Alternative Plan Formulation

Property
ontrol District
Please Return
1 W. Duran
AZ 85

STP Papago

Regional Flood Control Project

Watershed Study (FCD 95-46)

Property of
Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ 85009

Prepared for:

Flood Control District of Maricopa County

© Kimley-Horn and Associates, Inc. 1997
091131.00

Kimley-Horn
and Associates, Inc.

Engineering, Planning, and Environmental Consultants

KVL Consultants, Inc.

A027.915

Alternative Plan Formulation

STP Papago

Regional Flood Control Project

Watershed Study (FCD 95-46)

Prepared for:

Flood Control District of Maricopa County

© Kimley-Horn and Associates, Inc. 1997
091131.00

This document, together with the concepts and designs presented herein, as an instrument of service, is intended only for the specific purpose and client for which it was prepared. Reuse of and improper reliance on this document without written authorization and adaption by Kimley-Horn and Associates, Inc. shall be without liability to Kimley-Horn and Associates, Inc.

Registered Professional Engineer (Civil)
CERTIFICATE NO.
24426
DOUGLAS J.
PLASENCIA
Date Signed 4/17/97
ARIZONA, U.S.A.

KVL Consultants, Inc.

Table of Contents

1. Introduction

Scope of Project 1-1

2. Alternative Plans

Introduction 2-1
City of Scottsdale - Indian Bend Wash 2-2
City of Tempe - Salt River 2-3
City of Phoenix - Old Cross Cut Canal 2-4

List of Figures

1-1 Study Area 1-2

Appendices

Basin 01 Existing System
Basin 02 Existing System
Basin 03 Existing System
Basin 04 Existing System
Basin 05 Existing System
Basin 06 Existing System
Basin 07 Existing System
Basin 21 Existing System

Existing System Design Flows and Capacities

1. Introduction

Scope of Project

The STP Papago Watershed Study will prepare planning alternatives and a recommended final planning report for a stormwater management system in an area bounded by the Arizona Canal and Camelback Road (N), Indian Bend Wash (E), McKellips Road (S) and 56th Street (W) as shown in Figure 1-1.

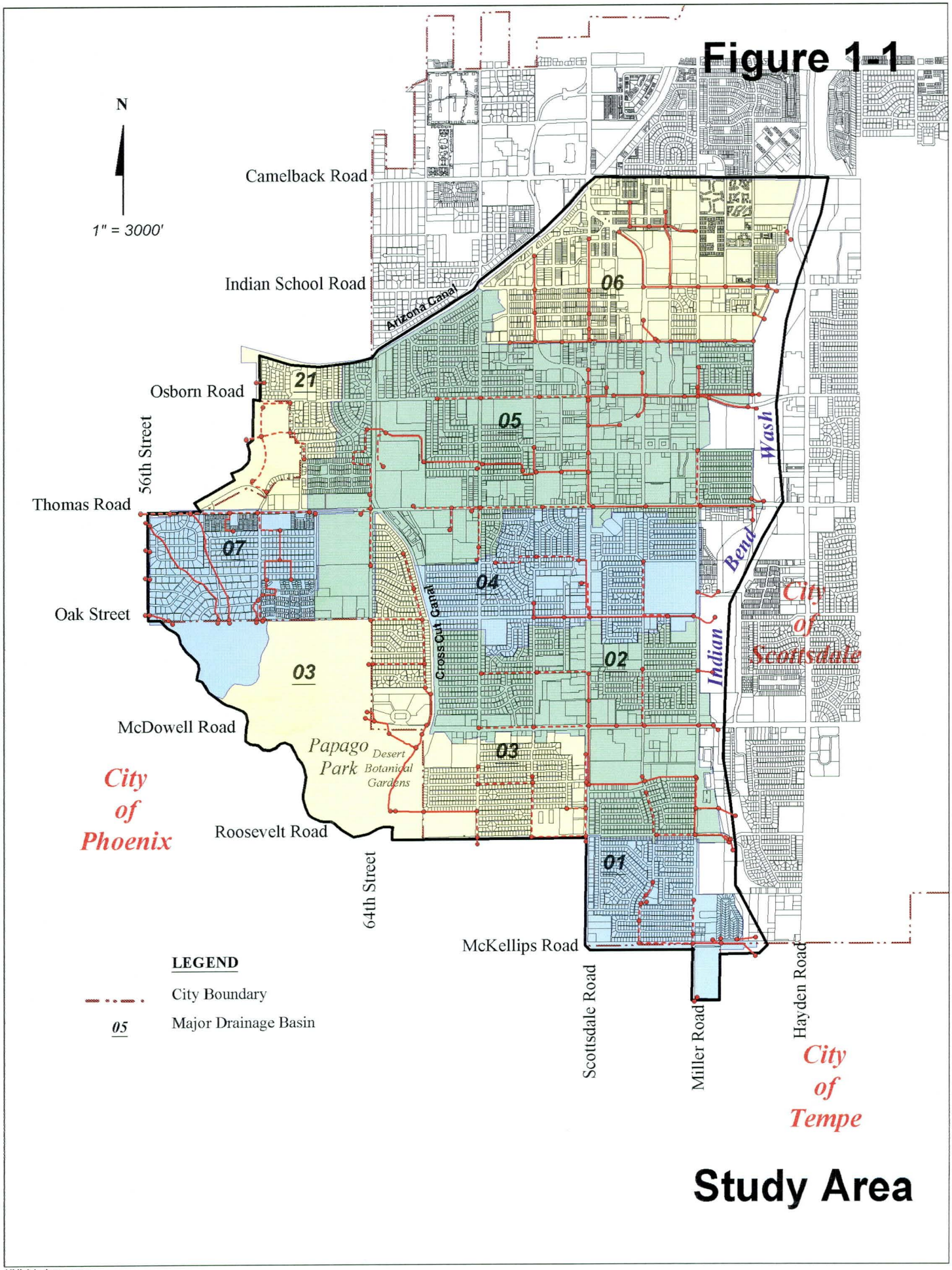
Key objectives include:

- Alleviating lower frequency flooding problems throughout the project area.
- Minimizing the size and number of distinct outfall facilities which will discharge to Indian Bend Wash and/or the Salt River.
- Maximizing the utilization of existing conveyance systems including storm drains, drainage easements, abandoned water lines and/or canals.
- Reducing or eliminating the limits of an existing "A" Zone floodplain along the west side of the Cross Cut Canal.

The Scope of Work includes a series of milestone reports that will lead to the final report scheduled for completion in September, 1997. The reports are:

- Hydrology Verification - Submitted
- **Alternative Plan Formulation**
- Draft Alternative Analysis
- Final Alternative Analysis
- Draft Recommended Plan
- Final Recommended Plan

This document is the Alternative Plan Formulation. Its purpose is to identify the project components and alternatives.



KVL/studarea.wor

2. Alternative Plans

Introduction

The City of Scottsdale's Stormwater Master Plan and Management Program established a numbering system and boundaries for major storm water basins in the City. The alternative plan formulation for this study utilizes the same system for conformance and ultimate incorporation of results back into the City of Scottsdale's system. The Basins to be analyzed in this study include Basins 1-7 inclusive and Basin 21 as shown in Figure 1-1. Individual maps of each of the Basins are provided in the appendix to this report.

The Cities that receive stormwater from the study area and their outfalls are:

- City of Scottsdale - Indian Bend Wash
- City of Tempe - Salt River
- City of Phoenix - Old Cross Cut Canal

Each of these Cities and outfalls have their own distinct alternatives and will be dealt with separately.

City of Scottsdale - Indian Bend Wash

Basins

Basins that outfall into the Indian Bend Wash within the City of Scottsdale include:

- Basin 01
- Basin 02
- Basin 04
- Basin 05
- Basin 06

Flooding

No areas of flood inundation have been identified in these basins. The problems relate to street drainage.

Opportunities

These basins are generally fully developed, leaving little opportunity for storage basins to attenuate peak flows. As a result, a design level of service must be achieved by conveying peak flows in underground facilities to the Indian Bend Wash.

Objectives

- Upgrade the major drainage system to an acceptable design level of service.

Components To Evaluate

- Osborn Corridor major drainage facility
- Oak Corridor major drainage facility
- Roosevelt Corridor major drainage facility
- Storage/collection in the vicinity of Osborn Road, east of Cross Cut Canal
- Opportunities to divert flow from an existing system to a new system
- Hydrologic effects on Indian Bend Wash

City of Tempe - Salt River

Basins

The Basin that outfalls to the Salt River within the City of Tempe is Basin 03.

Flooding

Basin 03 differs from the other Basins within the study because there is a significant flood mitigation component of the study. The area prone to flooding is currently designated a FEMA Flood Zone A and is located within the City of Scottsdale, east of 64th Street and North of McDowell Road.

Historically runoff originating within the City of Phoenix Papago Park, crosses 64th Street into Scottsdale, and ponds along the west side of the Cross Cut Canal. In September, 1995 a major storm event resulted in serious street flooding and the inundation of 14 homes adjacent to the Canal. The floodwaters outfall across McDowell Road, flow through the Desert Botanical Gardens, under the Cross Cut Canal facility of the Salt River Project, and ultimately discharge into 68th Street in the City of Tempe. The City of Tempe has experienced flood damages to several homes as a result of this flow, and is also concerned with the resulting street flooding.

Opportunities

In Basin 03, there are opportunities to construct storage basins west of 64th Street, at the AutoMall, and possibly within the Desert Botanical Gardens and/or the SRP PERA Club which are located downstream of McDowell Road. The storage basins west of 64th Street can attenuate downstream peak flows and if flows are retained, reduce the volume of floodwater entering the flood prone area. The storage basins downstream of McDowell Road can be used to attenuate peak flows ultimately entering the City of Tempe. However, the problem of extended period "surface trickle" into the City of Tempe needs to be considered.

Objectives

- Reduce or eliminate FEMA Flood Zone A
- Control downstream impacts of conveyance improvements
- Consider the quality of runoff impacting outfall or storage facilities
- Incorporate City of Scottsdale 64th Street drainage improvements

Components To Evaluate

- Storage Basins West of 64th Street
- Auto Mall Storage Basin (quantity and quality)
- McDowell Road Crossing
- Storage Basin SRP PERA Club
- Storage Basin in Desert Botanical Gardens
- City of Tempe Conveyance Capacity
- Cross Cut Canal for Conveyance

City of Phoenix - Old Cross Cut Canal

Basins

The Basins that outfall to the Old Cross Cut Canal within the City of Phoenix include:

- Basin 07
- Basin 21

Flooding

Runoff from basins that outfall into the City of Phoenix originate in Papago Park, enter the City of Scottsdale, cross Thomas Road reentering the City of Phoenix, and generally flow in a northwesterly direction through the Arizona Country Club towards the Old Cross Cut Canal. Street drainage problems and inundation have been identified in Scottsdale neighborhoods, at the Smittys store at 61st Street and Thomas, and in the Arizona Country Club. The Old Cross Cut Canal is not within the area of evaluation for this study, but represents the major receiving facility within the watershed.

Opportunities

In the upper areas of the watershed there are opportunities for stormwater storage to attenuate and/or reduce downstream flood flows.

Objectives

- Upgrade the major drainage system to an acceptable level of service

Components To Evaluate

- Collection and diversion of flows to major facilities
- Storage in upper watershed
- Committed flow rights in the Old Cross Cut Canal

Appendices

Disposition of Draft Report Comments

The majority of the comments were editorial in nature and were directly included in the text of the report. The following is a listing of direct comments.

Salt River Project - Letter of February 18, 1997 from Thomas Sands

1. Page 1-1 Introduction: The project study area map included in the report (Figure 1) does not include that portion of Tempe bounded by Roosevelt Road, Scottsdale Road, McKellips Road and the SRP Crosscut canal as requested by SRP and the City of Tempe. Has this area been added to the study?

RESPONSE: *This area has not yet been officially added to the study. At the time of the request significant flood problems in this area had not been identified that were independent from the major flooding problems in the rest of the watershed. At this time no alternatives are anticipated that would directly place project improvements in this area, rather the area will benefit from upper watershed controls and modifications that reduce the potential flow rate into the area. Considering the development of project alternatives an expansion of the study area at this time does not seem warranted. However as the study progresses this issue will continue to be examined.*

2. Page 2-2 City of Scottsdale - Indian Bend Wash: Suggest including SRP sump pump adjacent to the Crosscut Canal (SRP number 21E-7.4N) and SRP Irrigation lateral 2-1.7 in the listing of Components to Evaluate. Also suggest listing out the " Additional components as identified in field walk".

RESPONSE: *The Sump and Irrigation lateral in effect drains part of the SRP service yard in the area but have little impact on regional drainage issues. While the sump provides localized relief of ponding, it has no impact on the regional flows that cross under the Cross Cut Canal and flow to the east from the City of Scottsdale Park site. The sump plays a non-significant role in the development of a regional drainage system. Concur with the need to "line out" the field walk information.*

3. Page 2-3 City of Tempe - Salt River - Similar to comment made under 1, suggest the Basin 03 map be expanded to include the area south of Roosevelt Road. Also, suggest the City of Tempe storm drain conveyance system be shown on the map.

RESPONSE: *See 1*

4. Page 2-4 City of Phoenix - Old Cross Cut Canal: Under Components to Evaluate, suggest adding: Committed flow rights in Old Cross Cut Canal. These would include those belonging to SRP, City of Phoenix, and the FCDMC.

RESPONSE: *Added section that states "Committed flow rights in the Old Cross Cut Canal".*

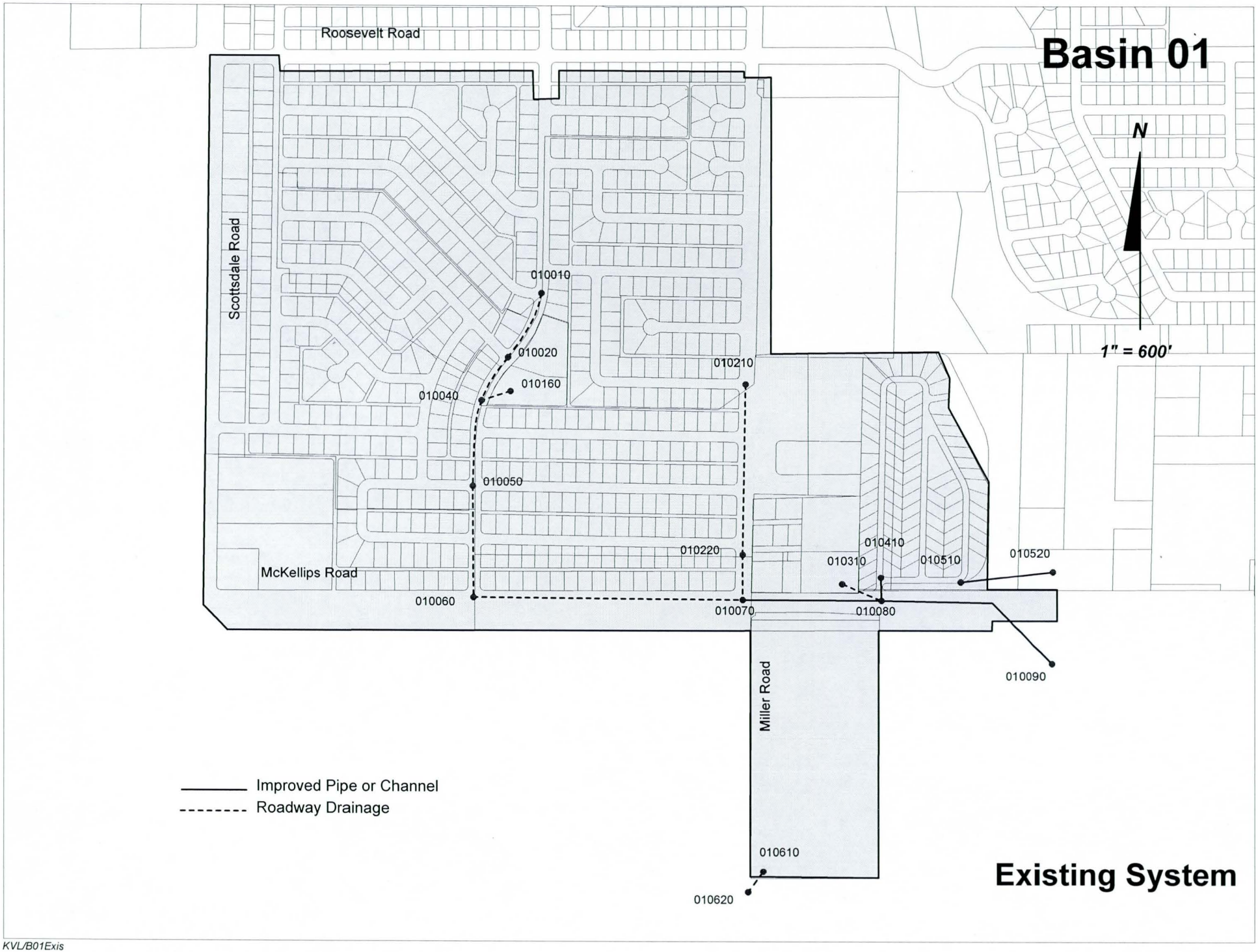
5. Basin Maps: Suggest the outfalls for all storm drains and channels be shown on the basin maps to indicate the entire storm runoff path. That is, show where and how stormwater gets to the various major drainage systems (Indian Bend Wash, Salt River and the Old Cross Cut Canal).

RESPONSE: As part of the recommended plan report project outfalls will be shown.

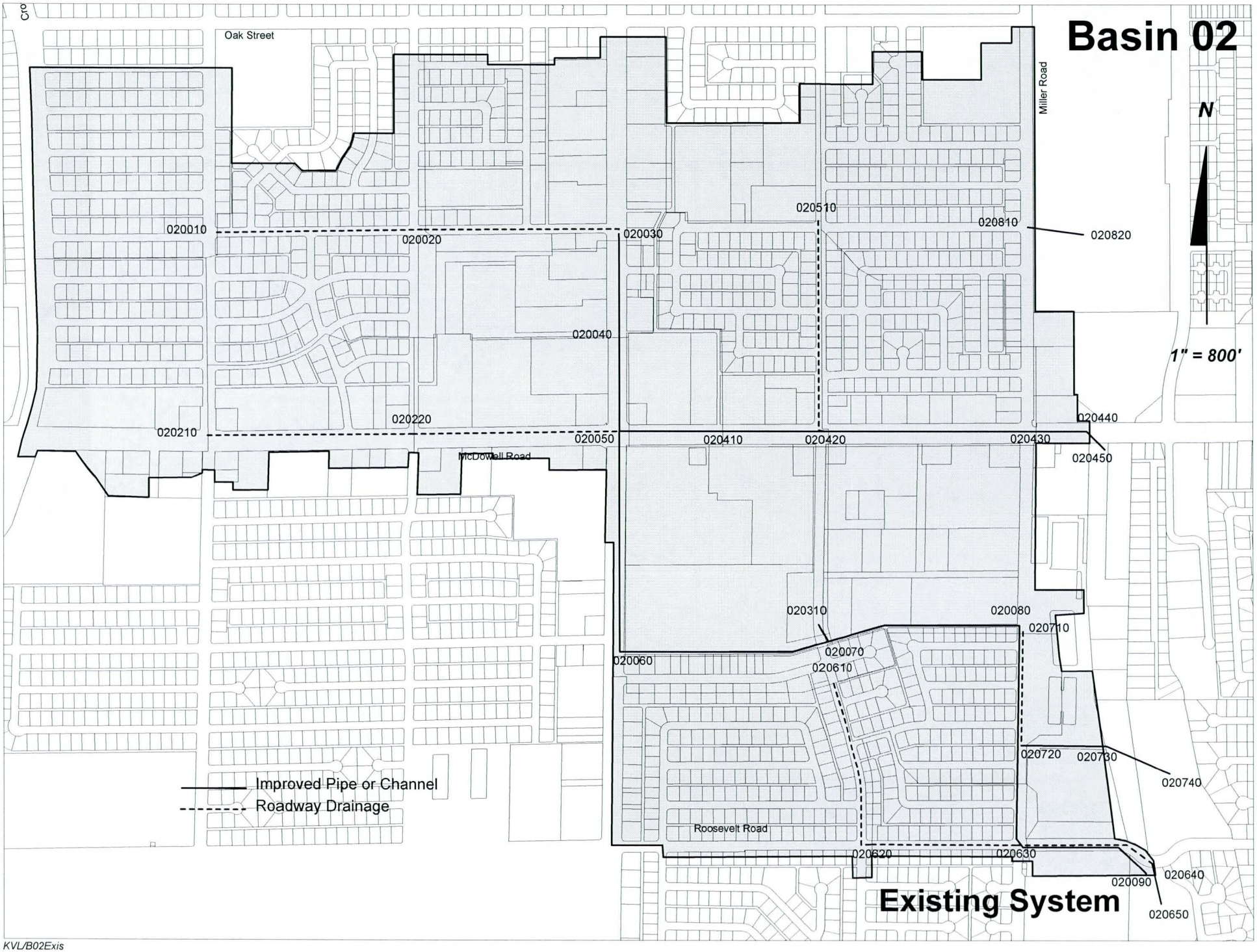
Internal Memorandum Flood Control District from Afshin A. to Scott Clement date January 6, 1997

1. For reducing flows to the Salt River through the City of Tempe, under the heading of opportunities, the consultant should include the possibility of improving the Automall Storage Basin. The Automall storage basin is being talked about as a component to be evaluated but it is not included as an opportunity for improvement.

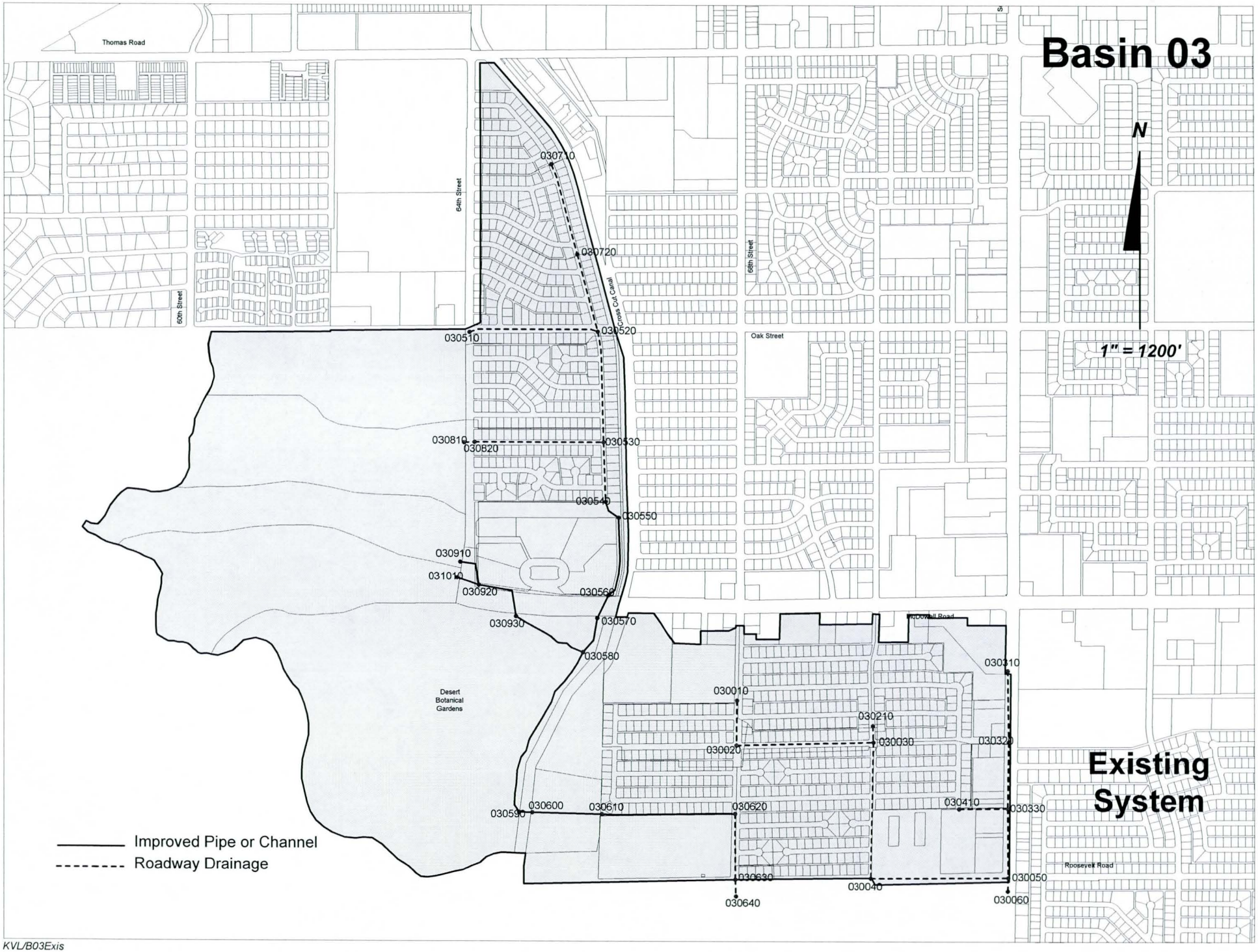
RESPONSE: Report was modified to address concern


Basin 01
N
1" = 600'
Roosevelt Road
Scottsdale Road
McKellips Road
Miller Road
010010
010020
010160
010040
010050
010060
010070
010080
010090
010210
010220
010310
010410
010510
010520
010610
010620
Improved Pipe or Channel
Roadway Drainage
Existing System

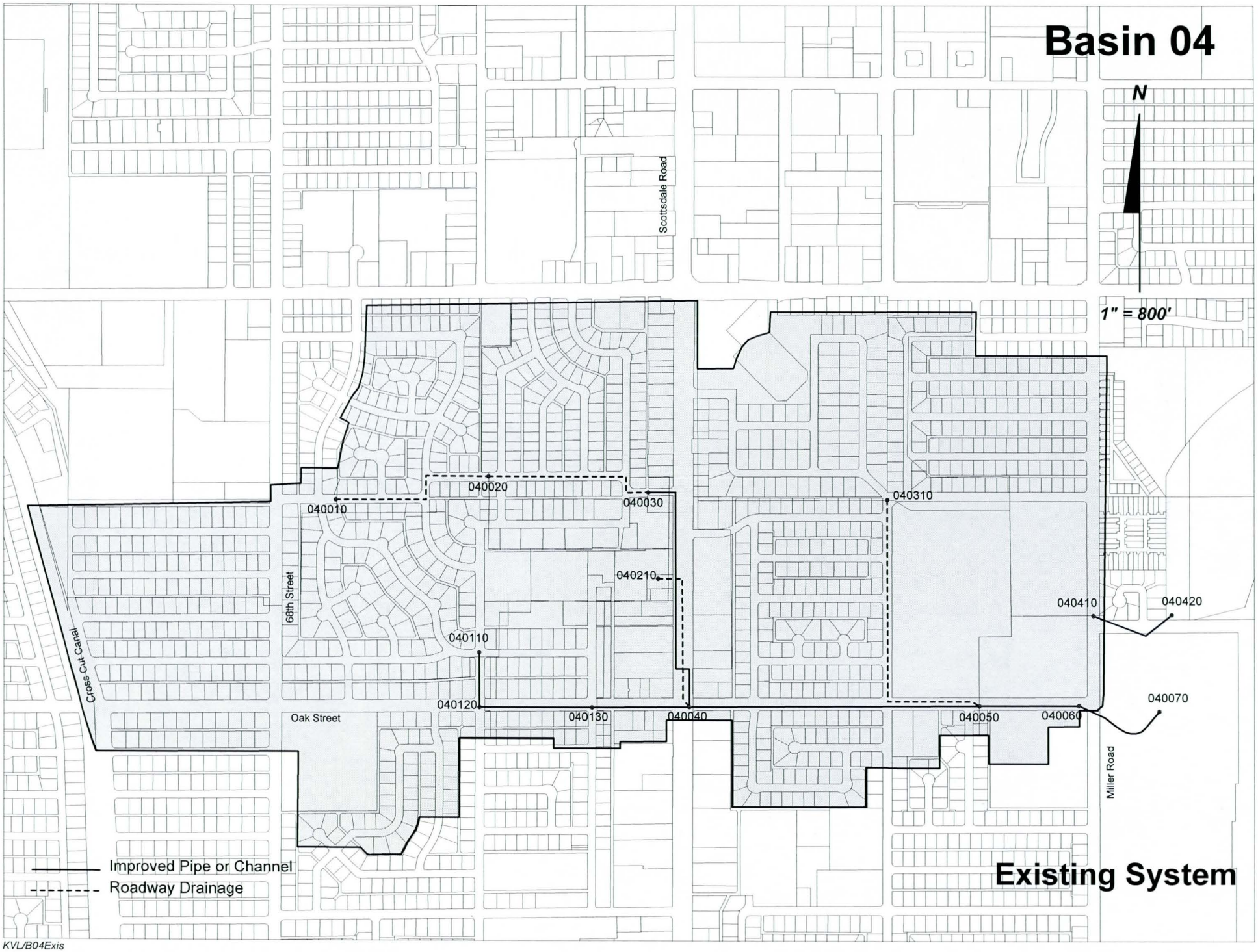
KVL/B01Exis


Basin 02
Oak Street
Miller Road
N
1" = 800'
020010
020020
020030
020510
020810
020820
020040
020220
020210
020050
020410
020420
020430
020440
020450
McDowell Road
020310
020080
020710
020070
020610
020060
020720
020730
020740
Improved Pipe or Channel
Roadway Drainage
Roosevelt Road
020620
020630
020640
020090
020650
Existing System

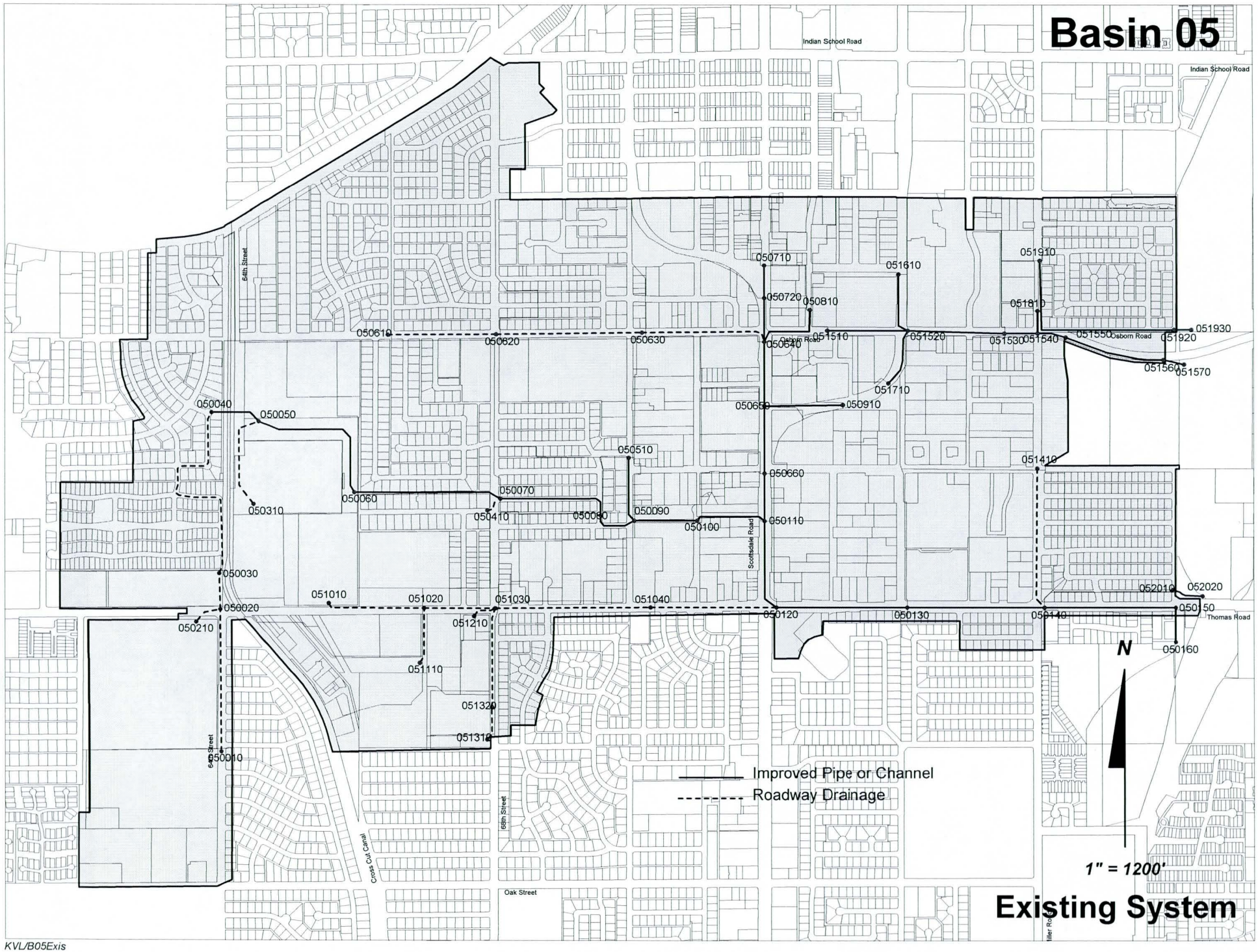
KVL/B02Exis


Basin 03
N
1" = 1200'
Thomas Road
64th Street
60th Street
68th Street
Oak Street
Cross Cut Canal
Desert Botanical Gardens
Roosevelt Road
Existing System
030710
030720
030510
030520
030810
030820
030530
030540
030550
030910
031010
030920
030560
030930
030570
030580
030310
030010
030210
030020
030030
030320
030590
030600
030610
030620
030410
030330
030630
030640
030040
030050
030060
Improved Pipe or Channel
Roadway Drainage

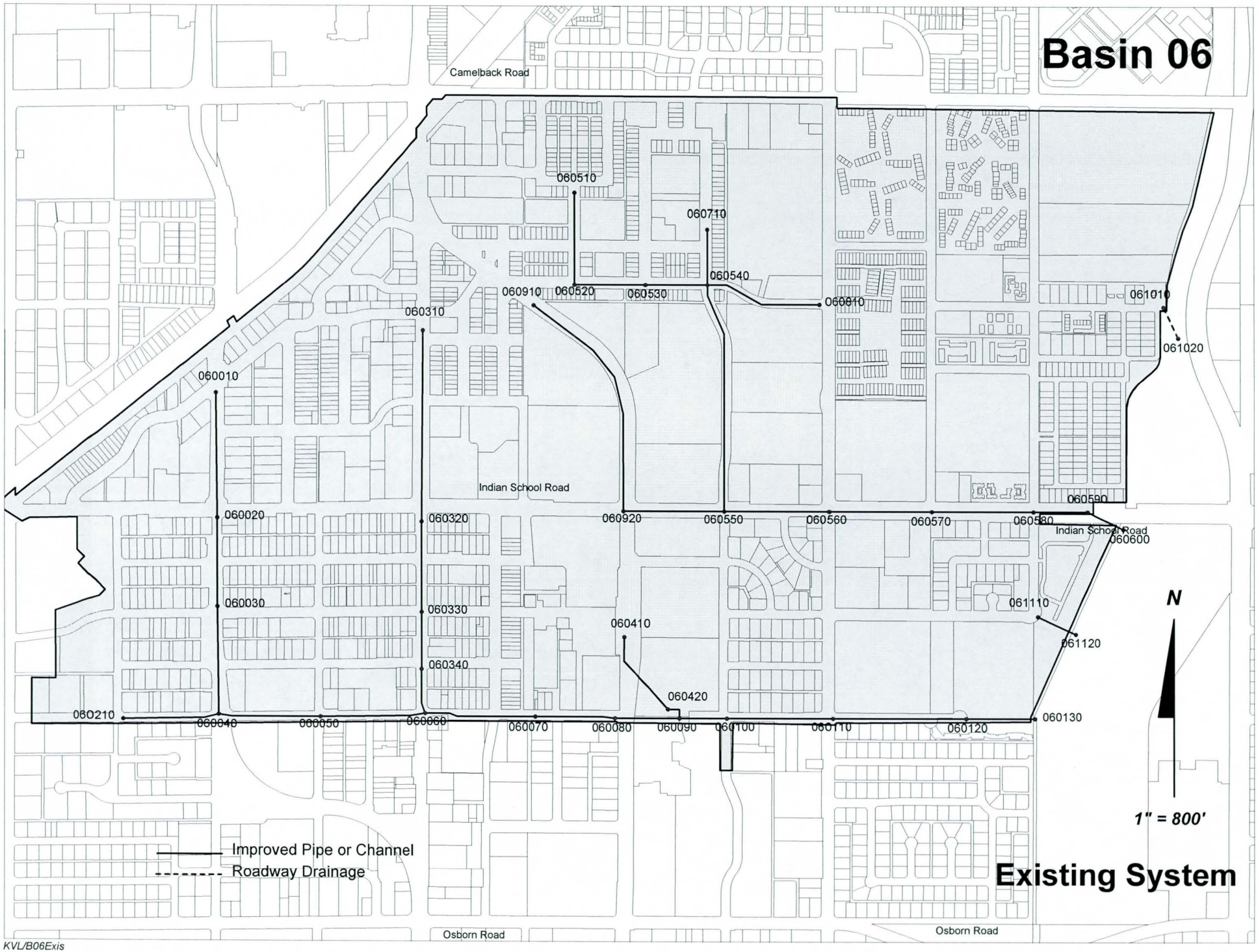
KVL/B03Exis


Basin 04
N
1" = 800'
Scottsdale Road
040020
040010
040030
040310
040210
040410
040420
68th Street
040110
Cross Cut Canal
040120
040130
040040
040050
040060
040070
Oak Street
Miller Road
Improved Pipe or Channel
Roadway Drainage
Existing System

KVL/B04Exis

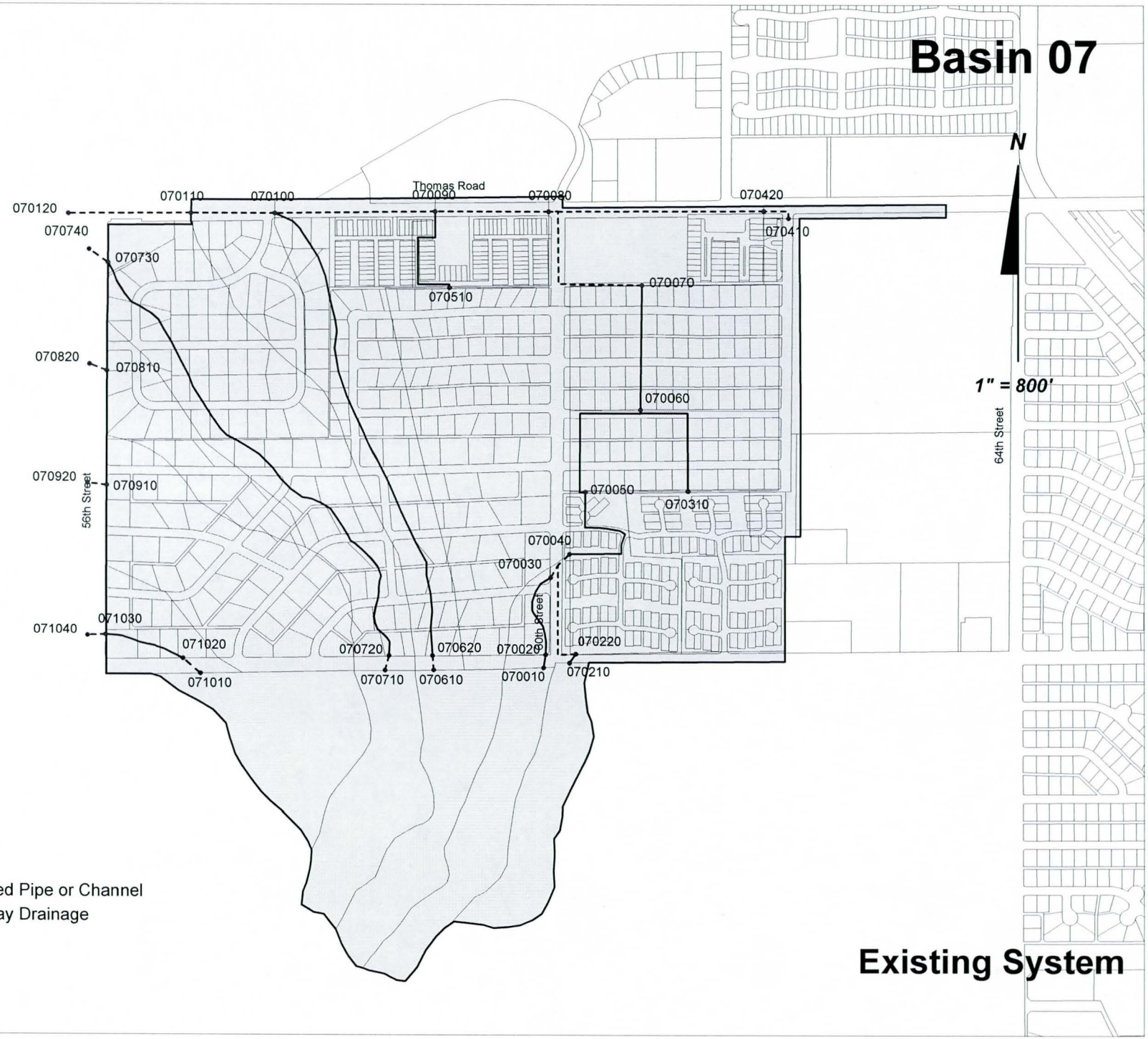

Basin 05
Indian School Road
Indian School Road
64th Street
Osborn Road
Osborn Road
Scottsdale Road
Thomas Road
Oak Street
Cross Cut Canal
68th Street
050710
051610
051910
050720
050810
051810
051930
050610
050620
050630
050640
051510
051520
051530
051540
051550
051920
051560
051570
051710
050650
050910
050040
050050
050510
051410
050660
050070
050060
050310
050410
050080
050090
050100
050110
050030
051010
051020
051030
051040
052010
052020
050020
050120
050130
050140
050150
050210
051210
050160
051110
051320
051310
050010
N
Improved Pipe or Channel
Roadway Drainage
1" = 1200'
Existing System

KVL/B05Exis


Basin 06
Camelback Road
Indian School Road
Osborn Road
060510
060710
060540
060910
060520
060530
060810
061010
061020
060310
060010
060020
060320
060920
060550
060560
060570
060580
060590
060600
060030
060330
060410
061110
061120
060340
060420
060210
060040
060050
060060
060070
060080
060090
060100
060110
060120
060130
N
1" = 800'
Improved Pipe or Channel
Roadway Drainage
Existing System

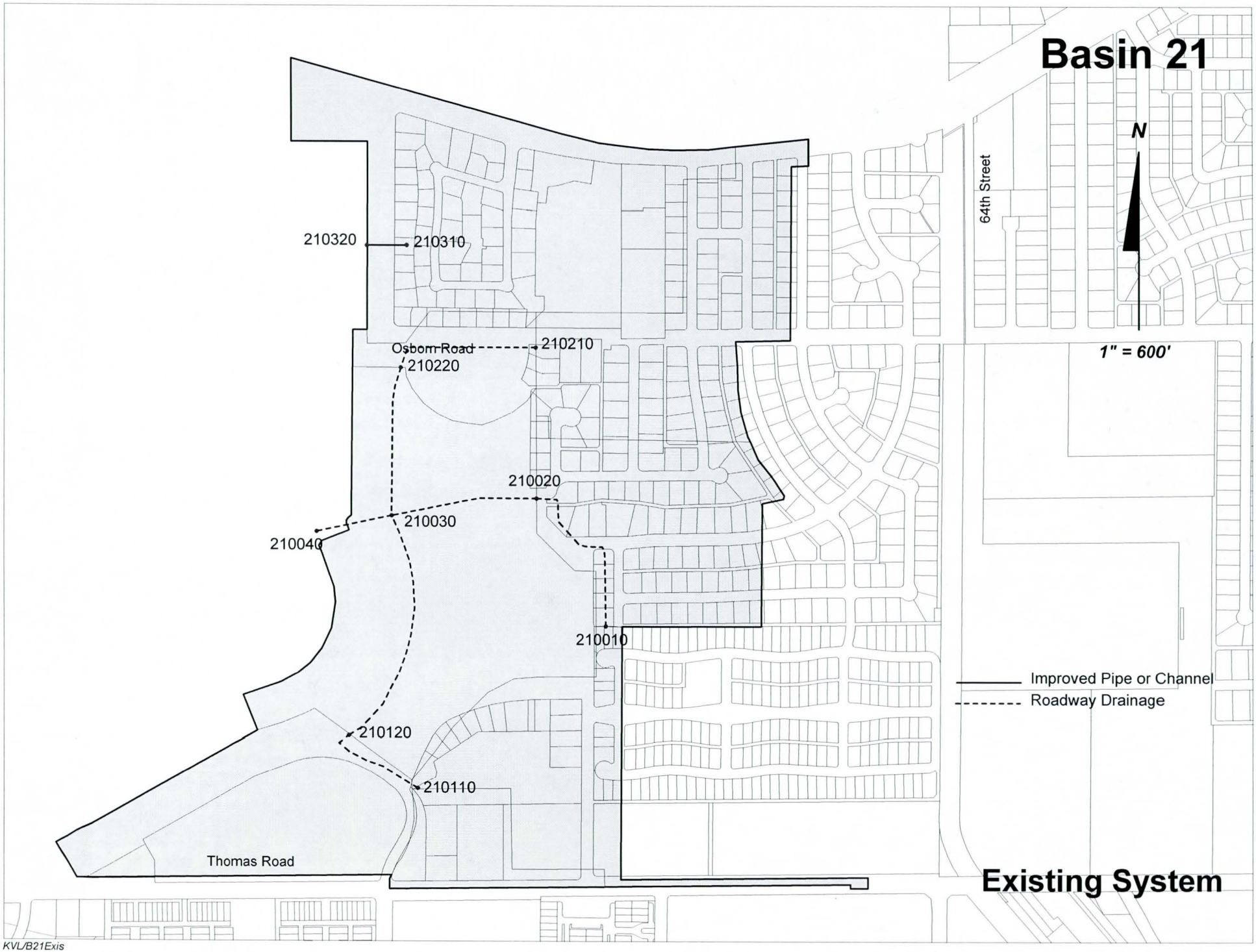
KVL/B06Exis

Basin 07



Existing System

KVL/B07Exis


Basin 21
N
1" = 600'
64th Street
210320
210310
Osborn Road
210210
210220
210020
210030
210040
210010
210120
210110
Thomas Road
Improved Pipe or Channel
Roadway Drainage
Existing System

KVL/B21Exis

STP Papago Watershed Study

Existing System Design Flows and Capacities

SECTION					SIZE				DESIGN FLOW			SECTION CAPACITY		
Major Basin	ID	Type	Length (feet)	Slope	No.	Pipe Size (inches)	Box or Channel Depth (feet)	Box or Channel Base (feet)	Q2 (cfs)	Q10 (cfs)	Q100 (cfs)	Roadway (cfs)	Improved Section (cfs)	Total Capacity (cfs)
01	010010-010020	Roadway	357	0.0078					22	45	87	53		53
01	010020-010040	Roadway	243	0.0078					31	64	124	53		53
01	010040-010050	Roadway	417	0.0078					31	63	123	53		53
01	010050-010060	Roadway	538	0.0078					67	138	263	53		53
01	010060-010070	Roadway	1305	0.0078					91	189	361	130		130
01	010070-010080	Pipe	671	0.0078	1	48			140	298	578	85	127	212
01	010080-010090	Pipe	937	0.0078	1	48			150	321	621	130	127	257
01	010160-010040	Roadway	147	0.0078							1	19		19
01	010210-010220	Roadway	821	0.0078					30	61	116	53		53
01	010220-010070	Roadway	219	0.0078					52	105	201	86		86
01	010310-010080	Roadway	211	0.0078							4	33		33
01	010410-010080	Pipe	111	0.0078	1	18			11	21	35		9	9
01	010510-010520	Pipe	444	0.0078	1	24			14	27	46		20	20
01	010610-010620	Roadway	123	0.0078					30	62	110	33		33
02	020010-020020	Roadway	1331	0.0085					28	56	106	55		55
02	020020-020030	Roadway	1308	0.0085					59	123	241	55		55
02	020030-020040	Pipe	650	0.0040	1	36			113	242	468	24	42	66
02	020040-020050	Pipe	601	0.0040	1	81			139	300	571	48	367	415
02	020050-020060	Pipe	1417	0.0080	1	60			92	201	386	15	233	248
02	020050-020410	Box	672	0.0065	1		6.0	6.0	138	306	585	130	377	507
02	020060-020070	Pipe	1355	0.0057	1	72			94	209	397	28	320	348
02	020070-020080	Pipe	1244	0.0059	1	72			140	319	597	29	325	354
02	020080-020090	Pipe	2283	0.0035	1	78			138	316	597	58	310	368
02	020210-020220	Roadway	1317	0.0085					39	82	155	136		136
02	020220-020050	Roadway	1335	0.0085					66	142	267	136		136
02	020310-020070	Pipe	123	0.0023	1	30			6	12	24	29	20	49
02	020410-020420	Box	663	0.0065	1		6.0	6.0	150	334	639	122	377	498
02	020420-020430	Box	1315	0.0065	1		6.0	6.0	182	405	780	147	377	524
02	020430-020440	Box	353	0.0107	1		6.0	6.0	203	458	893	132	484	615
02	020440-020450	Box	200	0.0107	1		3.0	6.0	205	463	905	62	185	247
02	020510-020420	Roadway	1388	0.0025					15	30	56	34		34
02	020610-020620	Roadway	1119	0.0025					14	28	54	30		30
02	020620-020630	Roadway	931	0.0085					44	97	188	55		55
02	020630-020640	Roadway	896	0.0085					50	112	220	90		90
02	020640-020650	Improved Channel	268	0.0025	1		2.0	50.0	51	118	232		434	434
02	020710-020720	Roadway	731	0.0025					55	117	221	30		30
02	020720-020730	Improved Channel	540	0.0085	1		1.0	25.0	69	149	290		200	200
02	020730-020740	Improved Channel	441	0.0025	1		2.0	50.0	78	169	328		434	434
02	020810-020820	Pipe	354	0.0077	1	18			36	77	149		9	9
03	030010-030020	Roadway	427	0.0050					34	74	133	69		69
03	030020-030030	Roadway	1326	0.0086					44	97	183	56		56
03	030030-030040	Roadway	1317	0.0010					69	155	299	19		19
03	030040-030050	Roadway	1317	0.0086					85	197	391	90		90
03	030050-030060	Roadway	129	0.0010					137	326	660	31		31
03	030210-030030	Roadway	154	0.0010					25	54	105	19		19
03	030310-030320	Roadway	683	0.0010					7	16	29	47		47
03	030320-030330	Roadway	641	0.0010					26	64	133	47		47
03	030330-030050	Roadway	670	0.0010					38	91	193	31		31
03	030410-030330	Roadway	464	0.0086					11	23	43	20		20
03	030510-030520	Roadway	1252	0.0143					6	38	115	117		117
03	030520-030530	Roadway	1067	0.0034					46	94	234	52		52
03	030530-030540	Roadway	574	0.0034					62	135	407	52		52
03	030540-030550	Improved Channel	210	0.0024	1		5.0	25.0	78	171	466		892	892
03	030550-030560	Improved Channel	778	0.0024	1		3.0	2.0			217		94	94
03	030560-030570	Pipe	249	0.0031	1	30					208		23	23
03	030570-030580	Improved Channel	369	0.0024	1		2.0	15.0			203		115	115
03	030580-030590	Improved Channel	1735	0.0024	1		2.0	15.0	15	83	303		115	115

STP Papago Watershed Study

Existing System Design Flows and Capacities

SECTION					SIZE				DESIGN FLOW			SECTION CAPACITY		
Major Basin	ID	Type	Length (feet)	Slope	No.	Pipe Size (inches)	Box or Channel Depth (feet)	Box or Channel Base (feet)	Q2 (cfs)	Q10 (cfs)	Q100 (cfs)	Roadway (cfs)	Improved Section (cfs)	Total Capacity (cfs)
03	030590-030600	Box	227	0.0129	1		2.0	4.0	29	176	536		69	69
03	030600-030610	Improved Channel	675	0.0086	1		2.0	8.0	29	176	534		178	178
03	030610-030620	Improved Channel	1290	0.0086	1		2.0	10.0	30	180	548		220	220
03	030620-030630	Roadway	637	0.0020					36	192	585	44		44
03	030630-030640	Roadway	162	0.0020					70	207	632	44		44
03	030710-030720	Roadway	900	0.0034					15	28	49	52		52
03	030720-030520	Roadway	776	0.0034					28	56	103	52		52
03	030810-030820	Roadway	101	0.0143					6	38	115	117		117
03	030820-030530	Roadway	1249	0.0143					6	37	115	107		107
03	030910-030920	Pipe	352	0.0150	1	36			5	30	90		82	82
03	030920-030930	Pipe	578	0.0150	2	42			14	79	231		247	247
03	030930-030580	Improved Channel	746	0.0034	1		3.0	8.0	15	84	246		228	228
03	031010-030920	Pipe	223	0.0129	2	36			9	50	145		152	152
04	040010-040020	Roadway	1136	0.0072					19	41	76	76		76
04	040020-040030	Roadway	1137	0.0072					30	70	142	76		76
04	040030-040040	Pipe	1636	0.0003	1	12			56	130	263	26	1	26
04	040040-040050	Pipe	1869	0.0060	2	42			122	295	625	89	156	245
04	040050-040060	Pipe	633	0.0033	2	48			201	475	974	76	165	241
04	040060-040070	Pipe	619	0.0033	2	48			208	490	1010	62	165	227
04	040110-040120	Pipe	351	0.0069	1	36			21	47	96	31	55	86
04	040120-040130	Pipe	730	0.0086	1	36			53	124	256	73	62	135
04	040130-040040	Pipe	625	0.0038	1	42			58	139	291	68	62	130
04	040210-040040	Roadway	990	0.0004							7	30		30
04	040310-040050	Roadway	1912	0.0004					44	86	159	12		12
04	040410-040420	Pipe	359	0.0065	1	15			23	55	110		5	5
05	050010-050020	Roadway	1370	0.0038					46	93	169	55		55
05	050020-050030	Roadway	347	0.0038					51	103	192	55		55
05	050030-050040	Roadway	2206	0.0038					49	101	186	55		55
05	050040-050050	Pipe	491	0.0334	1	30			95	217	425		75	75
05	050050-050060	Improved Channel	1465	0.0033	1		1.0	5.0	123	278	535		16	16
05	050060-050070	Improved Channel	1429	0.0033	1		1.0	5.0	119	275	527		14	14
05	050070-050080	Pipe	1112	0.0027	1	54			182	447	860	51	102	153
05	050080-050090	Pipe	416	0.0052	1	48			186	460	892	51	104	155
05	050090-050100	Pipe	609	0.0028	2	54			218	556	1096		208	208
05	050100-050110	Pipe	692	0.0058	2	48			244	624	1233		219	219
05	050110-050120	Pipe	888	0.0027	1	90			462	1131	2205	87	399	486
05	050120-050130	Box	1265	0.0027	1		6.0	7.0	551	1347	2605	62	344	405
05	050130-050140	Box	1319	0.0027	1		6.0	7.0	613	1490	2888	107	344	451
05	050140-050150	Box	1252	0.0006	2		8.0	5.0	709	1719	3329		299	299
05	050150-050160	Box	332	0.0048	2		6.0	6.0	712	1726	3341		747	747
05	050210-050020	Roadway	278	0.0033								56		56
05	050310-050050	Roadway	977	0.0038					35	75	132	55		55
05	050410-050070	Roadway	187	0.0038					42	84	150	60		60
05	050510-050090	Pipe	626	0.0052	1	48			37	78	147	38	104	142
05	050610-050620	Roadway	1052	0.0033					42	90	172	56		56
05	050620-050630	Roadway	1412	0.0033					94	203	396	56		56
05	050630-050640	Roadway	1250	0.0033					129	288	556	56		56
05	050640-050650	Pipe	620	0.0036	1	84			191	429	816	97	383	480
05	050650-050660	Pipe	648	0.0027	1	90			210	476	904	61	399	460
05	050660-050110	Pipe	458	0.0027	1	90			222	505	957	78	399	477
05	050710-050720	Pipe	316	0.0045	1	66			5	11	20	42	225	267
05	050720-050640	Pipe	422	0.0045	1	66			29	63	119	63	225	288
05	050810-050640	Pipe	705	0.0025	1	48			12	25	45		72	72
05	050910-050650	Box	751	0.0045	1		3.0	5.0	11	22	40		110	110
05	051010-051020	Roadway	948	0.0033							24	56		56
05	051020-051030	Roadway	694	0.0033					23	49	91	56		56
05	051030-051040	Roadway	1501	0.0033					53	120	221	56		56

STP Papago Watershed Study

Existing System Design Flows and Capacities

SECTION					SIZE				DESIGN FLOW			SECTION CAPACITY		
Major Basin	ID	Type	Length (feet)	Slope	No.	Pipe Size (inches)	Box or Channel Depth (feet)	Box or Channel Base (feet)	Q2 (cfs)	Q10 (cfs)	Q100 (cfs)	Roadway (cfs)	Improved Section (cfs)	Total Capacity (cfs)
05	051040-050120	Roadway	1222	0.0033					71	165	313	85		85
05	051110-051020	Roadway	541	0.0038							19	42		42
05	051210-051030	Roadway	241	0.0038					9	19	33	60		60
05	051310-051320	Roadway	333	0.0038								60		60
05	051320-051030	Roadway	960	0.0038							7	60		60
05	051410-050140	Roadway	1367	0.0038					87	170	296	60		60
05	051510-051520	Pipe	783	0.0050	2	72			10	21	39	26	599	625
05	051520-051530	Pipe	926	0.0043	1	86			53	109	194	62	446	509
05	051530-051540	Pipe	320	0.0043	1	86			95	199	358	69	446	515
05	051540-051550	Box	273	0.0025	1		3.0	5.0	103	216	389		82	82
05	051550-051560	Pipe	203	0.0018	1	96			102	214	385		398	398
05	051560-051570	Pipe	228	0.0018	1	96			106	222	399		398	398
05	051610-051520	Pipe	601	0.0047	1	60			19	39	70		179	179
05	051710-051520	Pipe	567	0.0032	1	48			4	8	14		81	81
05	051810-051540	Pipe	218	0.0045	1	54			6	12	21		132	132
05	051910-051920	Pipe	1930	0.0030	1	48			11	23	43		79	79
05	051920-051930	Pipe	165	0.0030	1	48			44	92	173		79	79
05	052010-052020	Improved Channel	300	0.0033	1		1.0	5.0	26	52	98		14	14
06	060010-060020	Pipe	806	0.0016	1	36			12	25	45	74	27	101
06	060020-060030	Pipe	567	0.0053	1	48			37	78	141	72	105	177
06	060030-060040	Pipe	689	0.0032	1	54			48	101	183	70	111	181
06	060040-060050	Pipe	653	0.0073	1	72			84	178	321	60	362	422
06	060050-060060	Pipe	672	0.0083	1	72			115	243	436		386	386
06	060060-060070	Pipe	717	0.0030	1	90			226	473	851	34	421	454
06	060070-060080	Pipe	514	0.0106	1	96			254	533	964	43	939	982
06	060080-060090	Box	417	0.0010	1		8.0	7.0	261	553	999		266	266
06	060090-060100	Pipe	305	0.0010	1	96			283	602	1085		289	289
06	060100-060110	Pipe	681	0.0010	1	96			307	649	1171		289	289
06	060110-060120	Pipe	859	0.0010	1	96			329	695	1253		289	289
06	060120-060130	Pipe	438	0.0010	1	96			345	729	1302		289	289
06	060210-060040	Pipe	696	0.0060	1	42			23	44	75	66	78	144
06	060310-060320	Pipe	1232	0.0045	1	36			24	50	92		45	45
06	060320-060330	Pipe	578	0.0045	1	54			80	169	308		132	132
06	060330-060340	Pipe	363	0.0045	1	60			96	202	368		175	175
06	060340-060060	Pipe	289	0.0045	1	60			105	220	401		175	175
06	060410-060420	Pipe	572	0.0024	1	48			20	38	64		70	70
06	060420-060090	Pipe	132	0.0045	1	48			20	38	64		96	96
06	060510-060520	Pipe	587	0.0021	1	36			26	56	102	59	31	90
06	060520-060530	Pipe	459	0.0101	1	48			48	100	182	70	144	215
06	060530-060540	Pipe	400	0.0101	1	48			59	126	231	68	144	212
06	060540-060550	Pipe	1480	0.0048	1	60			107	227	415	45	181	225
06	060550-060560	Pipe	674	0.0050	1	84			208	453	826	106	452	558
06	060560-060570	Pipe	662	0.0080	1	96			246	536	975	62	816	878
06	060570-060580	Pipe	648	0.0077	1	96			292	633	1154	75	801	876
06	060580-060590	Pipe	347	0.0077	1	96			353	763	1385	85	801	885
06	060590-060600	Pipe	255	0.0077	1	96			363	785	1430		801	801
06	060710-060540	Pipe	354	0.0057	1	36			10	22	40	67	50	117
06	060810-060540	Pipe	756	0.0020	1	36			5	12	24		30	30
06	060910-060920	Pipe	1572	0.0045	1	48			9	21	38		96	96
06	060920-060550	Pipe	650	0.0048	1	72			65	144	263	120	294	413
06	061010-061020	Roadway	216	0.0049					53	112	200	62		62
06	061110-061120	Pipe	269	0.0044	1	18			62	123	214		7	7
07	070010-070020	Pipe	178	0.0131	1	12			3	14	38		4	4
07	070020-070030	Natural Channel	520	0.0146	1				3	14	38		24	24
07	070030-070040	Roadway	177	0.0146					3	16	45	73		73
07	070040-070050	Improved Channel	878	0.0146	1		1.5	1.0	6	31	87		22	22
07	070050-070060	Improved Channel	872	0.0058	1		1.5	1.0	15	41	119		14	14

STP Papago Watershed Study

Existing System Design Flows and Capacities

SECTION					SIZE				DESIGN FLOW			SECTION CAPACITY		
Major Basin	ID	Type	Length (feet)	Slope	No.	Pipe Size (inches)	Box or Channel Depth (feet)	Box or Channel Base (feet)	Q2 (cfs)	Q10 (cfs)	Q100 (cfs)	Roadway (cfs)	Improved Section (cfs)	Total Capacity (cfs)
07	070060-070070	Improved Channel	726	0.0146	1		1.5	1.0	41	86	201		22	22
07	070070-070080	Roadway	964	0.0146					58	122	269	118		118
07	070080-070090	Roadway	667	0.0058					83	185	385	74		74
07	070090-070100	Roadway	942	0.0058					125	270	553	74		74
07	070100-070110	Roadway	492	0.0058					150	324	688	74		74
07	070110-070120	Roadway	713	0.0058					157	338	713	74		74
07	070210-070220	Pipe	164	0.0131	1	12			2	11	32		4	4
07	070220-070040	Roadway	723	0.0146					2	11	32	73		73
07	070310-070060	Improved Channel	745	0.0058	1		1.5	1.0	15	30	59		14	14
07	070410-070420	Roadway	183	0.0058					8	17	32	46		46
07	070420-070080	Roadway	1257	0.0058					10	21	40	52		52
07	070510-070090	Natural Channel	725	0.0146	1				35	70	139		24	24
07	070610-070620	Roadway	83	0.0146					3	15	42	118		118
07	070620-070100	Natural Channel	2833	0.0146	1				3	15	42		24	24
07	070710-070720	Roadway	89	0.0146					3	15	42	118		118
07	070720-070730	Natural Channel	3005	0.0146	1				3	15	42		24	24
07	070730-070740	Roadway	133	0.0058					33	66	152	74		74
07	070810-070820	Roadway	106	0.0058					10	20	39	74		74
07	070910-070920	Roadway	113	0.0058					23	46	93	74		74
07	071010-071020	Roadway	134	0.0146					3	15	44	118		118
07	071020-071030	Natural Channel	476	0.0146	1				3	15	44		24	24
07	071030-071040	Roadway	104	0.0058					6	21	61	74		74
21	210010-210020	Roadway	852	0.0020					15	36	71	27		27
21	210020-210030	Roadway	711	0.0032					19	51	114	34		34
21	210030-210040	Roadway	368	0.0032					88	215	445	34		34
21	210110-210120	Roadway	502	0.0020					9	19	35	27		27
21	210120-210030	Roadway	1181	0.0020					37	82	152	27		27
21	210210-210220	Roadway	723	0.0032					16	35	70	34		34
21	210220-210030	Roadway	719	0.0020					18	42	89	27		27
21	210310-210320	Improved Channel	191	0.0032	1		1.5	1.0	32	72	137		10	10