. DATE • ☐ CONTINUOUS ☐ EXTENDED ☒ POLICY TERM	POLICY NUMBER	LIMIT OF LIABILITY
WORKERS COMPENSATION	02/15/96	WC2-191-090063-015	Coverage Afforded Under WC Law of the Following States: COLORADO, ARIZONA, OKLAHOMA EMPLOYERS LIABILITY Bodily Injury By Accident 500,000 Each Accident Bodily Injury By Disease 500,000 Policy Limit Bodily Injury By Disease 500,000 Each Person
GENERAL LIABILITY ☐ CLAIMS MADE RETRO DATE ☒ OCCURRENCE	02/15/96	YD2-191-090063-065	General Aggregate-Other than Prod/Completed Operations 2,000,000 Products/Completed Operations Aggregate 1,000,000 Bodily Injury and Property Damage Liability 1, 000,000 Per Occurrence Personal and Advertising Injury 1,000,000 Per Person/ Organization Other: Other:
AUTOMOBILE LIABILITY ☒ OWNED ☒ NON-OWNED ☒ HIRED	02/15/96	AS2-191-090063-035	1,000,000 Each Accident - Single Limit - B. I. and P. D. Combined Each Person Each Accident or Occurrence Each Accident or Occurrence
OTHER UMBRELLA EXCESS LIABILITY	02/15/96	TH1-191-090063-055	$1,000,000 SINGLE LIMIT FOR PERSONAL INJURY (INCLUDING BODILY INJURY) AND PROPERTY DAMAGE OVER UNDERLYING LIMITS.

ADDITIONAL COMMENTS

IT IS HEREBY AGREED THAT FLOOD CONTROL DISTRICT OF MARICOPA COUNTY IS NAMED ADDITIONAL INSURED AS THEIR INTEREST MAY APPEAR

•IF THE CERTIFICATE EXPIRATION DATE IS CONTINUOUS OR EXTENDED TERM, YOU WILL BE NOTIFIED IF COVERAGE IS TERMINATED OR REDUCED BEFORE THE CERTIFICATE EXPIRATION DATE. HOWEVER, YOU WILL NOT BE NOTIFIED ANNUALLY OF THE CONTINUATION OF COVERAGE.

SPECIAL NOTICE - OHIO: ANY PERSON WHO, WITH INTENT TO DEFRAUD OR KNOWING THAT HE IS FACILITATING A FRAUD AGAINST AN INSURER, SUBMITS AN APPLICATION OR FILES A CLAIM CONTAINING A FALSE OR DECEPTIVE STATEMENT IS GUILTY OF INSURANCE FRAUD.

NOTICE OF CANCELLATION: (NOT APPLICABLE UNLESS A NUMBER OF DAYS IS ENTERED BELOW.) BEFORE THE STATED EXPIRATION DATE THE COMPANY WILL NOT CANCEL OR REDUCE THE INSURANCE AFFORDED UNDER THE ABOVE POLICIES UNTIL UNTIL AT LEAST DAYS NOTICE OF SUCH CANCELLATION HAS BEEN MAILED TO:

Liberty Mutual Insurance Group

Theresa M. Bacca
AUTHORIZED REPRESENTATIVE

CERTIFICATE HOLDER

ATTN LEANNA CUMBERLAND
CHIEF CONTRACTING BRANCH
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
2801 W DURANGO STREET
PHOENIX AZ 85009

02/15/95 DATE ISSUED

ENGLEWOOD OFFICE

This certificate is executed by LIBERTY MUTUAL INSURANCE GROUP as respects such insurance as is granted by those Companies 88 77268

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

May 11, 1995

Mr. Pedro Calza, Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Rio Verde South Floodplain Delineation Study
Contract FCD 93-07, MKE Job No. 89-407.003
Monthly Progress Report No. 14 for Invoice Nos. 14 and 15

Dear Mr. Calza:

The following progress is reported for the period February 26, 1995 to March 25, 1995:

TASK 1 - COORDINATION
a. Normal coordination consisting of telephone conversations and information exchange between involved parties.

TASK 2 - DATA COLLECTION
a. Reviewed the newspaper, *The Times of Fountain Hills and Rio Verde, Arizona*, for articles relating to rainfall, new development, and other information relating to the community, as it may affect floodplains, or floodplain management.

TASK 3 - TOPOGRAPHIC MAPPING
a. No activity reported this month.

TASK 4 - FIELD SURVEY
a. No activity reported this month.

TASK 5 - HYDROLOGY
a. No activity reported this month.
b. The Preliminary Hydrology Report is acceptable to the District.

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TASK 6 - FLOODPLAIN DELINEATION

a. Field work was completed for the Phase II field reconnaissance work.

TASK 7 - DELIVERABLES

a. Some of the FEMA forms were filled out, using the forms dated October 1994.

The estimated completion by Tasks are:

Task No.	Percentage Complete
1	61
2	95
3	86
4	75
5	98
6	56
7	40
OVERALL	72 *

*NOTE: Overall percentage complete has been adjusted to reflect the addition of Phase II to the project.

Please see Monthly Progress Report No. 15 for work completed during the month of April.

If you have any questions or require additional information please call me.

Very truly yours,

McLAUGHLIN KMETTY ENGINEERS, Ltd.

Geza E. Kmetty, P.E.
Principal

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

GEZA E. KMETTY
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RICHARD E. McLAUGHLIN

May 11, 1995

Mr. Pedro Calza, Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Rio Verde South Floodplain Delineation Study
Contract FCD 93-07, MKE Job No. 89-407.003
Monthly Progress Report No. 15 for Invoice Nos. 14 and 15

Dear Mr. Calza:

The following progress is reported for the period March 26, 1995 to April 25, 1995:

TASK 1 - COORDINATION

a. Normal coordination consisting of telephone conversations and information exchange between involved parties.
b. A coordination meeting was held on 17 April 1995 to review and approve the cross section locations. No meeting minutes are necessary.

TASK 2 - DATA COLLECTION

a. Reviewed the newspaper, *The Times of Fountain Hills and Rio Verde, Arizona*, for articles relating to rainfall, new development, and other information relating to the community, as it may affect floodplains, or floodplain management.

TASK 3 - TOPOGRAPHIC MAPPING

a. No activity reported this month.

TASK 4 - FIELD SURVEY

a. Activity reported this month consists of Wash 11 cross section survey and survey location of concrete levee in Section 36 along Wash 11.

TASK 5 - HYDROLOGY

a. No activity reported this month.
b. The Preliminary Hydrology Report is acceptable to the District.

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TASK 6 - FLOODPLAIN DELINEATION

a. The Phase II cross sections were location.
b. River mile stationing was completed.
c. Approved cross sections were submitted to Aerial Mapping Company for photogrammetric cross sections.
d. Roughness coefficients were determined for Phase II study washes.

TASK 7 - DELIVERABLES

a. Some of the FEMA forms were filled out, using the forms dated October 1994.

The estimated completion by Tasks are:

Task No.	Percentage Complete
1	61
2	95
3	86
4	98
5	98
6	59
7	40
OVERALL	75 *

*NOTE: Overall percentage complete has been adjusted to reflect the addition of Phase II to the project.

During the month of May, we plan to prepare a HEC-2 model for Wash 12, and for the Phase II portion of Wash 11, run, debug and plot the floodplain limits, and submit for District approval. Preliminary Hydraulic Report preparation will begin.

If you have any questions or require additional information please call me.

Very truly yours,

McLAUGHLIN KMETTY ENGINEERS, Ltd.

Geza E. Kmetty, P.E.
Principal

JOB

MKE McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 11 May 95 | Job No.: 89-407.003

To: Flood Control District of Maricopa County

Attention: Mr. Pedro Calza

Re: Rio Verde South

WE ARE SENDING YOU X ATTACHED ___ VIA mail

Original:	Copies	Date	Description
	1	—	new n value calculations and photographs (color zerox)

Remarks: Pedro,

here are the n values for Phase II Study washes; Reach 11F, 11G, 11H and 12A, 12B and 12C. Please review and comment, and insert into the 3 ring binder previously supplied with n values and photographs.

COPY TO ___

SIGNED Frank Edward Brown

Cola file

MKE **McLaughlin Kmetty Engineers, Ltd.**

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GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TORRES
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

Date 26 May 95

From Frank Brown

Transmitted to Fax Number 506-4601

To Mr. Pedro Calza

Company FCDMC

Comments Pedro, we have one of two choices to make:

1. extend Wash 12 thalweg to FIRM location of Verde River 100yr floodplain,

2. Keep thalweg as is, and extend Wash 12 floodplain to meet Verde River.

Reason for asking: the Verde River floodplain is in error per topography as of flight date, and what we do affects river mile stationing.

Please call me after 1PM.

Job # 89-407.003

NOTE: If this transmission is incomplete, please call
(602) 248-7702

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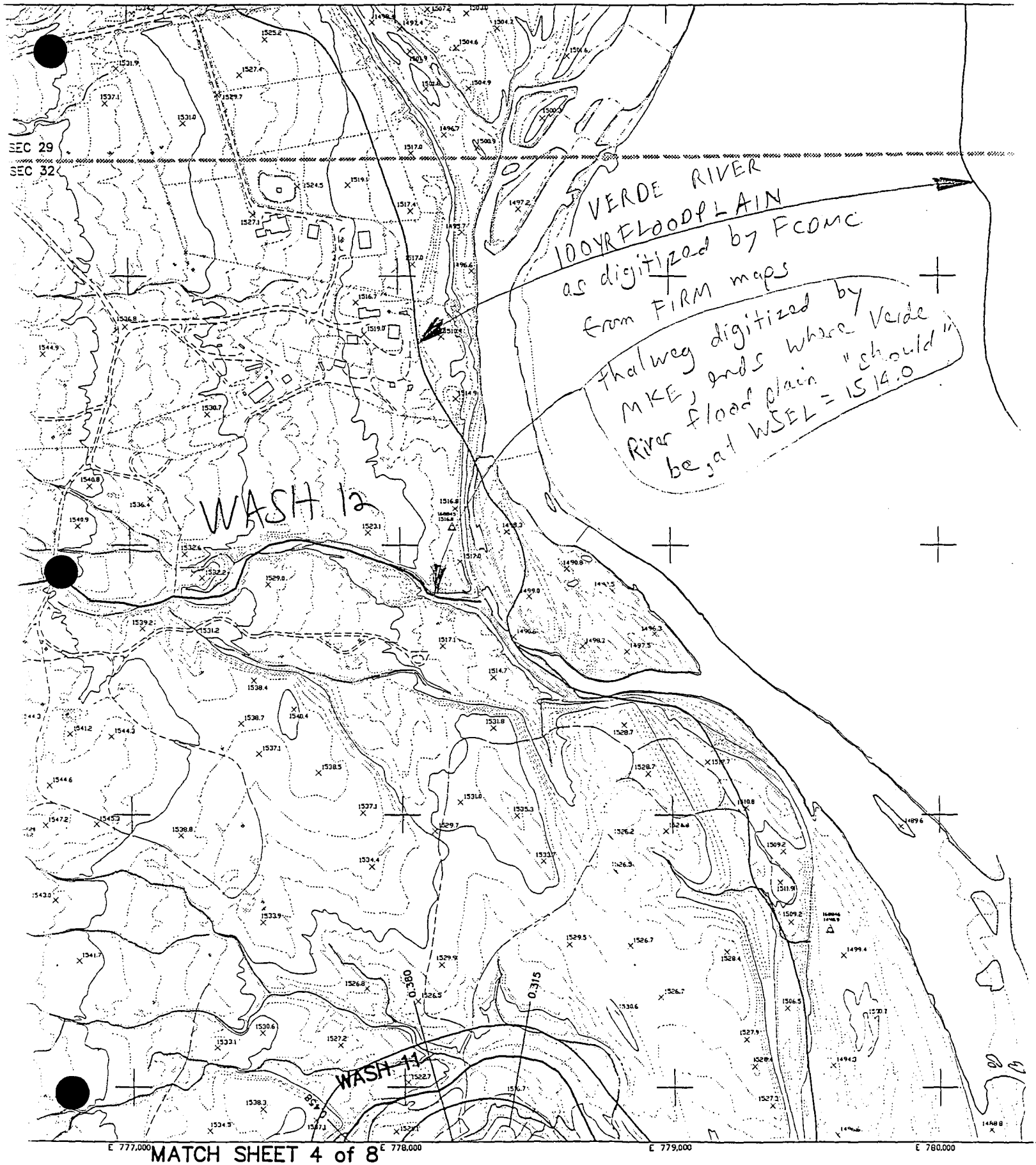


MATCH SHEET 4 of 8

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS
1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS AND BASED ON GROUND CONTROL SURVEY
DATA PROVIDED BY BURGESS AND NIPLE, INC

JDB

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix. Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 31 May 95 | Job No.: 89-407.003

To: FCDMC

Attention: Mr. Pedro Calza

Re: Rio Verde South

WE ARE SENDING YOU ✕ ATTACHED ___ VIA deliv

Original:	Copies	Date	Description
	1	May 95	Wash 12 floodplain map, natural condition, hand-drawn, profile plot cross section plots & disk
	1	31 May	Memo on flood debris and photos.

Remarks:

COPY TO ___

SIGNED Frank Edward Kmetty

JOB

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

May 31, 1995

To: Pedro Calza
FCDMC

From: Frank Edward Brown
McLaughlin Kmetty Engineers, Ltd.

Re: Debris in Floodplain
Rio Verde South
MKE Job No. 89-407.003

On march 9, 1995, I was in the Rio Verde South area as part of the standard field reconnaissance for the floodplain mapping on this project. I observed some debris that had been placed in the Wash 12 floodplain. Enclosed are the originals of three photographs, labeled on the reverse side, and a map showing photograph location plus access route. The yellow grid visible in the photographs measures 1.5 feet outside to outside. The photographs show the following information:

1. Photo E25: Plastic bag filled with rotting fish. Since there were several such bags, this does not appear to be the activity of fishermen in the area.

2. Photo E18 and Photo E19: Construction materials placed in the right overbank of the floodplain. These materials are comprised of earth fill, broken concrete, broken flagstone, plastic pipe, etc.

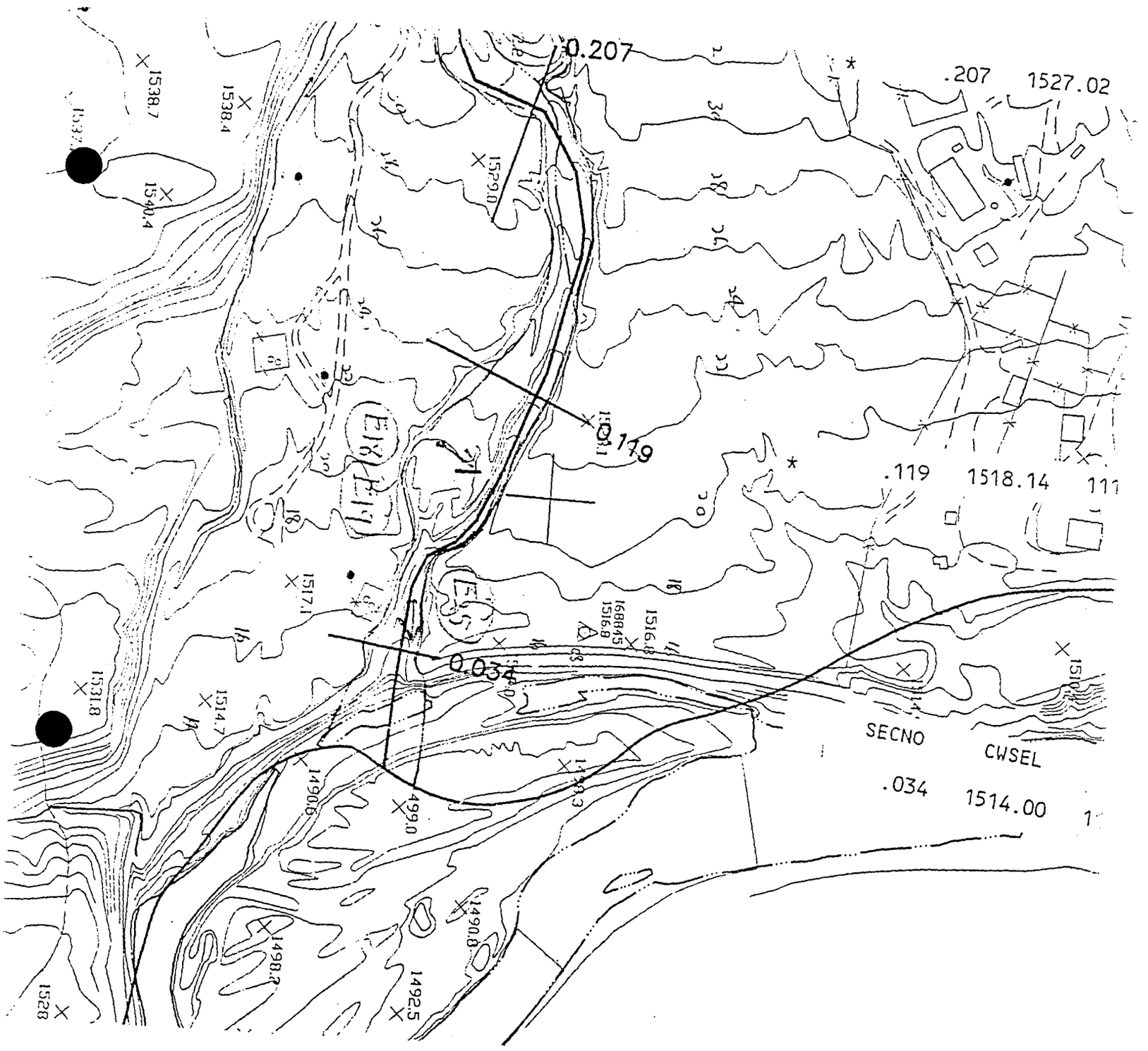
3. Not Photographed: Landscaping debris placed in the floodplain: Various vegetative landscaping debris dumped near River Mile 0.207 (labeled on the enclosed map)

My concern in writing this memo to you is that this material is within the floodplain, and will affect the actual water surface elevations.


E25


E18


E19


0.207
.207
1527.02
0.119
.119
1518.14
0.034
SECNO
CWSEL
.034
1514.00
1538.7
1538.4
1540.4
1529.0
1517.1
1516.8
1516.8
1531.8
1514.7
1490.6
499.0
1490.8
1498.2
1492.5
1528

Job file

MKE

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GEZA E. KMETTY
RONALD C McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

June 21, 1995

Mr. Pedro Calza, Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Rio Verde South Floodplain Delineation Study
Contract FCD 93-07, MKE Job No. 89-407.003
Monthly Progress Report No. 16 for Invoice No. 16

Dear Mr. Calza:

The following progress is reported for the period April 26, 1995 to May 25, 1995:

TASK 1 - COORDINATION
- a. Normal coordination consisting of telephone conversations and information exchange between involved parties.
- b. A coordination meeting was held on 9 May 1995 to discuss the floodplain and flow splits on Wash 12 and the upper end of Wash 11. No meeting minutes are necessary.
- c. George V. Sabol Engineers, Inc., the project hydrologist, was contacted for the hydrologic split flow computations and HEC-2 split flow computer disk, to assist us with Wash 11 flow splits.

TASK 2 - DATA COLLECTION
- a. Reviewed the newspaper, *The Times of Fountain Hills and Rio Verde, Arizona*, for articles relating to rainfall, new development, and other information relating to the community, as it may affect floodplains, or floodplain management.

TASK 3 - TOPOGRAPHIC MAPPING
- a. No activity reported this month.

TASK 4 - FIELD SURVEY
- a. No activity reported this month. No further survey work is anticipated to complete this project.

TASK 5 - HYDROLOGY
- a. No activity reported this month.

89407-00\PrgRpt16.003

TASK 6 - FLOODPLAIN DELINEATION

a. The n value calculations and photographs for Phase II study washes were submitted on 11 May 1995 for District approval.
b. The floodplain model (HEC-2) for the Phase II portion of Wash 12 was assembled, run and debugged. The flow splits were discussed in-house.
c. The floodplain model (HEC-2) for the Phase II portion of Wash 11 was assembled, run and debugged. The flow splits were discussed in-house.
d. FEMA profile plots were made for Wash 11 and 12.
e. Discussion with the District on starting river mile location for Wash 12. The thalweg will be extended to meet the FEMA floodplain.

TASK 7 - DELIVERABLES

a. Some of the FEMA forms were filled out.

The estimated completion by Tasks are:

Task No.	Percentage Complete
1	95
2	99
3	95
4	100
5	98
6	70
7	45
OVERALL	80 *

*NOTE: Overall percentage complete has been adjusted to reflect the addition of Phase II to the project.

During the month of June, we plan to submit the HEC-2 model and maps for Wash 12 for District review. Preliminary Hydraulic Report preparation will continue. Work will begin to finalize the HEC-2 model for Wash 9.

If you have any questions or require additional information please call me.

Very truly yours,

McLAUGHLIN KMETTY ENGINEERS, Ltd.

Frank Edward Brown

for Geza E. Kmetty, P.E.
Principal

Jack file

MKE McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix. Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 21 JUN 95 | Job No.: 89-407.003

To: FCDMC

Attention: Mr. Hasan Mushtaq

Re: Rio Verde South

WE ARE SENDING YOU X ATTACHED ___ VIA deliver

Original:	Copies	Date	Description
	1	July 94	Interim Hydraulic Report - Parameter estimation

Remarks: Hasan,

as we discussed today - here is my copy of the n value report. You may borrow it until project completion.

COPY TO _____

SIGNED Frank Edward [illegible]

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

INTERIM FIELD REVIEW MEETING

TO: **Distribution**

FROM: **Frank Edward Brown**
McLaughlin Kmetty Engineers, Ltd. (MKE)

DATE: **27 June 1995**

SUBJECT: **Floodplain Delineation for Wash 12**
Rio Verde Area South Floodplain Delineation Study
Contract FCD 93-07

An Interim Field Review meeting was held at the site to discuss the recent submittal of the HEC-2 output, cross section plots, stream profile plot, and floodplain delineation maps for Wash 12. The following attended the meeting:

Attendees: Mr. Hasan Mushtaq, Flood Control District of Maricopa County
Mr. Frank Edward Brown, McLaughlin Kmetty Engineers, Ltd.
Mr. Charles L. Joy, McLaughlin Kmetty Engineers, Ltd.
Mr. Ahmad Osman, McLaughlin Kmetty Engineers, Ltd.

The purpose of these meeting notes is to present a summary of the field review and to propose a course of action for floodplain delineation at the following locations.

1. **Left Bank Area:** Between River Mile 0.49 and River Mile 0.74 along the left bank of Wash 12, a natural embankment was inspected in the field. This embankment is well vegetated, and has the appearance of being naturally formed. The top width varies from about 10 feet wide to one foot wide. The embankment is between 1.5 feet and 4.0 feet high above the adjacent thalweg. There is evidence of flows recently in this channel, and in some places the channel side slopes are eroded to near vertical with evidence of sloughing. Mr. Brown took several photographs in this area. The channel between the above referenced river miles was walked, including a good portion of the proposed Zone A. The Box Bar Ranch lies due east of this area.

a. Computations show that the left bank is overtopped between River Mile 0.569 and River Mile 0.661.

b. As briefly discussed with Mr. Mushtaq in the field, the proposed course of action is to map

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the floodplain under two scenarios. The first is to map the floodplain on the stream side of the embankment with the embankment in place. This yields the maximum water surface, in the event the embankment stays in place during a 100 year event. The second is to map the nonstream side using the entire channel cross section, assuming runoff cuts through the embankment This yields the maximum lateral floodplain extent. Split flows and island flow situations are expected. These approaches should be discussed before we proceed. Generally, water deposited sediment has fairly good compaction. However, MKE lacks the geotechnical expertise to state for certain whether the embankment would remain in place or not during a 100 year flood. We recommend that a qualified geotechnical professional be hired to examine and test this area. We would supply flow rate, flow depth, velocity, and any other data available to us.

1. If flow cuts through the embankment, a portion of Wash 12 would flow through the Box Bar Ranch. The analysis could end with a standard "Limit of Detailed Study" note. If the detailed study area were continued through the Box Bar Ranch, approximately 0.5 stream miles would be added to the study, which is outside the present Scope Of Work.

2. **Right Bank Area:** What appears to be a manmade earthen levee is found along the Wash 12 right bank between River Mile 0.36 and River Mile 0.48 and was inspected in the field. Fill material is comprised of undetermined local material, small landscaping rock with plastic sheet remains, and other "junk" type fill. The top width is generally about 1.0 foot. It is generally well-vegetated, except for the more rocky portions.

a. This levee is overtopped and the floodplain is mapped as if the levee is completely gone.

3. **Right Bank Levee Construction Plans:** During Data Collection, MKE did not locate any construction or compaction or freeboard drawings, nor any reference to such drawings. The District will again search the files for construction details.

4. **Wash 12 at Forest Road:** The flow situation at Forest Road was examined. The true low point is south of the main thalweg, and occurs where runoff from Subbasin 500K (0.10 square miles) crosses Forest Road. The main thalweg occurs north of the Subbasin 500K crossing, where runoff from 7.5 square miles crosses the road.

a. The main thalweg should remain as shown on the flood maps.

b. The likely situation is that west of Forest Road, runoff in the main thalweg splits off to the south in several locations , thus most of the flow ends up at the true low point. Since this is outside of the floodplain study area, the exact nature of the split flows is not known. Since runoff flowing between the main thalweg and Rio Verde Drive to the north has momentum and the potential to cross Forest Road in a perpendicular fashion, a Zone A is delineated here since the exact flow rate cannot be determined.

5. **General field reconnaissance:** Several Study Wash locations were reviewed in the field, as follows (listed in viewing order):

a. Wash 11 at Agua Verde Drive.
b. Wash 10 between golf course and Forest Road.
c. Wash 11 near west end of Section 31. A new road is being constructed at this location. The concrete roll curb ends before the low water crossing.
d. Wash 11 in Section 36. The concrete levee diversion structure was viewed.
e. Wash 9 at Forest Road, at Via Hermosa, at Vado Court, and at Quail Haven Road.
f. Wash 10 at Avenida Del Ray.

Distribution: All Attendees
Pedro Calza, Flood Control District of Maricopa County

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

COORDINATION MEETING NO. 3* MINUTES
MEETING NO. 5*
July 12, 1995 at 9:00 a.m.
Flood Control District of Maricopa County
2801 West Durango St., Phoenix

SUBJECT: Phase II Wash 12 Floodplain Delineation Interim Submittal
Rio Verde Area South Floodplain Delineation Study
Contract FCD 93-07

Attendees:

Pedro Calza, Flood Control District of Maricopa County (FCDMC)	506-7346
Hasan Mushtaq, FCDMC	506-1501
Geza E. Kmetty, McLaughlin Kmetty Engineers, Ltd. (MKE)	248-7702
Frank Edward Brown, MKE	248-7702

Frank Edward Brown

After interim submittal of the Wash 12 Floodplain delineation, an interim Field Review Meeting was held on 27 June 1995 (please see separate memorandum summarizing field review). Today's meeting was held to decide on a course of action. The following presents our understanding of discussion items:

1. **Wash 12 Future Floodplain:** In all likelihood, this portion of Wash 12 will be channelized. Brooks Hersey is the engineering company working for the landowner. The NRCS (National Resource Conservation Service, formerly the Soil Conservation Service) has agreed to provide bank stabilization along the Verde River at the Box Bar Ranch (under same ownership), and we assume that the landowner will have no problem obtaining the necessary approvals for Wash 12 channelization.

2. **Floodplain near River Mile 0.49 to 0.74**: The options presented in the 27 June memo were discussed. The photographs taken by Mr. Brown were viewed. One set of original photographs and the handwritten photo key was given to the District.

   A. It was decided to present the floodplain as shown in the previous submittal, after addressing District review comments in a forthcoming review letter.

3. **Floodplain Violation:** Mr. Calza reports that the landowner has been cited for a floodplain violation due to the dumping of materials in the floodplain (see May 31 1995 Memorandum.) Mr. Brown reiterates that he thought the debris would cause higher flood levels, since the materials were in the floodplain. Mr. Brown reports that the debris has been cleaned up in one area and rearranged in another.

* Meetings with FCDMC are numbered consecutively as well as per category of meeting defined in the Scope of Work. Other coordination meetings have occurred with the District without meeting minutes prepared.

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4. **Floodplain at Forest Road:** Mr. Brown explained that the reason for the Zone A at Forest Road has to do with upstream split flows and the geometry of this street crossing. The District asks that this be fully described in the Report.

5. **Submittals:** Mr. Calza expects to send the results of this study to FEMA in August and has informed others of this time frame.

ACTION ITEMS:

The District is to:

1. Provide written review comments on the Wash 12 Floodplain Submittal.

MKE is to:

1. Address forthcoming Wash 12 review comments.

2. Along with the next floodplain submittal, resubmit the first floodplain submittal given to Cathy Regester.

3. Describe in the report text the flow situation at Forest Road.

89-407.003

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5859

RECEIVED JUL 1 8 1995

DATE : July 17, 1995.

MEMO TO : Frank Edward Brown, McLaughlin Kmetty Engineers, Ltd. (MKE).

FROM : Hasan Mushtaq, Hydrologist II, Flood Control District of Maricopa County.

SUBJECT : Rio Verde South - Wash # 12.

The review on the submittal of the above mentioned project is completed. The HEC-2 modeling of Wash 12 is accepted. However, it is suggested that documentation be attached with the report to justify the "A zone" between cross sections 0.207 and 0.661. According to the meeting on July 12, 1995, the "A zone" should remain as modeled.

The submittal on washes 9, 10, and 11, were reviewed by Cathy Regester, who is no longer with the District. Therefore, I would like to request that when the submittal on those washes are forwarded to me, you also include the comments made by Cathy Regester. So, I can familiarize myself with those washes also.

Hasan Mushtaq

Oak Hills

MKE

McLaughlin Kmetty Engineers, Ltd.

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GEZA E. KMETTY
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HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

August 2, 1995

Mr. Pedro Calza, Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Rio Verde South Floodplain Delineation Study
Contract FCD 93-07, MKE Job No. 89-407.003
Monthly Progress Report No. 18 for Invoice No. 18

Dear Mr. Calza:

The following progress is reported for the period June 26, 1995 to July 25, 1995:

TASK 1 - COORDINATION
- a. Normal coordination consisting of telephone conversations and information exchange between involved parties.
- b. An Interim Field Review Meeting and Coordination Meeting No. 3 were held. Please see further description under Task 6.

TASK 2 - DATA COLLECTION
- a. Reviewed the newspaper, *The Times of Fountain Hills and Rio Verde, Arizona*, for articles relating to rainfall, new development, and other information relating to the community, as it may affect floodplains, or floodplain management.

TASK 3 - TOPOGRAPHIC MAPPING
- a. No activity reported this month.

TASK 4 - FIELD SURVEY
- a. No activity reported this month. No further survey work is anticipated to complete this project.

TASK 5 - HYDROLOGY
- a. No activity reported this month. No further hydrology work is anticipated except for printing the final number of report copies.

89407-00\PrgRpt18.003

TASK 6 - FLOODPLAIN DELINEATION

a. An Interim Field Review Meeting was held on 28 June 95 at Wash 12 to review the floodplain delineation. Please see separate meeting notes.
b. Coordination Meeting No. 3 was held on 12 July 95 to finalize discussions on the Wash 12 floodplain. Please see separate meeting notes.
c. Wash 12 District review comments were sent to MKE on 17 July 95.
d. Work continues on the HEC-2 models for Washes 9, 10 & 11.

TASK 7 - DELIVERABLES

a. Work on the FEMA forms has ceased until the final floodplains are mapped.

The estimated completion by Tasks are:

Task No.	Percentage Complete
1	95
2	99
3	95
4	100
5	98
6	75
7	50
OVERALL	86 *

*NOTE: Overall percentage complete has been adjusted to reflect the addition of Phase II to the project.

During the month of August, we plan to make 4 submittals as requested by the District:

1. Wash 9 through 12 natural floodplains and Floodway Method 4 on 11 August 95.
2. Wash 9 through 12 Floodway Method 1, cross sections, profiles and drafted maps and 2 copies Draft Hydraulic TDN on 22 August 95.
3. Completed FEMA forms on 25 August 95.
4. Address review comments and submit FEMA report copies on 30 August 95.

If you have any questions or require additional information please call me.

Very truly yours,

McLAUGHLIN KMETTY ENGINEERS, Ltd.

Géza E. Kmetty, P.E.
Principal

MKE

McLaughlin Kmetty Engineers, Ltd.

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GEZA E. KMETTY
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TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

August 2, 1995

Mr. Pedro Calza, Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Rio Verde South Floodplain Delineation Study
Contract FCD 93-07, MKE Job No. 89-407.003
Monthly Progress Report No. 17 for Invoice No. 17

Dear Mr. Calza:

The following progress is reported for the period May 26, 1995 to June 25, 1995:

TASK 1 - COORDINATION

a. Normal coordination consisting of telephone conversations and information exchange between involved parties.

b. A memorandum dated May 31, 1995, was sent to this District, discussing debris in the floodplain of Wash 12. Photographs were included with the memo.

TASK 2 - DATA COLLECTION

a. Reviewed the newspaper, *The Times of Fountain Hills and Rio Verde, Arizona*, for articles relating to rainfall, new development, and other information relating to the community, as it may affect floodplains, or floodplain management.

TASK 3 - TOPOGRAPHIC MAPPING

a. No activity reported this month.

TASK 4 - FIELD SURVEY

a. No activity reported this month. No further survey work is anticipated to complete this project.

TASK 5 - HYDROLOGY

a. No activity reported this month. No further hydrology work is anticipated except for printing the final number of report copies.

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TASK 6 - FLOODPLAIN DELINEATION

a. The Wash 12 natural condition floodplain map, profile plot, cross sections and computer disk were submitted to the District on 31 May 95.
b. Work continued on back checking/debugging the HEC-2 models for Washes 9, 10 and 11.
c. Work began on incorporating the Burgess & Niple Elevation Reference Marks into the MKE base maps. Burgess & Niple was asked to proof the ERM list and answer MKE's questions on the list.
d. A copy of the Phase I n value calculations and photographs was loaned to the District on 21 June 95.

TASK 7 - DELIVERABLES

a. Some of the FEMA forms were filled out, and assembly began on the Hydraulic Technical Data Notebook (Appendices).

The estimated completion by Tasks are:

Task No.	Percentage Complete
1	95
2	99
3	95
4	100
5	98
6	72
7	50
OVERALL	83 *

*NOTE: Overall percentage complete has been adjusted to reflect the addition of Phase II to the project.

During the month of July, we plan to continue work on the HEC-2 models for Washes 9, 10 and 11. Review comments will be addressed on the Wash 12 floodplain submittal.

If you have any questions or require additional information please call me.

Very truly yours,

McLAUGHLIN KMETTY ENGINEERS, Ltd.

Geza E. Kmetty, P.E.
Principal

JOB

MKE McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 9 AUG 95 | Job No.: 89-407.003

To: FCD of MC

Attention: Mr. Hasan Mushtaq

Re: Rio Verde South

WE ARE SENDING YOU X ATTACHED ___ VIA deliver.

Original:	Copies	Date	Description
			Wash 9 Floodplain data as follows
			a. Sheets 2 and 3 flood maps
			b. W9 Floodway Method 4 HEC-2
			c. W9 island analysis HEC-2
			d. HY-8 culvert analysis
			e. Cross Sections
			d. Profile drawing
1			Original Notebook submitted earlier - has
			Cathy Rogers marks in orange.

Remarks:

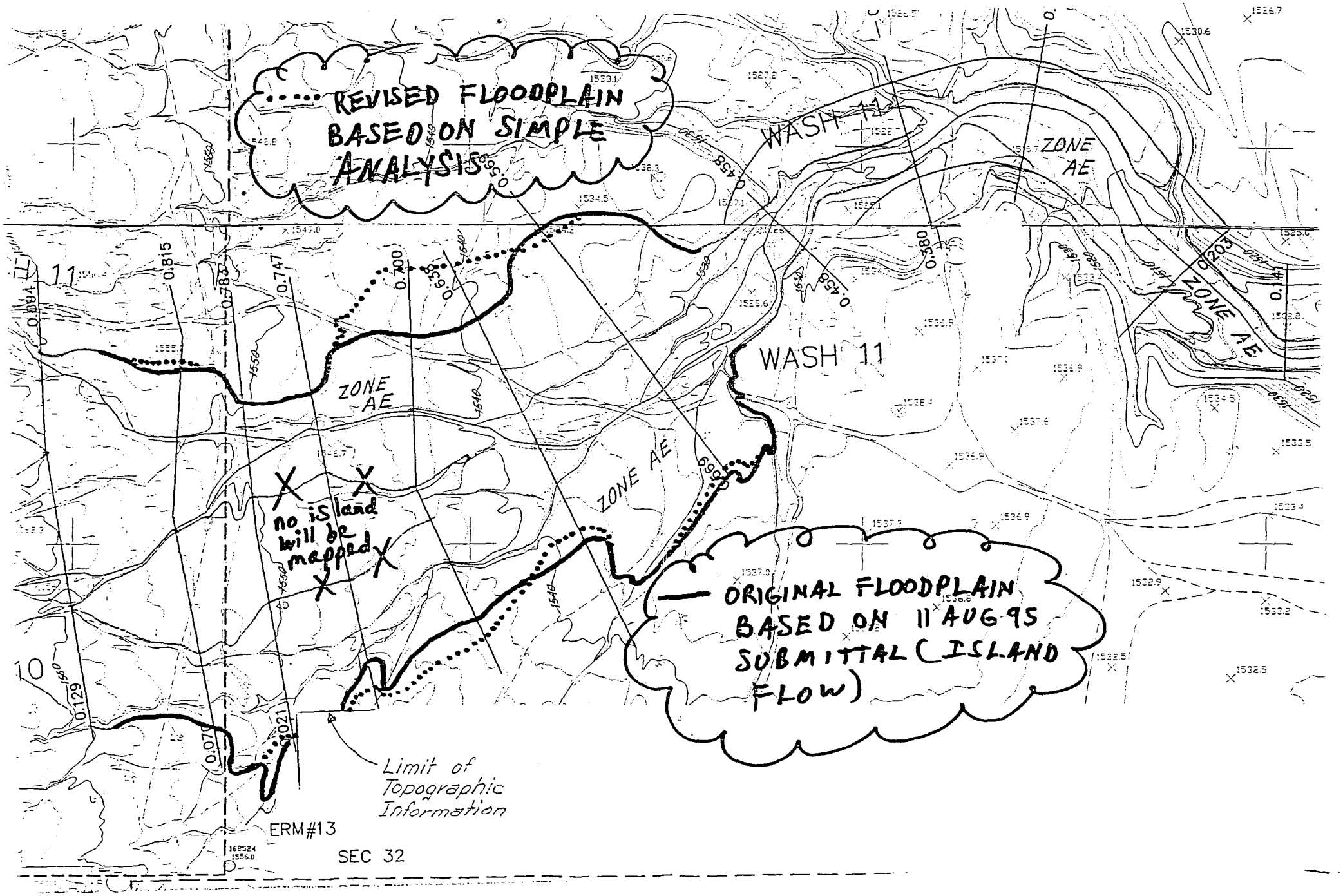
Hasan,

These are submitted per Tasks 6.6.c and 6.6.d. We are asking for your approval before we proceed to Floodway Method 1.

New cross Sections plots for Wash 12 are not ready yet - I'll have to send to you later, not today as promised.

COPY TO ___

SIGNED Frank Edward Brown


REVISED FLOODPLAIN BASED ON SIMPLE ANALYSIS
WASH 11
ZONE AE
WASH 11
ZONE AE
ZONE AE
ZONE AE
no island will be mapped
ORIGINAL FLOODPLAIN BASED ON 11 AUG 95 SUBMITTAL (ISLAND FLOW)
Limit of Topographic Information
ERM#13
SEC 32
11
10
0.815
0.783
0.747
0.700
0.659
0.458
0.380
0.203
0.129
0.070
0.021

F-6

RECEIVED AUG 2 5 1995

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5859

August 25, 1995

Frank Brown
McLaughlin Kmetty Engineers, Ltd.
3501 N. 16th Street
Phoenix, Arizona 85016-6419

SUBJECT : Rio Verde South Floodplain Delineation Study - HEC-2 analysis (1).

Dear Mr. Brown :

Please find the following comments on the HEC-2 analysis of Wash -12 of the above mentioned project.

(1) The value of J2.1 should be 15 since it is the last profile.
(2) Explain Water Surface Elevations 1514.0 ft. and 1515.0 ft.
(3) n-values are not properly listed in the x-section plots.
(4) Eliminate surcharges greater than 1.0 ft. rotate per P. Calza.
(5) Please explain x-sections 0.207, 0.569, 0.661, 0.846, regarding the floodway limits.
(6) Attemp to eliminate the abrupt change in the mean velocities in the Floodway summary output table.
(7) Please explain why the Top width and floodway widths are not equal in the Floodway summary output table.

It is recommended that the above mentioned comments are incorporated in the HEC-2 modeling. Should you need further information, please do not hesitate to contact me at (602)-506-1501 (W).

Sincerely,

Hasan Mushtaq

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

September 8, 1995

Mr. Hasan Mushtaq
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Rio Verde South Floodplain Delineation Study
Contract No. FCD 93-07, MKE Job No. 89-407.003

Dear Hasan:

We have addressed the District's review comments found in your 25 August 1995 review letter concerning Wash 12. Most of the comments were discussed in person during a meeting held in your conference room on 25 August 1995 at 1:30 p.m. Here are my responses to your comments, following the same numbering sequence:

1. The value of J2.1 is revised to 15.

2. The starting water surface elevation of 1514.0 for natural floodplain conditions is based upon a probable 100 year flood level in the Verde River. The starting elevation for the floodway run is one foot above that, at elevation 1515.0. A calculation sheet entitled "Starting Water Surface Elevations and Coincident Peak Considerations" will be added to each wash appendix, and was submitted to you on 7 September 1995. Starting water surfaces for all washes will be described in the report text.

3. The problem with n values not properly listed is due to the cross section plotting software we are using, which lists n values reported by HEC-2 in the output file. As discussed in our review meeting, the cross sections plots are acceptable to the District.

4. Floodway surcharges greater than 1.0 feet will be eliminated when we use Floodway Method 1.

5. The floodway limits shown on the cross section plots for sections 0.207, 0.569, 0.661, and 0.846 were due to a conflict between the X3 and ET records. This conflict will be resolved by truncating the cross section at the specified X3 record location, and deleting the X3 record. Full comment record documentation will be

ASPEN,CO (303) 925-1920 | TULSA, OK (918) 582-6800 | DENVER, CO (303) 458-5550 | SUMMIT COUNTY, CO (303) 468-2141

placed in the HEC-2 file. As agreed at our meeting, we will rotate the cross section at River Mile 0.207 to be perpendicular to the floodplain.

6. We will attempt to eliminate abrupt changes in the floodway mean velocity. However, the first cross section will have a low velocity because of the backwater effect from the Verde River.

7. The top width discrepancies between HEC-2 floodway tables is due to one table reporting the difference between stations and another table reporting the width of the actual water surface. The discrepancy is apparent when there is divided flow. We will present only Table 200 with the Floodway Method 1 submittal.

8. In addition to your written comments, we discussed the cross section plots and agreed that we would eliminate the circles around the GR data points.

As you recommended, we will incorporate these comments into the HEC-2 model for Wash 12, and will make similar modifications for the models on Washes 9, 10 and 11.

On 7 September 1995, we submitted the revised Wash 12 HEC-2 output, cross section plots and floodway/floodplain maps to you. This submittal includes these review comment responses and presents the final floodway computations based upon Method 1. On 8 September 1995, we sent the HEC-2 input and output files to you via modem. Please review and let us know when the Wash 12 analysis is acceptable to the District.

Sincerely,
McLAUGHLIN KMETTY ENGINEERS, Ltd.

Frank Edward Brown

Frank Edward Brown
Project Engineer

FB

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 Fax (602) 248-7851

GEZA E. KMETTY
RONALD C. McLAUGHLIN
LEO M. EISEL
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

September 15, 1995

Mr. Hasan Mushtaq
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Rio Verde South FDS
FCD No. 93-07
MKE Job No. 89-407.003

Dear Hasan:

The purpose of this letter is to present your recent review comments on the floodplain/floodway analysis and McLaughlin Kmetty Engineers Ltd.'s (MKE) response. Our submittal consisted of natural conditions floodplain and Floodway Method 4 for Wash 9, 10 and 11. The review comment meeting was held on 8 September 1995 at 1:30 p.m. at the offices of the District. Since we are fast tracking the review process on this project, there was insufficient time for you to write a review letter, hence the format for this response letter will be *your comment in italics* followed by our response in regular type.

1. *Table 3 should be revised to contain the final n values.*

Response: Will comply.

2. The report table containing a list of HEC-2 files utilized should be updated.

Response: Will comply.

3. *The files sent by modem added 3 columns to certain lines.*

Response: I checked with our modem expert, Mr. Robert Silva, who relates this is an unusual modification to the file. The District should inform us if this happens again so we can closely track it.

4. *Wash 9 cross section plot at River Mile 0.170 contains n values given as a range: 0 - 0.065.*

Response: The cross section plotting software we are using reports n values from the HEC-2 output table. The reported n value is 0.065 for right overbank flow (natural conditions) and 0.0 for the floodway run (there is no right overbank flow with the floodway). Even though the

n values are reported on the cross section plots in this manner, we discussed that the cross section plots are acceptable to the District.

5. *The District will allow the use of the revised confluence analysis recently presented by MKE at the Wash 10-11 confluence.*

Response: We are in concurrence with this decision.

6. *The text should be revised to reflect the revised confluence analysis.*

Response: Will comply.

7. *Should the Wash 10 breakout at Forest Road be mapped as floodplain?*

Response: We believe it is appropriate to place a large arrow on the floodplain map stating "BREAKOUT FLOW= 210 CFS". (Note: An error was found in the initial rating curve. The corrected rating curve changed the split flow from 270 to 210 cfs.)

8. *The starting water surface elevation for Wash 10 should start at Wash 11 cross section 0.815. The current Wash 10 model contains a small numeric error.*

Response: We will correct the error and start Wash 10 at the correct elevation. After reviewing our analysis, we decided it best to start Wash 10 at Wash 11 cross section 0.747 and use X5 records to and including cross section 0.815, in order to be able to define a floodplain for all of Wash 10. Floodways are computed independently for each wash until the floodway confluence.

9. *Explain why the Wash 10 thalweg is not at station 10,000 in the Wash 10 - 11 confluence area?*

Response: Near the confluence area, Wash 10 cross sections are based upon a 10,000 station on Wash 11 because at the time cross sections were laid out, it was not known where the two floodplains would converge. It is best to keep this arrangement now. All other hydraulic parameters (n-values, bank stations, etc.) were adjusted to account for the deviation. Comment records were added to the Wash 10 HEC-2 to make the GR record stationing clear.

10. *Avoid floodway surcharges greater than 1.0 feet for all washes.*

Response: Will comply with the Floodway Method 1 encroachment analyses.

11. *Explain the split flow HEC-2 analysis for Wash 10 at Forest Road.*

Response: The revised confluence analysis still requires the split flow analysis at Forest Road and this will be explained in the text. (See also Comment 7.)

12. *Please review the NH records for cross section 0.783 on Wash 11 as compared to cross section 0.021 on Wash 10- they should be the same for the same stations.*

Response: We will review this and correct the discrepancy.

13. *The existing wall forming the banks for Wash 10 ends further downstream than currently shown on the floodplain maps. Mr. Mike O'Neill with Brooks-Hersey and Associates viewed the maps last week and presented grading plans showing the wall.*

Response: As discussed previously, we added a cross section at River Mile 0.567 and remapped the floodplain in this area and presented revised floodplain maps today. Prior to this meeting, Mr. Brown located the grading plan transmittal letter, could not quickly locate the plans themselves, so the Brooks-Heresy plans were given to him at this meeting.

14. *The concrete levee on Sheet 8 should be labeled.*

Response: Will comply.

In conclusion, we will revise the report and HEC-2 models to incorporate the above responses. We discussed that we should continue with sequential submittals for Floodway Method 1 and that you would provide sequential review comments on each wash. At the conclusion of the 8 September meeting, MKE submitted the Floodway Method 1 analysis and maps for Wash 12, with the response letter and disk to follow on 11 September.

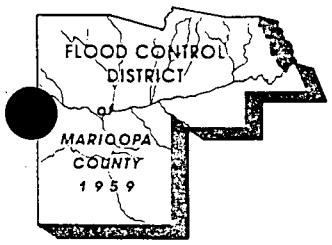
Very truly yours,
McLAUGHLIN KMETTY ENGINEERS, Ltd.

Frank Edward Brown

Frank Edward Brown, P.E.
Project Engineer

FB

RECEIVED SEP 2 2 1995



FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5859

September 21, 1995

Frank Brown
McLaughlin Kmetty Engineers, Ltd.
3501 N. 16th Street
Phoenix, Arizona 85016-6419

SUBJECT : Rio Verde South Floodplain Delineation Study - HEC-2 analysis (Wash 12).

Dear Mr. Brown :

I have completed reviewing the HEC-2 modeling (floodway method 1) for Wash 12. Previous comments (dated August 25, 1995) on the floodway method 4 have been adequately addressed. The floodplain and floodways are delineated according to the current HEC-2 modeling results. I find the study results for Wash 12 to be acceptable.

Sincerely,

Hasan Mushtaq

F-6.

RECEIVED DEC 27 1995

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5859

September 27, 1995

Frank Brown
McLaughlin Kmetty Engineers, Ltd.
3501 N. 16th Street
Phoenix, Arizona 85016-6419

SUBJECT : Rio Verde South Floodplain Delineation Study - HEC-2 analysis (Washes 10 and 11).

Dear Mr. Brown :

I have completed reviewing the HEC-2 modeling (floodway method 1) for Washes 10 and 11. Previous comments, during a review meeting on September 18, 1995, on the floodway method 4 have been adequately addressed. The floodplain and floodways are delineated according to the current HEC-2 modeling results. I find the study results for Washes 10 and 11 to be acceptable.

Review comments on the Technical Data Notebook, Hydraulics - Books 1 and 2, will be discussed in a review meeting scheduled at 9:00 AM on September 27, 1995.

Sincerely,

Hasan Mushtaq

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5859

September 28, 1995

Frank Brown
McLaughlin Kmetty Engineers, Ltd.
3501 N. 16th Street
Phoenix, Arizona 85016-6419

SUBJECT : Rio Verde South Floodplain Delineation Study - FEMA Forms.

Dear Mr. Brown :

I have completed reviewing the draft copy of the FEMA forms. It is recommended that the review comments are incorporated prior to submitting to FEMA. The associated comments can be found on the draft forms themselves. Please do not hesitate to contact me at 506-4528 if you have any further questions.

Sincerely,

Hasan Mushtaq

F2.

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 Fax (602) 248-7851

GEZA E. KMETTY
RONALD C. McLAUGHLIN
LEO M. EISEL
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WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

October 5, 1995

Mr. Pedro Calza, Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Rio Verde South Floodplain Delineation Study
Contract FCD 93-07, MKE Job No. 89-407.003
Monthly Progress Report No. 19A for Invoice No. 19

Dear Mr. Calza:

The following progress is reported for the period July 26, 1995 to August 25, 1995:

TASK 1 - COORDINATION
- a. Normal coordination consisting of telephone conversations and information exchange between involved parties.

TASK 2 - DATA COLLECTION
- a. Reviewed the newspaper, *The Times of Fountain Hills and Rio Verde, Arizona*, for articles relating to rainfall, new development, and other information relating to the community, as it may affect floodplains, or floodplain management.

TASK 3 - TOPOGRAPHIC MAPPING
- a. No activity reported this month.

TASK 4 - FIELD SURVEY
- a. No activity reported this month. No further survey work is anticipated to complete this project.

TASK 5 - HYDROLOGY
- a. The final Hydrology Report and TDN were transmitted to the District on August 2, 1995. No further hydrology work is anticipated to complete this project.

TASK 6 - FLOODPLAIN DELINEATION
- a. Task 6.6c and 6.6d (Natural floodplain and Method 4) were submitted for District review on August 9, 1995.
- b. On August 11, 1995, received the District's comments on 6.6c and 6.6d submittal.
- c. Work continuing on HEC-2 models using Floodway Method 1.

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TASK 7 - DELIVERABLES

a. Work on the FEMA forms has ceased until the final floodplains are mapped.

The estimated completion by Tasks are:

Task No.	Percentage Complete
1	97
2	100
3	95
4	100
5	100
6	90
7	80
OVERALL	95 *

*NOTE: Overall percentage complete has been adjusted to reflect the addition of Phase II to the project.

During the month of September, we plan to make 4 submittals as requested by the District:

1. Resolve District's review comments on Tasks 6.6c and 6.6d.
2. Complete Wash 9 through 12 Floodway Method 1, cross sections, profiles and drafted maps and 2 copies Draft Hydraulic TDN.
3. Complete FEMA forms.
4. Address review comments and submit FEMA report copies.

If you have any questions or require additional information please call me.

Very truly yours,

McLAUGHLIN KMETTY ENGINEERS, Ltd.

Geza E. Kmetty, P.E.
Principal

FB

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 Fax (602) 248-7851

GEZA E. KMETTY
RONALD C. McLAUGHLIN
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RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

October 5, 1995

Mr. Pedro Calza, Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Rio Verde South Floodplain Delineation Study
Contract FCD 93-07, MKE Job No. 89-407.003
Monthly Progress Report No. 19B for Invoice No. 19

Dear Mr. Calza:

The following progress is reported for the period August 26, 1995 to September 25, 1995:

TASK 1 - COORDINATION
- a. Normal coordination consisting of telephone conversations and information exchange between involved parties.

TASK 2 - DATA COLLECTION
- a. Reviewed the newspaper, *The Times of Fountain Hills and Rio Verde, Arizona*, for articles relating to rainfall, new development, and other information relating to the community, as it may affect floodplains, or floodplain management.

TASK 3 - TOPOGRAPHIC MAPPING
- a. No activity reported this month.

TASK 4 - FIELD SURVEY
- a. No activity reported this month. No further survey work is anticipated to complete this project.

TASK 5 - HYDROLOGY
- a. No activity reported this month. No further hydrology work is anticipated to complete this project.

TASK 6 - FLOODPLAIN DELINEATION
- a. Resolution of comments for Tasks 6.6c and 6.6d (Natural floodplain and Method 4) was finalized on September 8, 1995.
- b. Work continues on Floodway Method 1, with a review meeting held on September 18, 1995.

TASK 7 - DELIVERABLES
- a. The FEMA forms have been completed.
- b. The FEMA report copies were submitted.

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The estimated completion by Tasks are:

Task No.	Percentage Complete
1	100
2	100
3	100
4	100
5	100
6	100
7	100
OVERALL	100 *

*NOTE: Overall percentage complete has been adjusted to reflect the addition of Phase II to the project.

The project is substantially complete, and we are awaiting FEMA approval.

If you have any questions or require additional information please call me.

Very truly yours,

McLAUGHLIN KMETTY ENGINEERS, Ltd.

Geza E. Kmetty, P.E.
Principal

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 Fax (602) 248-7851

October 13, 1995

GEZA E. KMETTY
RONALD C. McLAUGHLIN
LEO M. EISEL
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
RICHARD E. McLAUGHLIN

Mr. Hasan Mushtaq
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Rio Verde South Floodplain Delineation Study
Contract No. FCD 93-07, MKE Job No. 89-407.003

Dear Hasan:

We have addressed all of the District's review comments concerning the Rio Verde South Floodplain Delineation Study. The FEMA submittal is being made under separate cover from this submittal letter. The Task 7.8.1 submittals, Original Affidavits of Publication, were previously transmitted to you, and I understand the District will transmit these to FEMA. We are transmitting to you the following:

- Task 7.8.2 - Two sets of floodplain/floodway maps (found in the report map pockets).
- Task 7.8.3 - Two copies of the Final Hydraulics Report, including a computer disk. The Final Hydrology Report was previously transmitted to you. We discovered a typing error on two pages of the Hydrology Report, and are sending the revised pages. If you would like, we can insert them for you.
- Task 7.8.4 - Two sets of completed FEMA forms. The District needs to sign Form 1 before forwarding to FEMA.
- Task 7.8.5 - This will be discussed with you. There are no significant supercritical reaches on the study washes.
- Task 7.8.6 - Three sets of survey notes. These are only the notes made by our surveying subconsultant. Please refer to the Rio Verde North project for the main portion of the survey notes.
- As required by the FEMA forms, one original transparent overlay, at the same scale as the current FIRM map, showing all flood plains delineated in this study. For ease of reference at this reduced scale, we have colored a photocopy of this map in blue.

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- As required by the FEMA forms, one original floodplain map showing all of the current FIRM-delineated flood plains (in red), drawn onto the work maps (1 inch = 200 feet scale).

- Removed sheets. All of the sheets we removed during the last round of review comments are being sent back to you.

On behalf of myself and the McLaughlin Kmetty staff, it has been a pleasure to work with you and the other District employees on this project. We look forward to working with the District on future projects.

Very truly yours,
McLAUGHLIN KMETTY ENGINEERS, Ltd.

Frank Edward Brown

Frank Edward Brown, P.E.
Project Engineer

H:\P\89407003\Tsk7-8.Sub

SECTION 1: GENERAL DOCUMENTATION AND CORRESPONDENCE

1.4 GENERAL CORRESPONDENCE

1.4.4 FEMA Regional Office

SECTION 1: GENERAL DOCUMENTATION AND CORRESPONDENCE

1.4 GENERAL CORRESPONDENCE

1.4.5 FEMA Washington

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
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TT (602) 506-5859

January 10, 1996

Michael K. Buckley, P.E., Chief
Hazard Identification Branch
Mitigation Directorate
Federal Emergency Management Agency
Washington, D. C. 20472

Attn: Mr. John Magnotti:

Re: LOMR Request for Rio Verde Washes 9, 10, 11 & 12
FCD Contract No. FCD93-07
FIRM Map Panel 1300E (9-4-91)

Dear Mr. Buckley:

This is a request for a LOMR for washes 9, 10, 11 and 12 which flow eastward through the unincorporated community of Rio Verde and which are tributaries of the Verde River. Washes 9, 10 and 11 are currently delineated as unnumbered A zones. Wash 12 is a newly delineated wash. The entire area lies within the unincorporated area of Maricopa County.

The above referenced study contract was undertaken on behalf of the Flood Control District by McLaughlin Kmetty Engineers, Limited in association with George V. Sabol Consulting Engineers, Inc.

The following information is submitted in support of the LOMR:

1. FEMA Application Forms with annotated FIRM panel 1300E.
2. Hydrology Report, Books 1 & 2 with input/output files on disk.
3. Hydraulics Report, Books 1 & 2 with input/output files on disk.
4. A complete set of LOMR application forms.
5. Separate set of survey notes.
6. Flood insurance study work maps including the showing of the previous approximate delineation (washes 9, 10 & 11 only).
7. One copy of reduced map and acetate overlay at FIRM map scale (2000) showing all washes delineated in the study.

A public meeting to kick off the project was held in the Rio Verde Community Activity Center in January, 1994 to invite public input and identification of local conditions and concerns. A follow-up meeting was held on December 19, 1995 for public review of the study results to obtain any additional input and discuss floodplain management and flood insurance implications with affected property owners.

Since the study indicates that several homes within the current A Zone will be removed from the redelineated floodplain and as many as ten homes may be within the revised floodplain of Wash 9 or 10, we request that an actual Letter of Map Revision with revised area map be issued.

Should additional information be required, please contact either Mr. Geza E. Kmetty, P.E., Project Manager for McLaughlin Kmetty Engineers or Hasan Mushtaq, Project Manager, Engineering Division of the District at (602) 506-1501.

Sincerely,

Ron Nevitt,
Program Manager, NFIP
Regulatory Division

Enclosures

Copy to: Terri Miller, State Coordinator, NFIP
Arizona Department of Water Resources
McLaughlin Kmetty Engineers, Ltd.

Federal Emergency Management Agency

Washington, D.C. 20472

January 31, 1996

Mr. Ron Nevitt
Program Manager
NFIP Regulatory Division
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

IN REPLY REFER TO:
Case No.: 96-09-355P
Community: Maricopa County, Arizona
Community No.: 040037

316-ACK

Dear Mr. Nevitt:

This is in response to your request dated January 10, 1996, for a revision to the Flood Insurance Rate Map (FIRM) for the above-referenced community. Pertinent information about the request is listed below.

Flooding Sources:	Washes 9 through 12
FIRM Panel Affected:	04013C1300 E

As you may know, the Federal Emergency Management Agency (FEMA) has implemented a procedure to recover costs associated with reviewing and processing requests for modifications to published flood information and maps. However, because your request is based solely on the incorporation of more detailed information, no fees will be assessed for our review.

We have completed an inventory of the items that you submitted. The items identified below are the additional items that are required before we can begin a detailed review of your request.

ITEM

1. With this letter, we are returning Application/Certification Form 1, entitled "Revision Requester and Community Official Form," which was not completed in its entirety. The items that must be completed and/or statements requesting data have been marked with an asterisk (*). Please revise and resubmit Form 1.

2. The submitted information did not include the as-built plans for the following culverts modeled in the submitted hydraulic analysis: culverts at Wash 9 crossing Via Hermosa, Vado Court, and Quail Haven Drive; and the culvert at Wash 11 crossing Agua Verde Drive. Please submit as-built plans for these culverts.

If all required items are not submitted within 90 days of the date of this letter, we will treat any subsequent request as an original submittal, and it will be subject to all submittal procedures.

Please direct all required data and questions concerning your request to our Technical Evaluation Contractor at the following address:

Michael Baker Jr., Inc.
3601 Eisenhower Avenue, Suite 600
Alexandria, Virginia 22304

Attention: Mr. Massoud Rezakhani
(703) 317-6239

When you write us about your request, you must include the case number referenced above in your letter.

If you have any questions concerning FEMA policy, or the National Flood Insurance Program in general, please contact Mr. John Magnotti of our staff in Washington, DC, either by telephone at (202) 646-3932 or by facsimile at (202) 646-4596.

Sincerely,

Michael Buckley

Michael K. Buckley, P.E., Chief
Hazard Identification Branch
Mitigation Directorate

Enclosure

cc: Ms. Terri Miller
State Coordinator, NFIP
Arizona Department of Water Resources

Mr. Geza E. Kmetty, P.E.
Project Manager
McLaughlin Kmetty Engineers, Ltd.

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5859

April 5, 1996

Michael Baker Jr., Inc.
3601 Eisenhower Avenue, Suite 600
Alexandria, Virginia 22304

Attn: Mr. Massoud Rezakhani:

Re: FEMA Case No. 96-09-355P
Rio Verde Washs 9 through 12
Maricopa County, Arizona.

Dear Mr. Rezakhani:

This is in response to a letter from Mr. Buckley dated January 31, 1996 requesting additional information on this LOMR request.

Attached are the record drawings from the consultant McLaughlin Kmetty Engineers on the culverts in question.

Sincerely,

Ron Nevitt

Ron Nevitt,
Program Manager,
NFIP Program

F/C: FCD 93-07 Rn

Attachments

Federal Emergency Management Agency

Washington, D.C. 20472

RECEIVED APR 1 9 1996

April 15, 1996

Mr. Ron Nevitt
Program Manager
NFIP Program
Flood Control District of Maricopa County
2801 West Durango Street, Fifth Floor
Phoenix, Arizona 85009

IN REPLY REFER TO:
Case No.: 96-09-355P
Community: Maricopa County, Arizona
Community No.: 040037

316-ACK

Dear Mr. Nevitt:

This is in response to your letter dated April 5, 1996, concerning your January 10, 1996, request for a revision to the Flood Insurance Rate Map (FIRM) for Maricopa County, Arizona and Incorporated Areas. Pertinent information about the request is listed below.

Flooding Source:	Washes 9 through 12
FIRM Panel Affected:	04013C1300 E

As you may know, the Federal Emergency Management Agency (FEMA) has implemented a procedure to recover costs associated with reviewing and processing requests for modifications to published flood information and maps. However, because your request is intended to show the effects of a publicly sponsored flood-control project that reduces flooding to existing development, no fees will be assessed for our review.

We have completed an inventory of the items that you submitted. We have received all of the data we require to begin a detailed technical review of your request. If additional data are required, we will inform you within 30 days of the date of this letter.

Please direct all questions concerning your request to our Technical Evaluation Contractor at the following address:

Michael Baker Jr., Inc.
3601 Eisenhower Avenue, Suite 600
Alexandria, Virginia 22304

Attention: Mr. Massoud Rezakhani
(703) 317-6239

When you write us about your request, you must include the case number referenced above in your letter.

If you have any questions concerning FEMA policy, or the National Flood Insurance Program in general, please contact Mr. John Magnotti of our staff in Washington, DC, either by telephone at (202) 646-3932 or by facsimile at (202) 646-4596.

Sincerely,

Michael Buckley

Michael K. Buckley, P.E., Chief
Hazard Identification Branch
Mitigation Directorate

cc: Ms. Terri Miller
State Coordinator, NFIP
Arizona Department of Water Resources

Mr. Geza E. Kmetty, P.E.
Project Manager
McLaughlin Kmetty Engineers, Ltd.

Federal Emergency Management Agency

Washington, D.C. 20472

RECEIVED JUL 5 1996

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

IN REPLY REFER TO:
Case No.: 96-09-355P

The Honorable Ed King
Chairman, Maricopa County
Board of Supervisors
301 West Jefferson Street, 10th Floor
Phoenix, Arizona 85003

Community: Maricopa County, Arizona
Community No.: 040037
Panel Affected: 04013C1300 E
Date of This
Effective Revision: JUN 28 1996

102-I-C

Dear Mr. King:

This is in response to a request for a revision to the effective Flood Insurance Study (FIS) and National Flood Insurance Program (NFIP) map for your community. Specifically, this responds to a letter dated January 10, 1996, from Mr. Ron Nevitt, Program Manager, NFIP Program, Flood Control District of Maricopa County, regarding the effective FIS report and Flood Insurance Rate Map (FIRM) for Maricopa County, Arizona and Incorporated Areas. Mr. Nevitt requested that the Federal Emergency Management Agency (FEMA) revise the effective FIRM to show the effects of construction of three culverts along Wash 9 at Via Hermosa, Vado Court, and Quail Haven Drive; construction of one culvert along Wash 11 at Agua Verde Drive; and updated topographic information along Wash 9 from its confluence with the Verde River to approximately 9,600 feet upstream of the confluence, along Wash 10 from its confluence with Wash 11 to approximately 4,900 feet upstream of Forest Road, along Wash 11 from its confluence with the Verde River to approximately 450 feet upstream of 176th Street, and along Wash 12 from its confluence with the Verde River to just downstream of Forest Road.

All data required to complete our review of this request were submitted with Mr. Nevitt's letters dated January 10 and April 5, 1996. Because this Letter of Map Revision (LOMR) solely incorporates more detailed information, fees were not assessed for the review.

We have completed our review of the submitted data and the flood data shown on the effective FIRM, and have revised the FIRM to modify the floodplain boundary delineations of a flood having a 1-percent chance of being equaled or exceeded in any given year (base flood) along Washes 9, 10, 11, and 12.

The width of the Special Flood Hazard Area (SFHA), an area inundated by the base flood, increases and decreases along the entire revised reach of Wash 9. The maximum increase in SFHA width, 400 feet, occurs approximately 2,000 feet upstream of the confluence with the Verde River. The maximum decrease in SFHA width, 100 feet, occurs approximately 4,000 feet upstream of the confluence with the Verde River.

The SFHA width increases and decreases along the entire revised reach of Wash 10. The maximum increase in SFHA width, 500 feet, occurs just upstream of the confluence with Wash 11. The maximum decrease in SFHA width, 200 feet, occurs approximately 3,500 feet upstream of the confluence with Wash 11.

The SFHA width increases and decreases along the entire revised reach of Wash 11. The maximum increase in SFHA width, 300 feet, occurs approximately 500 feet downstream of the confluence with Wash 10. The maximum decrease in SFHA width, 200 feet, occurs approximately 2,000 feet upstream of the confluence with the Verde River. The SFHA boundary delineations shift north by a maximum of 500 feet from just upstream to approximately 3,500 feet upstream of Forest Road. A new SFHA has been added from approximately 3,500 feet upstream to approximately 9,200 feet upstream of Forest Road. This area, previously designated Zone X (shaded), an area inundated by the base flood with average depths of less than 1 foot, is redesignated Zone A, an area inundated by the base flood with no base flood elevations determined. The base flood will be contained in the culvert at Agua Verde Drive.

An SFHA has been added for Wash 12 from its confluence with the Verde River to Forest Road. This area previously designated Zone X (shaded) is redesignated Zone A.

The modifications are shown on the enclosed annotated copy of FIRM Panel 04013C1300 E.

The revisions are effective as of the date of this letter; however, a review of the determination made by this LOMR and any requests to alter this determination should be made within 30 days. Any request to alter the determination must be based on scientific or technical data.

The projected date for the next preliminary FIRM and FIS report for Maricopa County, Arizona and Incorporated Areas is fall 1996. The modifications of this LOMR will be incorporated at that time into FIRM Panel 04013C1300 E.

This response to Mr. Nevitt's request is based on minimum floodplain management criteria established under the NFIP. Your community is responsible for approving all floodplain development, including this request, and for ensuring that necessary permits required by Federal or State law have been received. With knowledge of local conditions and in the interest of safety, State and community officials may set higher standards for construction, or may limit development in floodplain areas. If the State of Arizona or your community has adopted more restrictive or comprehensive floodplain management criteria, these criteria take precedence.

The basis of this LOMR is, in whole or in part, a culvert project. NFIP regulations, as cited in Paragraph 60.3(b)(7), require that communities assure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained. This provision is incorporated into your community's existing floodplain management regulations. Consequently, the ultimate responsibility for maintenance of the culvert rests with your community.

Because this LOMR will not be printed and distributed to primary users, such as local insurance agents and mortgage lenders, your community will serve as a repository for these new data. We encourage you to disseminate the information reflected by this LOMR throughout the community, so that interested persons, such as property owners, local insurance agents, and mortgage lenders, may benefit from the information. We also encourage you to prepare an article for publication in your community's local newspaper. This article should describe the changes that have been made and the assistance that officials of your community will give to interested persons by providing these data and interpreting the NFIP maps.

The map panel as listed above will be used for all flood insurance policies and renewals issued for your community.

This determination has been made pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (Public Law 93-234) and is in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, Public Law 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed minimum NFIP criteria. These criteria are the minimum and do not supersede any State or local requirements of a more stringent nature. This includes adoption of the effective FIRM to which the regulations apply and the modifications described in this LOMR. Our records show that your community has met this requirement.

A Consultation Coordination Officer (CCO) has been designated to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Dorothy M. Lacey
Director, Mitigation Division
Federal Emergency Management Agency, Region IX
The Presidio of San Francisco, Building 105
San Francisco, California 94129-1250
(415) 923-7177

If you have any questions regarding floodplain management regulations for your community or the NFIP in general, please contact the CCO for your community at the telephone number cited above. If you have any technical questions regarding this LOMR, please contact Mr. John Magnotti of our staff in Washington, DC, either by telephone at (202) 646-3932 or by facsimile at (202) 646-4596.

Sincerely,

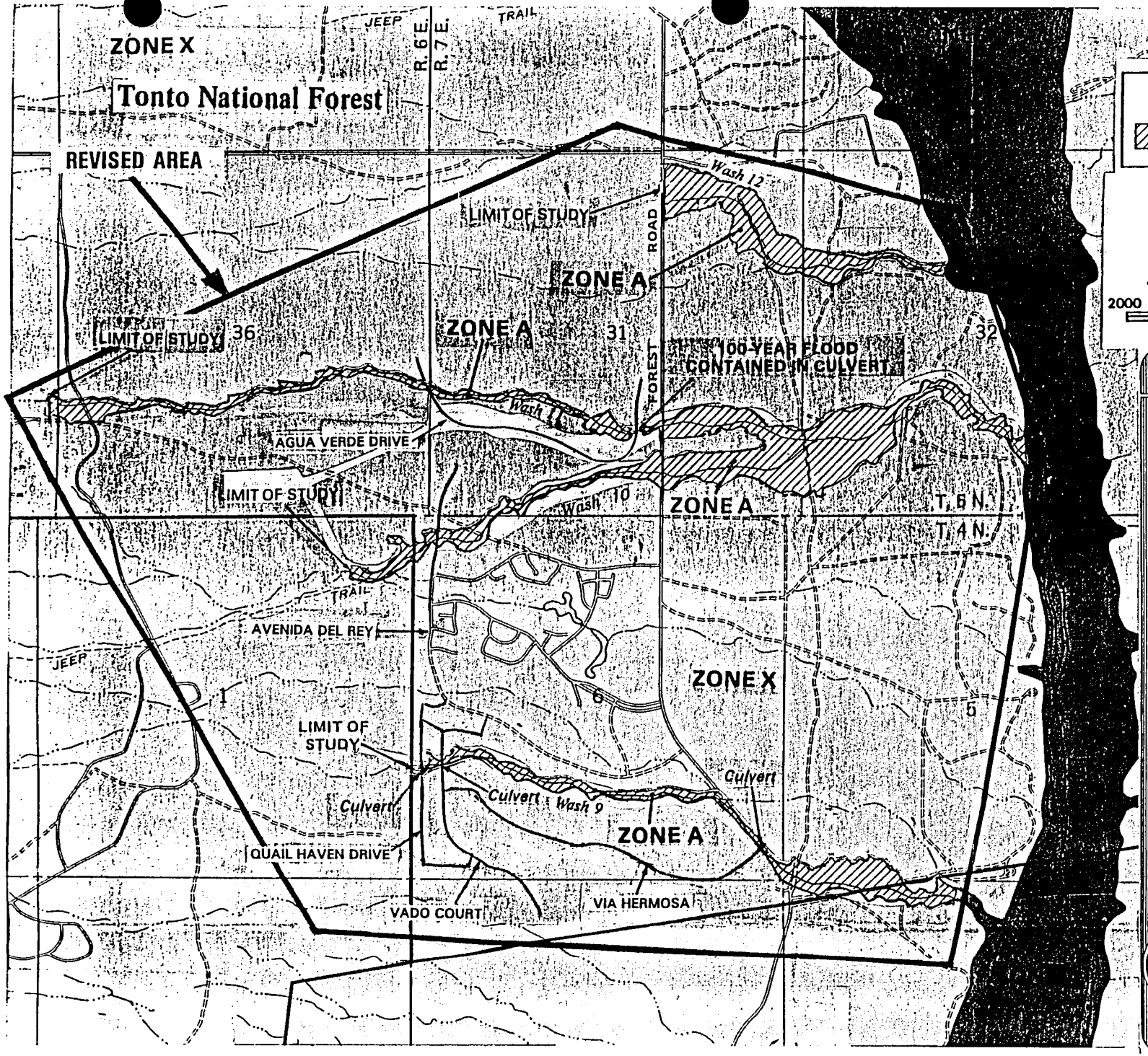
Michael K. Buckley, P.E., Chief
Hazard Identification Branch
Mitigation Directorate

Enclosure

cc: Mr. Ron Nevitt
Program Manager
NFIP Program
Flood Control District of Maricopa County

Ms. Terri Miller
State Coordinator, NFIP
Arizona Department of Water Resources

Mr. Geza E. Kmetty, P.E.
Project Manager
McLaughlin Kmetty Engineers, Ltd.



MAP LEGEND

Revised 100-Year Floodplain

APPROXIMATE SCALE IN FEET

2000 0 2000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 1300 OF 4350

REVISED TO REFLECT LOMR

COMMUNITY NUMBER PANEL SUF.

DATED JUN 2 8 19

MAP NUMBER
04013C1300E

MAP REVISED:
SEPTEMBER 4, 1991

Federal Emergency Management Agency

SECTION 1: GENERAL DOCUMENTATION AND CORRESPONDENCE

1.4 GENERAL CORRESPONDENCE

1.4.6 FEMA Technical Consultant

SECTION 1: GENERAL DOCUMENTATION AND CORRESPONDENCE

1.4 GENERAL CORRESPONDENCE

1.4.7 Copy of Public Notices

AFFIDAVIT OF PUBLICATION

RECEIVED JAN 1 1 1994

The Arizona Republic/The Phoenix Gazette

STATE OF ARIZONA
COUNTY OF MARICOPA } SS.

JOAN LOHR, being first duly sworn, upon oath deposes and says: That she is the legal advertising manager of the Arizona Business Gazette, a newspaper of general circulation in the county of Maricopa, State of Arizona, published at Phoenix, Arizona, by Phoenix Newspapers Inc., which also publishes The Arizona Republic and The Phoenix Gazette, and that the copy hereto attached is a true copy of the advertisement published in the said paper on the dates as indicated.

The Arizona Republic
~~The Phoenix Gazette~~

DECEMBER 22, 1993, JANUARY 5, 1994

INVOICE NO. 93653
ANNOUNCEMENT OF FLOOD HAZARD STUDY
The Flood Control District of Maricopa County, under authority of the National Flood Insurance act of 1968 (P.L. 90-448), as amended, and the Flood Disaster Protection Act of 1973 (P.L. 93-234), is funding a detailed study of flood hazard areas in The Rio Verde Area and surrounding vicinity, Arizona.
The study is being performed for the Flood Control District by Burgess & Niple Engineers and McLaughlin Kmetty Engineers.
The purpose of this study is to examine and evaluate flood hazard in areas which are developed or which are likely to be developed and to determine flood elevations for those areas. These flood elevations will be used by Maricopa County to carry out floodplain management and by the Federal Emergency Management Agency to determine flood insurance rates under the National Flood Insurance Program.
This announcement is intended to notify all interested persons of the commencement of this study so that they may have an opportunity to bring any relevant facts and technical data concerning local flood hazards to the attention of the Flood Control District for consideration in the course of this study. Such information should be addressed to Ms. Cathy Regester or Mr. Magnus Jolayemi, Flood Control District of Maricopa County, 2801 W. Durango Street, Phoenix, AZ 85009, telephone (602) 506-1501.
Published: Arizona Republic, December 29, January 5, 1993.

Sworn to before me this

5TH day of

JANUARY A.D. 19 94

Notary Public

OFFICIAL SEAL
THOMAS F. BIANCO
NOTARY PUBLIC-ARIZONA
MARICOPA COUNTY
My Comm. Expires Mar. 19, 1997

PUBLIC NOTICE

PUBLIC NOTICE
YOUR RIGHT TO KNOW
ANNOUNCEMENT OF FLOOD HAZARD STUDY

The flood Control District of Maricopa County, under authority of the National Flood Insurance Act of 1968 (P.L 90-448), as amended, and the Flood Disaster Protection Act of 1973 (P.L 93-234), is funding a detailed study of flood hazard areas in the Rio Verde Area and surrounding vicinity, Arizona. The study is being performed for the Flood Control District by Burgess & Niple Engineers and McLaughlin Kmetty Engineers.

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Published FH Times
12/22 & 12/29/93

AFFIDAVIT OF PUBLICATION

The Times
OF FOUNTAIN HILLS AND RIO VERDE, ARIZONA

A publication of Western States Publishers, Inc.

STATE OF ARIZONA
COUNTY OF MARICOPA } ss.

L. ALAN CRUIKSHANK, being first duly sworn, upon oath deposes and says: That he is the publisher of

THE TIMES OF FOUNTAIN HILLS AND RIO VERDE

a newspaper of general circulation in the County of Maricopa and the State of Arizona, published at Fountain Hills, Arizona, and that the copy hereto attached is a true copy of the advertisement as published weekly in The Times of Fountain Hills and Rio Verde on the following dates:

December 22, 1993
December 29, 1993

Sworn to before me this

4th day of

February A.D. 19 94

Notary Public

OFFICIAL SEAL
KAREN KIRKENDOLL
NOTARY PUBLIC-ARIZONA
MARICOPA COUNTY
My comm. expires May 14, 1997

AGENDA

Public Meeting
Rio Verde Flood Hazard Study

Rio Verde Community Center
Wednesday January 19, 1994
7:00 - 9:00 P.M.

I. Introduction - Jim Phipps, Public Information Coordinator

II. Purpose and Scope of Study

   A. Rio Verde South Study - Cathy Regester, Project Mgr.

   B. Rio Verde North Study - Magnus Jolayemi, Project Mgr.

III. Study Outcomes - Ron Nevitt, Floodplain Management

   A. Regulation

   B. Flood Insurance

IV. Drainage Issues - Steven Tucker, Stormwater Drainage

V. Summary

VI. Question and Answer Period

Flood Control District of Maricopa County

FACT SHEET

November 1992

Floodplain delineation

The Flood Control District is required by state law (ARS 48-3609) to delineate 100-year floodplains, and to regulate floodplain uses.

The floodplain delineation program began in 1973, when the Federal Emergency Management Agency (FEMA) completed several delineations. Since then, Federal budgeting has shifted the burden to the local level, forcing the District to become more active in this role. Since 1986, the District has delineated more than 500 miles of 100-year floodplain in nearly 40 studies.

The purpose of floodplain delineation is to identify potential flood hazard areas in order to safeguard life and property. The benefits of floodplain delineation are:

- Identification of flood hazards before significant development occurs;
- Identification of flood hazards caused by existing development;
- Determination of areas in need of flood protection, and structures that may require flood insurance;
- Minimize loss of life and property by regulating floodplain development;
- Development of hydrological information to address existing and future drainage problems.

The District's fiscal policy, adopted by the Board of Directors in 1988, suggests that up to 2% of the annual budget be allocated for floodplain management. With these funds, staff identifies areas to be studied, contracts for studies, conducts public meetings in the study areas, and develops floodplain maps based on the best available technical information.

The Board approves the contracts for studies in public meetings, for which its agenda is posted in a public place. Because floodplain delineations follow stringent technical guidelines, however, the Board is not asked to act on the study results.

Instead, the floodplain studies are submitted for review and approval to FEMA, which ultimately will issue a Flood Insurance Rate Map (FIRM) on the basis of the study finding, after a 90-day review period for technical comments.

Community involvement is an important aspect of a floodplain delineation. City and town officials are advised, and public meetings are conducted at the outset of a study and/or when a floodplain map is developed in an attempt to advise residents that floodplains have been identified. The District uses any of several means to alert residents to its study results: articles and legal ads in local and regional newspapers, association newsletters, cable television, utility bills, and posters.

Floodplain delineation results in safer, wiser development of our resources, and can have monetary rewards, too. Our active floodplain delineation program is partly responsible for the 15% reduction in flood insurance premiums for residents of the unincorporated area of the county.

The District received national recognition for its progressive actions to protect life and property by identifying flood hazard areas and by enforcing floodplain regulations from the Association of State Floodplain Managers as recipient of its Local Award for Excellence in 1992.

SECTION 1: General Documentation and Correspondence

1.5 Contract Documents

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TDD (602) 506-5897

89-92702-2

RECEIVED DEC 2 7 1993

Neil S. Erwin, P.E., Chief Engineer and General Manager

DEC 2 2 1993

Mr. Geza E. Kmetty, P.E.
Principal
McLaughlin Kmetty Engineers, Ltd.
3501 North 16th Street
Phoenix, Arizona 85016-6419

SUBJECT: Contract FCD 93-07, Rio Verde Area South Floodplain Delineation

Dear Mr. Kmetty:

This letter will serve as confirmation of the December 9, 1993 verbal Notice To Proceed for the work under the above-referenced contract that was approved by the Board of Directors on December 8, 1993.

A fully executed contract will be forwarded to you, upon receipt from the Board. If you have any questions, please contact Cathy Regester at 506-1501.

Sincerely,

Leanna Cumberland
Chief, Contracting Branch

SCOPE OF WORK
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
FLOODPLAIN DELINEATION AND TOPOGRAPHIC MAPPING
FOR RIO VERDE - SOUTH

GENERAL

Phase 1 of the project consists of 5.3 river miles of floodplain and floodway delineations for those washes identified on FIRM Panel # 04013C1300E as Washes 9, 10, and 11, and as shown on Exhibit 1. This will require the development of approximately 18 square miles of watershed hydrology, also shown on Exhibit 1. Phase 2 will consist of zero (0) to four (4) additional miles of floodplain and floodway delineation depending on the results of the hydrologic analysis. ***The consultant shall not proceed with any work under Phase 2 until having received written authorization from the District.***

The consultant will develop the hydrology using the Corps of Engineer's HEC-1 computer model, and the floodplain and floodway delineations using the HEC-2 computer model. The consultant must use sound engineering judgement in the development of the hydrologic and hydraulic models. The results of the models must be analyzed carefully and refinements made to the input parameters in order to obtain the most realistic results. All work must meet Arizona Department of Water Resources (ADWR) and Federal Emergency Management Agency (FEMA) requirements for floodplain delineations. The results of this study must be reviewed and accepted by FEMA prior to the finalization of this contract. All work under this Scope will be completed within 460 calendar days from the date of Notice to Proceed, including 100 days for District reviews.

PHASE 1: HYDROLOGY AND HYDRAULICS FOR WASHES 9, 10, AND 11

TASK 1 - COORDINATION

1.1 The consultant will submit a project schedule showing coordination meetings and completion dates for each of the tasks in the scope within 14 days of Notice To Proceed. The consultant shall update this project schedule when appropriate.

1.2 The consultant shall participate in regular coordination meetings (at least every three weeks) with the District's Project Manager and in milestone coordination meetings in the development of the hydrologic and hydraulic analyses. The consultant is responsible for the minutes of any meetings. Whenever possible, coordination and milestone meetings should be combined. The anticipated meetings are:

1.2.1 Public Meeting #1
1.2.2 Hydrology Meeting #1: Sub-Basins
1.2.3 Hydrology Meeting #2: Parameters
1.2.4 Hydrology Meeting #3: Preliminary HEC-1
1.2.5 Hydraulics Meeting #1: Cross Section Locations
1.2.6 Coordination Meeting #1
1.2.7 Hydrology Meeting #4
1.2.8 Coordination Meeting #2
1.2.9 Coordination Meeting No. 3
1.2.10 Public Meeting #2

1.3 The consultant will submit a quarterly estimation of the projected billing within 14 days of

Notice to Proceed. Thereafter, this estimation will be updated and submitted to the District's project manager at least 10 days prior to the end of each quarter.

1.4 The consultant shall submit monthly progress reports at least 5 days before submittal of monthly invoices. The report shall be brief and should be no longer than two typed pages. At a minimum, the monthly report shall contain the following:

a. A description of the work accomplished by task during the reporting month.

b. Percent (%) completed for the month and percent (%) cumulative completed for each task.

c. A brief description of the work to be accomplished the following month.

d. A description of any problems encountered.

1.5 The consultant is responsible for placing the legal advertising at the beginning of the study for purposes of notifying the public of the study. The ad will cover the Rio Verde South and Rio Verde North Studies and will be run in a widely circulated newspaper two times, with approximately one week between runs. The ad must also be run two times in a local newspaper that serves the area being studied. After the ad is run, the consultant will supply the District with two (2) original affidavits of publication from the newspapers for each day that the ad ran.

1.6 The consultant will notify all property owners and obtain any necessary Rights of Entry for the study area. The District will assist the consultant as may be necessary to complete this task. The consultant will furnish the District with a list of all the property owners notified and a sample Right of Entry letter.

1.7 The consultant shall meet with the community, neighborhood associations, and local officials. The purpose of these meetings is to identify local flooding problems and obtain information on current and planned public works projects, channel modifications, storm-drainage systems, development, and the current corporate limits.

1.8 The District will plan and conduct two public meetings in conjunction with this study. The first meeting will be to inform the public of the purpose and scope of the study. The second meeting will be to inform the public and obtain public comment on the study results, and shall take place prior to the submittal of the final report to FEMA. Two (2) representatives from the consultant (one for hydrology and one for hydraulics) will attend each of the meetings. The consultant will respond to the comments from the public and make revisions to the study if necessary. The District will prepare graphic displays for these meetings with any available data being supplied by the consultant. The person-hours for this work are included under Task 1.2.

1.9 The consultant will complete and submit all applicable Application/Certification Forms required by FEMA for Physical Map Revisions. This work will be done under Task 7.8.4. Tables of culvert data and references to culvert information in the Technical Data Notebook (TDN), as appropriate, will be acceptable for Form 7. The District will pay all applicable FEMA fees.

1.10 Consultant/District Performance Evaluations will be performed upon completion of the HEC-1 model review (informal evaluation), upon completion of the floodplain (natural profile) model for FIRM Washes 9, 10, and 11 (informal evaluation), and upon completion of Phase 2 (formal evaluation).

TASK 2 - DATA COLLECTION

2.1 The consultant will collect and review pertinent data from the District and other outside sources. Data to be collected will include previous flood hazard reports and hydrology for the study area; existing topographic mapping; historical flooding information; as-built plans for existing structures; FEMA Flood Hazard Boundary Maps and any Letters of Map Amendment and/or Revisions, and other pertinent information.

2.2 A written report summarizing the data collected will be submitted to the District for information purposes. A preliminary draft of this report is due within 90 days of Notice to Proceed.

TASK 3 - TOPOGRAPHIC MAPPING

3.1 An aerial survey subcontractor shall be retained by the consultant for the Rio Verde North Study. The Rio Verde South consultant shall coordinate all the required aerial surveying work with the Rio Verde North consultant. The Rio Verde South consultant is responsible for ensuring that the requested topographic mapping covers the area of the proposed delineation. Quality control on surveys will be per the latest edition of FEMA Document 37, Flood Insurance Study Guidelines and Specifications for Study Contractors.

3.2 The consultant will provide a tabular list of the elevation reference markers (ERM's) in Section 2 of the Technical Data Notebook (TDN). The Rio Verde-North Consultant shall place the ERM's.

3.3 Digital contour and planimetric data developed for this study shall be delivered according to the District's HIS specifications. This work is to be done by the Rio Verde-North Consultant.

3.4 The consultant shall provide permanent non-erasable topographic mylars of the work study drawings. The drawings shall be 24" X 36" in size, with a scale of 1 inch = 200 feet and a contour interval of 2 feet for all mapping with the exception of section line roads which will have a contour interval of 1 foot. A cover sheet will be provided with the project title, date of topographic mapping, and a location map showing geographic range covered by each specific mapping sheet. Each drawing shall include the floodplain and floodway delineations and a minimum of a north arrow, scale, section corners and quarter corners, current and proposed streets and highway names, State Plane Coordinate System, major drainage features, corporate boundaries, cross section lines, channel station center line, index map, and description and elevation of elevation reference marks (ERM's). A note explaining the proper means to convert the NGVD 29 elevations to NAVD 88 elevations shall be included in "NOTES" in the map border. The mapping will have an accuracy such that ninety percent (90%) of all contours shall be within one-half contour of the true elevations and the remaining ten percent (10%) of the

contours shall not be in error by more than one contour interval.

3.5 Hydrologic work maps should be at a scale of 1 inch = 2000 feet (or larger scale if available) and shall include: reproducible overlay maps (using manual drafting or ACAD layers) of existing drainage patterns, subwatersheds; major flow paths; and general topographic maps.

Hydrologic Base Maps: The term off-site will be used to refer to the study area which is not covered by the mapping provided under Task 3.1. The term on-site will be used to refer to the area which is covered by the Task 3.1 mapping. The Hydrologic Base Maps will be prepared as follows:

1. The overall watershed drainage basin map and sheet index will be prepared at a scale of 1 inch = 2000 feet. The most current USGS 7.5-minute quadrangle maps will be provided by the consultant as AutoCAD files, at project datum.

2. The off-site soils and land use maps, and the off-site sub-basin delineation, time of concentration, and flood routing maps will be based on 1 inch = 1000 foot scale enlarged copies of the map created in item 1 above.

3. The on-site soils and land use maps, and the on-site sub-basin delineation, time of concentration, and flood routing maps will be based on 1 inch = 400 foot scale maps prepared using the contour maps in AutoCAD format supplied by the Rio Verde North Consultant.

3.6 GIS Conversion: The GIS conversion to ARC-INFO will be done under subcontract with GIS Consultants of Arizona, Ltd. Conversions will be done for both hydrology and hydraulics mapping, in conformance with the District HIS data delivery specifications GIS/HIS DDS Rev. 01.1 as revised to include only those items listed under Tasks 3.6.3.1, and 3.6.3.3.

Every consultant or subcontractor who digitizes, converts or otherwise creates an Arc feature required for submittal to the District (e.g. point, arc, polygon) must use a unique corresponding Expanded Feature ID number in the pat, aat, rat, or xat table. The numbers must come from a set provided to the consultant by the District at the time notice to proceed is given. For example, if drainage basins are to be digitized, unique numbers from the list provided by the District should be placed in the DRNBSN_PID column of the DRNBSN.PAT table for each basin. It does not matter what number is used or what order the numbers are assigned - only that there is a unique number for every separate feature and that the number comes from the set provided by the District. If the initial set given to the consultant is not sufficient, contact the District and additional numbers will be allocated.

3.6.1 Coordination: This task includes coordination between MKE, GVSCE and the GIS consultant for all work under Task 3.6.

3.6.2 Hydrology Parameters: The necessary work will be done to provide areas of land use, terrain class, and soils categories. The following data will be supplied:

1. Areas of sub-basins and major basins.

2. The total area of each soil map unit, land use category, and terrain classification in every sub-basin.
3. The length of the time of concentration flow path for every sub-basin.
4. The length of every channel route reach.

3.6.3 Final Conversion: This task is the final conversion of all data in conformance with District specifications. It includes preparation and plotting of report map exhibits. Final cleanup of hydrology exhibits (ie. placement of text and symbols) will be done either by hand or in AutoCAD under Task 7.

3.6.3.1 Hydrology Conversion: ARC-INFO coverages will be prepared for the following:

1. Drainage Study boundary.
2. Sub-basins and major basins.
3. Soils boundaries, as required by Task 5.1.1.
4. Land use classifications, as required by Task 5.1.2.

Final exhibit drawings will be prepared for the hydrology report. This work includes one set of check plots and final plotted mylars.

3.6.3.2 Survey and Mapping Conversion: This task will be done by the Rio Verde North consultant.

3.6.3.3 Floodplain and Floodway Conversion: This task includes preparation of ARC-INFO coverage for the following:

1. Floodplain FCD Zone.
2. Floodplain FCD Cross section.
3. Check plots will be prepared and compared to the FEMA work maps.
4. Calculation of floodplain and floodway areas for each reach.

TASK 4 - FIELD SURVEY

4.1 Ground Control for Floodplain Delineations:

4.1.1 All survey work shall meet or exceed Federal Emergency Management Agency (FEMA) minimum criteria as defined in the March, 1993 edition of FEMA Document 37, Flood Insurance Study Guidelines and Specifications for Study Contractors (FEMA 37).

4.1.2 Horizontal and Vertical Control: Where readily available, surveys will tie into State Plane Coordinate System 1983 NAD. Surveys will be based on National Geodetic Vertical Datum (NGVD) 1929, per FEMA guidelines. A conversion factor, including documentation of how it was derived, will be provided by the Rio Verde North consultant

to allow comparison of NGVD 29 elevations to NAVD 88 elevations and will be included in TDN Section 2 of the Final Report.

4.2 The consultant shall verify the accuracy of the mapping by the procedures called for in FEMA Document 37 or other methods approved by FEMA. This shall include the verification of cross sections used in the floodplain delineation. This work is to be done by the Rio Verde-North Consultant.

4.3 Field surveys of all bridges, culverts, and hydraulic structures are to be obtained by the consultant. Culverts smaller than or equal to 36-inch round (or equivalent) will not be surveyed. This information should be reduced and compiled into an 11"x 17" (maximum size) drawing for inclusion in the final report; hand drawings are acceptable. The information presented in the drawing should be in a format appropriate for use in the HEC-2 model. Field surveys and "as-built" plans of bridges, culverts, hydraulic structures, and routing reaches must also be obtained where necessary for proper hydrologic modeling.

TASK 5 HYDROLOGY

5.1 Base Maps: The base maps will consist of 1 inch = 1000 and 1500 feet scale maps prepared from 7.5 minute USGS quadrangle maps, and 1 inch = 200 feet scale maps prepared using the topographic maps created in Task 3. These maps will cover the entire watershed and will be used as a base for the following exhibits:

- The overall watershed drainage basin map and sheet index (1500 scale).
- The soils and land use maps (1000 scale).
- The offsite sub-basin delineation, time of concentration, and flood routing maps (1000 scale).
- The onsite sub-basin delineation, time of concentration, and flood routing maps (200 scale).

For the purpose of this Scope, the term "offsite" will be used to describe the undeveloped watershed area outside the limits of the mapping prepared under Task 3. The term "onsite" will be used to describe the area covered by the mapping prepared under Task 3. The above map scales are approximate and may be revised.

5.1.1 Soil Boundaries: The District has digitized and converted the SCS soil map for the subject area into Arc-Info. The District will provide the consultant with a hardcopy plot of the soil map, an Arc-Info coverage and with a DXF format file of the map for use in AutoCad in the 1983 NAD Coordinate System. The consultant will determine the soil boundary information from the general state soil map, that is missing on the District-provided soils. The District shall be advised of any proposed changes and be provided a copy of the modified DXF file. The soils boundaries will be loaded onto MKE's computer system and

broken into base sheets for exhibit drawing purposes.

5.1.2 Land Use Boundaries : The District has a digital land use classification which is currently being reviewed for adoption by the member agencies of the Maricopa Association of Governments. At least part of the study area is covered by this classification. The consultant will be provided a hardcopy plot of the map. The consultant shall review the plot and determine whether the classification is adequate for the purposes of this study. If so, the District will provide an Arc-Info coverage and a DXF format file of the classification in the 1983 NAD Coordinate System and it shall be used for this study. If the consultant finds that the land use classification is not useful, the consultant may, with the consent of the District, prepare a new classification study provided the stipulations of Task 5.1.2.1 are adhered to. The defined land use maps will be broken into base sheets for exhibit drawing purposes.

5.1.2.1 The consultant must use land classifications adopted by the District and the Maricopa Association of Governments for all land use classification work done under this contract. These classifications are different than those in the HIS specification. A copy of the classification system will be provided to the consultant.

5.2 Preliminary Sub-Basin Delineation: This task will include preliminary sub-basin delineation, and tentative definition of time of concentration flow paths and routing paths. Check plots will be made of the soil and land use maps and the sub-basin delineation, time of concentration, and flood routing maps. Preliminary hand-drawn drawings are acceptable. These check plots will be submitted to the District along with tentative HEC-1 parameter estimation calculations and sample parameter calculations. The watershed will be delineated into drainage sub-basins using appropriate hydrologic judgement. The sub-basins will be as homogeneous as possible using watershed area, watershed type (mountain versus valley, developed versus undeveloped), and time of concentration as criteria. Sub-basin break-downs will be done in sufficient detail to provide peak discharges at the following locations:

1. The upstream and downstream ends of the washes for which floodplain delineation (Study Washes) will be done.
2. At confluences of Study Washes and at confluences along Study Washes where a significant change in peak discharge or a hydrologically significant flow split occurs.
3. Where Study Washes cross major collector or arterial sheets.
4. Where Study Washes enter roadway cross structures or other features where significant diversion may occur.
5. At other locations, mutually agreed upon between the consultant and the District.

This proposal is based on a total of 80 sub-basins, with an average sub-basin size of 140 acres.

The selection of concentration points for the onsite area will also be governed by a practical routing reach length. The average slope of washes in the study area ranges from 1% to 5%. It is anticipated that a computation time interval (CTI) of 1-minute will be used because time of

concentration values may be under 10-minutes.

The number of hydrograph ordinates will be selected to allow for complete calculation of the flood hydrograph without sacrificing resolution of the flood peak or total runoff volume. Calculations and assumptions used in developing sub-basin and routing parameters will be documented and made a part of the hydrology report.

5.3 Field Reconnaissance: A detailed field reconnaissance will be done to accomplish the following:

1. Verify sub-basin delineations boundaries.

2. Verify time of concentration flow path locations.

3. Visually check surface soils for discrepancies with soils mapping.

4. Verify flow patterns in the urbanized area.

5. Determine actual land use for urbanized parcels.

6. Identify flow diversion locations caused by natural obstructions, drainage structures, flood control structures, storm drains or site grading.

7. Obtain field cross sections at natural hydraulic flow splits in the off-site study area.

8. Vegetation transects will be taken on the watershed at representative locations to establish average vegetation cover densities.

9. The T_c data, routing reach data, and vegetation cover data will be summarized and documented for input to the parameter estimation spreadsheets.

District personnel may accompany the consultant at any time during the field reconnaissance. A regular coordination meeting will be dedicated to discuss the results of the field reconnaissance.

5.4 Final Sub-Basin Delineation: The soils and land use maps, and the sub-basin delineation, time of concentration, and flood routing maps will be revised to reflect the findings of the field reconnaissance and to address District comments. The information will be digitized using AutoCAD Version 12.0 using procedures to define each polyline and label each polygon that will ensure a seamless translation of the final drawings into ARC-INFO format for only the themes required in Task 3.6.3.1. The appropriate AutoCAD drawings will then be converted to ARC-INFO. Adjustments to the AutoCAD drawings will be made to reflect changes necessary for the ARC-INFO conversion. Time of concentration flow path lengths, reach route lengths, and top and bottom elevations will be measured and tabulated.

5.5 Parameter Estimations: All of the parameter estimations will be placed in the final report format. A draft table of contents and final report outline will be developed. The parameters, base HEC-1 models, and the report outline will be submitted to the District for review and

submittal to ADWR. The following parameters will be estimated under this task:

5.5.1 Soils : Green and Ampt values for each soil map unit in each sub-basin will be input to the parameter spreadsheet, and composite values for each sub-basin calculated using the areas calculated under Task 3.

5.5.2 Land Use: The percent impervious values for urban areas will be estimated for the existing condition by assigning values to zoning classifications. The assumed values will then be checked against actual values for each parcel using the aerial photography and notes taken during the field reconnaissance. Adjustments will be made as appropriate.

5.5.3 Terrain Class: Mountain versus hillslope and desert terrain distinctions will be determined using soil characteristics.

5.5.4 Time of Concentration: T_c physical parameter data will be determined using the Design Manual criteria and entered into a spreadsheet. The Green and Ampt values, RTIMP, sub-basin areas, and T_c values will then be input to the MCUHP1 program and the base HEC-1 input data files created.

5.5.5 Channel Routing: The channel cross sections will be selected, reduced to 8-point sections and then plotted. Average velocities will be estimated for each reach, and the number of routing steps calculated. All routing parameters and HEC-1 input data will be prepared and summarized.

5.5.6 Hydraulic Flow Splits: Stage versus discharge rating curves will be developed for the hydraulic flow split locations. The curves will be plotted and flow split diversion tables calculated. The structures at roadway crossings and drainage diversions will be analyzed using HEC-2. All diversion data and substantiating calculations will be prepared and summarized.

5.6 HEC-1 Diagram: The schematic map from the HEC-1 computer model will be acceptable as the HEC-1 diagram.

5.7 HEC-1 Computer Models: The District review comments received from the hydrology meeting on parameter estimations will be addressed and the parameters adjusted appropriately. The base 100-year 6-hour and 24-hour HEC-1 input files will be made into working models by the addition of hydrograph routing, flow diversion, and combination control operations in accordance with the routing diagram. Comments on logic, assumptions, and watershed identification will also be added to the files. The models will then be run and debugged, and submitted to the District for review. Comments will be discussed at the next coordination meeting.

5.7.1 100-Year Existing Condition Model: The 100-year existing condition files for the 6-hour and 24-hour storms will be created, run, and debugged.

5.7.2 HEC-1 Computer Model Calibration: The model results will be checked for reasonableness. The results will be compared with statistical data for representative washed and any available precipitation and flow gage data available for the study

watershed. Transmission losses will be added to the model as a part of the calibration process. The HEC-1 models will then be calibrated, if possible, and the reach route parameters optimized until HEC-1 calculated reach route travel times match the number of routing steps input. The goal of this process will be to obtain the most realistic results.

TASK 6 - FLOODPLAIN AND FLOODWAY DELINEATION

6.1 Floodplain and floodway delineations must be obtained using the U.S. Army Corps of Engineers HEC-2 Water Surface Profiles computer model, version 4.6.2, May 1991, and methodology acceptable to FEMA. This model will simulate the effects of floodplain geomorphology, flow changes, bridges, culverts, hydraulic roughness factors, effective flow limitations, split-flows, and other considerations. The consultant will prepare the study using the guidelines established in the March, 1993 edition of FEMA Document 37, Flood Insurance Study Guidelines and Specification for Study Contractors (FEMA 37) and FIA Document 12, Appeals, Revisions, and Amendments to Flood Insurance Maps, January 1990. Mapping check sections and HEC-2 check sections will be located and surveyed by the Rio Verde-North Consultant.

6.2 The delineation work shall meet requirements for floodplain and floodway delineations as prescribed by the Arizona Department of Water Resources. The ADWR forms in State Standard Attachment SSA-90-1 will be prepared.

6.3 The delineation study shall be based on the final results of the hydrologic study as directed by the District.

6.4 Adjustments to the input parameters for obtaining the most realistic results is normal to the scope. The consultant is to make adjustments to the HEC-2 model based on review of the model results by the District, FEMA, and the Technical Evaluation Contractor.

6.5 The consultant will present available working maps and models of the 100-year floodplain and floodway during the course of the hydraulic modeling analysis for review by the District at progress and milestone meetings. Floodways are to be determined using equal conveyance encroachment methods to start with, but only encroachment method 1 will be used in the final analysis.

6.6 The consultant must obtain District approval at each of the following steps:

a. Field reconnaissance report and estimation of Manning's "n" values.

b. Proposed location and alignment of the cross sections and channel centerline.

c. Floodplain (natural) delineation.

d. Floodway delineation using equal conveyance encroachment (Method 4).

e. Floodway delineation using encroachment method 1.

f. Final report.

6.7 Field Reconnaissance

6.7.1 The consultant will conduct a field reconnaissance of the full study reach. This will include observation of channel and floodplain conditions for estimation of Manning's "n" values; photographic documentation of floodplain characteristics; determination of channel bank stations; observation of possible overflow areas; inspection of levees or other flood control structures; and measurement of bridge dimensions.

District personnel may accompany the consultant at any time during the field reconnaissance.

6.7.2 Mannings "n" values are to be determined using the methodology in the USGS report, Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona, April 1991. Copies of the report are available through the District.

6.7.3 A draft report on the field reconnaissance will be submitted to the District for review and approval prior to beginning the HEC-2 modeling. The report will present the determination of channel and overbank "n" values using captioned color photographs or color photocopies. The report will also discuss floodplain conditions affecting the delineation, describe structures and obstructions, and provide color photos or photocopies of major hydraulic structures. Photo locations, structures, and "n" values will be displayed on reduced scale mapping and included in the report. The final report will be included in Section 4 of the Technical Data Notebook.

6.8 Cross Sections

6.8.1 The cross-section locations will be determined after District approval of the topographic mapping developed under Task 3 and after District authorization to proceed with Phase II. The location and alignment of cross sections and channel centerline will be submitted for the District's review and approval prior to digitizing the cross section data. Cross section stationing will be from left to right looking downstream with the thalweg as station 10,000. Cross sections will be spaced approximately every 500 feet, unless geographic or

structural constraints dictate otherwise, and will extend the full width of the area inundated by 100-year flood waters. Identification of cross sections will be in river miles, increasing upstream. The stationing will tie into the specified river mile of the existing FEMA studies. Cross section orientation may need to be altered after running of HEC-2 model to make sure that they are perpendicular to flow per FEMA criteria.

6.8.2 All cross sections will be plotted at an engineering scale using a pen, laser, or electrostatic plotter. The cross section plots will show water surface profiles, ineffective flow areas, "n" values, encroachments, channel stationing and other pertinent information. All plots are to be accompanied by a legend. These plots are to be available at all reviews.

6.8.3 Cross section plots are limited to one plot at the following four stages of work: (a.) A plot of digitized "GR" data and centerline (station 10,000) to be used to set bank stations STCHL and STCHR. (b.) a plot of digitized "GR", STCHL, STCHR, centerline (station 10,000) to be used as a check of input data and for working sections during compilation of the floodplain model; (c.) a plot of the cross section for the completed floodplain run which shows the floodplain water surface elevation, ineffective flow areas, "n" factor, and encroachments to be used as working sections for development of the floodway model; (d.) a plot of the final floodway model cross sections which will show Type 1 encroachments and encroached water surface, in addition to data covered in items (b.) and (c.). These cross sections will be submitted as part of Section 4.7 of the Technical Data Notebook generated under item (d.).

6.9 Bridges and culverts must be modeled in compliance with HEC-2 modeling requirements for the selected routine. Where multiple bridges occur, each bridge will be modeled separately. The HEC-2 modeling results for bridges, culverts, and other hydraulic structures must be checked by using an independent method approved by the District to analyze these structures. Culverts smaller than or equal to 36-inch round (or equivalent) will not be modeled, nor surveyed.

6.10 HEC-2 Models

6.10.1 For floodplains identified as ponding areas, it is preferable to analyze the area by using the HEC-2 model, which will provide the District with water surface elevations. The HEC-2 computer models of the study reaches will be prepared for the natural floodplain delineation.

6.10.2 Floodway Delineation - Method 4 Subcritical: The 100-year floodway delineation for subcritical reaches will be done using the working HEC-2 model from item 6.7. The floodway limits will be sketched on the work maps and submitted to the District for review and approval along with the HEC-2 model. The review comments will be addressed, and incorporated into the model, and approval obtained from the District to proceed with item 6.12.

6.10.3 Floodway Delineation - Method 1 Subcritical: The 100-year floodway delineation for subcritical reaches will be finalized using encroachment method 1 and by visually examining and interpreting the results from item 6.10.2. The resultant floodway limits will be drafted on the work maps and submitted to the District for

review and approval, along with the HEC-2 model. The final floodway encroachment will be as near the one foot maximum rise in elevation as possible.

6.11 Flood zones must be determined according to FEMA criteria and clearly labelled on the final drawings.

6.12 An additional HEC-2 model, reflecting a supercritical flow regime, will be prepared for those washes displaying supercritical flow conditions using the working HEC-2 model from Task 6.10.1. The HEC-2 input/output data and diskettes for the supercritical models will be submitted under a separate cover from the final report as stated in Task 7.8.5.

6.13 The total area of the floodplain and floodway must be determined for each reach in square miles and acres.

6.14 Work maps no larger than 11" x 17" for the study area must be included in the TDN Section 4 of the final report along with the flood profile maps.

6.15 The consultant will submit delineation maps, hydraulics report, and HEC-2 model through the District for review by FEMA, the Technical Evaluation Contractor (TEC), and any other governmental agency reviewers as outlined in Task 7 - Deliverables. The consultant will respond to questions by the reviewers and make modifications to the delineation maps, hydraulics report, and HEC-2 model as required.

TASK 7 - DELIVERABLES

7.1 Preliminary Hydrology Report: The preliminary hydrology report will be prepared using the State Standard Attachment SSA-90-1, Instructions for Organizing and Submitting Technical Documentation for Flood Studies. The report will contain the following information, as a minimum:

1. Scope of the study.
2. Description of the watershed.
3. Previous studies and reports.
4. Methodology.
5. Assumptions.
6. Results.
7. Comparison of the results with other studies and/or stream gages.
8. Conclusion.
9. List of references and agencies contacted.

Tables and Figures for the main text:

1. Location map (maximum size 11" x 17") at the appropriate scale.
2. Table showing the flow peaks and volumes at critical concentration points for different rainfall events.
3. Table showing the critical peaks and volumes for major concentrations points as compared to previous studies (where available).
4. Table(s) showing the major parameters for all sub-basins (slope, area, rainfall loss calculations, friction, total rainfall, time of concentration or lag, major structures, etc.).

Table and Figures for the appendices:

1. Topographic base map(s) showing the sub-basins, routing reaches, T_C flow paths or lag flow paths, major man-made structures, and references (i.e. street names, Township, Range, Section, etc.) at scales of 1 inch = 400, 1000, and 2000 feet. These map scales are approximate and may be revised.
2. Soils map(s) at the same scale as the base map.

3. Land use map(s) at the same scale as above.

4. Schematic map for the HEC-1 models as available from the computer model itself.

5. Pertinent data on all the structures in the watershed (such as spillway elevation, rating curves, etc.).

6. One set of study maps (i.e. sub-basin boundary maps, flow path maps, soils maps, land use maps) to be folded and delivered under separate cover.

One copy of the report and the HEC-1 input files on diskette will be submitted for review.

7.2 HEC-1 District Review

7.3 HEC-1 Review Revisions

7.4 Final Hydrology Report: The review comments will be addressed and the final report prepared. The submittal will be under Task 7.8.

7.5 Preliminary Hydraulics Report to conform to Section 4 of the Technical Data Notebook (TDN) in accordance with ADWR State StandardAttachment SSA-90-1.

One (1) copy of the report and HEC-2 input files on diskette will be submitted for review.

7.6 HEC-2 District Review

7.7 Final Hydraulics Report: The review comments will be addressed and the final report prepared. The submittal will be under Task 7.8.

7.8 FEMA Submittal: The consultant will submit the following items to the District for review by FEMA and any other appropriate governmental agency. All of the following products are considered deliverables for the FEMA submittal:

7.8.1 Original Affidavits of Publication

7.8.2 Two (2) complete sets of blueline topographic base maps with the floodplain/floodway delineations shown. Hand drawn work maps are acceptable for submittal. All drawings will be signed and sealed by persons of appropriate professional registration(s). Each registrant will provide a specific statement as to what service they performed.

7.8.3 Two (2) complete copies of the Final Report, including HEC-1 and HEC-2 input/output files on diskettes, as outlined below. The Final Report will be issued in two (2) volumes, Final Hydrology Report (Task 7.8.3.1) and Final Hydraulics Report (Task 7.8.3.2). The Final Report will reflect all work performed under Phase I and Phase II of this contract.

i. Title Page
ii. Table of Contents
iii. Narrative Introduction

I. Area Studied

II. Engineering Methods

III. Floodplain Management Applications

IV. Community Rating Summary

V. Other Studies

VI. Location of Data

VII. Bibliography

VIII. Technical Data Notebook (TDN) in accordance with ADWR State Standard Attachment SSA-90-1.

7.8.4 Two (2) sets of completed FEMA forms, as specified in Task 1.9 will be submitted in a notebook separate from the Final Report.

7.8.5 Two (2) sets of complete HEC-2 input/output data, with files on computer diskette, and a short report for the supercritical profiles.

7.8.6 Three (3) sets of complete survey notes will be submitted in a notebook separate from the Final Report.

7.9 Final Submittal: The following products are considered deliverables for the final submittal to the District after FEMA approval is issued:

7.9.1 One (1) complete set of non-erasable topographic mylars. Sheets shall be 24" X 36" in size and numbered to correspond to the delineation maps. The scale shall be 1 inch = 200 feet with a contour interval of 2 feet for all mapping with the exception of section line roads which will have a contour interval of 1 foot. These maps shall be supplied by the Rio Verde North consultant.

7.9.2 One (1) complete sets of mylars and four (4) complete sets of sealed blueline topographic base maps with the floodplain/floodway delineations shown. All drawings will be signed and sealed by persons of appropriate professional registration(s). Each registrant will provide a specific statement as to what service they performed.

7.9.3 One (1) complete set of transparent overlays of photo-mylars. Sheet size, numbering, and layout shall correspond to the delineation work maps. These mylars are to be supplied by the Rio Verde-North Consultant.

7.9.4 Digitized topographic data and floodplain/floodway boundaries in conformance with the District's HIS Specifications.

7.9.5 Four (4) complete copies of the Final Report including HEC-1 and HEC-2 input/output files on diskettes. The format of the report shall follow the outline specified in Task 7.8.3. This submittal of the Final Report shall include any correspondence and/or meeting minutes with the reviewing agencies and shall reflect any revisions required by those reviewing agencies. Revisions may include, but are not limited to, modifications to the delineation maps, the HEC-1 model, the HEC-2 model, and/or the Final Report.

PHASE II: HYDRAULICS FOR ADDITIONAL DELINEATION

No work will proceed under Phase II without written authorization from the District.

Phase II work will begin upon finalization of the hydrologic analysis. The District will coordinate with the consultant to identify those additional washes to be delineated under Phase II.

Phase II work will consist of those items listed under Task 6 - Floodplain and Floodway Delineation for Phase I. The appropriate deliverables as determined by Task 6 and identified in Task 7 - Deliverables will be included in the Final Report. The Final Report will be inclusive of all work completed under both Phase I and Phase II of this project.

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

July 28, 1994

Ms. Cathy Regester
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Re: Rio Verde (South) Flood Delineation Study
Contract No. FCD 93-07
MKE Job No. 89-407.003

Dear Ms. Regester:

Enclosed is our Change Order request for $6,550.00 to perform additional mapping for the Rio Verde South project. The present mapping was flown in December, 1993. Since that time, the developer of the Tonto Verde subdivision has channelized portions of Wash 10 and Wash 11 within the floodplain mapping area. This area must be remapped for the floodplain to match existing conditions, and for the floodplain to match the contours. In addition to the cost associated with remapping, we are requesting an additional 90 days time extension. This is to cover the initial delay in receipt of aerial mapping, and for the time it will take to obtain the remapping data. This could be reduced to 60 days with prompt change order request processing.

Approximately 1.25 river miles have been channelized and affect Phase I of the Rio Verde South project. The affected areas are Wash 10 from Forest Road upstream to the golf course, and Wash 11 from Forest Road upstream to 900 feet West of the R6E/R7E boundary. The affected area appears on Sheets 5 of 8 and 7 of 8 of the aerial mapping. The enclosed costs include time spent to date attempting to utilize the Brooks- Hersey mapping, resetting panel points, and new aerial strip mapping along the washes. Cost proposals from our subconsultants are being sent with this letter. You have directed us to forego revising the hydrologic maps since any changes as a result of the new contours are likely to be small in nature. The HEC-1 routing path in the newly channelized areas has been smoothed out. We will delay the aerial map GIS translation until the new mapping is received. The cost of new semi-rectified photo sheets is not included with this change order.

A concrete diversion structure has been constructed in Section 36 within Rio Verde South Phase II and appears on Sheet 8 of 8. The disposition of the floodplain mapping at this diversion structure will be deferred until Phase II Scope of Work discussions. At this time, it is anticipated to use field survey methods to incorporate the diversion structure into the HEC-2 floodplain model. The HEC-1 hydrology model does acknowledge the effect of the diversion structure. The structure would not be incorporated into the computerized aerial mapping and therefore would not appear in the ARC-INFO GIS mapping. Please contact me if this is not your understanding.

89407-00\CO#1.003

This matter must be decided now because the GIS translation of the mapping will probably be completed prior to Phase II.

Please advise me if additional information is needed. Please call me or Frank Brown if you have questions. It is a pleasure doing business with you and we look forward to getting this project back on track.

Very truly yours,

McLAUGHLIN KMETTY ENGINEERS, Ltd.

Geza E. Kmetty, P.E.
Vice President

89407-00\CO#1.003

89-407.002

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5859

RECEIVED AUG 19 1994

AUG 18 1994

Mr. Geza E. Kmetty
Vice President
McLaughlin Kmetty Engineers, Ltd.
3501 North 16th Street
Phoenix, Arizona 85016-6419

SUBJECT: Contract FCD 93-07, Rio Verde (South) Flood Delineation Study
Change Order No. 1

Dear Mr. Kmetty:

Enclosed for your file is change order no. 1. If you have any questions, please contact Cathy Register at 506-1501.

Sincerely,

Leanna Cumberland
Chief, Contracting Branch

Enclosure (1)

84-407.003

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5859

RECEIVED FEB 1 6 1995

February 14, 1995

Mr. Frank E. Brown, P.E.
McLaughlin Kmetty Engineers, Ltd.
3501 N 16th Street
Phoenix, Arizona 85016-6419

SUBJECT: Rio Verde South Floodplain Delineation Study
FCD #93-07
Phase II

Dear Mr. Brown:

Upon reviewing the results of the preliminary final hydrology, we have decided to delineate approximately 2.0 miles of floodplains under Phase II of this contract. The washes to be delineated are shown on topographic map sheets 6, 7, and 8 of 8. Please review the Phase II reach lengths and determine the actual miles proposed under Phase II. Upon verification of this mileage, I will prepare a written authorization to proceed.

I have attached some examples of small, end-of-section, breakouts which occurred on the Powerline/Tank and Star Washes floodplain delineation studies as we discussed. In addition, I have attached a page from the Star Wash Study which addresses the issue of coincidental/non-coincidental flows.

An updated (October 1994) copy of the FEMA forms is enclosed for your use. I would prefer to use these new forms for the FEMA submittal. If you feel that these forms are beyond your scope, please contact me so that we may discuss this matter in more detail.

If you have any questions or require additional information, please feel free to call me at (602) 506-1501.

Sincerely,

Catherine W. Regester

Catherine W. Regester
Hydrologist

Enclosures

PhaseIIA.NWP CWR 02/14/95

MKE

McLaughlin Kmetty Engineers, Ltd

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

February 22, 1995

Ms. Cathy Regester
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

SUBJECT: Rio Verde South Floodplain Delineation Study
FCD #93-07
Phase II Study Limits

Dear Ms. Regester:

We have reviewed topographic map sheets 6, 7 and 8 showing the Phase II study Washes. The study wash lengths were measured to be 2.015 miles. Two different measurement methods were utilized, one directly from the computer model and the other using a map wheel (hand calculations enclosed).

According to our final Scope of Work, the Phase II contract amount would be $3,700 fixed cost plus $4,000 per mile, for a Phase II total cost of $11,760. Please prepare written authorization for McLaughlin Kmetty Engineers to proceed with this work.

One of the Phase II study washes is unnamed. Since it lies directly north of Wash 11, we propose to name it Wash 12. Such a naming scheme would be consistent with the study area. Are you aware of any locally-used name for this wash? If not, please authorize us to use "Wash 12" as the official wash name.

Very truly yours,

McLAUGHLIN KMETTY ENGINEERS, Ltd.

Frank Edward Brown

Frank Edward Brown, P.E.
Project Engineer

c: Geza Kmetty, MKE

89407-00\Ph2scope.003

MKE McLaughlin Kmetty Engineers, Ltd.

Project Title RIO VERDE SOUTH Project No. 89-407-003 Date 17 FEB 95
CHECKED BY: DL 21 FEB 95
Subject Designed Page 1/1

PHASE II FLOODPLAIN LIMITS

Measure length of thalweg for Wash 12 (assumed name) and Wash 11 extended. Measurements made using Keuffel + Esser Map Wheel, model #62-0310, calibrated to 1/16th inch.

Sheet No.	Wash	Distance inches	Distance feet	Distance miles	
6	12 (assumed)	19 7/8			
7	12 (assumed)	4 1/4	____	____	
	TOTAL	24 1/8	4825.0	0.914	TOTAL WASH 12 (assumed name)
7	11 - starting @ Phase I boundary	7			
8	11	22 1/16	____	____	
	TOTAL	29 1/16	5812.5	1.101	TOTAL WASH 11

PHASE II TOTAL: WASH 12 + WASH 11

0.914 + 1.101 = 2.015 miles TOTAL PHASE II

PHASE II Contract Amount:

$3,700.00 Lump Sum + $4,000.00/mile (2.015 mi) = $11760 TOTAL ADDITIONAL CONTRACT

LEGEND:
✓ = check in-house, OK.

NOTE: The computer distances match above mileage. Individual lengths were rounded up, but they still total 2.015 mi.

Job file
89-407.003

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FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5859

January 23, 1995

Geza E. Kmetty, P.E.
McLaughlin Kmetty Engineers, Ltd.
3501 N. 16th Street
Phoenix, Arizona 85016-6419

SUBJECT: Rio Verde South Floodplain Delineation Study
FCD #93-07
Phase II

Dear Mr. Kmetty:

This letter serves as written authorization to proceed on Phase II of the subject contract which was approved by the Board of Directors on December 8, 1993. Phase II will consist of floodplain and floodway delineation for 2.015 miles of wash length as identified on topographic map sheets 6, 7, and 8 previously transmitted to Mr. Frank E. Brown, P.E. of your office. As specified in the contract, Phase II will be paid as a one-time mobilization cost of $3700.00 plus $4000.00 per mile of delineation. Therefore, the final cost to perform the work under Phase II shall not exceed $11,760.

In addition, Mr. Brown has raised a question regarding the naming of the unnamed Phase II wash to the north of Wash 11. I am not aware of any locally-used names for this wash and agree that using *Wash 12* would be consistent with the study area. Therefore, please refer to this wash as *Wash 12* on the delineation maps and in the Technical Data Notebook. This will not be truly an official wash name unless submitted to and approved by the U.S. Board on Geographic Names. However, I do not foresee any problems with FEMA regarding its use.

If you have any questions or require additional information, please feel free to call me at (602) 506-1501.

Sincerely,

Catherine W. Regester

Catherine W. Regester
Hydrologist

PhaseII.NWP CWR 02/23/95

SECTION 2: MAPPING AND SURVEY INFORMATION

2.1 Description of Mapping

The base mapping for the floodplain analysis was prepared by Aerial Mapping Company, Inc. (AMC) in 1994 under a subcontract with the Rio Verde North Study Contractor, Burgess & Niple, Inc. Horizontal and vertical control was done by Burgess & Niple. The initial aerial photography date was 22 December 1993, with an aerial mapping update on 22 August 1994 for a portion of Sheets 5 and 7. The AMC project number is 93168. The coordinate grid system is based upon the North American Datum (NAD) of 1983 Arizona State Plane Coordinate System. Elevations are based upon National Geodetic Vertical Datum (NGVD) of 1929.

The base maps cover the following areas:

T4N R6E: Portions of Sections 1 and 2
T4N R7E: Section 6 and portions of Sections 5, 7 and 8
T5N R6E: Section 6 and portions of Sections 25 and 35
T5N R7E: Section 31 and portions of Sections 29, 30 and 32

Full size folded copies of the floodplain maps are contained at the rear of Book 1 of 2 and reduced copies are provided in Appendix I (Book 2 of 2).

A description of the elevation reference marks (ERM's) supplied by Burgess & Niple, and applicable to this study are contained in Appendix A. Supplemental survey data consisting of field surveys at culverts, bridges, hydraulic structures and some cross sectional data was obtained by Alcocer Land Surveyors (ALS) on behalf of the Rio Verde South Study Contractor. Copies of the supplemental survey data are located in Appendix B. For additional survey data used in this study, refer to the Rio Verde North Floodplain Delineation Study Technical Data Notebook, Hydrology prepared by Burgess and Niple (Reference 3, Section 6.5).

SECTION 3: HYDROLOGIC ANALYSIS

Refer to the separately bound "Rio Verde South Floodplain Delineation Study, Technical Data Notebook, Hydrology". The next two pages are a photocopy of each cover sheet for ease of reference. Table 3-1 (following) contains a summary of the peak discharge rates at all hydrologic concentration points within the study washes. There are many flow diversions within the watershed. The drainage areas tabulated in Table 3-1 do not consider the additional area associated with the flow diversions, but are simply the sum of subbasin areas directly above the hydrologic concentration point. These drainage area values differ from the HEC-1 Hydrology model since HEC-1 includes contributing areas from upstream flow splits or diversions.

TABLE 3-1
SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	HYDROLOGIC CONCENTRATION POINT	DRAINAGE AREA* (S. M.)	100-YEAR (cfs)	
Wash 9				
At confluence with Verde River	C570	3.25	1140	
Near Indian Reservation Boundary at River Mile 0.265	C569	2.91	1010	
At Forest Road near McDowell Mountain Road	C568	2.81	1010	
At Forest Road above White Wing Drive	C567	2.70	960	
About 0.1 mile above Danny Lane	C566	2.36	760	
At Vado Court	C565	2.28	660	
Wash 10				
Above confluence with Wash 11	C545R	2.66	1910	**
Above Forest Road near Mountainaire Drive	C543	2.48	1890	**
At Avenida Del Ray	C542	2.24	1430	
About 0.23 miles above Avenida Del Ray	C540	2.12	1420	
Wash 11				
At confluence with Verde River	C546	9.54	2100	**
After confluence with Wash 10	C545	9.23	2010	**
Above confluence with Wash 10	C545L	6.57	740	
At Forest Road	C536	6.52	740	
About 0.2 mile above R6E/R7E Boundary	C575	6.37	740	
At 176th Street	C574	approx 6.09	720	
About 550 feet west of 176th Street	C535	6.09	940	
Wash 12				
At confluence with Verde River	C523	2.91	1110	
Approximately 0.26 miles west of confluence with Verde River	C576	2.79	1060	
Approximately 0.45 miles west of confluence with Verde River	C520	2.61	1010	
Approximately 0.23 miles east of Forest Rd.	C512	2.24	750	
At Forest Rd.	After C511	approx 1.94	730	(Approximated)

* Drainage area reported is total subbasin area directly above the hydrologic concentration point.
These values differ from the HEC-1 hydrology model, since HEC-1 includes contributing areas from upstream flow splits or diversions.

** Maximum flow, with or without Section 36 Levee, whichever produces maximum flow.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
PHOENIX, ARIZONA

RIO VERDE SOUTH FLOODPLAIN DELINEATION STUDY

FCD 93-07

TECHNICAL DATA NOTEBOOK HYDROLOGY Existing Condition

Book 1 of 2

McLaughlin Kmetty Engineers, Ltd.
In Association with George V. Sabol Consulting Engineers, Inc.
Phoenix, Arizona

AUGUST 1995

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
PHOENIX, ARIZONA

RIO VERDE SOUTH FLOODPLAIN DELINEATION STUDY

FCD 93-07

TECHNICAL DATA NOTEBOOK HYDROLOGY Existing Condition

Book 2 of 2

McLaughlin Kmetty Engineers, Ltd.
In Association with George V. Sabol Consulting Engineers, Inc.
Phoenix, Arizona

AUGUST 1995

Registered Professional Engineer (Civil) CERTIFICATE NO. 23969 FRANK EDWARD BROWN Date Signed 1 AUG 95 ARIZONA, U.S.A.

Registered Professional Engineer (Civil) CERTIFICATE NO. 17928 GEORGE V. SABOL Date Signed 21 Aug 95 ARIZONA, U.S.A.