

Rio Verde Area Drainage Master Plan Floodplain Delineation FCD 2001C056

Volume 3 1-Dimensional Hydrology Technical Data Notebook

November 2007



Prepared by:

Dibble
Engineering™

In association with:



RIO VERDE AREA DRAINAGE MASTER PLAN
FLOODPLAIN DELINEATION
FCD Contract No.: 2001C056

1-DIMENSIONAL HYDROLOGY
TECHNICAL DATA NOTEBOOK

November 2007

Prepared for:



**FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY**

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Appendix B: General Documentation and Correspondence

Appendix D: Hydrologic Analysis Supporting Documentation

(Note: Appendices A, B, & D are bound separately).



SECTION 4.1

METHOD DESCRIPTION

4.1 METHOD DESCRIPTION

The hydrologic modeling of the study area is done using a combination of HEC-1 and FLO-2D methodology. The Piedmont Assessment results of the study area were used to identify the areas appropriate for one-dimensional (1D) and two-dimensional (2D) flow analysis. The geomorphologic evaluation indicates that the upper watershed areas with steeper slopes and more defined channels are modeled using one-dimensional analysis while the lower areas with unconfined channels and flatter slopes are modeled using the two-dimensional analysis. The flat slopes and poorly defined channels made it difficult to accurately model how flows were routed through the watershed without a 2D model. **FIGURE 4.1-1** shows the 1D and 2D modeling areas in the Rio Verde watershed.

The Rio Verde watershed is modeled using methodology set forth in the *Drainage Design Manual for Maricopa County, Arizona, Volume I – Hydrology* (“Drainage Manual”), prepared by the Engineering Division of the District dated January 1, 1995. There are three main basin areas modeled for the 100-year, 6-hour and the 100-year, 24-hour duration storms. The temporal rainfall distributions used were those suggested in the Drainage Manual for the 6-hour and 24-hour duration storms. The Phoenix Mountain S-Graph was used for unit hydrograph development. Rainfall losses were estimated using the Green and Ampt infiltration equation. Hydrographs were routed through the watershed using normal-depth channel routing. The flow diversion distribution at split flow locations were evaluated by backwater analysis using HEC-RAS. The evaluated energy grade line at the flow diversion location is the criterion used in apportioning the amount of flows for diversion.

The U.S. Army Corps of Engineer’s HEC-1 computer program (Version: 4.1, Release Date: July 1997) was used to evaluate the hydrology of the one-dimensional flow area, which is the upper watershed. The FLO-2D program (O’Brien, 2001), on the other hand, was used to evaluate the hydrology and flow hydraulics of the lower watershed. The The Drainage Design Management System for Windows (DDMSW) program (Version: 2.1.0, Release Date: September 9, 2002), a model development tool for HEC-1 developed by KVL Consultants for the Flood Control District of Maricopa County, was used to automate the evaluation of model parameters for various methodologies such as infiltration loss and unit hydrograph.

The original hydrology of the entire Rio Verde Study Area, which comprises 46.3 sq. miles of drainage area, is from three separate studies conducted in 1995, 2000, and 2001. The northern most watershed area, which comprised of 15.54 sq. miles and 96 sub-basins, was studied by Primatech in 2001. The middle section, which comprises 13.74 sq. miles and 55 sub-basins, was studied by David Evans & Associates in 2000. The southern portion of the study area, which comprises 17.0 sq. miles and 70 sub-basins, was studied in 1995 by McLaughlin & Kmetty Engineers, Ltd. The drainage boundaries of the three basin areas in the 1D modeling area are shown in FIGURE 4.1-2. The goal of the current study is to update the original hydrologic models from the three separate studies to reflect recent improvements and include hydraulic features that were not considered in earlier modeling efforts.

Three 1D hydrology models have been prepared and are referred to within as watershed area "North-North", "North-South", and "South". Two models were developed for the North-South drainage area to represent the impact of the existing stock tank on the watershed: *North-South Without Tank* and *North-South With Tank*. The *North-South Without Tank* is the effective model and the *North-South With Tank* is a secondary model prepared to determine what flows would discharge into the adjacent subbasin if the tank were to remain in place during a flood event.

It is from these updated models that existing and future condition models for the study area would be developed utilizing the 100-year flood events for 6-hour and 24-hour duration storms. Future Condition hydrology was developed for the planning portion of the overall study beyond the floodplain study. It is important to note that only the existing condition models were used for the floodplain delineation and the future hydrology is provided in the TDN to have a consistent location for all hydrology performed for the study.

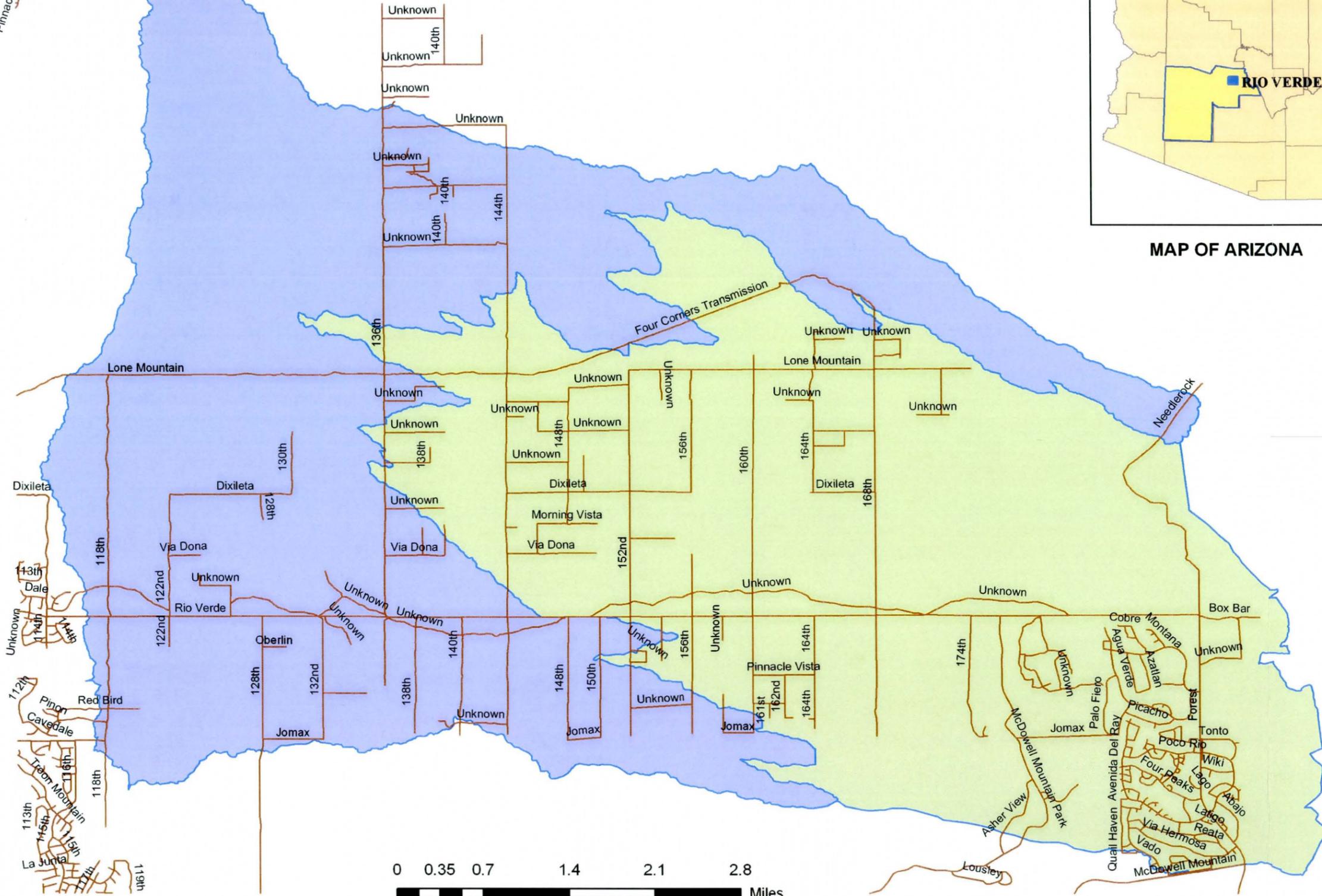
In summary, the objectives of the hydrologic tasks performed for the Rio Verde ADMP project are summarized as follows:

- (1) Update the original hydrology from the three studies to reflect improvements in the study area and to include hydraulic features not considered in earlier studies. The update includes re-delineation of existing drainage basins using the 2001 detailed topographic map and the 2002 aerial photograph of the study area. The

updated hydrology, however, only covers the 1D area identified from the Piedmont Assessment evaluation.

- (2) Develop the existing condition models for the 1D area for the 100-year, 24-hour duration storm and the 100-year, 6-hour duration storm events.
- (3) Develop the future condition models for the 1D area for the 100-year, 24-hour duration storm and the 100-year, 6-hour duration storm events for the purposes of the planning portion of the overall study beyond the floodplain delineation. The future conditions hydrology is provided in the TDN to have a consistent location for all hydrology performed for the study.

Pinnacle Peak Power Line



MAP OF ARIZONA



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LEGEND:

- Maricopa County
- Project Location
- Arizona Counties
- Major Streets

AreaID

- 1D Modeling Area
- 2D Modeling Area

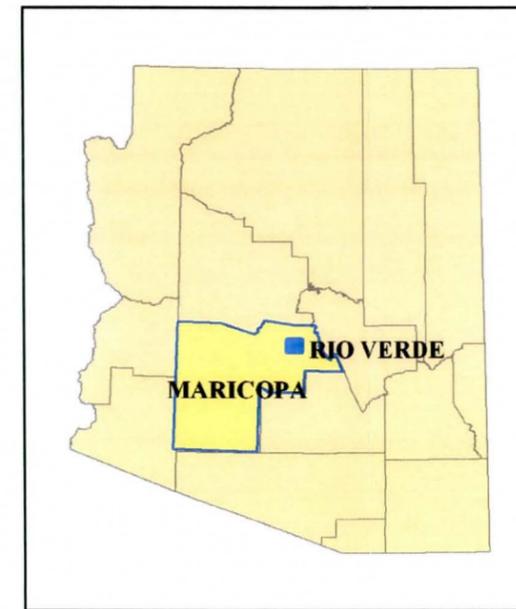
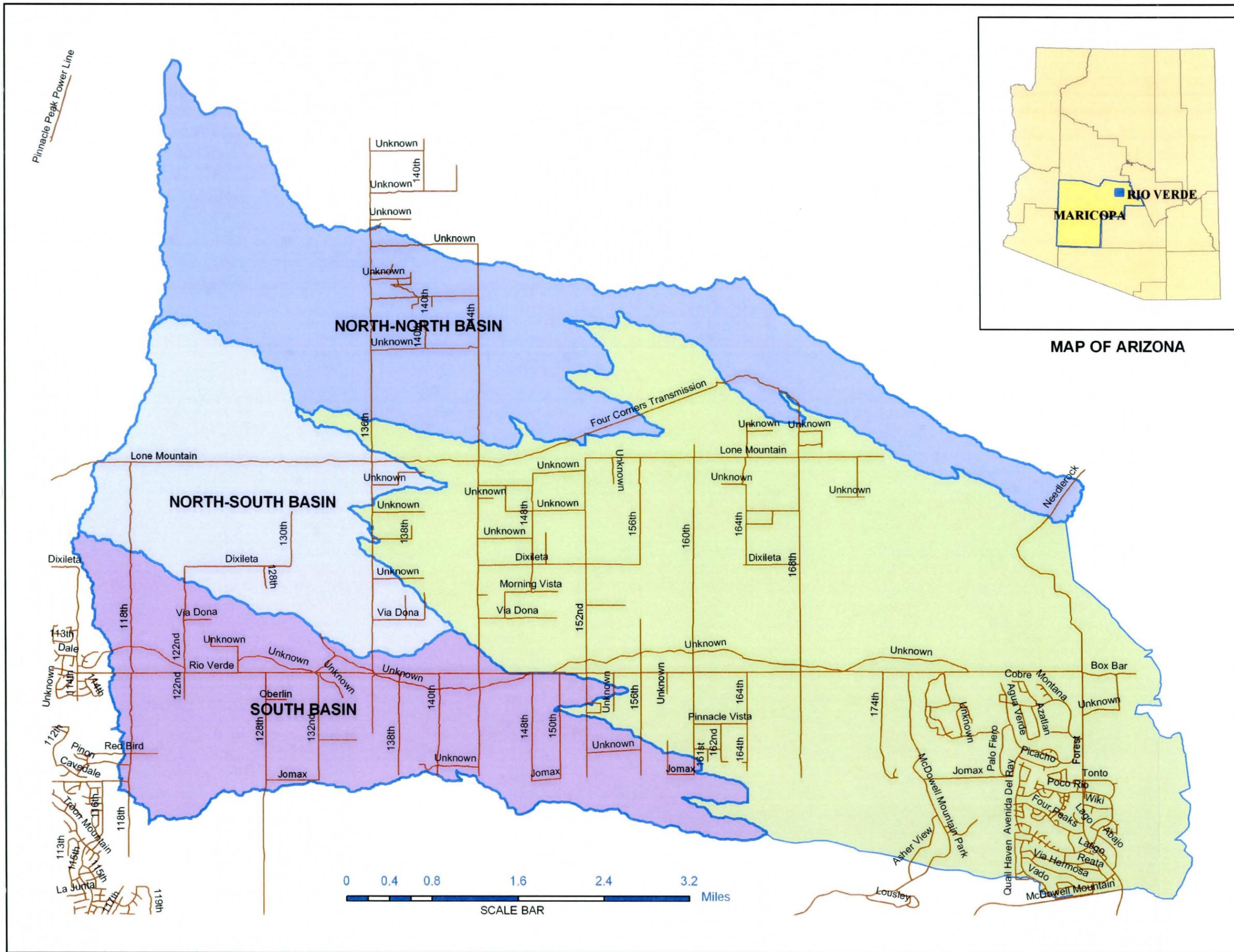


1 inch equals 4,500 feet

**THE RIO VERDE WATERSHED
SHOWING THE 1D AND 2D
MODELING AREAS**

FIGURE 4.1-1





MAP OF ARIZONA



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F.C.D. CONTRACT NO. 2001C056

LEGEND:

-  Major Streets
-  North-North Basin
-  North-South Basin
-  South Basin
-  Maricopa County



1 inch equals 4,500 feet

**THREE BASIN AREAS
(1D MODELING AREA)**

FIGURE 4.1-2



SECTION 4.2

PARAMETER ESTIMATION

4.2 PARAMETER ESTIMATION

The evaluation of hydrologic parameters for both the existing and future condition models are derived from three main data sets that include the drainage data, soils, and land use. The drainage data set includes drainage boundaries for the individual sub-basins, flow paths, basin centroids, Lca's, and flow concentration points. Using the same topographic data used in the delineation of the drainage boundaries, other hydrologic features could be identified such as split flows or flow diversions, and detention basins or storage tanks. The soils map, which describes the soil characteristics of the study area, provides information to estimate infiltration parameters such as hydraulic conductivity, wetting front capillary suction, and volumetric soil moisture deficit. These infiltration parameters are associated with the soil texture classification tied to the soil units identified in the soils map. The land use data set describes the areal extent of land use and site development that aid in assigning parameter values that describe surface retention loss, impervious characteristics, and the extent of vegetative cover.

4.2.1 Drainage Area Boundaries. The sub-basin boundaries for the three basins in the 1D area were delineated from the 2001 topographic data and 2002 aerial photograph of the watershed. The three basin areas are described as follows:

- (a) **North-North Basin.** FIGURE 4-2-1 shows the drainage area boundaries for the 54 sub-basins in the North-North drainage basin of the 1D modeling area. The map also shows the flow paths and the drainage outlets (or flow concentration points) for the individual sub-basins.
- (b) **North-South Basin.** FIGURE 4.2-2 shows the drainage area boundaries for the 30 sub-basins in the North-South drainage basin of the 1D modeling area. The map also shows the flow paths and the drainage outlets (or flow concentration points) for the individual sub-basins.
- (c) **South Basin.** FIGURE 4.2-3 shows the drainage area boundaries for the 36 sub-basins in the South drainage basin of the 1D modeling area. The map also shows the flow paths and the drainage outlets (or flow concentration points) for the individual sub-basins.

4.2.2 Watershed Work Maps. The 2002 aerial photo and the 2001 topographic map of the watershed were used as base maps for the project. In addition to delineating drainage boundaries for the three basin areas, these base maps have assisted in identifying drainage features such as split flows or flow diversions, and detention basins or storage tanks as part of the hydrologic elements modeled in the watershed. The same maps were used in the evaluation of drainage basin attributes such as flow path length, lag-flow length, and stream slope. For storage tanks, the maps were employed to define storage characteristics and establish discharge rating data for storage routing purposes. For channel routing, the same maps were used to extract eight-point cross-section information.

- (a) **Subbasin Boundaries and Concentration Points.** The naming convention used for the subbasins and flow concentration points in the three basin areas (shown in **FIGURES 4.2-1 4.2-2, and 4.2-3**) correlated with the naming conventions used in the original hydrologic models [McLaughlin & Kmetty Engineers, Ltd. (1995); David Evans & Associates (2000); and Primatch (2001)]. This was made to facilitate the comparison of basin area boundaries and attributes, and model performances between the updated and the original models. The evaluated subbasin data and attributes for the three basin areas are provided in Section 4.2.6.
- (b) **Time of Concentration or Lag Flow Paths.** The estimation of basin lag parameter for the unit hydrograph methodology utilizing the Phoenix Mountain S-graph employs various basin information evaluated for individual subbasins. This information includes the evaluated longest stream length within the subbasin area, L_{ca} , stream slope, and Manning's "n". The subbasin centroids as shown in **FIGURES 4.2-4, 4.2-5, and 4.2-6** are key to the evaluation of L_{ca} 's for each subbasin that serve as input data for the evaluation of unit hydrograph ordinates. The evaluated subbasin stream lengths, stream slopes, and L_{ca} 's for the three basin areas are provided in Section 4.2.6.
- (c) **Hydrograph Routing Paths.** The naming convention employed for hydrograph routing for the updated models is identical to the naming conventions used in the original models [McLaughlin & Kmetty Engineers, Ltd (1995); David Evans & Associates (2000); and Primatch (2001)]. This was made to facilitate model

comparison between the updated and the original models. The updated routing paths for the three basin areas are shown in **FIGURES 4.2-7, 4.2-8, and 4.2-9**. The hydrograph routing paths and associated routing section data are provided in Section 4.2.6.

(d) **Flow Diversions and Split Flows.** **FIGURES D.5.2, D.5.3, D.5.4, D.5.5, and D.5.6** show the cross-section stations used in the evaluation of the flow distribution for the five split flows in the South Basin. The analysis performed through the use of the U.S. Army Corps of Engineer's HEC-RAS program was made by developing a 5- to 6-station geometric model through which six or more discharges are used for the flow diversion distribution analysis. The approach requires that the evaluated energy grades at the split flow location for the OUTPUT and DIVERSION reaches are the same. The schematics of the hydraulic modeling for the split flow analysis is shown in **FIGURE D.5-1**.

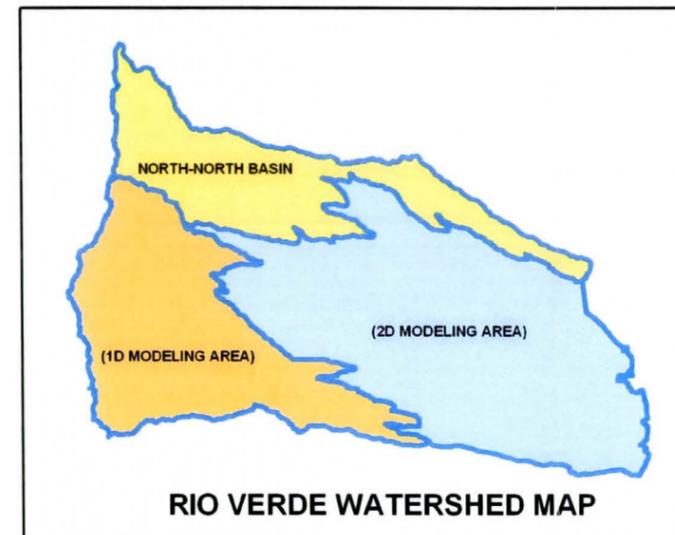
(e) **Soil Boundaries.** **FIGURES 4.2-10, 4.2-11, and 4.2-12** show the soil information for the three basins in the 1D modeling area. The soil information shown is used to develop existing and future condition HEC-1 models. Associated parameter values for the soil map units shown are listed in Section 4.2.6.

(f) **Land Use Boundaries.** – **FIGURES 4.2-13, 4.2-14, and 4.2-15** show the land use classifications of various land areas in the three basins for the existing condition. The maps shown reflect the modified land use classification to include recent developments in the project area as identified in the 2002 aerial photographs. Associated land use parameters for the existing condition are provided in Section 4.2.6.

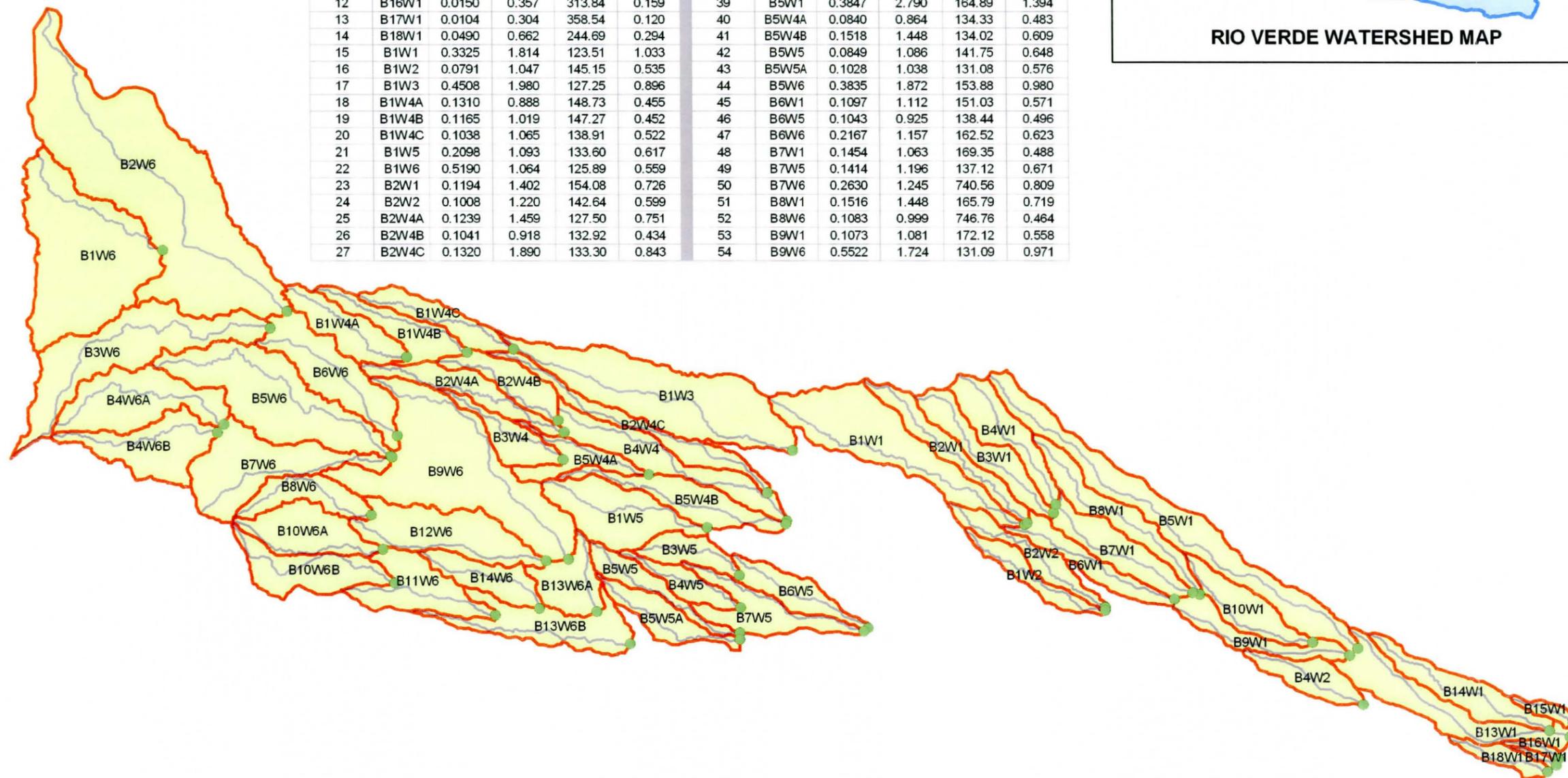
FIGURES 4.2-16, 4.2-17, and 4.2-18 show the land use classifications projected for the future developed conditions of the North-North, North-South, and South basin areas, respectively. Future condition land use assumes that all developable and undedicated areas are developed to their fullest extent converting all DESERT type to VLDR (or very low density residential). Associated land use parameters for the future conditions are provided in Section 4.2.6.



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NORTH-NORTH SUB-BASIN DATA											
No.	Sub-Basin ID	Area (sq.mi)	Flow Path Length (mi)	Slope (ft/mi)	Lca (mi)	No.	Sub-Basin ID	Area (sq.mi)	Flow Path Length (mi)	Slope (ft/mi)	Lca (mi)
1	B10W1	0.1219	1.001	191.86	0.501	28	B2W6	0.9575	2.492	156.48	1.197
2	B10W6A	0.1580	1.015	792.37	0.501	29	B3W1	0.1355	1.164	168.39	0.543
3	B10W6B	0.1643	1.213	681.15	0.584	30	B3W4	0.0937	0.914	135.60	0.370
4	B11W6	0.1633	0.936	149.51	0.482	31	B3W5	0.0798	0.684	152.02	0.379
5	B12W6	0.2287	1.211	151.98	0.606	32	B3W6	0.3610	2.128	290.40	1.075
6	B13W1	0.2100	1.522	189.19	0.863	33	B4W1	0.1427	0.986	156.14	0.560
7	B13W6A	0.1131	0.514	136.29	0.222	34	B4W2	0.0963	0.791	182.11	0.359
8	B13W6B	0.1914	1.361	135.23	0.511	35	B4W4	0.1919	1.592	123.14	0.881
9	B14W1	0.1435	1.280	204.68	0.584	36	B4W5	0.0709	0.841	149.88	0.381
10	B14W6	0.1066	0.840	145.23	0.385	37	B4W6A	0.2405	1.277	173.80	0.619
11	B15W1	0.0243	0.411	350.75	0.186	38	B4W6B	0.1890	1.120	208.95	0.459
12	B16W1	0.0150	0.357	313.84	0.159	39	B5W1	0.3847	2.790	164.89	1.394
13	B17W1	0.0104	0.304	358.54	0.120	40	B5W4A	0.0840	0.864	134.33	0.483
14	B18W1	0.0490	0.662	244.69	0.294	41	B5W4B	0.1518	1.448	134.02	0.609
15	B1W1	0.3325	1.814	123.51	1.033	42	B5W5	0.0849	1.086	141.75	0.648
16	B1W2	0.0791	1.047	145.15	0.535	43	B5W5A	0.1028	1.038	131.08	0.576
17	B1W3	0.4508	1.980	127.25	0.896	44	B5W6	0.3835	1.872	153.88	0.980
18	B1W4A	0.1310	0.888	148.73	0.455	45	B6W1	0.1097	1.112	151.03	0.571
19	B1W4B	0.1165	1.019	147.27	0.452	46	B6W5	0.1043	0.925	138.44	0.496
20	B1W4C	0.1038	1.065	138.91	0.522	47	B6W6	0.2167	1.157	162.52	0.623
21	B1W5	0.2098	1.093	133.60	0.617	48	B7W1	0.1454	1.063	169.35	0.488
22	B1W6	0.5190	1.064	125.89	0.559	49	B7W5	0.1414	1.196	137.12	0.671
23	B2W1	0.1194	1.402	154.08	0.726	50	B7W6	0.2630	1.245	740.56	0.809
24	B2W2	0.1008	1.220	142.64	0.599	51	B8W1	0.1516	1.448	165.79	0.719
25	B2W4A	0.1239	1.459	127.50	0.751	52	B8W6	0.1083	0.999	746.76	0.464
26	B2W4B	0.1041	0.918	132.92	0.434	53	B9W1	0.1073	1.081	172.12	0.558
27	B2W4C	0.1320	1.890	133.30	0.843	54	B9W6	0.5522	1.724	131.09	0.971



LEGEND:

- Concentration Points
- Flow Paths
- Subbasins
- North-North Basin
- 1D Modeling Area
- 2D Modeling Area



1 inch equals 3,500 feet

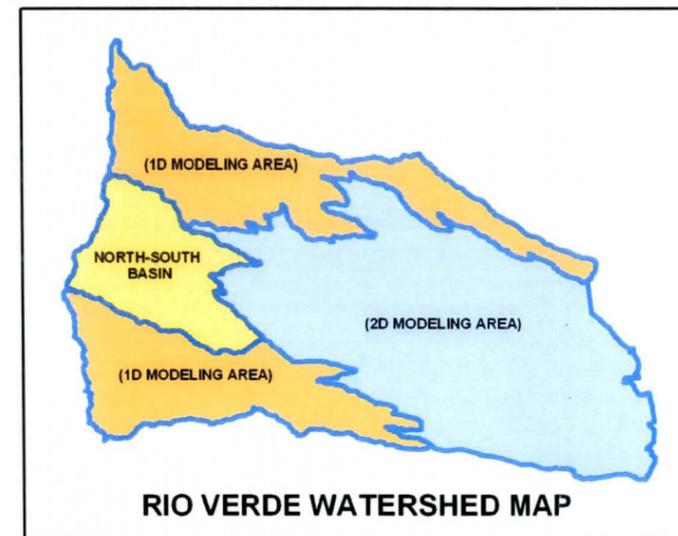
NORTH-NORTH SUBBASIN BOUNDARIES

FIGURE 4.2-1

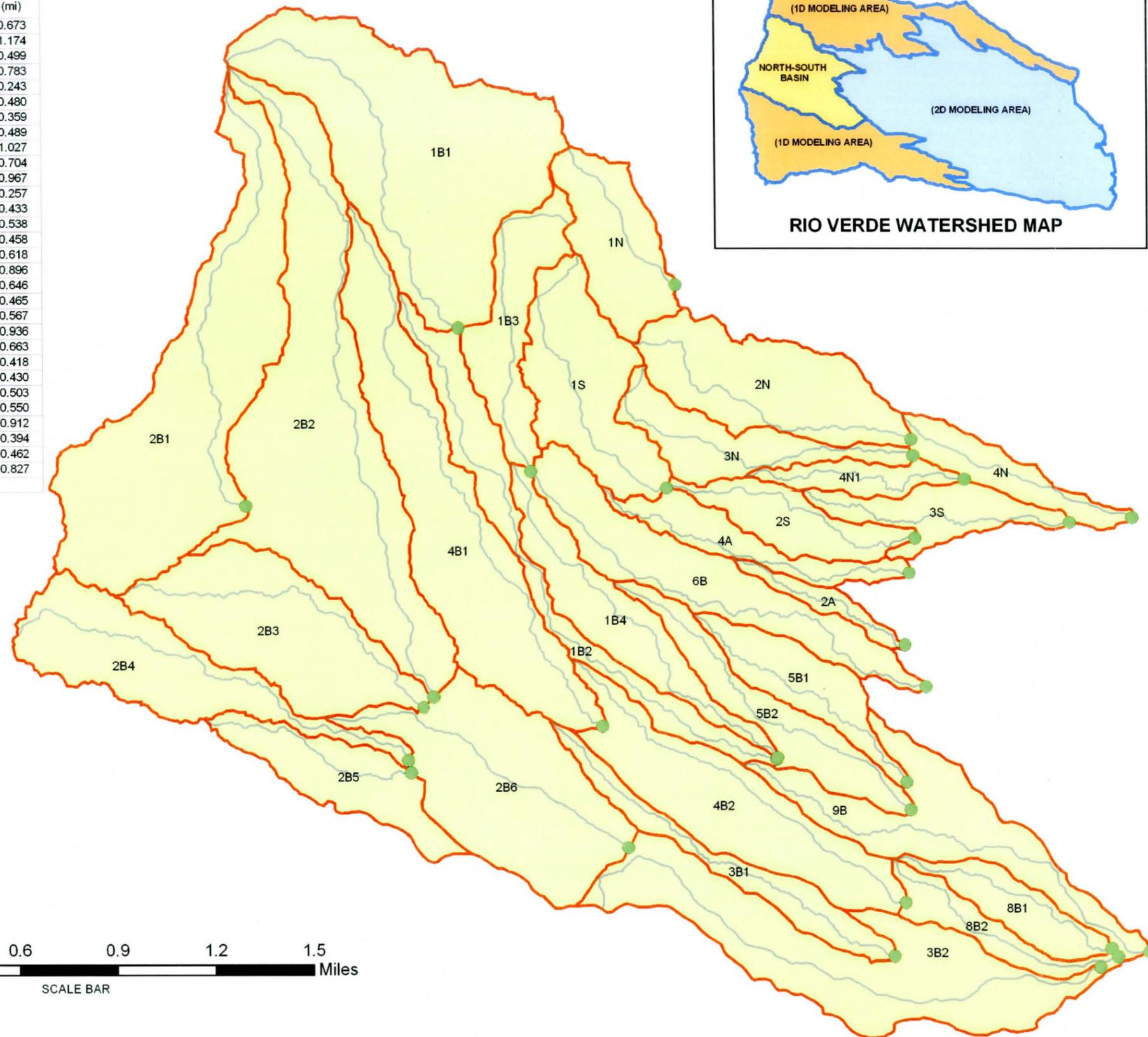




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NORTH-SOUTH SUB-BASIN DATA					
No.	Sub-Basin ID	Area (sq.mi.)	Flow Path Length (mi)	Slope (ft/mile)	Lca (mi)
1	1B1	0.4935	1.4120	426.35	0.673
2	1B2	0.1607	2.1547	135.23	1.174
3	1B3	0.1294	1.0486	463.46	0.499
4	1B4	0.1411	1.4078	125.02	0.783
5	1N	0.1311	0.5826	1314.78	0.243
6	1S	0.1877	1.0165	515.51	0.480
7	2A	0.0309	0.6997	114.33	0.359
8	2B1	0.4717	1.5827	393.01	0.489
9	2B2	0.5328	2.2758	319.73	1.027
10	2B3	0.2590	1.2018	113.16	0.704
11	2B4	0.2117	1.4945	117.76	0.967
12	2B5	0.1247	0.7627	133.73	0.257
13	2B6	0.3077	1.1038	78.14	0.433
14	2N	0.2046	1.0995	345.61	0.538
15	2S	0.0921	0.9147	133.38	0.458
16	3B1	0.0983	1.4035	111.59	0.618
17	3B2	0.3416	1.9021	172.57	0.896
18	3N	0.1103	1.1666	392.60	0.646
19	3S	0.0871	0.9543	138.32	0.465
20	4A	0.0818	1.1219	133.70	0.567
21	4B1	0.3682	2.0183	125.85	0.936
22	4B2	0.2400	1.3594	117.70	0.663
23	4N	0.0741	0.8149	137.44	0.418
24	4N1	0.0499	0.8169	129.03	0.430
25	5B1	0.0994	0.9583	123.14	0.503
26	5B2	0.1245	1.2627	125.13	0.550
27	6B	0.2037	1.6136	123.95	0.912
28	8B1	0.0763	0.8255	123.56	0.394
29	8B2	0.0641	0.8611	127.59	0.462
30	9B	0.1998	1.5765	113.84	0.827



LEGEND:

- Concentration Points
- Flow Paths
- Subbasins
- North-South Basin
- 1D Modeling Area
- 2D Modeling Area



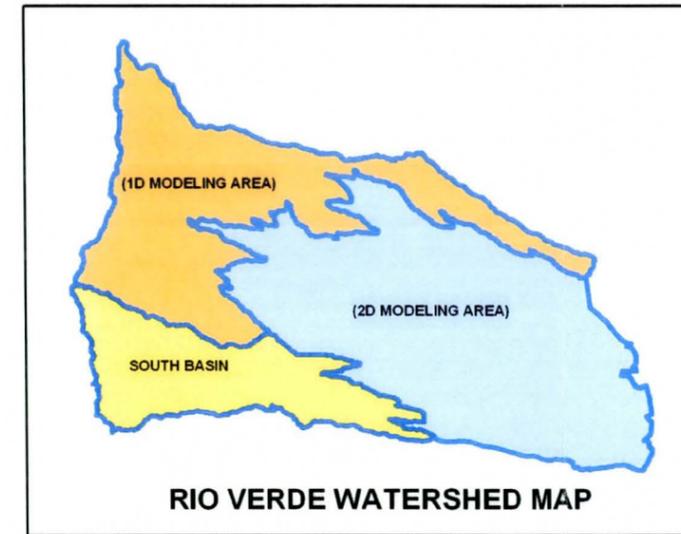
1 inch equals 1,800 feet

**NORTH-SOUTH
SUBBASIN BOUNDARIES**

FIGURE 4.2-2



SOUTH SUB-BASIN DATA											
No.	Sub-Basin ID	Area	Flow Path Length	Slope	Lca	No.	Sub-Basin ID	Area	Flow Path Length	Slope	Lca
		(sq.mi)	(mi)	(ft/mi)	(mi)			(sq.mi)	(mi)	(ft/mi)	(mi)
1	500A	0.2041	1.1157	124.58	0.5306	19	511C1	0.3291	1.4737	101.78	0.8594
2	500B	0.1924	1.8112	118.71	0.8291	20	511C2	0.3923	1.7593	102.88	0.9492
3	509A1	0.1926	1.4185	121.26	0.6897	21	511C3	0.1414	1.0161	125.98	0.5047
4	509A2	0.1279	1.2821	130.25	0.6282	22	511C4	0.0200	0.3455	141.84	0.1818
5	509A3	0.1621	1.0731	123.01	0.4765	23	511C5	0.1105	0.8606	130.38	0.3935
6	509A4	0.0619	0.4930	105.49	0.2314	24	511C6	0.0349	0.5922	99.62	0.3036
7	509A5	0.0204	0.4170	107.19	0.1821	25	511C7	0.1211	1.2201	120.48	0.5104
8	509A6	0.0321	0.3687	94.37	0.1942	26	511C8	0.0406	0.3768	122.07	0.1988
9	509B	0.6540	3.5765	123.02	1.5879	27	511D	0.1210	1.1731	152.59	0.5384
10	509D	0.3824	2.6554	126.16	1.0363	28	511E1	0.2963	1.6118	147.66	0.8400
11	510A	0.9233	3.0034	112.87	1.5307	29	511E2	0.2760	1.6283	117.79	0.8708
12	511A1	0.2940	1.4047	128.50	0.7194	30	511F	0.1573	0.9353	114.08	0.3978
13	511A2	0.0587	0.6564	123.40	0.3030	31	511G1	0.3102	1.0731	276.58	0.5634
14	511A3	0.2942	1.2344	93.97	0.6424	32	511G2	0.1573	0.9850	105.59	0.5243
15	511B1	0.5828	2.0693	107.77	1.0666	33	511G3	0.0967	1.0645	105.21	0.4574
16	511B2	0.2221	1.6372	120.33	0.7832	34	511G4	0.2984	1.3941	121.94	0.7692
17	511B3	0.0796	0.7288	116.62	0.4030	35	511H	0.3029	1.3558	102.52	0.7830
18	511B4	0.1942	1.2047	431.66	0.6005	36	511I	0.1980	1.1046	123.84	0.6190



RIO VERDE ADMP
F.C.D. CONTRACT NO. 2001C056

LEGEND:

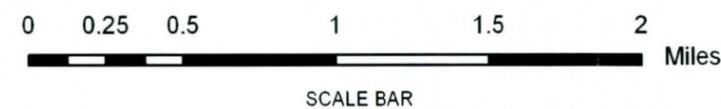
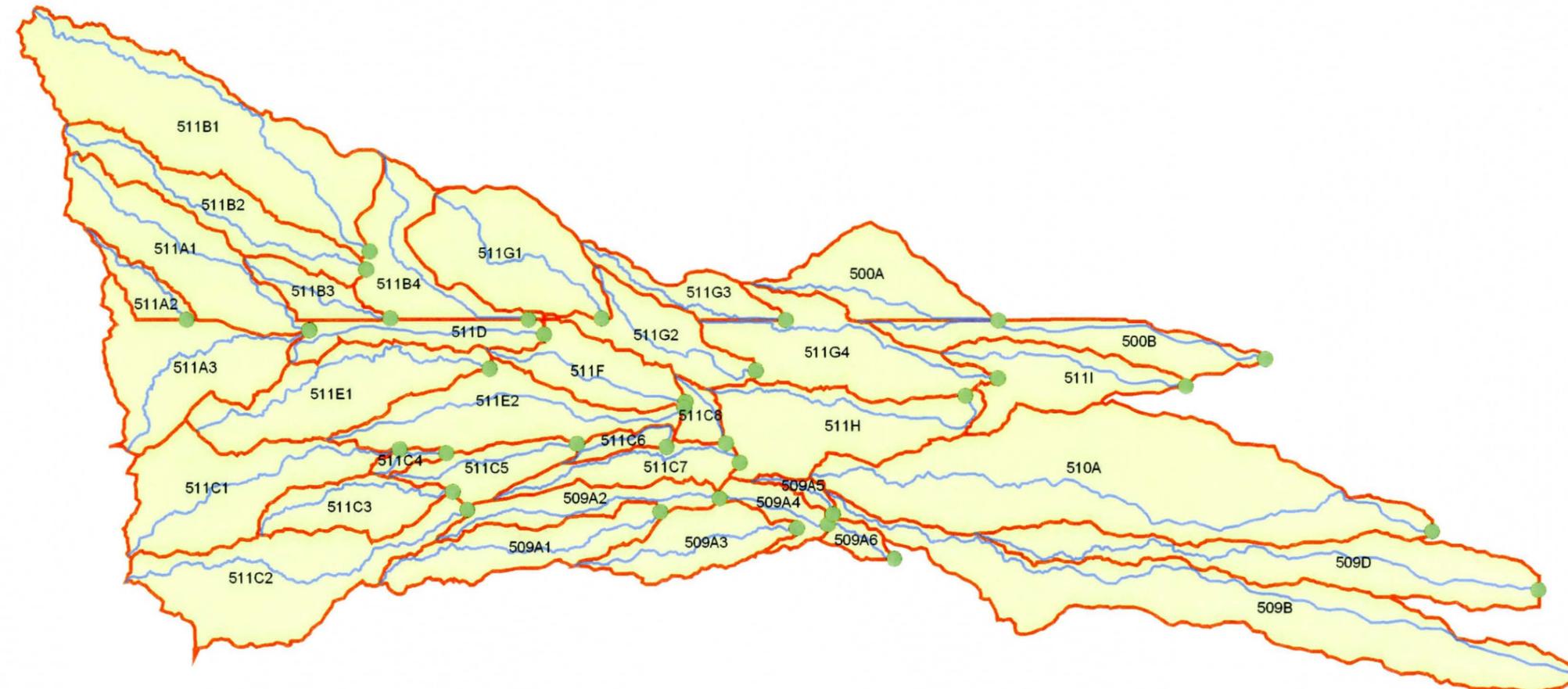
- Concentration Points
- Flow Paths
- Subbasins
- South Basin
- 1D Modeling Area
- 2D Modeling Area



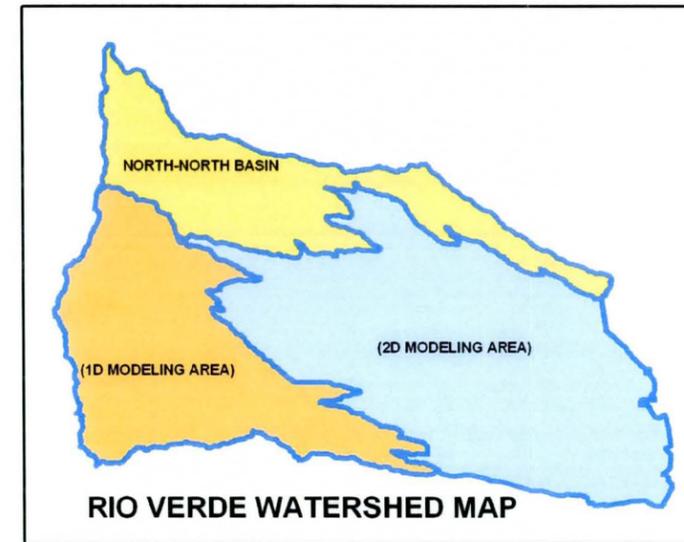
1 inch equals 3,000 feet

SOUTH SUBBASIN BOUNDARIES

FIGURE 4.2-3



NORTH-NORTH SUB-BASIN DATA											
No.	Sub-Basin ID	Area	Flow Path Length	Slope	Lca	No.	Sub-Basin ID	Area	Flow Path Length	Slope	Lca
		(sq.mi)	(mi)	(ft/mi)	(mi)			(sq.mi)	(mi)	(ft/mi)	(mi)
1	B10W1	0.1219	1.001	191.86	0.501	28	B2W6	0.9575	2.492	156.48	1.197
2	B10W6A	0.1580	1.015	792.37	0.501	29	B3W1	0.1355	1.164	168.39	0.543
3	B10W6B	0.1643	1.213	681.15	0.584	30	B3W4	0.0937	0.914	135.60	0.370
4	B11W6	0.1633	0.936	149.51	0.482	31	B3W5	0.0798	0.684	152.02	0.379
5	B12W6	0.2287	1.211	151.98	0.606	32	B3W6	0.3610	2.128	290.40	1.075
6	B13W1	0.2100	1.522	189.19	0.863	33	B4W1	0.1427	0.986	156.14	0.560
7	B13W6A	0.1131	0.514	136.29	0.222	34	B4W2	0.0963	0.791	182.11	0.359
8	B13W6B	0.1914	1.361	135.23	0.511	35	B4W4	0.1919	1.592	123.14	0.881
9	B14W1	0.1435	1.280	204.68	0.584	36	B4W5	0.0709	0.841	149.88	0.381
10	B14W6	0.1066	0.840	145.23	0.385	37	B4W6A	0.2405	1.277	173.80	0.619
11	B15W1	0.0243	0.411	350.75	0.186	38	B4W6B	0.1890	1.120	208.95	0.459
12	B16W1	0.0150	0.357	313.84	0.159	39	B5W1	0.3847	2.790	164.89	1.394
13	B17W1	0.0104	0.304	358.54	0.120	40	B5W4A	0.0840	0.864	134.33	0.483
14	B18W1	0.0490	0.662	244.69	0.294	41	B5W4B	0.1518	1.448	134.02	0.609
15	B1W1	0.3325	1.814	123.51	1.033	42	B5W5	0.0849	1.086	141.75	0.648
16	B1W2	0.0791	1.047	145.15	0.535	43	B5W5A	0.1028	1.038	131.08	0.576
17	B1W3	0.4508	1.980	127.25	0.896	44	B5W6	0.3835	1.872	153.88	0.980
18	B1W4A	0.1310	0.888	148.73	0.455	45	B6W1	0.1097	1.112	151.03	0.571
19	B1W4B	0.1165	1.019	147.27	0.452	46	B6W5	0.1043	0.925	138.44	0.496
20	B1W4C	0.1038	1.065	138.91	0.522	47	B6W6	0.2167	1.157	162.52	0.623
21	B1W5	0.2098	1.093	133.60	0.617	48	B7W1	0.1454	1.063	169.35	0.488
22	B1W6	0.5190	1.064	125.89	0.559	49	B7W5	0.1414	1.196	137.12	0.671
23	B2W1	0.1194	1.402	154.08	0.726	50	B7W6	0.2630	1.245	740.56	0.809
24	B2W2	0.1008	1.220	142.64	0.599	51	B8W1	0.1516	1.448	165.79	0.719
25	B2W4A	0.1239	1.459	127.50	0.751	52	B8W6	0.1083	0.999	746.76	0.464
26	B2W4B	0.1041	0.918	132.92	0.434	53	B9W1	0.1073	1.081	172.12	0.558
27	B2W4C	0.1320	1.890	133.30	0.843	54	B9W6	0.5522	1.724	131.09	0.971



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F.C.D. CONTRACT NO. 2001C056

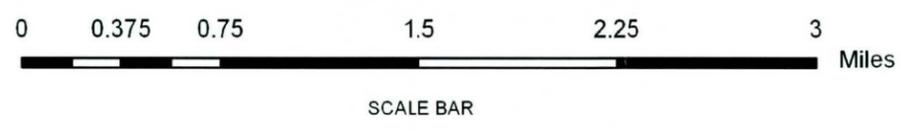
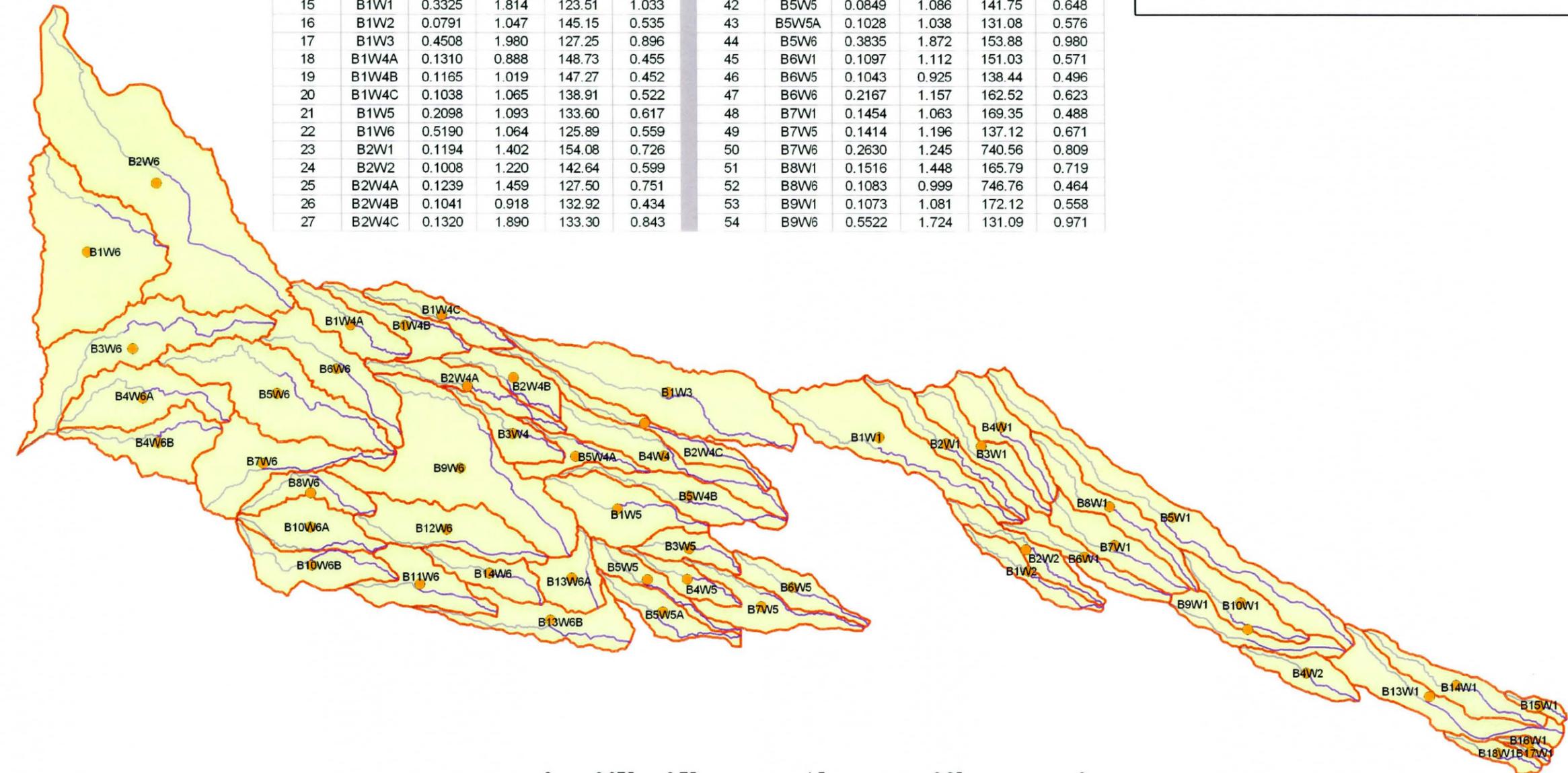
- LEGEND:**
- Centroids
 - Lca
 - Subbasins
 - North-North Basin
 - 1D Modeling Area
 - 2D Modeling Area



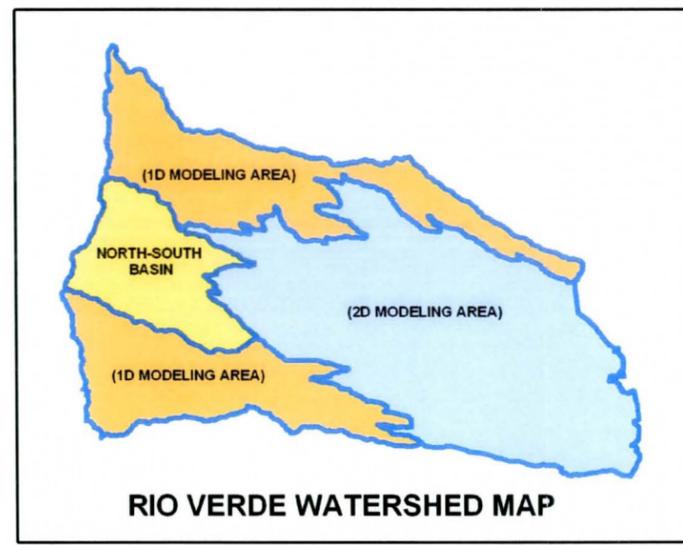
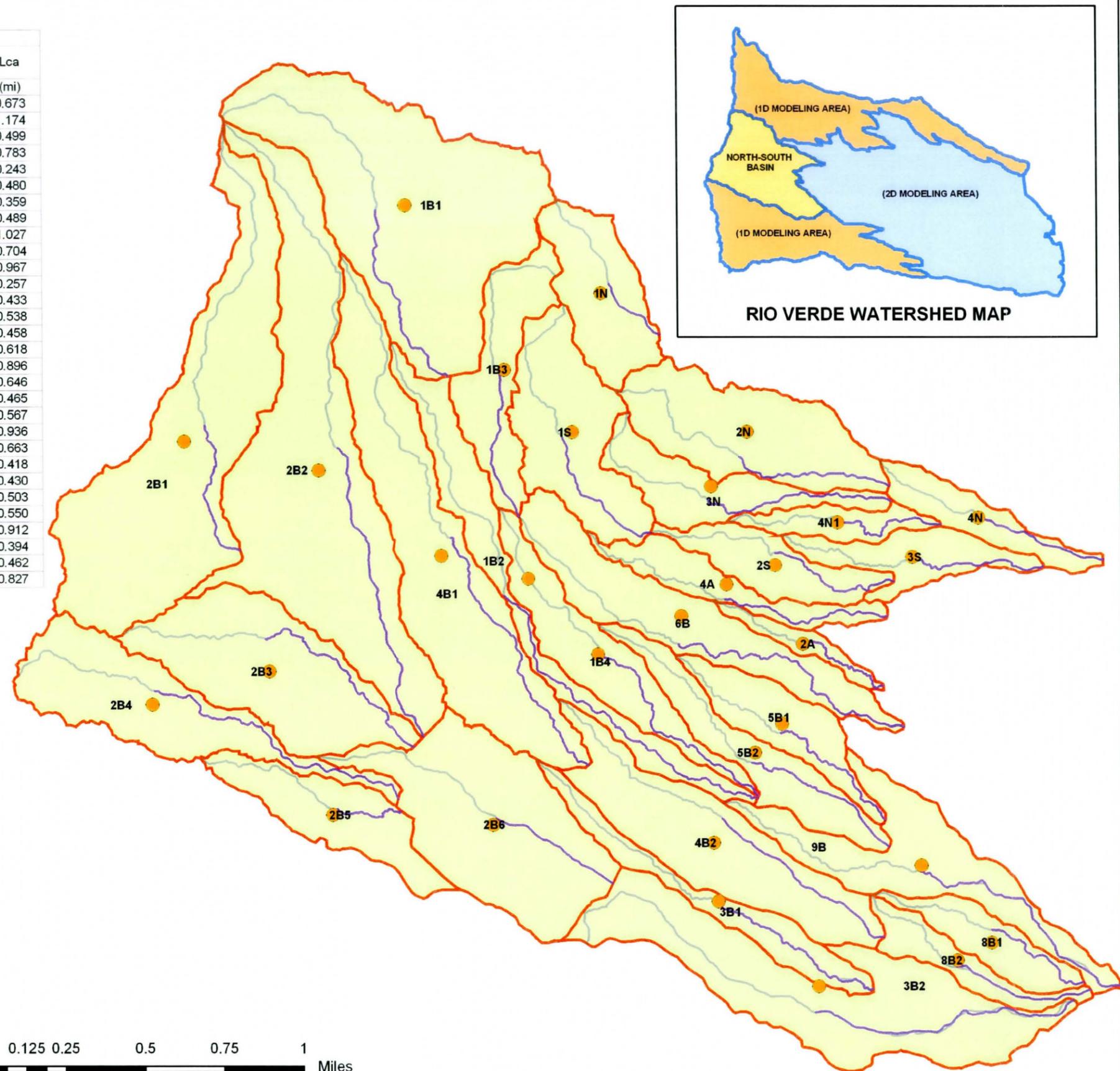
1 inch equals 3,500 feet

NORTH-NORTH SUBBASIN CENTROIDS AND LCA'S

FIGURE 4.2-4



NORTH-SOUTH SUB-BASIN DATA					
No.	Sub-Basin ID	Area (sq.mi.)	Flow Path Length (mi)	Slope (ft/mile)	Lca (mi)
1	1B1	0.4935	1.4120	426.35	0.673
2	1B2	0.1607	2.1547	135.23	1.174
3	1B3	0.1294	1.0486	463.46	0.499
4	1B4	0.1411	1.4078	125.02	0.783
5	1N	0.1311	0.5826	1314.78	0.243
6	1S	0.1877	1.0165	515.51	0.480
7	2A	0.0309	0.6997	114.33	0.359
8	2B1	0.4717	1.5827	393.01	0.489
9	2B2	0.5328	2.2758	319.73	1.027
10	2B3	0.2590	1.2018	113.16	0.704
11	2B4	0.2117	1.4945	117.76	0.967
12	2B5	0.1247	0.7627	133.73	0.257
13	2B6	0.3077	1.1038	78.14	0.433
14	2N	0.2046	1.0995	345.61	0.538
15	2S	0.0921	0.9147	133.38	0.458
16	3B1	0.0983	1.4035	111.59	0.618
17	3B2	0.3416	1.9021	172.57	0.896
18	3N	0.1103	1.1666	392.60	0.646
19	3S	0.0871	0.9543	138.32	0.465
20	4A	0.0818	1.1219	133.70	0.567
21	4B1	0.3682	2.0183	125.85	0.936
22	4B2	0.2400	1.3594	117.70	0.663
23	4N	0.0741	0.8149	137.44	0.418
24	4N1	0.0499	0.8169	129.03	0.430
25	5B1	0.0994	0.9583	123.14	0.503
26	5B2	0.1245	1.2627	125.13	0.550
27	6B	0.2037	1.6136	123.95	0.912
28	8B1	0.0763	0.8255	123.56	0.394
29	8B2	0.0641	0.8611	127.59	0.462
30	9B	0.1998	1.5765	113.84	0.827



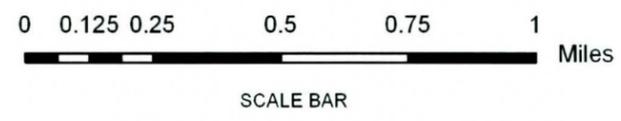
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F.C.D. CONTRACT NO. 2001C056

- LEGEND:**
- Centroids
 - Lca's
 - Flow Paths
 - Subbasins
 - North-South Basin
 - 1D Modeling Area
 - 2D Modeling Area

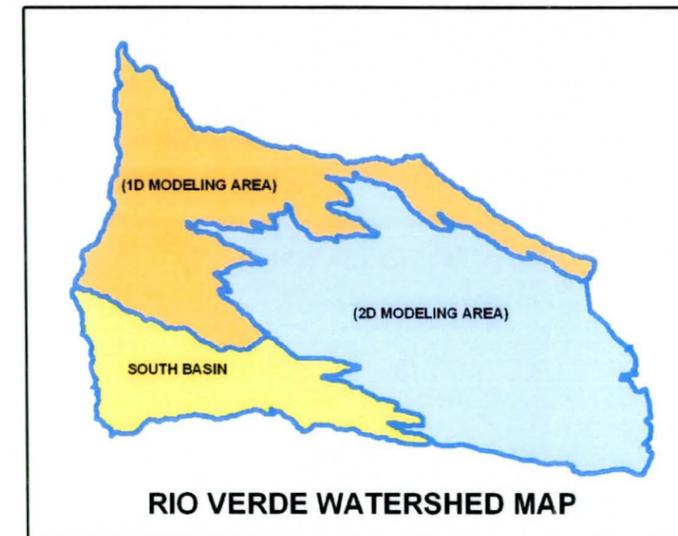


1 inch equals 1,800 feet

**NORTH-SOUTH SUBBASIN
CENTROIDS AND LCA'S**
FIGURE 4.2-5



SOUTH SUB-BASIN DATA											
No.	Sub-Basin ID	Area	Flow Path Length	Slope	Lca	No.	Sub-Basin ID	Area	Flow Path Length	Slope	Lca
		(sq.mi)	(mi)	(ft/mi)	(mi)			(sq.mi)	(mi)	(ft/mi)	(mi)
1	500A	0.2041	1.1157	124.58	0.5306	19	511C1	0.3291	1.4737	101.78	0.8594
2	500B	0.1924	1.8112	118.71	0.8291	20	511C2	0.3923	1.7593	102.88	0.9492
3	509A1	0.1926	1.4185	121.26	0.6897	21	511C3	0.1414	1.0161	125.98	0.5047
4	509A2	0.1279	1.2821	130.25	0.6282	22	511C4	0.0200	0.3455	141.84	0.1818
5	509A3	0.1621	1.0731	123.01	0.4765	23	511C5	0.1105	0.8606	130.38	0.3935
6	509A4	0.0619	0.4930	105.49	0.2314	24	511C6	0.0349	0.5922	99.62	0.3036
7	509A5	0.0204	0.4170	107.19	0.1821	25	511C7	0.1211	1.2201	120.48	0.5104
8	509A6	0.0321	0.3687	94.37	0.1942	26	511C8	0.0406	0.3768	122.07	0.1988
9	509B	0.6540	3.5765	123.02	1.5879	27	511D	0.1210	1.1731	152.59	0.5384
10	509D	0.3824	2.6554	126.16	1.0363	28	511E1	0.2963	1.6118	147.66	0.8400
11	510A	0.9233	3.0034	112.87	1.5307	29	511E2	0.2760	1.6283	117.79	0.8708
12	511A1	0.2940	1.4047	128.50	0.7194	30	511F	0.1573	0.9353	114.08	0.3978
13	511A2	0.0587	0.6564	123.40	0.3030	31	511G1	0.3102	1.0731	276.58	0.5634
14	511A3	0.2942	1.2344	93.97	0.6424	32	511G2	0.1573	0.9850	105.59	0.5243
15	511B1	0.5828	2.0693	107.77	1.0666	33	511G3	0.0967	1.0645	105.21	0.4574
16	511B2	0.2221	1.6372	120.33	0.7832	34	511G4	0.2984	1.3941	121.94	0.7692
17	511B3	0.0796	0.7288	116.62	0.4030	35	511H	0.3029	1.3558	102.52	0.7830
18	511B4	0.1942	1.2047	431.66	0.6005	36	511I	0.1980	1.1046	123.84	0.6190



RIO VERDE ADMP
F.C.D. CONTRACT NO. 2001C056

LEGEND:

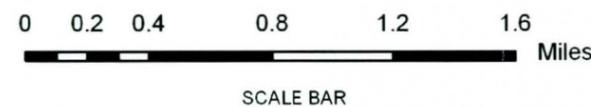
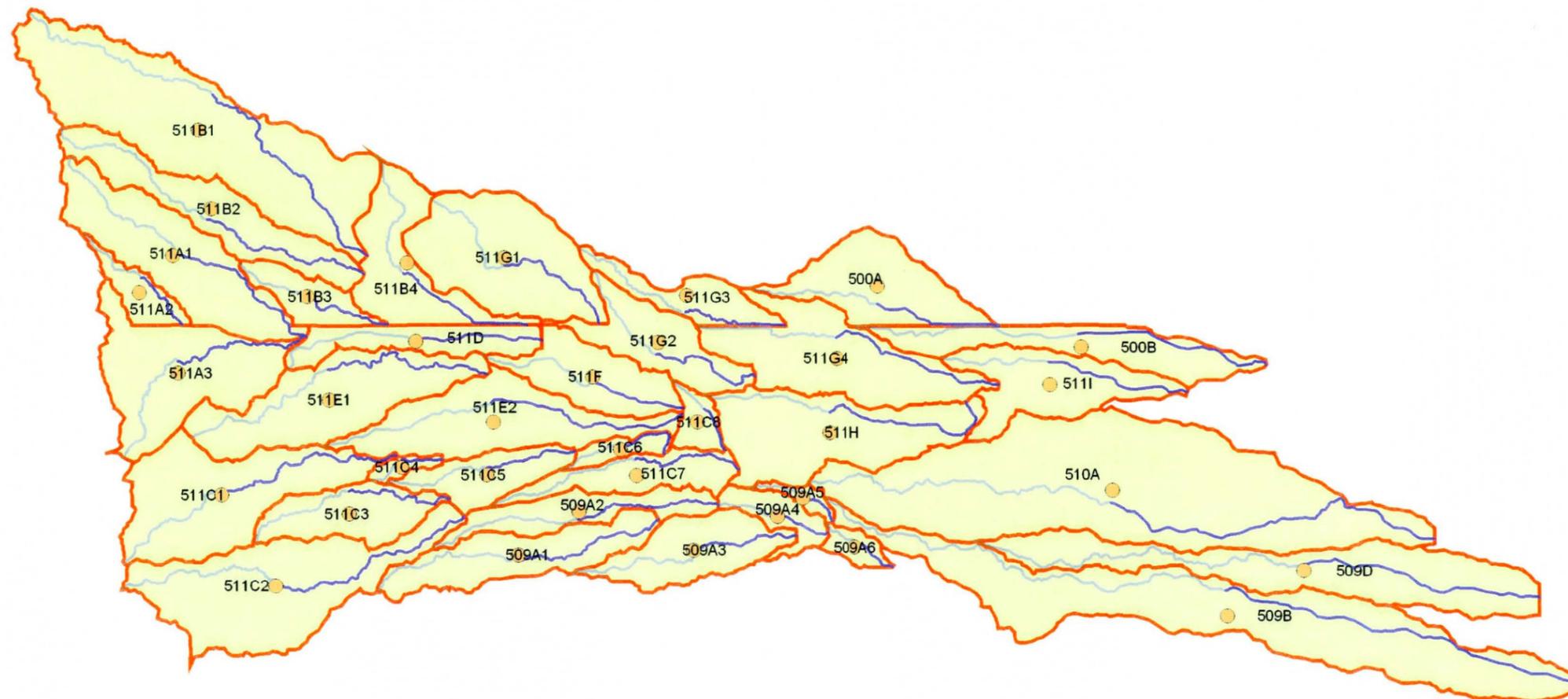
- Centroids
- Lca's
- Subbasins
- South Basin
- 1D Modeling Area
- 2D Modeling Area



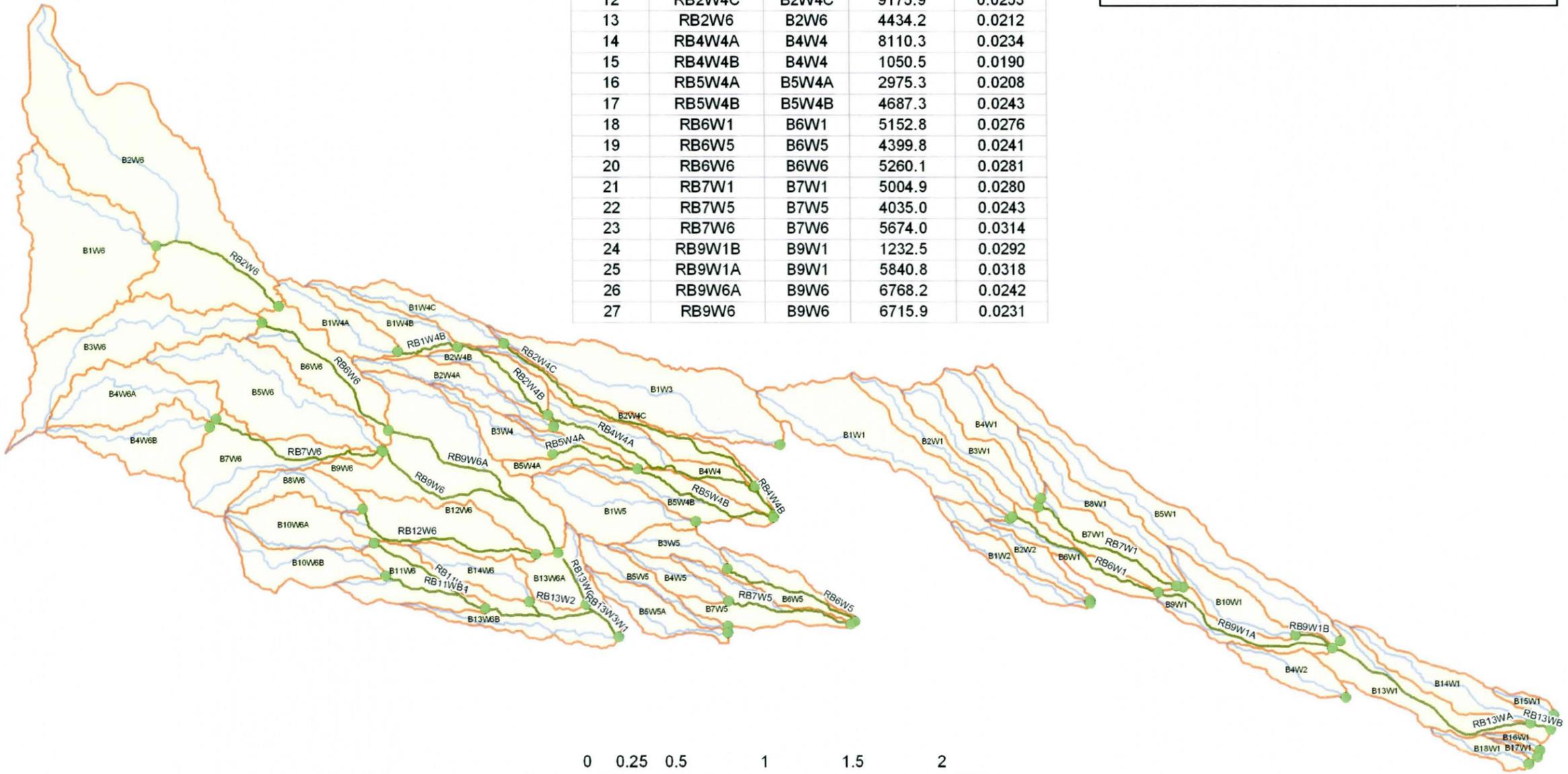
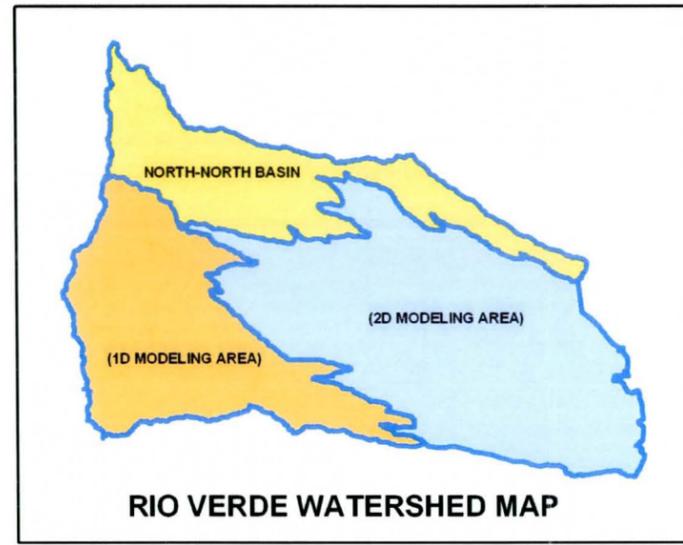
1 inch equals 3,000 feet

SOUTH SUBBASIN CENTROIDS AND LCA'S

FIGURE 4.2-6



ROUTING REACH DATA				
NORTH-NORTH BASIN				
No.	Route ID	Sub-Basin	Length (ft)	Slope (ft/ft)
1	RB11WB	B11W6	3284.3	0.0253
2	RB11WA	B11W6	3975.5	0.0262
3	RB12W6	B12W6	5915.9	0.0267
4	RB13WB	B13W1	641.4	0.0281
5	RB13WA	B13W1	7423.5	0.0353
6	RB13WC	B13W6A	1543.7	0.0194
7	RB13W3	B13W6B	1405.1	0.0199
8	RB13W2	B13W6B	3279.0	0.0217
9	RB13W1	B13W6B	4527.6	0.0239
10	RB1W4B	B1W4B	2065.8	0.0213
11	RB2W4B	B2W4B	3686.4	0.0255
12	RB2W4C	B2W4C	9175.9	0.0253
13	RB2W6	B2W6	4434.2	0.0212
14	RB4W4A	B4W4	8110.3	0.0234
15	RB4W4B	B4W4	1050.5	0.0190
16	RB5W4A	B5W4A	2975.3	0.0208
17	RB5W4B	B5W4B	4687.3	0.0243
18	RB6W1	B6W1	5152.8	0.0276
19	RB6W5	B6W5	4399.8	0.0241
20	RB6W6	B6W6	5260.1	0.0281
21	RB7W1	B7W1	5004.9	0.0280
22	RB7W5	B7W5	4035.0	0.0243
23	RB7W6	B7W6	5674.0	0.0314
24	RB9W1B	B9W1	1232.5	0.0292
25	RB9W1A	B9W1	5840.8	0.0318
26	RB9W6A	B9W6	6768.2	0.0242
27	RB9W6	B9W6	6715.9	0.0231



RIO VERDE ADMP
F.C.D. CONTRACT NO. 2001C056

- LEGEND:**
- Concentration Points
 - Routing Reaches
 - Flow Paths
 - Subbasins
 - North-North Basin
 - 1D Modeling Area
 - 2D Modeling Area



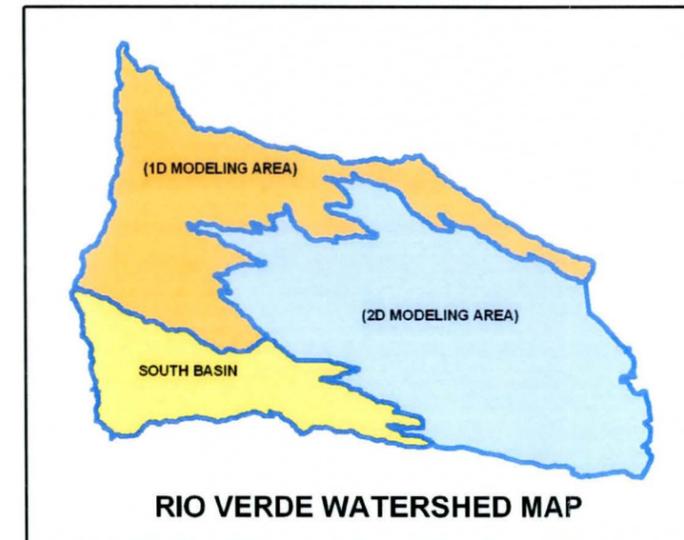
1 inch equals 3,500 feet

NORTH-NORTH ROUTING PATHS

FIGURE 4.2-7



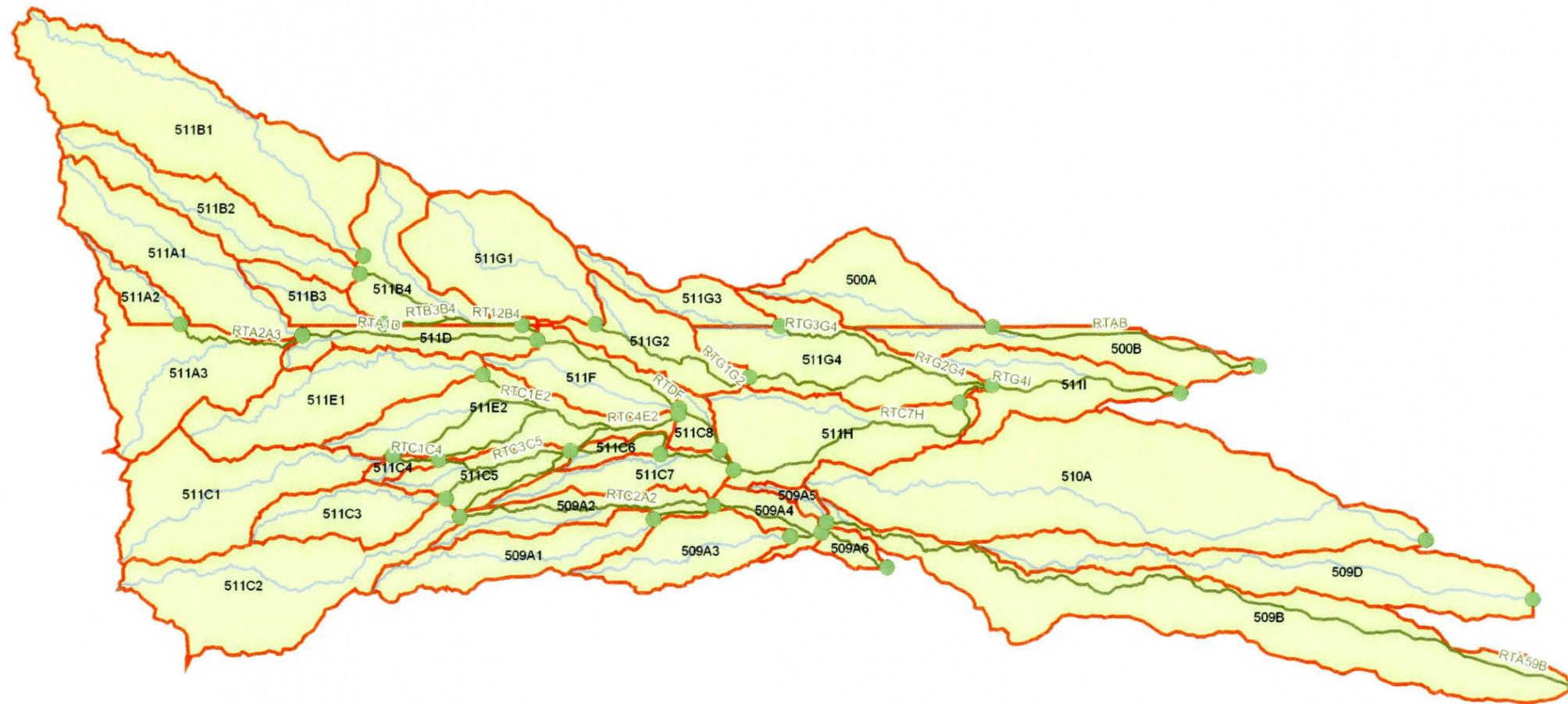
ROUTING REACH DATA									
SOUTH BASIN									
NO	Route ID	Sub-Basin ID	Length (ft)	Slope (ft/ft)	NO	Route ID	Sub-Basin ID	Length (ft)	Slope (ft/ft)
1	RT12B4	511B4	3972.9	0.01863	17	RTC4C5	511C5	3181.7	0.02357
2	RTA1A2	509A2	1427.4	0.02340	18	RTC4E2	511E2	6075.4	0.02140
3	RTA1D	511D	5357.9	0.01857	19	RTC5C6	511C6	2643.7	0.01551
4	RTA2A3	511A3	3286.0	0.01582	20	RTC5E2	511E2	2668.4	0.02174
5	RTA2A4	509A4	2603.8	0.03841	21	RTC6C7	511C7	1800.8	0.02332
6	RTA3A4	509A4	717.0	0.01674	22	RTC7H	511H	6347.6	0.01764
7	RTA4A6	509A6	1777.8	0.01845	23	RTC8C7	511C7	547.2	0.01553
8	RTA59B	509B	18484.1	0.02326	24	RTDF	511F	3664.2	0.01910
9	RTAB	500B	6186.8	0.02829	25	RTE1E2	511E2	4907.0	0.01875
10	RTB3B4	511B4	3125.7	0.02048	26	RTEFC8	511C8	1277.6	0.01409
11	RTB4D	511D	520.6	0.01786	27	RTG1G2	511G2	4245.8	0.01460
12	RTC1C4	511C4	1058.3	0.01701	28	RTG2G4	511G4	5907.9	0.01896
13	RTC1E2	511E2	7084.5	0.02089	29	RTG3G4	511G4	5322.4	0.02311
14	RTC2A2	509A2	6045.3	0.02183	30	RTG4I	511I	4437.7	0.03606
15	RTC2C5	511C5	3085.9	0.02301	31	RTHG4	511G4	932.7	0.02091
16	RTC3C5	511C5	3234.3	0.02319					



RIO VERDE ADMP
F.C.D. CONTRACT NO. 2001C056

LEGEND:

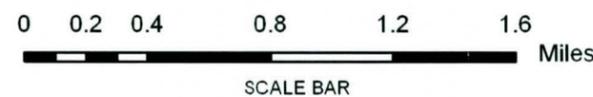
- Flow Paths
- Routing Paths
- Subbasins
- South Basin
- 1D Modeling Area
- 2D Modeling Area



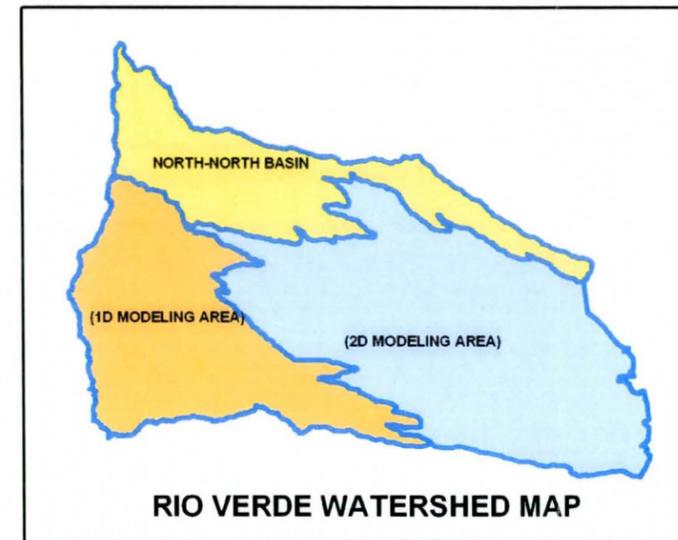
1 inch equals 3,000 feet

SOUTH SUBBASIN ROUTING PATHS

FIGURE 4.2-9



SOIL DATA					
NORTH-NORTH BASIN					
NO	Soil Code	Area (sq. mi)	XKSAT (in/hr)	Rock Outcrop (%)	Soil Description
1	6	0.6351	0.62	0.00	Anthony-Arizo complex
2	33	2.8134	0.23	0.00	Eba very gravelly loam, 1 to 8 percent slopes
3	34	0.0002	0.23	0.00	Eba very gravelly loam, 8 to 20 percent slopes
4	37	1.6316	0.13	0.00	Eba-Continental-Cave association, 3 to 20 percent slopes
5	40	0.3822	0.17	0.00	Eba-Pinaleno complex, 3 to 20 percent slopes
6	41	0.0029	0.17	0.00	Eba-Pinaleno complex, 20 to 40 percent slopes
7	61	2.3712	0.15	0.00	Gran-Wickenburg complex, 1 to 10 percent slopes
8	63	0.9174	0.14	25.00	Gran-Wickenburg-Rock outcrop complex, 1 to 7 percent slopes
9	93	0.0580	0.33	0.00	Nickel-Cave complex, 8 to 30 percent slopes
10	96	0.3350	0.07	0.00	Pinaleno-Tres Hermanos complex, 1 to 10 percent slopes
11	121	0.0410	0.12	0.00	Tres Hermanos-Anthony complex, 1 to 5 percent slopes
12	122	0.4496	0.33	0.00	Vado gravelly sandy loam, 1 to 5 percent slopes
13	301	0.2759	0.40	0.00	Sandy Loam



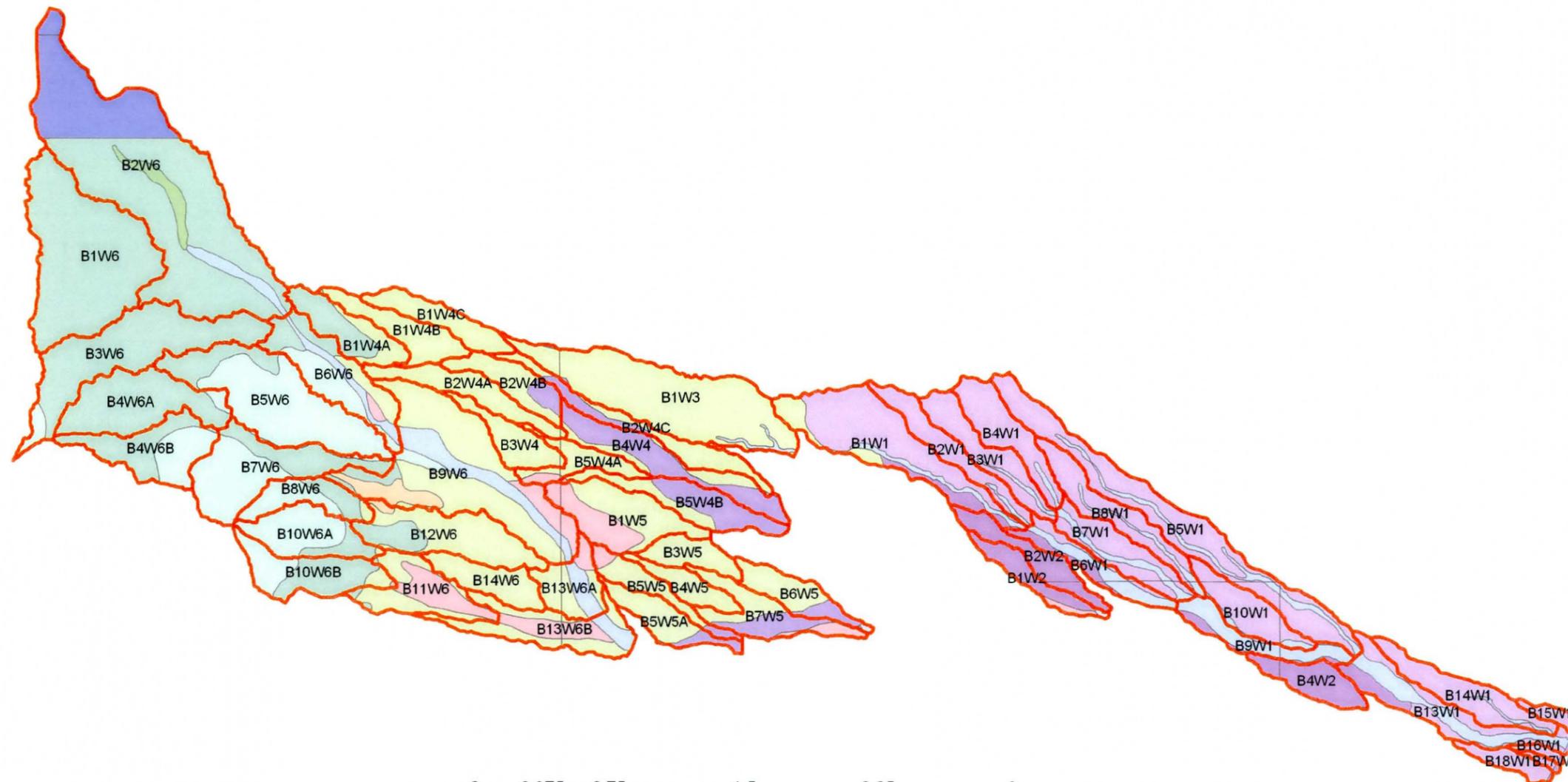
RIO VERDE ADMP
F.C.D. CONTRACT NO. 2001C056

LEGEND:

- North-North Basin
- 1D Modeling Area
- 2D Modeling Area
- Subbasins

SOIL CODES:

- | | |
|--|---|
| 121 | 41 |
| 122 | 6 |
| 301 | 61 |
| 33 | 63 |
| 34 | 93 |
| 37 | 96 |
| 40 | |



1 inch equals 3,800 feet

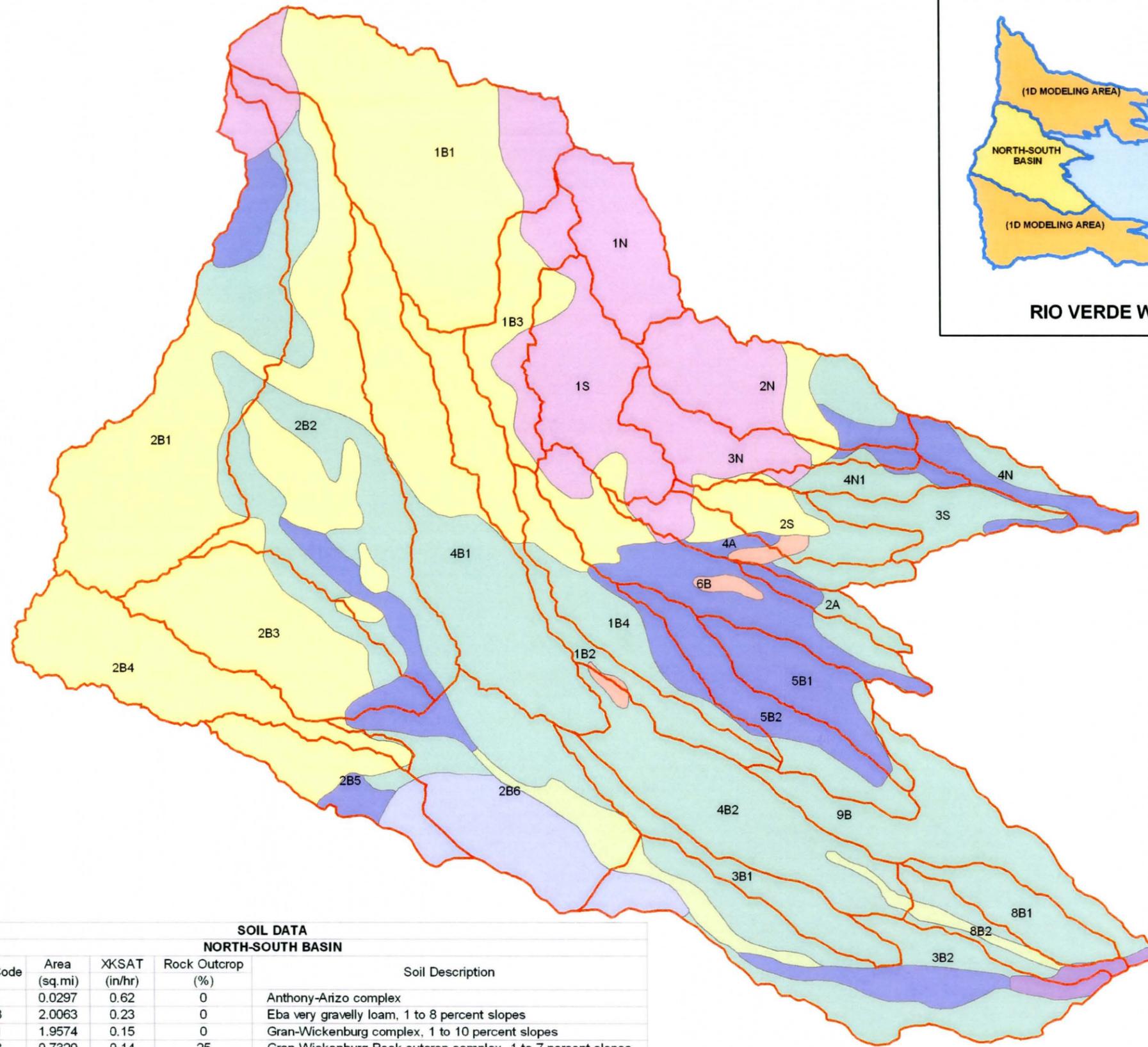
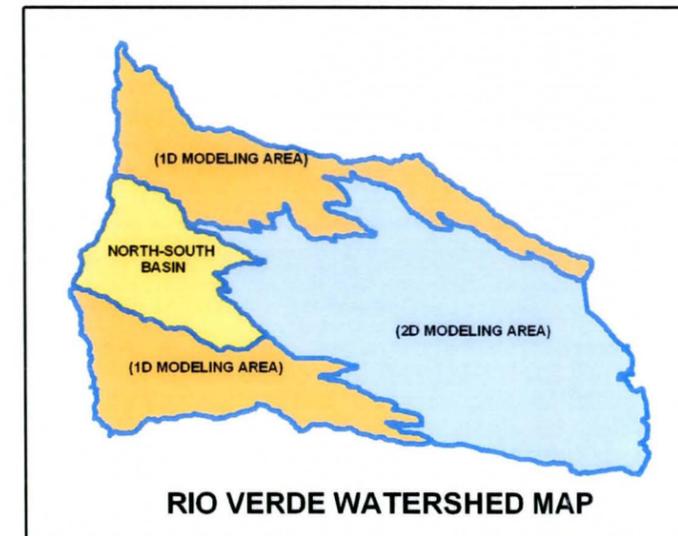
SOILS MAP
NORTH-NORTH BASIN

FIGURE 4.2-10





RIO VERDE ADMP
F.C.D. CONTRACT NO. 2001C056



LEGEND:

- North-South Basin
- 1D Modeling Area
- 2D Modeling Area
- Subbasins

SOIL CODE:

- | | |
|--|---|
| 121 | 63 |
| 33 | 72 |
| 6 | 93 |
| 61 | 96 |

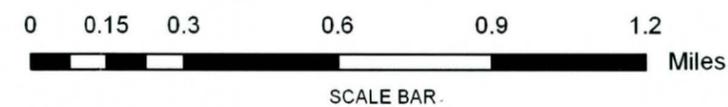


1 inch equals 1,800 feet

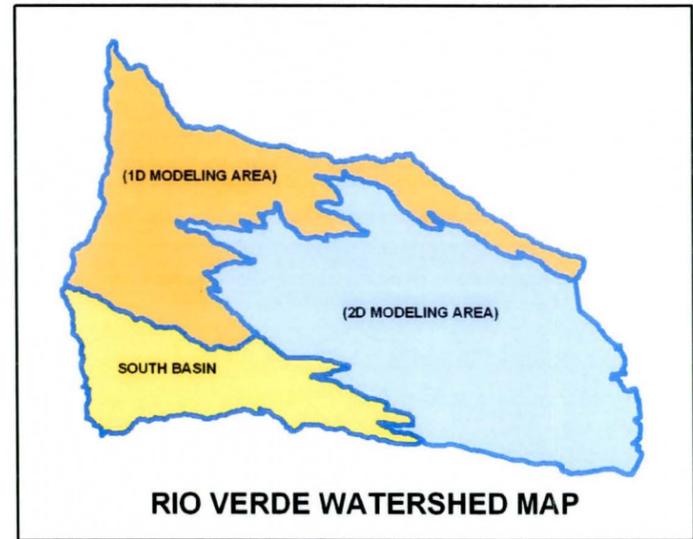
**SOILS MAP
NORTH-SOUTH BASIN**

FIGURE 4.2-11

SOIL DATA NORTH-SOUTH BASIN					
No.	Soil Code	Area (sq.mi)	XKSAT (in/hr)	Rock Outcrop (%)	Soil Description
1	6	0.0297	0.62	0	Anthony-Arizo complex
2	33	2.0063	0.23	0	Eba very gravelly loam, 1 to 8 percent slopes
3	61	1.9574	0.15	0	Gran-Wickenburg complex, 1 to 10 percent slopes
4	63	0.7320	0.14	25	Gran-Wickenburg-Rock outcrop complex, 1 to 7 percent slopes
5	72	0.1902	0.09	30	Lehmans-Rock outcrop complex, 8 to 65 percent slopes
6	93	0.0294	0.33	0	Nickel-Cave complex, 8 to 30 percent slopes
7	96	0.6506	0.07	0	Pinaleno-Tres Hermanos complex, 1 to 10 percent slopes
8	121	0.1022	0.12	0	Tres Hermanos-Anthony complex, 1 to 5 percent slopes



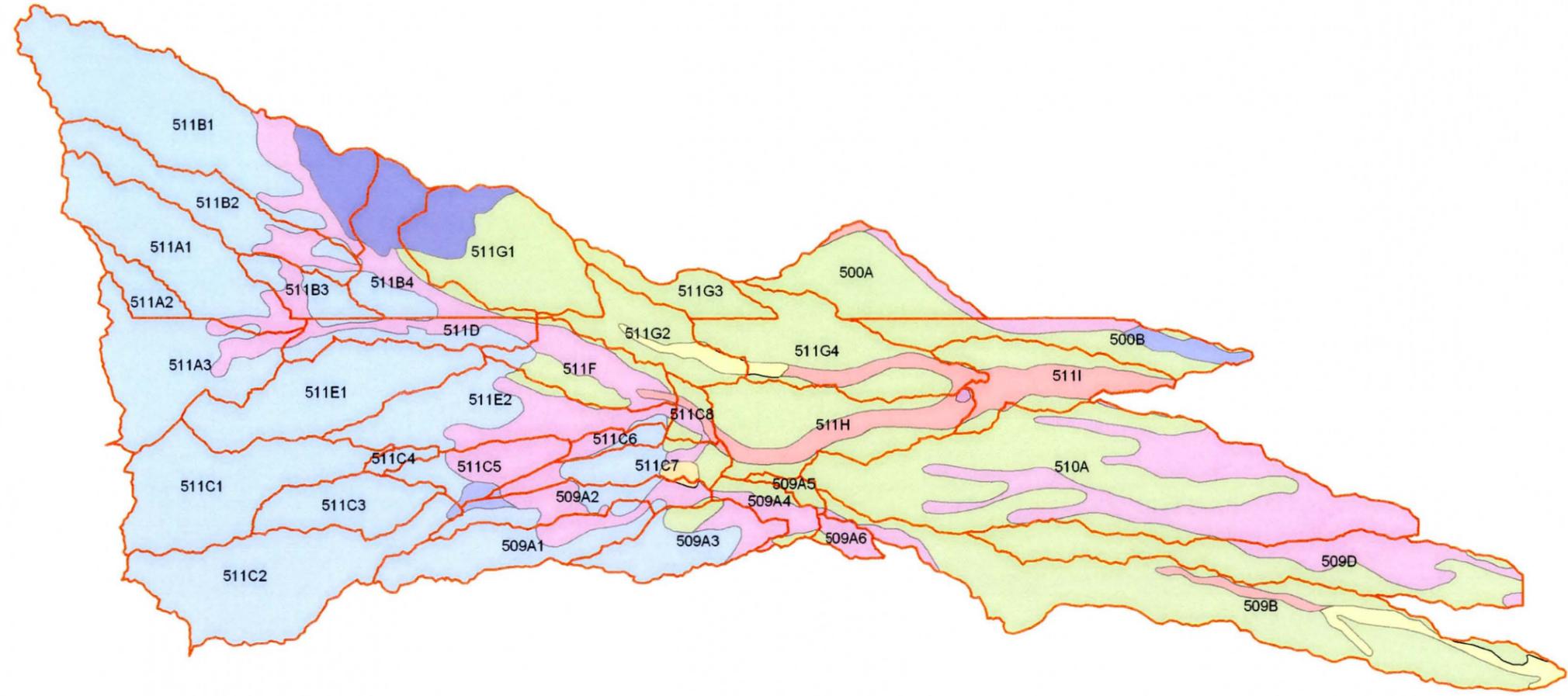
SOIL DATA					
SOUTH BASIN					
No.	Soil Code	Area (sq. mi)	XKSAT (in/hr)	Rock Outcrop (%)	Soil Description
1	6	0.2926	0.62	0.00	Anthony-Arizo complex
2	33	2.8306	0.23	0.00	Eba very gravelly loam, 1 to 8 percent slopes
3	61	3.1463	0.15	0.00	Gran-Wickenburg complex, 1 to 10 percent slopes
4	63	0.0134	0.14	25.00	Gran-Wickenburg-Rock outcrop complex, 1 to 7 percent slopes
5	72	0.2405	0.09	30.00	Lehmans-Rock outcrop complex, 8 to 65 percent slopes
6	93	0.0098	0.33	0.00	Nickel-Cave complex, 8 to 30 percent slopes
7	96	1.3995	0.07	0.00	Pinaleno-Tres Hermanos complex, 1 to 10 percent slopes
8	121	0.1018	0.12	0.00	Tres Hermanos-Anthony complex, 1 to 5 percent slopes
9	122	0.0344	0.33	0.00	Vado gravelly sandy loam, 1 to 5 percent slopes
10	W	0.0025	0.00	0.00	Lakes, ponds, reservoirs - perennial



RIO VERDE ADMP
F.C.D. CONTRACT NO. 2001C056

- LEGEND:**
- 1D Modeling Area
 - 2D Modeling Area
 - South Basin
 - Subbasins

- SOIL CODE:**
- | | |
|--|---|
| 121 | 63 |
| 122 | 72 |
| 33 | 93 |
| 6 | 96 |
| 61 | W |



1 inch equals 3,000 feet

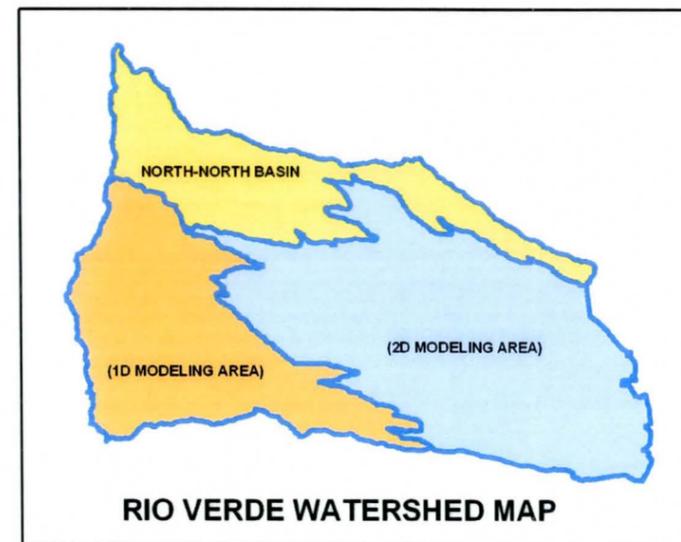
SOILS MAP
SOUTH BASIN

FIGURE 4.2-12

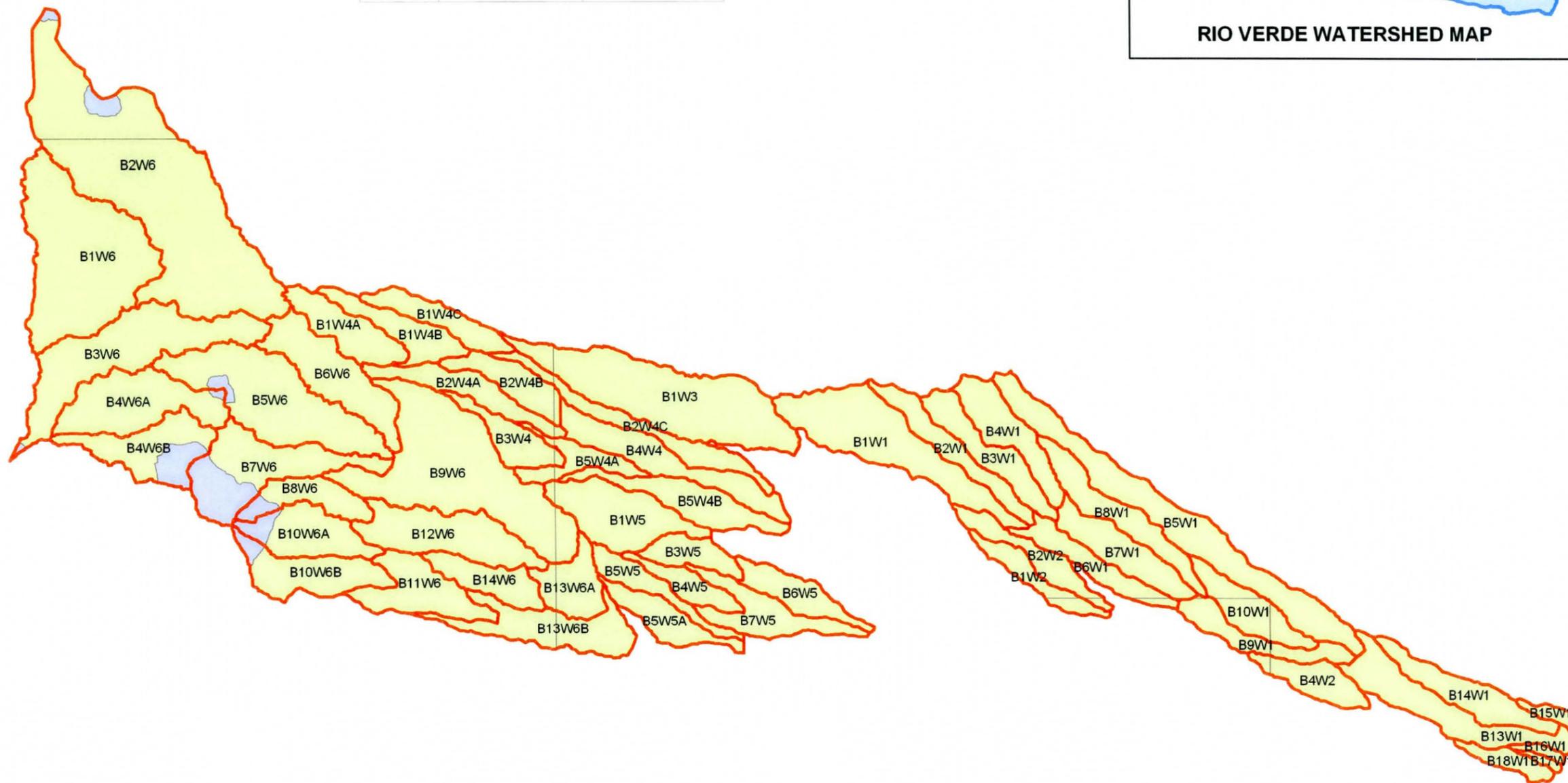




RIO VERDE ADMP
F.C.D. CONTRACT NO. 2001C056



EXISTING LAND USE DATA NORTH-NORTH BASIN		
No.	Land Use Type	Area (sq. mi)
1	DESERT	9.6298
2	HILLSIDE	0.2426



LEGEND:

- North-North Basin
- 1D Modeling Area
- 2D Modeling Area
- Subbasins
- LAND USE TYPE**
- DESERT
- HILLSIDE



1 inch equals 3,500 feet

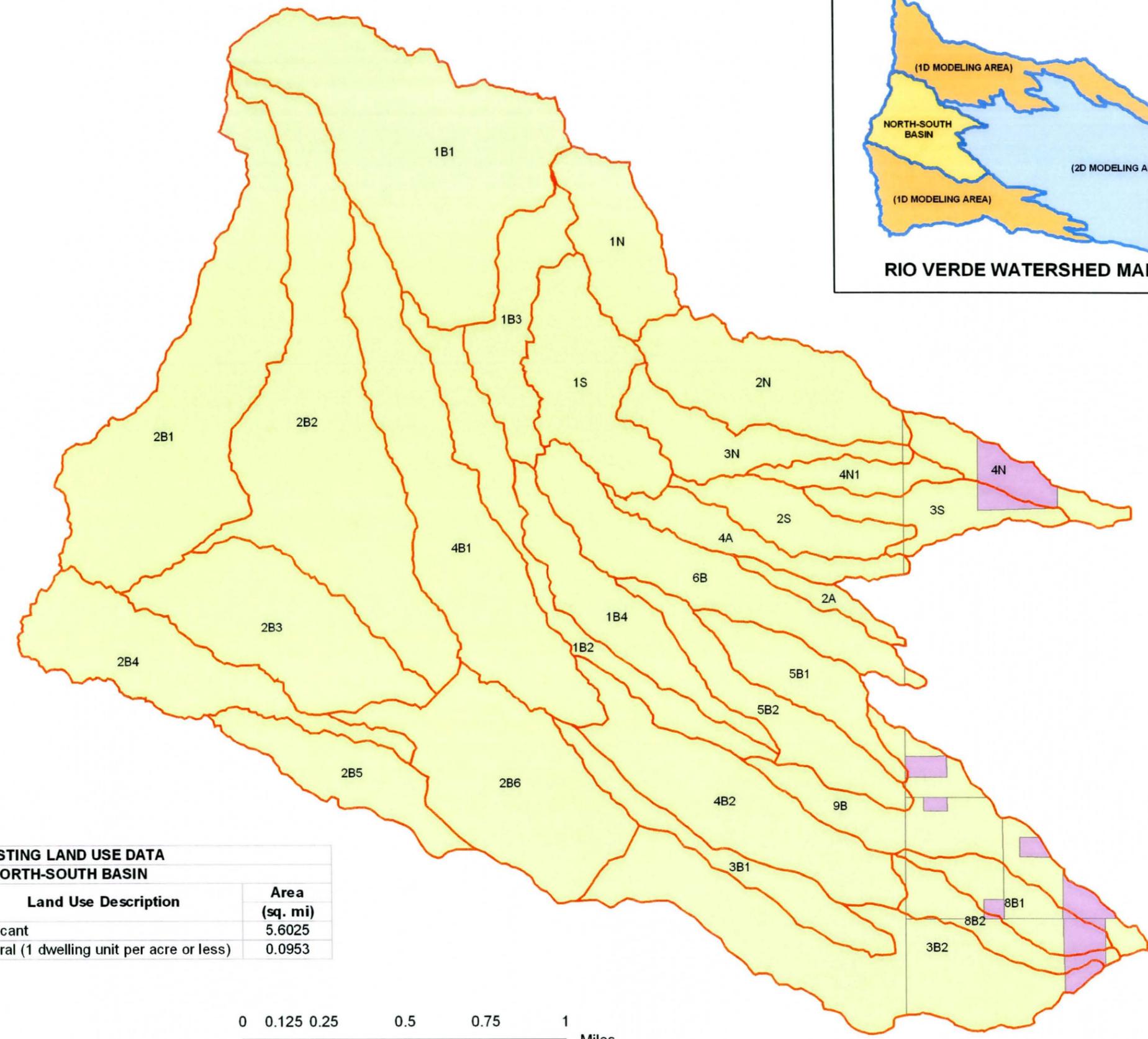
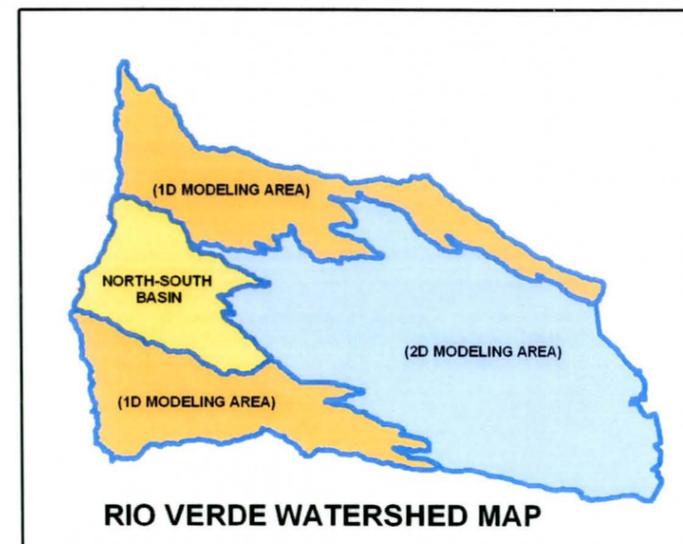
**LAND USE MAP
NORTH-NORTH BASIN
(EXISTING CONDITION)**

FIGURE 4.2-13





RIO VERDE ADMP
F.C.D. CONTRACT NO. 2001C056



- LEGEND:**
- North-South Basin
 - 1D Modeling Area
 - 2D Modeling Area
 - Subbasins

- LAND USE TYPE**
- DESERT
 - VLDR

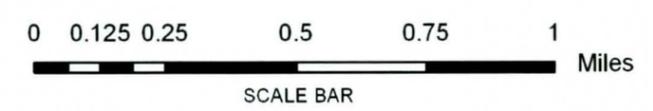


1 inch equals 1,800 feet

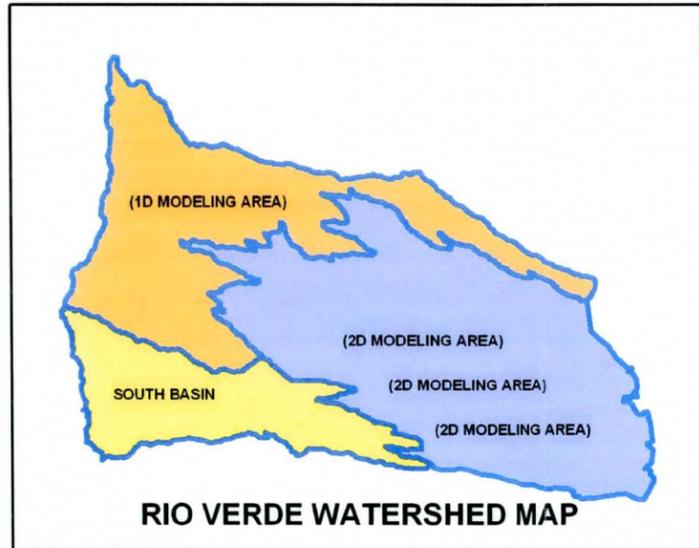
LAND USE MAP
NORTH-SOUTH BASIN
(EXISTING CONDITION)

FIGURE 4.2-14

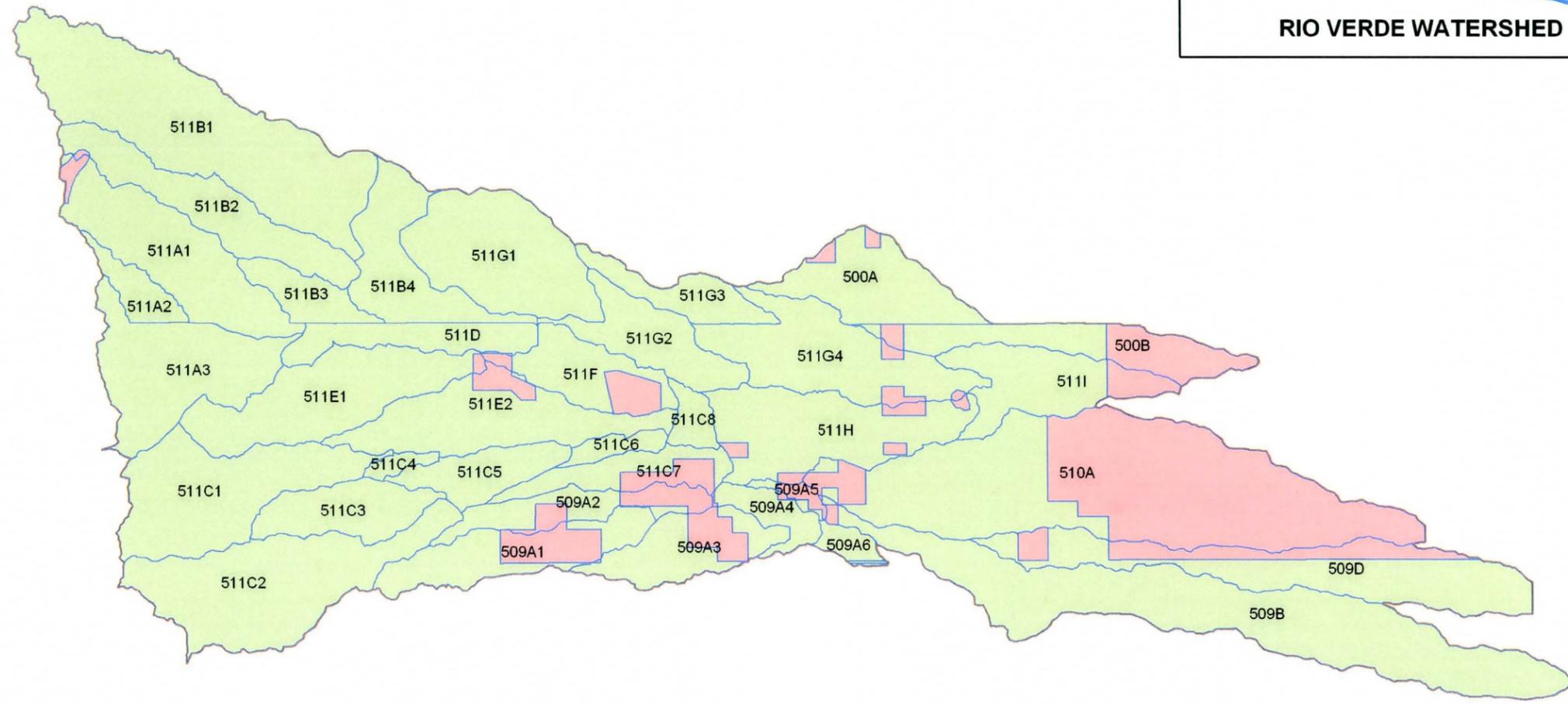
EXISTING LAND USE DATA NORTH-SOUTH BASIN			
No.	Land Use	Land Use Description	Area (sq. mi)
1	DESERT	Vacant	5.6025
2	VLDR	Rural (1 dwelling unit per acre or less)	0.0953



EXISTING LAND USE DATA SOUTH BASIN		
No	Land Use Type	Area (sq. mi.)
1	DESERT	6.932
2	VLDR	1.151



RIO VERDE ADMP
F.C.D. CONTRACT NO. 2001C056



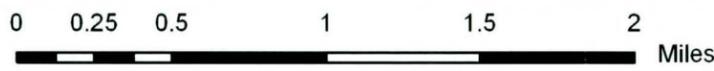
- LEGEND:**
- South Basin
 - 1D Modeling Area
 - 2D Modeling Area
 - Subbasins
- LAND USE TYPE**
- DESERT
 - VLDR



1 inch equals 3,041 feet

**LAND USE MAP
SOUTH BASIN
(EXISTING CONDITION)**

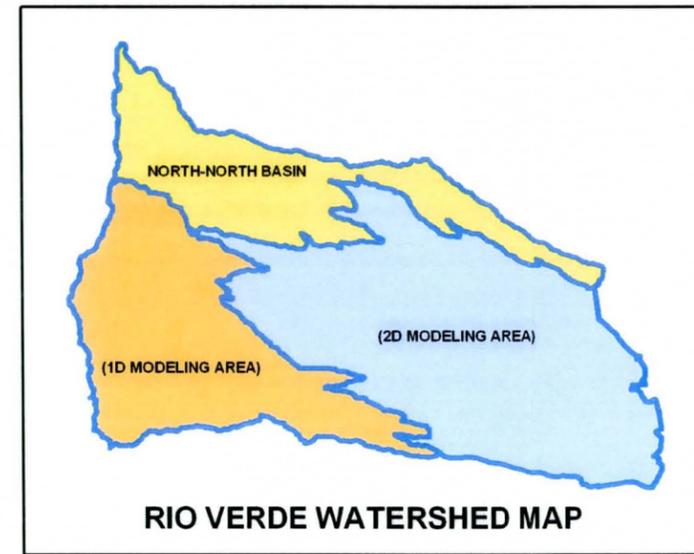
FIGURE 4.2-15



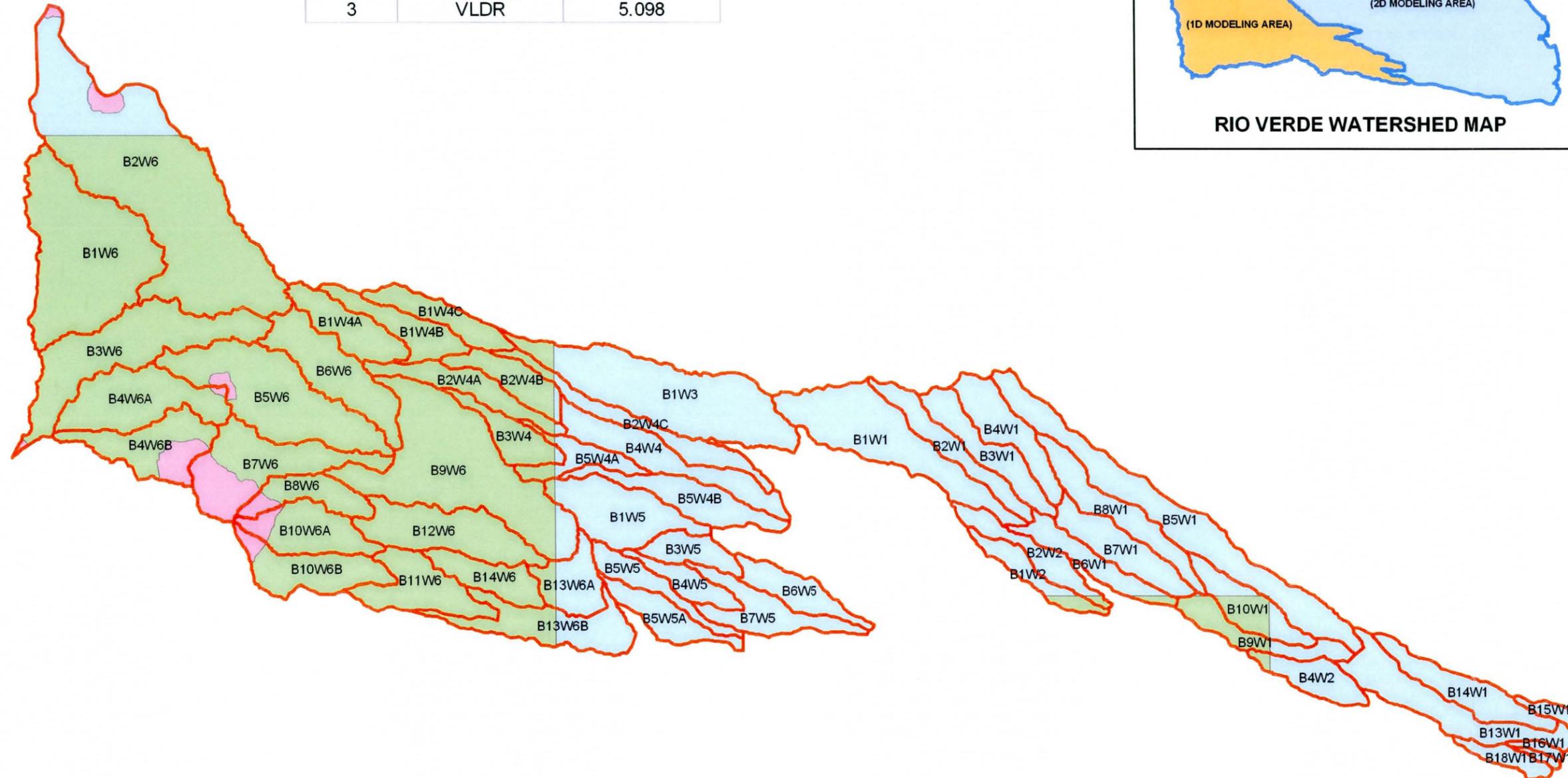
SCALE BAR



FUTURE CONDITION LAND USE DATA NORTH-NORTH BASIN		
No	Land Use Type	Area (sq. mi.)
1	DESERT	4.532
2	HILLSIDE	0.243
3	VLDR	5.098



RIO VERDE ADMP
F.C.D. CONTRACT NO. 2001C056



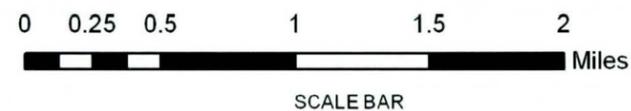
- LEGEND:**
- North-North Basin
 - 1D Modeling Area
 - 2D Modeling Area
 - Subbasins
- LAND USE TYPE**
- DESERT
 - HILLSIDE
 - VLDR



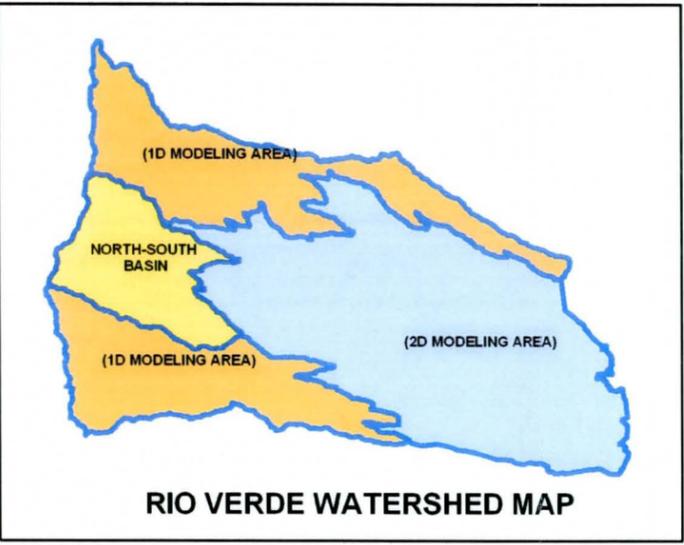
1 inch equals 3,500 feet

**LAND USE MAP
NORTH-NORTH BASIN
(Future Condition)**

FIGURE 4.2-16



FUTURE CONDITION LAND USE DATA NORTH-SOUTH BASIN			
No.	Land Use Type	Description	Area (sq. mi.)
1	VLDR	Very Low Density Residential	5.6978



RIO VERDE ADMP
F.C.D. CONTRACT NO. 2001C056

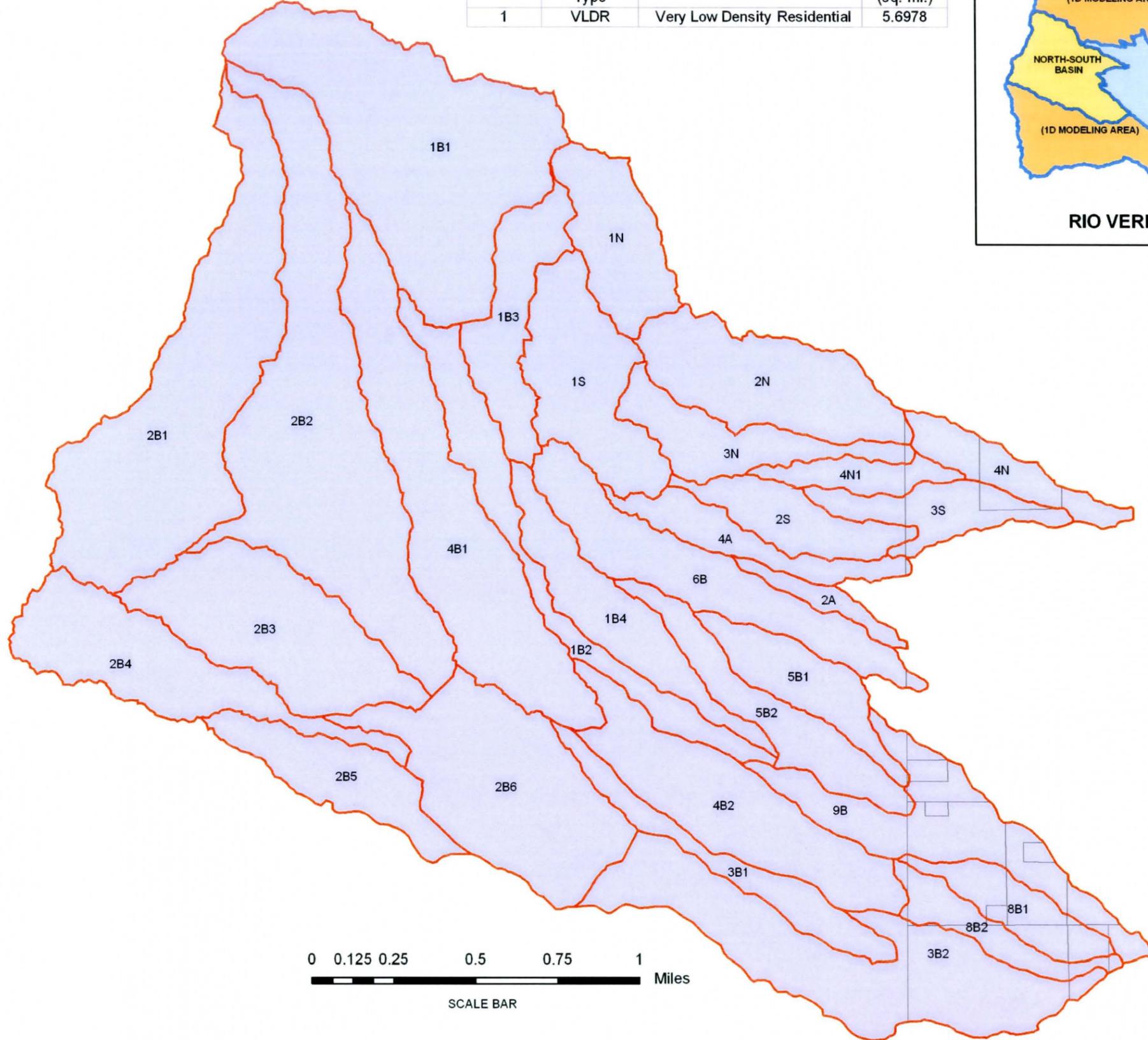
- LEGEND:**
- 1D Modeling Area
 - 2D Modeling Area
 - North-South Basin
 - Subbasins
- Land Use Type**
- VLDR



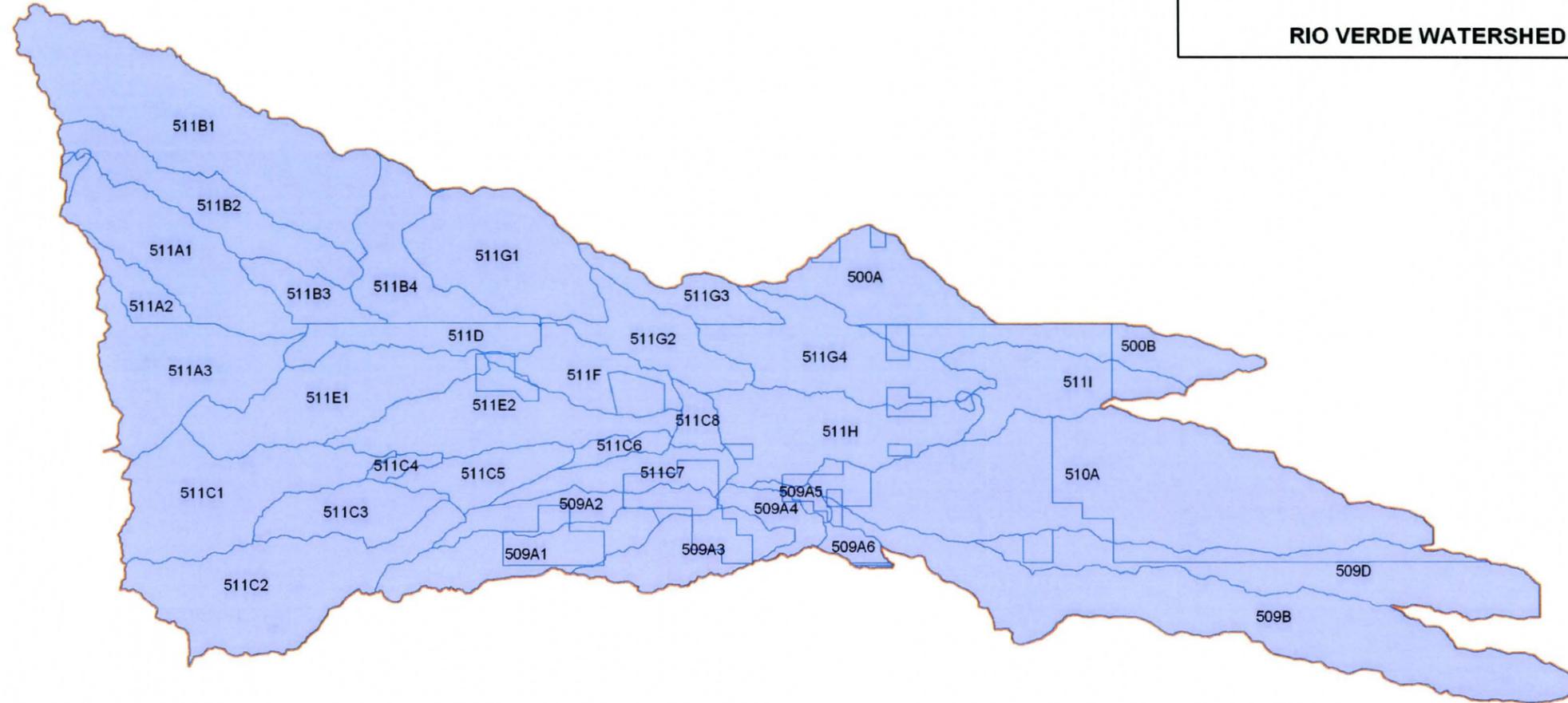
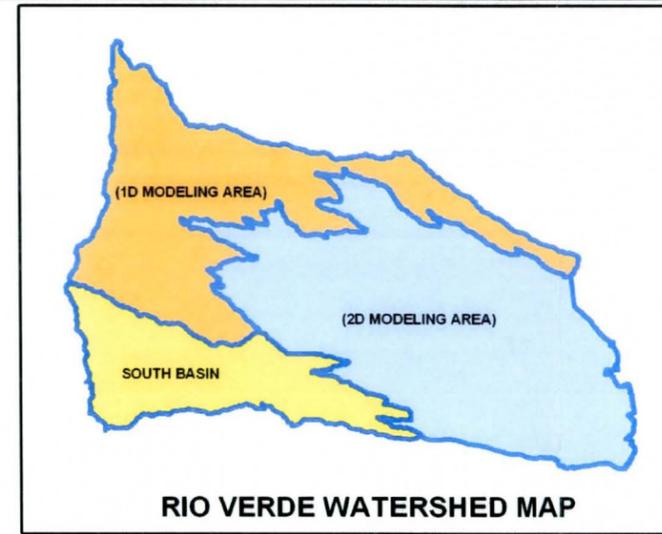
1 inch equals 1,800 feet

**LAND USE MAP
NORTH-SOUTH BASIN
(Future Condition)**

FIGURE 4.2-17



FUTURE CONDITION LAND USE DATA SOUTH BASIN			
No.	Future Land Use	Existing Land Use	Area (sq. mi.)
1	VLDR	DESERT	6.9319
2	VLDR	VLDR	1.1511



RIO VERDE ADMP
F.C.D. CONTRACT NO. 2001C056

LEGEND:

- South Basin
- 1D Modeling Area
- 2D Modeling Area
- Subbasins

LAND USE TYPE

- VLDR



1 inch equals 3,000 feet

**LAND USE MAP
SOUTH BASIN
(Future Condition)**

FIGURE 4.2-18



4.2.3 Gage Data. No gage data was used for the development of the hydrologic models as well as in the validation of the peak discharges from the models. The precipitation data used were from NOAA isopluvial maps taken from Chapter 2 of the Drainage Design Manual for Maricopa County, Arizona (Volume 1 – Hydrology). The peak runoff rates generated from HEC-1 models were not validated from historical flow records but were validated from the peak flows evaluated from the original hydrologic models.

4.2.4 Statistical Parameters. No statistical parameters were used in the validation of the peak runoffs generated from the hydrologic models.

4.2.5 Precipitation. The precipitation data used for the development of the new models were from NOAA ATLAS 2 (Volume VIII) isopluvial maps taken from Chapter 2 of the Drainage Design Manual for Maricopa County, Arizona (Volume I – Hydrology). The precipitation depths are slightly different from earlier HEC-1 models. The data comparison between the earlier and the current HEC-1 models are provided in **TABLE 4.2-1**.

TABLE 4.2-1 Comparison of Precipitation Data Between the Original and the Updated HEC-1 Models					
Basin	Model	Area (sq. miles)	100-Year Event	Point Precipitation (inches)	With Areal Reduction (inches)
(1)	(2)	(3)	(4)	(5)	(6)
North-North	2001 Model	15.54	6-hour	3.40	3.14
			24-hour	4.42	4.08
	DIBBLE	9.87	6-hour	3.48	3.273
			24-hour	4.65	4.375
North-South	2000 Model	13.74	6-hour	3.41	3.166
			24-hour	4.60	4.271
	DIBBLE	5.69	6-hour	3.48	3.331
			24-hour	4.63	4.472
South	1995 Model	17.0	6-hour	3.40	-
			24-hour	4.40	-
	DIBBLE	8.08	6-hour	3.44	3.260
			24-hour	4.58	4.358

NOTE: The areal reductions of the point precipitation data in column (6) were directly evaluated by DDMSW. The 2001, 2000, and 1995 models refer to the hydrologic studies performed by David Evans & Associates, Inc., Primatech, and McLaughlin & Kmetty Engineers, Ltd., respectively.

4.2.6 Physical Parameters. The land use and soil maps were the key maps employed in evaluating the physical parameters that define the infiltration loss and the unit hydrograph ordinates for the HEC-1 models. The five Green-Ampt infiltration loss parameters defined in the LG card (namely: IA, THETA, PSIF, XKSAT, and RTIMP) for each subbasin were evaluated within DDMSW using the drainage data set with the land use and soils data, which are packaged separately as DDMSW files. Attributes from these data sets were generated in GIS and pre-processed in Excel before the files were imported into DDMSW. The sections that follow provide the soils and land use information used in the evaluation of Green-Ampt loss parameters and S-graph unit hydrograph ordinates for the HEC-1 models.

(a) **Soil Parameters.** Soil parameter values for the soil map units shown in **FIGURES 4.2-10, 4.2-11, and 4.2-12** are listed in **TABLE 4.2-2**. The sources of these parameter values are from Aguila-Carefree from the NRCS/SCS soil survey and the Flood Control District of Maricopa County. The District developed Green Ampt soil parameters for the area of the 1-D study in the Tonto National Forest where no soil surveys were available. Refer to Section 4.2.7.2 of the 2-Dimensional Hydrology and Floodplain Modeling Technical Data Notebook for a discussion of the determination of these values.

TABLE 4.2-2 Soil Parameter Values						
No	Soil Survey	Parameters				
		MAP UNIT	XKSAT	ROCK OUTCROP	Uniform Loss Rate (CNSTL)	Initial Loss (STRTL)
			(in/hr)	(%)	(in/hr)	(inches)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Aguila/Carefree	6	0.62	0	0	0
2	Aguila/Carefree	33	0.23	0	0	0
3	Aguila/Carefree	34	0.23	0	0	0
4	Aguila/Carefree	37	0.13	0	0	0
5	Aguila/Carefree	40	0.17	0	0	0
6	Aguila/Carefree	41	0.17	0	0	0

TABLE 4.2-2 Soil Parameter Values						
No	Soil Survey	Parameters				
		MAP UNIT	XKSAT	ROCK OUTCROP	Uniform Loss Rate (CNSTL)	Initial Loss (STRTL)
			(in/hr)	(%)	(in/hr)	(inches)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
7	Aguila/Carefree	61	0.15	0	0	0
8	Aguila/Carefree	63	0.14	25	0	0
9	Aguila/Carefree	72	0.09	30	0	0
10	Aguila/Carefree	93	0.33	0	0	0
11	Aguila/Carefree	96	0.07	0	0	0
12	Aguila/Carefree	121	0.12	0	0	0
13	Aguila/Carefree	122	0.33	0	0	0
14	Aguila/Carefree	W	0.00	0	0	0
15	USFS, Tonto National Forest	301	0.40	0	0	0

(b) **Land Use Parameters for Existing Condition** – TABLE 4.2-3 lists the land use parameter values for the existing condition. These parameters were used to evaluate infiltration loss parameters and unit-hydrograph ordinates for each subbasin in the 1D modeling areas.

North-North Basin. The 2001 HEC-1 model developed by David Evans & Associates, Inc. employed three land use types as follows: DESERT, DESERT – BURNED AREA, and HILLSIDE. The updated existing condition HEC-1 model developed for the 1D area of the north-north basin used only the DESERT” and “HILLSIDE” land use types with parameters listed in TABLE 4.2-3 (columns (3) and (4)) below. Originally, the land use types identified in the north-north basin area included “Dedicated or Non-Developable Open Space”, “Vacant”, and “Water”. All these land use types were reclassified as “DESERT”. A “HILLSIDE” land use type was delineated from areas where small hills are identified.

North-South Basin - The 2000 HEC-1 model developed by Primatch used two land use classifications as follows: DESERT and Very Low Density Residential (VLDR). The existing condition HEC-1 model developed for the 1D area of the north-south basin

adopts the same land use types with the parameters provided in **TABLE 4.2-3** (columns (3) and (5)). It should be noted that additional VLDR areas were delineated to include recent residential developments in the area using the 2002 Aerial orthophotos.

South Basin - The 1995 HEC-1 model developed by McLaughlin & Kmetty Engineers, Ltd. used a number of land use classifications such as: AGRICULTURAL, COMMERCIAL, NON-CONTRIBUTING, NATURAL DESERT, GOLF COURSE, LOW DENSITY RESIDENTIAL and MULTI-FAMILY RESIDENTIAL. For the existing condition HEC-1 model, the land-use types identified in the 1D area of the south basin include: DESERT, and VLDR. Parameters assigned for these land use types are provided in **TABLE 4.2-3** (columns (3) and (5)). Additional VLDR areas were delineated to include recent residential developments in the South basin area using the 2002 Aerial orthophotos.

TABLE 4.2-3 Land Use Parameter Values for Existing Condition				
No.	Parameters	Land Use Classification		
		DESERT	HILLSIDE	VLDR
(1)	(2)	(3)	(4)	(5)
1	Saturation	Dry	Dry	Dry
2	% Veg.Cover	25	10	10
3	RTIMP (%)	0	35	15
4	IA (in)	0.15	0.15	0.10
5	K_n	0.05	0.06	0.045
Comments		Natural Desert (from both the "Dedicated" and "Undedicated" Open Spaces)	This land use type only applies to the North-north Basin.	

- (c) **Land Use Parameters for Future Condition.** – **TABLE 4.2-4** lists the parameter values for the future condition in the 1D modeling area. These parameters were used

to evaluate composite infiltration loss parameters and unit-hydrograph ordinates for each subbasin in the 1D modeling areas. Future condition land use assumes that all developable and undedicated areas are developed to their fullest extent converting all DESERT type to VLDR (or very low density residential).

North-North Basin - All developable “DESERT” areas were converted to “VLDR” land use in the future developed condition. The “Dedicated or Non-Developable Open Space”, however, remained as “DESERT” for the future condition models. The “HILLSIDE” land use in the existing condition remained unchanged for the future developed condition. **TABLE 4.2-4** (see columns (3), (4), (5)) shows the land use parameter values for the future condition land use for the North-North Basin.

North-South Basin - For the future developed condition HEC-1 model, all the “developable” DESERT areas were converted to VLDR with parameters reflected in **TABLE 4.2-4** (see column (5)).

South Basin – Similarly for the South Basin, all the developable DESERT areas were converted to VLDR with parameters reflected in **TABLE 4.2-4** (see column (5)).

TABLE 4.2-4				
Land Use Parameter Values for Future Condition				
(Without Development Guidelines)				
No.	Parameters	Land Use Classification		
		DESERT	HILLSIDE	VLDR
(1)	(2)	(3)	(4)	(5)
1	Saturation	Dry	Dry	Dry
2	% Veg.Cover	25	10	10
3	RTIMP (%)	0	35	15
4	IA (in)	0.15	0.15	0.10
5	K_n	0.05	0.06	0.045
Comments		The DESERT areas are those in the “Dedicated” Open Space.	This land use type only applies to the North-North Basin.	

The Green-Ampt Parameters evaluated for each sub-basin in the 1D modeling areas are provided in **Section D.2 - Physical Parameter Calculations (APPENDIX B)**.

4.2.7 Unit Hydrograph. The Phoenix Mountain S-Graph was used to generate the unit hydrograph distribution for the three basins. This S-Graph was designed to be used for flood hydrology studies of watersheds that drain predominantly mountainous terrain such as the Rio Verde Area. The distribution of the Phoenix Mountain S-Graph is tabulated in **TABLE 4.2-5**.

The DDMSW program was used to generate the unit hydrograph distribution for each sub-basin modeled in HEC-1 using the Phoenix Mountain S-Graph.

TABLE 4.2-5 Phoenix Mountain S-Graph Distribution (Source: Drainage Design Manual for Maricopa County, Arizona, Volume I – Hydrology).						
No	Percent Ultimate Discharge	Time in Percent Lag		No	Percent Ultimate Discharge	Time in Percent Lag
(1)	(2)	(3)		(4)	(5)	(6)
1	0	0		27	52	103.4
2	2	23		28	54	107
3	4	31		29	56	110.8
4	6	37		30	58	114.7
5	8	42		31	60	118.7
6	10	46		32	62	122.9
7	12	49.8		33	64	127.3
8	14	53.4		34	66	131.9
9	16	56.8		35	68	136.7
10	18	60		36	70	141.7
11	20	63.1		37	72	147.1
12	22	66.1		38	74	152.8
13	24	69		39	76	158.8
14	26	71.8		40	78	165.5
15	28	74.4		41	80	172.9
16	30	76.8		42	82	181.6
17	32	79.1		43	84	191
18	34	81.2		44	86	201
19	36	83.2		45	88	212
20	38	85.1		46	90	226
21	40	86.8		47	92	244
22	42	88.8		48	94	265
23	44	91		49	96	295
24	46	93.8		50	98	342
25	48	96.8		51	100	462
26	50	100				

SECTION 4.3

PROBLEMS ENCOUNTERED DURING THE STUDY

4.3 PROBLEMS ENCOUNTERED DURING THE STUDY

4.3.1 Special Problems and Solutions. No special problems were encountered in this study.

4.3.2 Modeling Warning and Error Messages. No modeling warning and error messages were encountered in the development and execution of the HEC-1 models.

SECTION 4.4
CALIBRATION

4.4 CALIBRATION

The performance of the developed hydrologic models was validated by comparing model results with the earlier models. No calibration procedure was made on the models to assess model performance against physical gage data.

The HEC-1 model parameters are applied in a manner consistent with the previous HEC-1 models within the study area and consistent with the FCDMC Drainage Manual. The updated model results compare favorably with the previous studies after proper credit is given to subbasin parameter revisions.

SECTION 4.5

FINAL RESULTS

4.5 FINAL RESULTS

4.5.1 Hydrologic Analysis Results. The results of the hydrologic analysis for the Rio Verde Study Area are summarized in this section. Three sets of model comparison are made providing various data assumptions and development conditions. These are:

- Model comparison between 24-hour duration and 6-hour duration storms for the 100-year recurrence interval.
- Model comparison between the original models from previous studies and the updated models developed for this study.
- Model comparison between existing conditions and future developed conditions “without development guidelines”.

(a) **24-hr Duration Storm vs. 6-hr Duration Storm (Existing Condition).** TABLES 4.5-1, 4.5-2, 4.5-3, and 4.5-4 show the evaluated 100-year peak discharges involving the 24-hour and 6-hour duration storms for the North-North, North-South, and South Basins, respectively. For the three basins, the peak flows generated by the 24-hour duration storms are greater than the 6-hour duration storm events. Further evaluation of the results is summarized as follows:

- For the North-North Basin, the peak flow differences between the 24-hour and 6-hour duration models range from 16.5 % to 92.3 %.
- For the North-South Basin with Black Hills Tank, the peak flow differences between the 24-hour and 6-hour duration models range from 6.4 % to 200 %. The same range of peak flow differences was found for the North-South Basin without Black Hills Tank.
- For the South Basin, the peak flow differences between the 24-hour and 6-hour duration models range from 0 % to 80 %.

(b) **Updated Models vs. Original Hydrologic Models.** TABLES 4.5-5, 4.5-6, 4.5-7 and 4.5-8 show the tabulated 100-year peak flows generated from the 24-hour and 6-hour duration storms for both the updated and the original hydrologic models. The updated models for the North-North, North-South, and South Basins involved only the 1D area delineated from the results of the Piedmont Assessment results. The original hydrologic models, which covered larger drainage areas than the updated models, have employed the HEC-1 program for both the 1D and 2D areas.

The evaluation of the two models shows some differences on the drainage boundary conditions. The reliability of the drainage boundaries developed for the updated models is due to the availability of more detailed topographic information of the study area mapped at 2-ft contour interval (CI) and the availability of the 2002 aerial photograph. The naming conventions used for the updated models for the hydrologic elements such as sub-basins, concentration points, and routing reaches were retained from the original hydrologic models.

(c) **Existing Condition Models vs. Future Developed Condition (Without Guidelines) Models.** TABLES 4.5-9, 4.5-10, 4.5-11, and 4.5-12 show the model results for the existing condition and future developed conditions.

- For the North-North Basin, the peak flow differences between the existing condition and the future condition (without Guidelines) models range from 0 % to 23.5 % for the 24-hour storm and 0 % to 31.8% for the 6-hour storm.
- For the North-South Basin with Black Hills Tank, the peak flow differences between the existing condition and the future condition (without Guidelines) models range from 0 % to 76.2 % for the 24-hour storm and 0 % to 77.8 % for the 6-hour storm. For the North-South Basin without Black Hills Tank, the peak flow differences range from 0 % to 23.3 % for the 24-hour storm and 0 % to 50.0 % for the 6-hour storm.
- For the South Basin, the peak flow differences between the existing condition and the future condition (without development Guidelines) models range from 0 % to 28.6 % for the 24-hour storm and 0 % to 39.4 % for the 6-hour storm.

4.5.2 Verification of Results. The discrepancies found between earlier and new models are due significantly to the following reasons:

- (a) The drainage boundaries developed for the updated hydrology were slightly different from the drainage boundaries developed in the original hydrologic studies. The use of the 2-ft CI topographic map and the 2002 orthophotos taken for the entire study area made the current delineation very reliable. Existing developments and current drainage features identified from orthophotos were used to locate appropriate drainage boundary limits for the updated hydrology. In addition, site investigations

were made to further verify information not sufficiently clear from the work maps.

- (b) The generated peak flows for the new HEC-1 models are generally greater than the earlier models. One significant reason is the use of higher precipitation data for the new models as presented in Section 4.2.5 above (see **TABLE 4.2-1**). The higher precipitation data was due to changes in areal reduction since this study focused on the upper watershed and the other studies analyzed the entire watershed. These new precipitation values were determined for the 1D modeling area using the isopluvial maps presented in the Drainage Design Manual for Maricopa County, Arizona (Volume I – Hydrology).
- (c) In the 1995 hydrologic study of the south basin, it was concluded that the 100-year peak flows were mostly controlled by the 6-hour storm event. The current HEC-1 models indicate that the 24-hour storm event controls the hydrology in the south basin due to the increase of the evaluated 24-hour precipitation data from 4.40 inches (MKE, 1995) to 4.58 inches. The new value was evaluated specifically for the south basin area using the isopluvial map shown in Figure 2.13 of the Drainage Design Manual for Maricopa County, Arizona (Volume I – Hydrology).
- (d) The resulting effective discharge values have been compared to regional regression equations as part of the verification process. The 100-year peak discharge relation for Flood Region 12 (where Rio Verde area is located) was used to plot HEC-1 flow data points for North-North Basin (see **FIGURE 4.5-1**), North-South Basin (see **FIGURE 4.5-2**) and South Basin (see **FIGURE 4.5-3**). Comparison plots show good fit of the Rio Verde HEC-1 flows with the regional regression relation.

TABLE 4.5-1
Peak Discharge Summary Table for the North-North Basin
(Existing Condition Model)

Line No.	Type	ID	Drainage Area (sq.mi)	100-Year Flood Event			
				24-Hour Duration		6-Hour Duration	
				Peak Flow	Time-to-Peak	Peak Flow	Time-to-Peak
				(cfs)	(hr)	(cfs)	(hr)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Hydrograph	B1W1	0.33	358	12.35	261	4.40
2	Hydrograph	B2W1	0.12	159	12.25	110	4.30
3	Combined	CB2W1	0.45	504	12.30	366	4.35
4	Routed	RB6W1	0.45	458	12.65	349	4.70
5	Hydrograph	B6W1	0.11	151	12.15	93	4.20
6	Combined	CB6W1	0.56	504	12.60	391	4.65
7	Hydrograph	B8W1	0.15	200	12.25	138	4.30
8	Hydrograph	B3W1	0.14	203	12.15	134	4.20
9	Hydrograph	B4W1	0.14	223	12.15	147	4.20
10	Combined	CB3W1	0.28	426	12.15	280	4.20
11	Routed	RB7W1	0.28	381	12.40	263	4.50
12	Hydrograph	B7W1	0.14	226	12.15	143	4.20
13	Combined	CB7W1	0.42	510	12.35	374	4.40
14	Combined	CB9W1A	1.14	1037	12.40	850	4.50
15	Routed	RB9W1A	1.14	1016	12.65	825	4.75
16	Hydrograph	B10W1	0.12	199	12.15	127	4.15
17	Routed	RB9W1B	0.12	198	12.20	127	4.20
18	Hydrograph	B9W1	0.11	137	12.15	76	4.20
19	Combined	CB9W1	1.36	1109	12.65	904	4.70
20	Hydrograph	B5W1	0.38	356	12.45	271	4.50
21	Combined	CB13WA	1.75	1434	12.60	1148	4.70
22	Routed	RB13WA	1.75	1373	12.85	1128	4.95
23	Hydrograph	B13W1	0.21	255	12.25	171	4.30
24	Hydrograph	B14W1	0.14	218	12.15	145	4.20
25	Routed	RB13WB	0.14	218	12.20	145	4.25
26	Combined	CB13W1	2.10	1481	12.80	1239	4.90
27	Hydrograph	B15W1	0.02	58	12.05	32	4.05
28	Hydrograph	B16W1	0.01	37	12.00	20	4.00
29	Hydrograph	B17W1	0.01	25	12.00	13	4.00
30	Hydrograph	B18W1	0.05	98	12.10	59	4.10
31	Hydrograph	B1W2	0.08	118	12.15	78	4.20
32	Hydrograph	B2W2	0.10	143	12.20	95	4.25
33	Combined	CB2W2	0.18	261	12.20	173	4.25
34	Hydrograph	B4W2	0.10	172	12.10	105	4.10

TABLE 4.5-1
Peak Discharge Summary Table for the North-North Basin
(Existing Condition Model)

Line No.	Type	ID	Drainage Area	100-Year Flood Event			
				24-Hour Duration		6-Hour Duration	
			Peak Flow	Time-to-Peak	Peak Flow	Time-to-Peak	
			(sq.mi)	(cfs)	(hr)	(cfs)	(hr)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
35	Hydrograph	B3W5	0.08	138	12.10	82	4.10
36	Routed	RB6W5	0.08	110	12.45	73	4.50
37	Hydrograph	B6W5	0.10	156	12.15	96	4.20
38	Combined	CB6W5	0.18	191	12.30	147	4.40
39	Hydrograph	B4W5	0.07	118	12.10	71	4.15
40	Routed	RB7W5	0.07	112	12.25	69	4.30
41	Hydrograph	B7W5	0.14	189	12.20	125	4.25
42	Combined	CB7W5	0.21	297	12.25	193	4.30
43	Combined	CB67W5	0.40	487	12.25	334	4.35
44	Hydrograph	B5W5	0.09	118	12.20	78	4.25
45	Hydrograph	B5W5A	0.10	142	12.20	91	4.25
46	Hydrograph	B1W5	0.21	303	12.20	205	4.25
47	Hydrograph	B1W6	0.52	758	12.20	505	4.25
48	Routed	RB2W6	0.52	620	12.50	460	4.55
49	Hydrograph	B2W6	0.96	917	12.40	670	4.45
50	Combined	CB2W6	1.48	1525	12.45	1128	4.50
51	Hydrograph	B3W6	0.36	420	12.30	303	4.40
52	Combined	CB3W6	1.84	1901	12.40	1413	4.45
53	Routed	RB6W6	1.84	1855	12.60	1390	4.65
54	Hydrograph	B6W6	0.22	335	12.15	219	4.20
55	Combined	CB6W6	2.05	1958	12.60	1502	4.65
56	Routed	RB9W6A	2.05	1884	12.75	1474	4.80
57	Hydrograph	B5W6	0.38	462	12.30	351	4.40
58	Hydrograph	B4W6A	0.24	346	12.20	233	4.25
59	Hydrograph	B4W6B	0.19	315	12.15	211	4.20
60	Combined	CB4W6	0.43	654	12.15	443	4.20
61	Routed	RB7W6	0.43	636	12.35	436	4.40
62	Hydrograph	B7W6	0.26	437	12.15	302	4.20
63	Combined	CB7W6A	0.69	987	12.30	712	4.30
64	Combined	CB7W6	1.08	1449	12.30	1057	4.35
65	Routed	RB9W6	1.08	1308	12.50	1011	4.55
66	Hydrograph	B9W6	0.55	589	12.30	411	4.40
67	Combined	CB9W6	3.68	3301	12.65	2696	4.70
68	Hydrograph	B8W6	0.11	211	12.10	134	4.10
69	Routed	RB12W6	0.11	171	12.45	122	4.45

TABLE 4.5-1
Peak Discharge Summary Table for the North-North Basin
(Existing Condition Model)

Line No.	Type	ID	Drainage Area	100-Year Flood Event			
				24-Hour Duration		6-Hour Duration	
			Peak Flow	Time-to-Peak	Peak Flow	Time-to-Peak	
			(sq.mi)	(cfs)	(hr)	(cfs)	(hr)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
70	Hydrograph	B12W6	0.23	316	12.20	207	4.25
71	Combined	CB12W6	0.34	397	12.35	304	4.35
72	Combined	CB9W6A	4.02	3522	12.65	2907	4.65
73	Routed	RB13WC	4.02	3515	12.65	2906	4.70
74	Hydrograph	B13W6A	0.11	232	12.05	128	4.05
75	Combined	C13W6A	4.13	3524	12.65	2922	4.70
76	Routed	RB13W3	4.13	3522	12.70	2918	4.75
77	Hydrograph	B10W6A	0.16	311	12.10	199	4.10
78	Routed	RB11WA	0.16	256	12.40	177	4.55
79	Hydrograph	B11W6	0.16	262	12.15	170	4.20
80	Hydrograph	B10W6B	0.16	282	12.15	183	4.15
81	Routed	RB11WB	0.16	251	12.40	169	4.55
82	Combined	CB11W6	0.49	652	12.40	467	4.45
83	Routed	RB13W1	0.49	596	12.55	460	4.60
84	Hydrograph	B14W6	0.11	177	12.10	107	4.15
85	Routed	RB13W2	0.11	156	12.30	101	4.35
86	Hydrograph	B13W6B	0.19	265	12.20	175	4.25
87	Combined	C13W6B	4.91	4192	12.65	3509	4.70
88	Hydrograph	B1W3	0.45	472	12.35	332	4.40
89	Hydrograph	B1W4A	0.13	210	12.15	132	4.15
90	Routed	RB1W4B	0.13	190	12.25	125	4.30
91	Hydrograph	B1W4B	0.12	178	12.15	110	4.20
92	Combined	CB1W4	0.25	349	12.25	231	4.25
93	Routed	RB2W4B	0.25	339	12.30	227	4.35
94	Hydrograph	B2W4B	0.10	161	12.15	99	4.15
95	Combined	CB2W4B	0.35	459	12.25	312	4.30
96	Hydrograph	B2W4A	0.12	148	12.25	100	4.30
97	Combined	CB2W4	0.48	607	12.25	412	4.30
98	Routed	RB4W4A	0.48	469	12.70	358	4.75
99	Hydrograph	B4W4	0.19	205	12.30	137	4.35
100	Hydrograph	B1W4C	0.10	149	12.15	95	4.20
101	Routed	RB2W4C	0.10	85	12.75	66	4.85
102	Hydrograph	B2W4C	0.13	143	12.30	99	4.35
103	Combined	CB2W4C	0.24	165	12.45	133	4.65
104	Routed	RB4W4B	0.24	164	12.50	132	4.75

TABLE 4.5-1
Peak Discharge Summary Table for the North-North Basin
(Existing Condition Model)

Line No.	Type	ID	Drainage Area (sq.mi)	100-Year Flood Event			
				24-Hour Duration		6-Hour Duration	
				Peak Flow	Time-to-Peak	Peak Flow	Time-to-Peak
				(cfs)	(hr)	(cfs)	(hr)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
105	Combined	CB4W4	0.90	728	12.65	579	4.70
106	Hydrograph	B3W4	0.09	151	12.15	93	4.15
107	Routed	RB5W4A	0.09	120	12.45	82	4.55
108	Hydrograph	B5W4A	0.08	134	12.15	84	4.15
109	Combined	CB5W4A	0.18	182	12.40	139	4.45
110	Routed	RB5W4B	0.18	149	12.80	118	4.90
111	Hydrograph	B5W4B	0.15	188	12.20	121	4.25
112	Combined	CB5W4B	0.33	206	12.35	170	4.60
113	Combined	DUMMY	9.87	7176	12.65	6159	4.70

TABLE 4.5-2
Peak Discharge Summary Table for the North-South Basin With Black Hills Tank
(Existing Condition Model)

Line No.	Type	ID	Drainage Area	100-Year Flood Event			
				24-Hour Duration		6-Hour Duration	
			Peak Flow	Time-to-Peak	Peak Flow	Time-to-Peak	
			(sq.mi.)	(cfs)	(hr)	(cfs)	(hr)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Hydrograph	1B1	0.49	794	12.15	553	4.20
2	Routed	RT1112	0.49	497	12.90	428	4.95
3	Hydrograph	1B2	0.16	167	12.40	129	4.45
4	Combined	CP1B2	0.65	569	12.90	500	4.95
5	Hydrograph	1B3	0.13	235	12.10	159	4.15
6	Diversion	1B3R	0.13	230	12.10	158	4.15
7	Hydrograph	1B3L	0.13	6	12.10	2	4.15
8	Routed	RT1314	0.13	1	13.55	0	5.60
9	Hydrograph	1B4	0.14	183	12.25	136	4.30
10	Combined	CP1B4	0.27	183	12.25	136	4.30
11	Combined	CP1214	0.92	617	12.85	553	4.90
12	Routed	RT1452	0.92	591	13.05	534	5.05
13	Hydrograph	5B2	0.12	193	12.20	142	4.25
14	Combined	CP5B2	1.05	617	13.00	567	5.05
15	Routed	RT529B	1.05	563	13.40	521	5.45
16	Hydrograph	5B1	0.10	170	12.15	123	4.20
17	Routed	RT519B	0.10	100	12.70	91	4.75
18	Hydrograph	9B	0.20	239	12.30	177	4.35
19	Hydrograph	8B1	0.08	132	12.10	86	4.15
20	Routed	RT819B	0.08	132	12.15	86	4.20
21	Hydrograph	4B1	0.37	401	12.35	306	4.40
22	Routed	RT4142	0.37	355	12.60	285	4.70
23	Hydrograph	4B2	0.24	310	12.25	220	4.30
24	Combined	CP4B2	0.61	505	12.55	439	4.55
25	Routed	RT4282	0.61	490	12.70	427	4.70
26	Hydrograph	8B2	0.06	104	12.15	69	4.15
27	Hydrograph	2B1	0.47	776	12.15	531	4.20
28	Routed	RT2122	0.47	620	12.40	479	4.45
29	Hydrograph	2B2	0.53	645	12.30	486	4.35
30	Hydrograph	2B3	0.26	361	12.20	263	4.25
31	Combined	CP2223	1.26	1552	12.35	1200	4.35
32	Routed	RT2226	1.26	1498	12.50	1176	4.55
33	Hydrograph	2B4	0.21	253	12.30	192	4.35
34	Hydrograph	2B5	0.13	257	12.10	170	4.10
35	Combined	CP2425	0.34	436	12.15	331	4.20

TABLE 4.5-2
Peak Discharge Summary Table for the North-South Basin With Black Hills Tank
(Existing Condition Model)

Line No.	Type	ID	Drainage Area	100-Year Flood Event			
				24-Hour Duration		6-Hour Duration	
			Peak Flow	Time-to-Peak	Peak Flow	Time-to-Peak	
			(sq.mi.)	(cfs)	(hr)	(cfs)	(hr)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
36	Routed	RT4526	0.34	349	12.55	296	4.60
37	Hydrograph	2B6	0.31	483	12.20	353	4.20
38	Combined	CP2B6	1.91	2090	12.50	1721	4.55
39	Routed	RS2B6	1.91	761	13.10	700	5.20
40	Routed	RT2631	1.91	743	13.30	688	5.40
41	Hydrograph	3B1	0.10	126	12.25	90	4.25
42	Combined	CP3B1	2.01	751	13.25	693	5.40
43	Routed	RT3132	2.01	717	13.50	664	5.65
44	Hydrograph	3B2	0.34	416	12.30	315	4.35
45	Combined	CP3B2	2.35	722	13.50	676	5.60
46	Routed	RT3282	2.35	721	13.50	677	5.65
47	Combined	CP8B2	3.02	869	12.45	805	5.60
48	Routed	RT829B	3.02	871	13.50	804	5.60
49	Combined	CP9B	4.44	1478	13.45	1356	5.60
50	Hydrograph	1B36B	0.00	230	12.10	158	4.15
51	Routed	RT136B	0.00	166	12.75	135	4.80
52	Hydrograph	6B	0.20	263	12.30	206	4.35
53	Combined	CP6B	0.20	301	12.65	283	4.65
54	Hydrograph	1N	0.13	331	12.05	201	4.05
55	Hydrograph	4A	0.08	125	12.20	89	4.20
56	Hydrograph	2A	0.03	58	12.10	38	4.10
57	Hydrograph	1S	0.19	364	12.10	248	4.10
58	Routed	RT1S2S	0.19	309	12.30	229	4.35
59	Hydrograph	2S	0.09	152	12.15	102	4.15
60	Combined	CP2S	0.28	432	12.25	321	4.25
61	Routed	RT2S3S	0.28	414	12.35	316	4.40
62	Hydrograph	3S	0.09	143	12.15	96	4.15
63	Combined	CP3S	0.37	500	12.35	393	4.40
64	Routed	RT3S4N	0.37	495	12.40	392	4.45
65	Hydrograph	3N	0.11	189	12.15	134	4.15
66	Routed	RT34N1	0.11	189	12.20	134	4.20
67	Hydrograph	4N1	0.05	85	12.15	57	4.15
68	Combined	CP4N1	0.16	269	12.20	190	4.20
69	Routed	RT4N14	0.16	234	12.35	182	4.40
70	Hydrograph	2N	0.20	364	12.15	252	4.15
71	Routed	RT2N4N	0.20	312	12.35	238	4.40

TABLE 4.5-2
Peak Discharge Summary Table for the North-South Basin With Black Hills Tank
(Existing Condition Model)

Line No.	Type	ID	Drainage Area (sq.mi.)	100-Year Flood Event			
				24-Hour Duration		6-Hour Duration	
				Peak Flow	Time-to-Peak	Peak Flow	Time-to-Peak
				(cfs)	(hr)	(cfs)	(hr)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
72	Hydrograph	4N	0.07	140	12.10	97	4.15
73	Combined	CP4N	0.81	1112	12.35	885	4.40

TABLE 4.5-3
Peak Discharge Summary Table for the North-South Basin Without Black Hills Tank
(Existing Condition Model)

Line No.	Type	ID	Drainage Area	100-Year Flood Event			
				24-Hour Duration		6-Hour Duration	
			Peak Flow	Time-to-Peak	Peak Flow	Time-to-Peak	
			(sq.mi.)	(cfs)	(hr)	(cfs)	(hr)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Hydrograph	1B1	0.49	794	12.15	553	4.20
2	Routed	RT1112	0.49	497	12.90	428	4.95
3	Hydrograph	1B2	0.16	167	12.40	129	4.45
4	Combined	CP1B2	0.65	569	12.90	500	4.95
5	Hydrograph	1B3	0.13	235	12.10	159	4.15
6	Diversion	1B3R	0.13	230	12.10	158	4.15
7	Hydrograph	1B3L	0.13	6	12.10	2	4.15
8	Routed	RT1314	0.13	1	13.55	0	5.60
9	Hydrograph	1B4	0.14	183	12.25	136	4.30
10	Combined	CP1B4	0.27	183	12.25	136	4.30
11	Combined	CP1214	0.92	617	12.85	553	4.90
12	Routed	RT1452	0.92	591	13.05	534	5.05
13	Hydrograph	5B2	0.12	193	12.20	142	4.25
14	Combined	CP5B2	1.05	617	13.00	567	5.05
15	Routed	RT529B	1.05	563	13.40	521	5.45
16	Hydrograph	5B1	0.10	170	12.15	123	4.20
17	Routed	RT519B	0.10	100	12.70	91	4.75
18	Hydrograph	9B	0.20	239	12.30	177	4.35
19	Combined	CP9BA	1.35	630	13.35	587	5.40
20	Hydrograph	8B1	0.08	132	12.10	86	4.15
21	Routed	RT819B	0.08	132	12.15	86	4.20
22	Hydrograph	4B1	0.37	401	12.35	306	4.40
23	Routed	RT4142	0.37	355	12.60	285	4.70
24	Hydrograph	4B2	0.24	310	12.25	220	4.30
25	Combined	CP4B2	0.61	505	12.55	439	4.55
26	Routed	RT4282	0.61	490	12.70	427	4.70
27	Hydrograph	8B2	0.06	104	12.15	69	4.15
28	Combined	CP8B2A	0.67	510	12.65	452	4.70
29	Hydrograph	2B1	0.47	776	12.15	531	4.20
30	Routed	RT2122	0.47	620	12.40	479	4.45
31	Hydrograph	2B2	0.53	645	12.30	486	4.35
32	Hydrograph	2B3	0.26	361	12.20	263	4.25
33	Combined	CP2223	1.26	1552	12.35	1200	4.35
34	Routed	RT2226	1.26	1498	12.50	1176	4.55
35	Hydrograph	2B4	0.21	253	12.30	192	4.35

TABLE 4.5-3
Peak Discharge Summary Table for the North-South Basin Without Black Hills Tank
(Existing Condition Model)

Line No.	Type	ID	Drainage Area (sq.mi.)	100-Year Flood Event			
				24-Hour Duration		6-Hour Duration	
				Peak Flow	Time-to-Peak	Peak Flow	Time-to-Peak
				(cfs)	(hr)	(cfs)	(hr)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
36	Hydrograph	2B5	0.13	257	12.10	170	4.10
37	Combined	CP2425	0.34	436	12.15	331	4.20
38	Routed	RT4526	0.34	349	12.55	296	4.60
39	Hydrograph	2B6	0.31	483	12.20	353	4.20
40	Combined	CP2B6	1.91	2090	12.50	1721	4.55
41	Routed	RT2632	1.91	1646	12.95	1472	5.00
42	Hydrograph	3B1	0.10	126	12.25	90	4.25
43	Routed	RT3132	0.10	88	12.65	70	4.80
44	Hydrograph	3B2	0.34	416	12.30	315	4.35
45	Combined	CP3B2	2.35	1838	12.90	1664	4.95
46	Routed	RT3282	2.35	1835	12.90	1661	4.95
47	Combined	CP8B2	3.02	2254	12.90	2039	4.95
48	Routed	RT829B	3.02	2257	12.90	2045	4.95
49	Combined	CP9B	4.44	2819	12.90	2572	4.95
50	Hydrograph	1B36B	0.00	230	12.10	158	4.15
51	Routed	RT136B	0.00	166	12.75	135	4.80
52	Hydrograph	6B	0.20	263	12.30	206	4.35
53	Combined	CP6B	0.20	301	12.65	283	4.65
54	Hydrograph	1N	0.13	331	12.05	201	4.05
55	Hydrograph	4A	0.08	125	12.20	89	4.20
56	Hydrograph	2A	0.03	58	12.10	38	4.10
57	Hydrograph	1S	0.19	364	12.10	248	4.10
58	Routed	RT1S2S	0.19	309	12.30	229	4.35
59	Hydrograph	2S	0.09	152	12.15	102	4.15
60	Combined	CP2S	0.28	432	12.25	321	4.25
61	Routed	RT2S3S	0.28	414	12.35	316	4.40
62	Hydrograph	3S	0.09	143	12.15	96	4.15
63	Combined	CP3S	0.37	500	12.35	393	4.40
64	Routed	RT3S4N	0.37	495	12.40	392	4.45
65	Hydrograph	3N	0.11	189	12.15	134	4.15
66	Routed	RT34N1	0.11	189	12.20	134	4.20
67	Hydrograph	4N1	0.05	85	12.15	57	4.15
68	Combined	CP4N1	0.16	269	12.20	190	4.20
69	Routed	RT4N14	0.16	234	12.35	178	4.40
70	Hydrograph	2N	0.20	364	12.15	252	4.15
71	Routed	RT2N4N	0.20	312	12.35	234	4.40

TABLE 4.5-3
Peak Discharge Summary Table for the North-South Basin Without Black Hills Tank
(Existing Condition Model)

Line No.	Type	ID	Drainage Area (sq.mi.)	100-Year Flood Event			
				24-Hour Duration		6-Hour Duration	
				Peak Flow	Time-to-Peak	Peak Flow	Time-to-Peak
				(cfs)	(hr)	(cfs)	(hr)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
72	Hydrograph	4N	0.07	140	12.10	97	4.15
73	Combined	CP4N	0.81	1112	12.35	876	4.40

TABLE 4.5-4
Peak Discharge Summary Table for the South Basin
(Existing Condition Model)

Line No.	Type	ID	Drainage Area (sq.mi.)	100-Year Flood Event			
				24-Hour Duration		6-Hour Duration	
				Peak Flow	Time-to-Peak	Peak Flow	Time-to-Peak
				(cfs)	(hr)	(cfs)	(hr)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	HYDROGRAPH	511A1	0.29	382	12.23	272	4.30
2	HYDROGRAPH	511A2	0.06	109	12.1	68	4.10
3	ROUTED TO	RTA2A3	0.06	80	12.3	57	4.37
4	HYDROGRAPH	511A3	0.29	391	12.23	276	4.27
5	3 COMBINED	CP11A	0.65	849	12.23	605	4.30
6	ROUTED TO	RTA1D	0.65	732	12.53	564	4.57
7	HYDROGRAPH	511D	0.12	190	12.17	132	4.20
8	2 COMBINED	CP11D	0.77	824	12.5	656	4.53
9	HYDROGRAPH	511B4	0.19	337	12.13	230	4.17
10	HYDROGRAPH	511B1	0.58	616	12.4	476	4.43
11	HYDROGRAPH	511B2	0.22	272	12.3	199	4.33
12	2 COMBINED	CPB1B2	0.81	874	12.37	671	4.40
13	ROUTED TO	RT12B4	0.81	811	12.53	642	4.60
14	HYDROGRAPH	511B3	0.08	143	12.13	94	4.13
15	ROUTED TO	RTB3B4	0.08	122	12.27	86	4.30
16	3 COMBINED	CP11B	1.08	1021	12.5	855	4.50
17	ROUTED TO	RTB4D	1.08	1019	12.5	854	4.53
18	2 COMBINED	CP11DF	1.85	1844	12.5	1510	4.53
19	ROUTED TO	RTDF	1.85	1815	12.6	1462	4.73
20	HYDROGRAPH	511F	0.16	265	12.13	177	4.17
21	2 COMBINED	CP11F	2.00	1888	12.6	1536	4.70
22	HYDROGRAPH	511C1	0.33	387	12.3	282	4.37
23	DIVERSION	DIC1C4	0.33	201	12.3	146	4.37
24	HYDROGRAPH	DIC1E2	0.33	186	12.3	136	4.37
25	ROUTED TO	RTC1E2	0.33	142	12.8	117	4.83
26	HYDROGRAPH	511E1	0.30	364	12.27	262	4.33
27	ROUTED TO	RTE1E2	0.30	307	12.53	236	4.60
28	HYDROGRAPH	511E2	0.28	342	12.3	259	4.37
29	2 COMBINED	CPE1E2	0.57	586	12.43	460	4.53
30	HYDROGRAPH	511C4	0.02	46	12.03	26	4.03
31	HYDROGRAPH	DRC1C4	0.00	201	12.3	146	4.37
32	ROUTED TO	RTC1C4	0.00	194	12.37	143	4.43
33	2 COMBINED	CP11C4	0.02	202	12.33	155	4.37
34	DIVERSION	DIC4C5	0.02	140	12.33	109	4.37

TABLE 4.5-4
Peak Discharge Summary Table for the South Basin
(Existing Condition Model)

Line No.	Type	ID	Drainage Area	100-Year Flood Event			
				24-Hour Duration		6-Hour Duration	
			Peak Flow	Time-to-Peak	Peak Flow	Time-to-Peak	
			(sq.mi.)	(cfs)	(hr)	(cfs)	(hr)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
35	HYDROGRAPH	DIC4E2	0.02	62	12.33	46	4.37
36	ROUTED TO	RTC4E2	0.02	42	12.83	33	5.03
37	3 COMBINED	CP11E2	0.92	661	12.47	568	4.63
38	HYDROGRAPH	511C5	0.11	195	12.13	131	4.13
39	HYDROGRAPH	DRC4C5	0.00	140	12.33	109	4.37
40	ROUTED TO	RTC4C5	0.00	133	12.47	106	4.53
41	HYDROGRAPH	511C3	0.14	217	12.17	144	4.20
42	ROUTED TO	RTC3C5	0.14	198	12.3	138	4.33
43	HYDROGRAPH	511C2	0.39	434	12.33	322	4.40
44	DIVERSION	DIC2A2	0.39	167	12.33	120	4.40
45	HYDROGRAPH	DIC2C5	0.39	267	12.33	202	4.40
46	ROUTED TO	RTC2C5	0.39	244	12.5	191	4.57
47	4 COMBINED	CP11C5	0.64	626	12.4	510	4.43
48	DIVERSION	DIC5C6	0.64	448	12.4	384	4.43
49	HYDROGRAPH	DIC5E2	0.64	215	12.4	126	4.43
50	ROUTED TO	RTC5E2	0.64	171	12.5	123	4.63
51	2 COMBINED	CP11EF	1.56	830	12.53	691	4.63
52	2 COMBINED	CPEF	3.57	2712	12.57	2221	4.67
53	ROUTED TO	RTEFC8	3.57	2678	12.63	2209	4.70
54	HYDROGRAPH	511C8	0.04	88	12.07	50	4.07
55	2 COMBINED	CP11C8	3.61	2681	12.63	2215	4.70
56	ROUTED TO	RTC8C7	3.61	2680	12.63	2213	4.73
57	HYDROGRAPH	511C7	0.12	182	12.17	127	4.23
58	HYDROGRAPH	511C6	0.04	68	12.1	44	4.10
59	HYDROGRAPH	DRC5C6	0.00	448	12.27	384	4.43
60	ROUTED TO	RTC5C6	0.00	406	12.63	351	4.67
61	2 COMBINED	CP11C6	0.04	417	12.63	368	4.63
62	ROUTED TO	RTC6C7	0.04	409	12.67	362	4.73
63	3 COMBINED	CP11C7	3.76	3149	12.63	2639	4.70
64	ROUTED TO	RTC7H	3.76	3029	12.8	2577	4.87
65	HYDROGRAPH	511H	0.30	333	12.27	223	4.33
66	2 COMBINED	CP11H	4.07	3135	12.8	2673	4.87
67	ROUTED TO	RTHG4	4.07	3129	12.8	2670	4.87
68	HYDROGRAPH	511G1	0.31	505	12.13	329	4.17
69	ROUTED TO	RTG1G2	0.31	417	12.37	298	4.43

TABLE 4.5-4
Peak Discharge Summary Table for the South Basin
(Existing Condition Model)

Line No.	Type	ID	Drainage Area (sq.mi.)	100-Year Flood Event			
				24-Hour Duration		6-Hour Duration	
				Peak Flow	Time-to-Peak	Peak Flow	Time-to-Peak
				(cfs)	(hr)	(cfs)	(hr)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
70	HYDROGRAPH	511G2	0.16	228	12.17	151	4.20
71	2 COMBINED	CP11G2	0.47	594	12.3	429	4.37
72	ROUTED TO	RTG2G4	0.47	565	12.43	422	4.50
73	HYDROGRAPH	511G3	0.10	138	12.17	90	4.20
74	ROUTED TO	RTG3G4	0.10	122	12.4	85	4.43
75	HYDROGRAPH	511G4	0.30	348	12.27	238	4.33
76	3 COMBINED	CPG_G4	0.86	975	12.37	720	4.43
77	2 COMBINED	CP11G4	4.93	3612	12.77	3129	4.80
78	ROUTED TO	RTG4I	4.93	3586	12.83	3115	4.90
79	HYDROGRAPH	511I	0.20	254	12.17	158	4.23
80	2 COMBINED	CP11I	5.13	3627	12.83	3155	4.87
81	HYDROGRAPH	510A	0.92	866	12.53	707	4.57
82	HYDROGRAPH	509A5	0.02	46	12.03	26	4.03
83	DIVERSION	DIA5S	0.02	1	12.03	1	4.03
84	HYDROGRAPH	DIA59B	0.02	45	12.03	25	4.03
85	ROUTED TO	RTA59B	0.02	13	13.7	11	5.87
86	HYDROGRAPH	509B	0.65	497	12.63	384	4.63
87	2 COMBINED	CP09B	0.67	497	12.63	385	4.63
88	HYDROGRAPH	509A1	0.19	265	12.23	192	4.27
89	ROUTED TO	RTA1A2	0.19	250	12.33	187	4.37
90	HYDROGRAPH	509A2	0.13	195	12.2	140	4.23
91	HYDROGRAPH	DRC2A2	0.00	167	12.33	120	4.40
92	ROUTED TO	RTC2A2	0.00	145	12.6	111	4.67
93	3 COMBINED	CP09A2	0.32	475	12.33	386	4.47
94	ROUTED TO	RTA2A4	0.32	453	12.5	377	4.60
95	HYDROGRAPH	509A3	0.16	258	12.17	176	4.20
96	ROUTED TO	RTA3A4	0.16	249	12.23	174	4.27
97	HYDROGRAPH	509A4	0.06	133	12.07	81	4.07
98	3 COMBINED	CP09A4	0.55	668	12.33	554	4.40
99	ROUTED TO	RTA4A6	0.55	652	12.43	547	4.53
100	HYDROGRAPH	DRA5A6	0.00	1	12.03	1	4.03
101	ROUTED TO	RTA5A6	0.00	1	12.3	1	4.37
102	HYDROGRAPH	509A6	0.03	75	12.03	45	4.03
103	3 COMBINED	CP09A6	0.58	666	12.43	565	4.50
104	HYDROGRAPH	509D	0.38	394	12.4	304	4.47

TABLE 4.5-4
Peak Discharge Summary Table for the South Basin
(Existing Condition Model)

Line No.	Type	ID	Drainage Area (sq.mi.)	100-Year Flood Event			
				24-Hour Duration		6-Hour Duration	
				Peak Flow	Time-to-Peak	Peak Flow	Time-to-Peak
				(cfs)	(hr)	(cfs)	(hr)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
105	HYDROGRAPH	500A	0.20	288	12.17	191	4.23
106	ROUTED TO	RTAB	0.20	266	12.37	185	4.40
107	HYDROGRAPH	500B	0.19	233	12.27	171	4.33
108	2 COMBINED	CP500B	0.40	493	12.33	355	4.37

TABLE 4.5-5
HEC-1 Peak Flow Comparison for North-North Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by Primatech, LLC.				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	Hydrograph	B1W1	0.33	358	261	1	HYDROGRAPH AT	B1W1	0.35	322	228
2	Hydrograph	B2W1	0.12	159	110	2	HYDROGRAPH AT	B2W1	0.12	132	87
3	Combined	CB2W1	0.45	504	366	3	2 COMBINED AT	CB2W1	0.47	446	312
4	Routed	RB6W1	0.45	458	349	4	ROUTED TO	RB6W1	0.47	406	297
5	Hydrograph	B6W1	0.11	151	93	5	HYDROGRAPH AT	B6W1	0.1	114	66
6	Combined	CB6W1	0.56	504	391	6	2 COMBINED AT	CB6W1	0.57	438	326
7	Hydrograph	B8W1	0.15	200	138	7	HYDROGRAPH AT	B8W1	0.15	182	117
8	Hydrograph	B3W1	0.14	203	134	8	HYDROGRAPH AT	B3W1	0.14	182	111
9	Hydrograph	B4W1	0.14	223	147	9	HYDROGRAPH AT	B4W1	0.14	232	138
10	Combined	CB3W1	0.28	426	280	10	2 COMBINED AT	CB3W1	0.28	410	248
11	Routed	RB7W1	0.28	381	263	11	ROUTED TO	RB7W1	0.28	345	228
12	Hydrograph	B7W1	0.14	226	143	12	HYDROGRAPH AT	B7W1	0.15	195	120
13	Combined	CB7W1	0.42	510	374	13	2 COMBINED AT	CB7W1	0.43	468	327
14	Combined	CB9W1A	1.14	1037	850	14	3 COMBINED AT	CB9W1	1.15	892	705
15	Routed	RB9W1A	1.14	1016	825	15	ROUTED TO	RB9W1	1.15	853	671
16	Hydrograph	B10W1	0.12	199	127	16	HYDROGRAPH AT	B10W1	0.12	185	112
17	Routed	RB9W1B	0.12	198	127	17	ROUTED TO	RB10W1	0.12	179	110
18	Hydrograph	B9W1	0.11	137	76	18	HYDROGRAPH AT	B9W1	0.1	118	63
19	Combined	CB9W1	1.36	1109	904	19	3 COMBINED AT	CB10W1	1.37	923	740
20	Hydrograph	B5W1	0.38	356	271	20	HYDROGRAPH AT	B5W1	0.38	359	256
21	Combined	CB13WA	1.75	1434	1148	21	2 COMBINED AT	CB12W1	1.75	1184	955
22	Routed	RB13WA	1.75	1373	1128	22	ROUTED TO	RB12W1	1.75	1119	910

TABLE 4.5-5
HEC-1 Peak Flow Comparison for North-North Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by Primatech, LLC.				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
23	Hydrograph	B13W1	0.21	255	171	23	HYDROGRAPH AT	B12W1	0.09	157	87
24	Hydrograph	B14W1	0.14	218	145	24	2 COMBINED AT	C12W1	1.84	1125	920
25	Routed	RB13WB	0.14	218	145	25	ROUTED TO	RB13W1	1.84	1092	894
26	Combined	CB13W1	2.10	1481	1239	26	HYDROGRAPH AT	B13W1	0.12	171	109
27	Hydrograph	B15W1	0.02	58	32	27	HYDROGRAPH AT	B14W1	0.14	196	128
28	Hydrograph	B16W1	0.01	37	20	28	3 COMBINED AT	CB13W1	2.1	1149	960
29	Hydrograph	B17W1	0.01	25	13	29	HYDROGRAPH AT	W1A	0.02	53	28
30	Hydrograph	B18W1	0.05	98	59	30	HYDROGRAPH AT	W1B	0.01	34	18
31	Hydrograph	B1W2	0.08	118	78	31	HYDROGRAPH AT	W1C	0.01	23	11
32	Hydrograph	B2W2	0.10	143	95	32	4 COMBINED AT	CB14W1	2.14	1149	961
33	Combined	CB2W2	0.18	261	173	33	HYDROGRAPH AT	B1W2	0.08	113	70
34	Hydrograph	B4W2	0.10	172	105	34	HYDROGRAPH AT	B2W2	0.1	149	92
35	Hydrograph	B3W5	0.08	138	82	35	2 COMBINED AT	CB2W2	0.18	261	162
36	Routed	RB6W5	0.08	110	73	36	ROUTED TO	RB3W2	0.18	196	140
37	Hydrograph	B6W5	0.10	156	96	37	DIVERSION TO	DB3W2	0.18	0	0
38	Combined	CB6W5	0.18	191	147	38	HYDROGRAPH AT	DV3W2	0.18	196	140
39	Hydrograph	B4W5	0.07	118	71	39	HYDROGRAPH AT	B3W2	0.12	150	93
40	Routed	RB7W5	0.07	112	69	40	2 COMBINED AT	CB3W2	0.3	314	219
41	Hydrograph	B7W5	0.14	189	125	41	ROUTED TO	RB5W2	0.3	262	195
42	Combined	CB7W5	0.21	297	193	42	HYDROGRAPH AT	B4W2	0.1	158	92
43	Combined	CB67W5	0.40	487	334	43	HYDROGRAPH AT	B5W2	0.06	93	55
44	Hydrograph	B5W5	0.09	118	78	44	3 COMBINED AT	CB6W2	0.46	330	264

TABLE 4.5-5
HEC-1 Peak Flow Comparison for North-North Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by Primatech, LLC.				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
45	Hydrograph	B5W5A	0.10	142	91	45	ROUTED TO	RB6W2	0.46	313	248
46	Hydrograph	B1W5	0.21	303	205	46	HYDROGRAPH AT	B6W2	0.11	158	92
47	Hydrograph	B1W6	0.52	758	505	47	HYDROGRAPH AT	B7W2	0.09	100	64
48	Routed	RB2W6	0.52	620	460	48	3 COMBINED AT	CB7W2	0.66	449	338
49	Hydrograph	B2W6	0.96	917	670	49	ROUTED TO	RB8W2	0.66	436	334
50	Combined	CB2W6	1.48	1525	1128	50	HYDROGRAPH AT	B8W2	0.03	59	30
51	Hydrograph	B3W6	0.36	420	303	51	HYDROGRAPH AT	W2A	0.05	89	49
52	Combined	CB3W6	1.84	1901	1413	52	HYDROGRAPH AT	W2B	0.03	52	28
53	Routed	RB6W6	1.84	1855	1390	53	4 COMBINED AT	CB8W2	0.77	492	366
54	Hydrograph	B6W6	0.22	335	219	54	HYDROGRAPH AT	B1W3	0.45	453	308
55	Combined	CB6W6	2.05	1958	1502	55	DIVERSION TO	DIB1W3	0.45	2	0
56	Routed	RB9W6A	2.05	1884	1474	56	HYDROGRAPH AT	DV1W3	0.45	451	308
57	Hydrograph	B5W6	0.38	462	351	57	ROUTED TO	RB2W3	0.45	425	298
58	Hydrograph	B4W6A	0.24	346	233	58	HYDROGRAPH AT	B2W3	0.21	327	199
59	Hydrograph	B4W6B	0.19	315	211	59	2 COMBINED AT	CB2W3	0.66	529	415
60	Combined	CB4W6	0.43	654	443	60	ROUTED TO	RB4W3	0.66	522	411
61	Routed	RB7W6	0.43	636	436	61	DIVERSION TO	DB4W3	0.66	176	157
62	Hydrograph	B7W6	0.26	437	302	62	HYDROGRAPH AT	DV4W3	0.66	346	254
63	Combined	CB7W6A	0.69	987	712	63	ROUTED TO	RB4W3A	0.66	327	236
64	Combined	CB7W6	1.08	1449	1057	64	HYDROGRAPH AT	B1W4	0.16	266	151
65	Routed	RB9W6	1.08	1308	1011	65	ROUTED TO	RB2W4	0.16	202	130
66	Hydrograph	B9W6	0.55	589	411	66	HYDROGRAPH AT	B2W4	0.43	538	333

TABLE 4.5-5
HEC-1 Peak Flow Comparison for North-North Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by Primatech, LLC.				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
67	Combined	CB9W6	3.68	3301	2696	67	2 COMBINED AT	CB2W4	0.59	682	443
68	Hydrograph	B8W6	0.11	211	134	68	ROUTED TO	RB4W4	0.59	609	415
69	Routed	RB12W6	0.11	171	122	69	HYDROGRAPH AT	B3W4	0.12	203	116
70	Hydrograph	B12W6	0.23	316	207	70	ROUTED TO	RB5W4	0.12	164	104
71	Combined	CB12W6	0.34	397	304	71	DIVERSION TO	DB5W4	0.12	97	69
72	Combined	CB9W6A	4.02	3522	2907	72	HYDROGRAPH AT	DV5W4	0.12	67	35
73	Routed	RB13WC	4.02	3515	2906	73	ROUTED TO	RDB5W4	0.12	57	32
74	Hydrograph	B13W6A	0.11	232	128	74	2 COMBINED AT	C2W4	0.71	667	447
75	Combined	C13W6A	4.13	3524	2922	75	DIVERSION TO	DB4W4	0.71	212	132
76	Routed	RB13W3	4.13	3522	2918	76	HYDROGRAPH AT	DV4W4	0.71	455	314
77	Hydrograph	B10W6A	0.16	311	199	77	ROUTED TO	RB4W4A	0.71	430	305
78	Routed	RB11WA	0.16	256	177	78	HYDROGRAPH AT	B4W4	0.31	332	224
79	Hydrograph	B11W6	0.16	262	170	79	2 COMBINED AT	CB4W4	1.02	597	458
80	Hydrograph	B10W6B	0.16	282	183	80	HYDROGRAPH AT	B5W4	0.18	239	155
81	Routed	RB11WB	0.16	251	169	81	HYDROGRAPH AT	R5W4	0	97	69
82	Combined	CB11W6	0.49	652	467	82	ROUTED TO	RB5W4A	0	74	59
83	Routed	RB13W1	0.49	596	460	83	HYDROGRAPH AT	R4W4	0	212	132
84	Hydrograph	B14W6	0.11	177	107	84	ROUTED TO	RDB4W4	0	202	129
85	Routed	RB13W2	0.11	156	101	85	HYDROGRAPH AT	B1W5	0.21	322	221
86	Hydrograph	B13W6B	0.19	265	175	86	DIVERSION TO	DB1W5	0.21	188	125
87	Combined	C13W6B	4.91	4192	3509	87	HYDROGRAPH AT	DV1W5	0.21	134	96
88	Hydrograph	B1W3	0.45	472	332	88	ROUTED TO	RDB1W5	0.21	124	93

TABLE 4.5-5
HEC-1 Peak Flow Comparison for North-North Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by Primatech, LLC.				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
89	Hydrograph	B1W4A	0.13	210	132	89	4 COMBINED AT	CB5W4	0.39	403	317
90	Routed	RB1W4B	0.13	190	125	90	ROUTED TO	RB8W4	0.39	392	311
91	Hydrograph	B1W4B	0.12	178	110	91	HYDROGRAPH AT	B8W4	0.02	31	7
92	Combined	CB1W4	0.25	349	231	92	2 COMBINED AT	CB8W4	0.41	392	311
93	Routed	RB2W4B	0.25	339	227	93	2 COMBINED AT	C8W4	1.43	988	768
94	Hydrograph	B2W4B	0.10	161	99	94	ROUTED TO	RB7W4	1.43	978	762
95	Combined	CB2W4B	0.35	459	312	95	HYDROGRAPH AT	R1W3	0	2	0
96	Hydrograph	B2W4A	0.12	148	100	96	ROUTED TO	RDB1W3	0	0	0
97	Combined	CB2W4	0.48	607	412	97	2 COMBINED AT	CB8W4A	1.43	978	762
98	Routed	RB4W4A	0.48	469	358	98	HYDROGRAPH AT	B7W4	0.4	556	376
99	Hydrograph	B4W4	0.19	205	137	99	2 COMBINED AT	CB7W4	1.83	1105	915
100	Hydrograph	B1W4C	0.10	149	95	100	ROUTED TO	RB9W4	1.83	1064	886
101	Routed	RB2W4C	0.10	85	66	101	HYDROGRAPH AT	B9W4	0.21	285	172
102	Hydrograph	B2W4C	0.13	143	99	102	2 COMBINED AT	CB9W4	2.04	1083	907
103	Combined	CB2W4C	0.24	165	133	103	ROUTED TO	RB10W4	2.04	1075	901
104	Routed	RB4W4B	0.24	164	132	104	DIVERSION TO	DB10W4	2.04	516	430
105	Combined	CB4W4	0.90	728	579	105	HYDROGRAPH AT	DV10W4	2.04	559	470
106	Hydrograph	B3W4	0.09	151	93	106	HYDROGRAPH AT	B4W3	0.15	182	125
107	Routed	RB5W4A	0.09	120	82	107	3 COMBINED AT	CB4W3	2.85	874	718
108	Hydrograph	B5W4A	0.08	134	84	108	ROUTED TO	RB7W3	2.85	837	697
109	Combined	CB5W4A	0.18	182	139	109	HYDROGRAPH AT	B7W3	0.26	263	162
110	Routed	RB5W4B	0.18	149	118	110	2 COMBINED AT	CB7W3	3.11	858	711

TABLE 4.5-5
HEC-1 Peak Flow Comparison for North-North Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by Primatech, LLC.				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
111	Hydrograph	B5W4B	0.15	188	121	111	HYDROGRAPH AT	R4W3	0	176	157
112	Combined	CB5W4B	0.33	206	170	112	ROUTED TO	RDB4W3	0	171	154
113	Combined	DUMMY	9.87	7176	6159	113	HYDROGRAPH AT	B3W3	0.13	163	107
						114	2 COMBINED AT	CB3W3	0.13	268	222
						115	ROUTED TO	RB5W3	0.13	261	220
						116	HYDROGRAPH AT	B5W3	0.07	130	79
						117	2 COMBINED AT	CB5W3	0.2	305	252
						118	ROUTED TO	RB6W3	0.2	280	246
						119	HYDROGRAPH AT	R3W2	0	0	0
						120	ROUTED TO	RDB3W2	0	0	0
						121	2 COMBINED AT	C6W3	0.2	280	246
						122	ROUTED TO	RB6W3A	0.2	272	242
						123	HYDROGRAPH AT	B6W3	0.26	296	211
						124	2 COMBINED AT	CB6W3	0.46	374	319
						125	2 COMBINED AT	C7W3	3.57	1154	985
						126	ROUTED TO	RB8W3	3.57	1152	985
						127	HYDROGRAPH AT	B8W3	0.12	154	90
						128	2 COMBINED AT	CB8W3	3.69	1156	988
						129	HYDROGRAPH AT	R1W5	0	188	125
						130	ROUTED TO	RB2W5	0	146	111
						131	HYDROGRAPH AT	B2W5	0.13	192	131
						132	2 COMBINED AT	CB2W5	0.13	218	193

TABLE 4.5-5
HEC-1 Peak Flow Comparison for North-North Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by Primatech, LLC.				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						133	DIVERSION TO	DB2W5	0.13	101	93
						134	HYDROGRAPH AT	DV2W5	0.13	116	99
						135	ROUTED TO	RDB2W5	0.13	113	98
						136	ROUTED TO	RB9W4A	0.13	109	96
						137	ROUTED TO	RB11W4	0.13	106	93
						138	HYDROGRAPH AT	B11W4	0.09	149	77
						139	2 COMBINED AT	CB11W4	0.22	149	94
						140	ROUTED TO	R12W4	0.22	112	88
						141	HYDROGRAPH AT	R10W4	0	516	430
						142	HYDROGRAPH AT	B10W4	0.07	112	57
						143	2 COMBINED AT	CB10W4	0.07	516	431
						144	ROUTED TO	RB12W4	0.07	510	427
						145	2 COMBINED AT	CB12W4	0.29	609	514
						146	HYDROGRAPH AT	B12W4	0.12	184	96
						147	2 COMBINED AT	C12W4	0.41	609	514
						148	ROUTED TO	RB13W4	0.41	605	510
						149	HYDROGRAPH AT	B13W4	0.05	91	46
						150	2 COMBINED AT	CB13W4	0.46	605	510
						151	ROUTED TO	RB16W4	0.46	601	507
						152	HYDROGRAPH AT	B14W4	0.04	72	37
						153	ROUTED TO	R16W4	0.04	67	36
						154	2 COMBINED AT	CB16W4	0.5	601	507

TABLE 4.5-5
 HEC-1 Peak Flow Comparison for North-North Basin Models
 (Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by Primatech, LLC.				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						155	ROUTED TO	RBVW4	0.5	600	506
						156	HYDROGRAPH AT	B16W4	0.04	70	37
						157	2 COMBINED AT	C16W4	0.54	600	506
						158	HYDROGRAPH AT	B3W5	0.08	148	93
						159	ROUTED TO	RB6W5	0.08	122	86
						160	HYDROGRAPH AT	B6W5	0.09	147	97
						161	2 COMBINED AT	CB6W5	0.17	215	168
						162	HYDROGRAPH AT	R2W5	0	101	93
						163	2 COMBINED AT	C2W5	0.17	306	252
						164	HYDROGRAPH AT	B4W5	0.06	126	75
						165	ROUTED TO	RB7W5	0.06	90	64
						166	HYDROGRAPH AT	B7W5	0.09	160	105
						167	2 COMBINED AT	CB7W5	0.15	177	145
						168	2 COMBINED AT	CB8W5	0.32	481	397
						169	ROUTED TO	R8W5	0.32	474	394
						170	HYDROGRAPH AT	B5W5	0.25	391	265
						171	ROUTED TO	RB8W5	0.25	355	255
						172	HYDROGRAPH AT	B8W5	0.27	418	278
						173	2 COMBINED AT	C8W5	0.52	568	474
						174	2 COMBINED AT	CB9W5	0.84	1040	861
						175	ROUTED TO	RB9W5	0.84	1008	844
						176	HYDROGRAPH AT	B9W5	0.32	385	243

TABLE 4.5-5
HEC-1 Peak Flow Comparison for North-North Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by Primatech, LLC.				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
(1)	(2)	(3)	(4) (sq. mi.)	(5) (cfs)	(6) (cfs)	(7)	(8)	(9)	(10) (sq. mi.)	(11) (cfs)	(12) (cfs)
						177	2 COMBINED AT	C9W5	1.16	1148	985
						178	ROUTED TO	RB10W5	1.16	1115	965
						179	HYDROGRAPH AT	B10W5	0.1	122	68
						180	2 COMBINED AT	CB10W5	1.26	1131	981
						181	HYDROGRAPH AT	B1W6	0.52	762	471
						182	ROUTED TO	RB2W6	0.52	656	426
						183	HYDROGRAPH AT	B2W6	0.83	775	551
						184	HYDROGRAPH AT	B3W6	0.37	376	265
						185	3 COMBINED AT	CB3W6	1.72	1803	1234
						186	ROUTED TO	RB6W6	1.72	1705	1207
						187	HYDROGRAPH AT	B6W6	0.22	282	178
						188	2 COMBINED AT	CB6W6	1.94	1823	1320
						189	ROUTED TO	RB9W6	1.94	1755	1296
						190	HYDROGRAPH AT	B9W6	0.28	328	196
						191	2 COMBINED AT	CB9W6	2.22	1854	1383
						192	HYDROGRAPH AT	B4W6	0.44	579	382
						193	ROUTED TO	RB7W6	0.44	563	376
						194	HYDROGRAPH AT	B5W6	0.39	436	300
						195	HYDROGRAPH AT	B7W6	0.28	416	267
						196	3 COMBINED AT	CB7W6	1.11	1285	906
						197	ROUTED TO	RB13W6	1.11	1234	885
						198	HYDROGRAPH AT	B13W6	0.14	198	122

TABLE 4.5-5
HEC-1 Peak Flow Comparison for North-North Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by Primatech, LLC.				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						199	2 COMBINED AT	CB13W6	1.25	1321	967
						200	2 COMBINED AT	C9W6	3.47	2980	2280
						201	ROUTED TO	RB15W6	3.47	2960	2268
						202	HYDROGRAPH AT	B15W6	0.09	182	100
						203	2 COMBINED AT	CB15W6	3.56	2968	2283
						204	HYDROGRAPH AT	B8W6	0.11	198	116
						205	ROUTED TO	RB12W6	0.11	136	91
						206	HYDROGRAPH AT	B12W6	0.24	300	192
						207	2 COMBINED AT	CB12W6	0.35	363	253
						208	2 COMBINED AT	CB17W6	3.91	3174	2472
						209	ROUTED TO	RB17W6	3.91	3085	2425
						210	HYDROGRAPH AT	B17W6	0.13	176	101
						211	2 COMBINED AT	C17W6	4.04	3103	2445
						212	HYDROGRAPH AT	B10W6	0.32	574	335
						213	ROUTED TO	RB11W6	0.32	334	239
						214	HYDROGRAPH AT	B11W6	0.25	258	179
						215	2 COMBINED AT	CB11W6	0.57	476	358
						216	HYDROGRAPH AT	B14W6	0.19	230	146
						217	3 COMBINED AT	CB14W6	4.8	3560	2846
						218	ROUTED TO	RB19W6	4.8	3474	2779
						219	HYDROGRAPH AT	B16W6	0.03	61	30
						220	ROUTED TO	RB18W6	0.03	37	23

TABLE 4.5-5
HEC-1 Peak Flow Comparison for North-North Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by Primatech, LLC.				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						221	HYDROGRAPH AT	B18W6	0.14	197	123
						222	2 COMBINED AT	CB18W6	0.17	214	138
						223	HYDROGRAPH AT	B19W6	0.08	129	67
						224	3 COMBINED AT	CB19W6	5.05	3506	2816
						225	ROUTED TO	RB20W6	5.05	3472	2793
						226	DIVERSION TO	DB20W6	5.05	340	171
						227	HYDROGRAPH AT	DV20W6	5.05	3132	2622
						228	HYDROGRAPH AT	B20W6	0.14	244	140
						229	HYDROGRAPH AT	B21W6	0.09	145	95
						230	3 COMBINED AT	CB20W6	5.28	3148	2644
						231	ROUTED TO	RB23W6	5.28	3093	2600
						232	HYDROGRAPH AT	B23W6	0.14	178	97
						233	2 COMBINED AT	CB23W6	5.42	3097	2604
						234	ROUTED TO	RB28W6	5.42	3087	2593
						235	HYDROGRAPH AT	B28W6	0.17	192	121
						236	2 COMBINED AT	CB28W6	5.59	3100	2605
						237	HYDROGRAPH AT	B29W6	0.05	88	53
						238	HYDROGRAPH AT	B22W6	0.04	91	55
						239	ROUTED TO	RB25W6	0.04	52	42
						240	HYDROGRAPH AT	B25W6	0.07	123	81
						241	2 COMBINED AT	CB25W6	0.11	138	104
						242	ROUTED TO	RB26W6	0.11	126	102

TABLE 4.5-5
HEC-1 Peak Flow Comparison for North-North Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by Primatech, LLC.				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						243	HYDROGRAPH AT	B26W6	0.08	139	90
						244	2 COMBINED AT	CB26W6	0.19	238	176
						245	ROUTED TO	RB29W6	0.19	232	175
						246	3 COMBINED AT	CB29W6	5.83	3158	2666
						247	ROUTED TO	RB30W6	5.83	3057	2600
						248	HYDROGRAPH AT	B30W6	0.17	227	121
						249	2 COMBINED AT	CB30W6	6	3058	2601
						250	ROUTED TO	RB32W6	6	2984	2560
						251	HYDROGRAPH AT	B32W6	0.11	131	64
						252	2 COMBINED AT	CB32W6	6.11	2984	2560
						253	HYDROGRAPH AT	B27W6	0.27	307	180
						254	ROUTED TO	RB31W6	0.27	285	167
						255	HYDROGRAPH AT	B31W6	0.08	103	53
						256	2 COMBINED AT	CB31W6	0.35	328	194
						257	2 COMBINED AT	C32W6	6.46	2998	2572
						258	ROUTED TO	R33W6	6.46	2999	2569
						259	2 COMBINED AT	C33W6	7.72	3405	2977
						260	ROUTED TO	RB33W6	7.72	3396	2972
						261	HYDROGRAPH AT	B33W6	0.07	100	59
						262	HYDROGRAPH AT	B15W4	0.08	95	55
						263	HYDROGRAPH AT	B36W6	0.05	82	43
						264	4 COMBINED AT	CB33W6	7.92	3398	2974

TABLE 4.5-5
HEC-1 Peak Flow Comparison for North-North Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by Primatech, LLC.				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						265	2 COMBINED AT	C16W4A	8.46	3982	3463
						266	ROUTED TO	RB35W6	8.46	3969	3457
						267	HYDROGRAPH AT	B35W6	0.03	59	29
						268	3 COMBINED AT	CB35W6	12.18	4997	4357
						269	ROUTED TO	R38W6	12.18	4993	4359
						270	HYDROGRAPH AT	B9W3	0.07	98	56
						271	2 COMBINED AT	CB9W3	12.25	4993	4359
						272	ROUTED TO	RB38W6	12.25	4946	4324
						273	HYDROGRAPH AT	B34W6	0.16	190	129
						274	HYDROGRAPH AT	B37W6	0.11	156	108
						275	HYDROGRAPH AT	B38W6	0.1	167	90
						276	4 COMBINED AT	CB38W6	12.62	4954	4334

TABLE 4.5-6
HEC-1 Peak Flow Comparison for North-South Basin Models With Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	Hydrograph	1B1	0.49	794	553	1	HYDROGRAPH AT	1B	0.690	737	496
2	Routed	RT1112	0.49	497	428	2	DIVERSION TO	1B-6B	0.690	87	37
3	Hydrograph	1B2	0.16	167	129	3	HYDROGRAPH AT	DIV1B	0.690	650	459
4	Combined	CP1B2	0.65	569	500	4	ROUTED TO	1B-5B	0.690	491	388
5	Hydrograph	1B3	0.13	235	159	5	HYDROGRAPH AT	5B	0.520	584	386
6	Diversion	1B3R	0.13	230	158	6	2 COMBINED AT	CP5B	1.210	624	510
7	Hydrograph	1B3L	0.13	6	2	7	ROUTED TO	5B-9B	1.210	582	485
8	Routed	RT1314	0.13	1	0	8	HYDROGRAPH AT	9B	0.130	173	99
9	Hydrograph	1B4	0.14	183	136	9	2 COMBINED AT	CP9B	1.340	586	489
10	Combined	CP1B4	0.27	183	136	10	HYDROGRAPH AT	4B	0.610	458	313
11	Combined	CP1214	0.92	617	553	11	ROUTED TO	4B-8B	0.610	434	304
12	Routed	RT1452	0.92	591	534	12	HYDROGRAPH AT	8B	0.140	203	115
13	Hydrograph	5B2	0.12	193	142	13	2 COMBINED AT	CP8B	0.750	458	336
14	Combined	CP5B2	1.05	617	567	14	HYDROGRAPH AT	2B	1.920	1507	1072
15	Routed	RT529B	1.05	563	521	15	ROUTED TO	2B-3B	1.920	1406	1035
16	Hydrograph	5B1	0.10	170	123	16	HYDROGRAPH AT	3B	0.320	366	234
17	Routed	RT519B	0.10	100	91	17	2 COMBINED AT	CP3B	2.240	1519	1149
18	Hydrograph	9B	0.20	239	177	18	ROUTED TO	3B-7B	2.240	1471	1114
19	Hydrograph	8B1	0.08	132	86	19	HYDROGRAPH AT	7B	0.130	183	105
20	Routed	RT819B	0.08	132	86	20	2 COMBINED AT	CP7B	2.360	1482	1125
21	Hydrograph	4B1	0.37	401	306	21	3 COMBINED AT	CPB	4.450	2265	1773

TABLE 4.5-6
HEC-1 Peak Flow Comparison for North-South Basin Models With Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
22	Routed	RT4142	0.37	355	285	22	ROUTED TO	B-11B	4.450	2236	1757
23	Hydrograph	4B2	0.24	310	220	23	HYDROGRAPH AT	6B	0.170	218	143
24	Combined	CP4B2	0.61	505	439	24	HYDROGRAPH AT	RT1B	0.000	87	37
25	Routed	RT4282	0.61	490	427	25	ROUTED TO	1B-6B	0.000	60	27
26	Hydrograph	8B2	0.06	104	69	26	2 COMBINED AT	CP6B	0.170	223	148
27	Hydrograph	2B1	0.47	776	531	27	ROUTED TO	6B-10B	0.170	186	135
28	Routed	RT2122	0.47	620	479	28	HYDROGRAPH AT	10B	0.180	243	151
29	Hydrograph	2B2	0.53	645	486	29	2 COMBINED AT	CP10B	0.340	295	239
30	Hydrograph	2B3	0.26	361	263	30	ROUTED TO	10B-11	0.340	290	232
31	Combined	CP2223	1.26	1552	1200	31	HYDROGRAPH AT	11B	0.350	394	240
32	Routed	RT2226	1.26	1498	1176	32	3 COMBINED AT	CP11B	5.140	2482	1960
33	Hydrograph	2B4	0.21	253	192	33	DIVERSION TO	11B-12	5.140	895	684
34	Hydrograph	2B5	0.13	257	170	34	HYDROGRAPH AT	DIV11B	5.140	1587	1276
35	Combined	CP2425	0.34	436	331	35	ROUTED TO	11B-5A	5.140	1562	1258
36	Routed	RT4526	0.34	349	296	36	HYDROGRAPH AT	2A	0.030	55	31
37	Hydrograph	2B6	0.31	483	353	37	ROUTED TO	2A-3A	0.030	30	22
38	Combined	CP2B6	1.91	2090	1721	38	HYDROGRAPH AT	3A	0.210	285	170
39	Routed	RS2B6	1.91	761	700	39	2 COMBINED AT	CP3A	0.240	285	170
40	Routed	RT2631	1.91	743	688	40	ROUTED TO	3A-5A	0.240	176	126
41	Hydrograph	3B1	0.10	126	90	41	HYDROGRAPH AT	1A	0.150	178	118
42	Combined	CP3B1	2.01	751	693	42	ROUTED TO	1A-4A	0.150	138	102
43	Routed	RT3132	2.01	717	664	43	HYDROGRAPH AT	4A	0.170	177	111

TABLE 4.5-6
HEC-1 Peak Flow Comparison for North-South Basin Models With Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
44	Hydrograph	3B2	0.34	416	315	44	2 COMBINED AT	CP4A	0.320	198	154
45	Combined	CP3B2	2.35	722	676	45	ROUTED TO	4A-5A	0.320	185	146
46	Routed	RT3282	2.35	721	677	46	HYDROGRAPH AT	5A	0.370	401	253
47	Combined	CP8B2	3.02	869	805	47	4 COMBINED AT	CP5A	6.070	1952	1559
48	Routed	RT829B	3.02	871	804	48	DIVERSION TO	5A-8IS	6.070	1064	857
49	Combined	CP9B	4.44	1478	1356	49	HYDROGRAPH AT	DIV5A	6.070	887	702
50	Hydrograph	1B36B	0.00	230	158	50	DIVERSION TO	5A-6A1	6.070	494	384
51	Routed	RT136B	0.00	166	135	51	HYDROGRAPH AT	DIV5A	6.070	393	318
52	Hydrograph	6B	0.20	263	206	52	ROUTED TO	5A-6A2	6.070	386	314
53	Combined	CP6B	0.20	301	283	53	DIVERSION TO	6A-1F	6.070	187	156
54	Hydrograph	1N	0.13	331	201	54	HYDROGRAPH AT	DIV6A	6.070	199	158
55	Hydrograph	4A	0.08	125	89	55	HYDROGRAPH AT	12B	0.230	359	207
56	Hydrograph	2A	0.03	58	38	56	HYDROGRAPH AT	R11B	0.000	895	684
57	Hydrograph	1S	0.19	364	248	57	ROUTED TO	11B-12	0.000	887	676
58	Routed	RT1S2S	0.19	309	229	58	2 COMBINED AT	CP12B	0.230	895	684
59	Hydrograph	2S	0.09	152	102	59	ROUTED TO	12B-6A	0.230	870	666
60	Combined	CP2S	0.28	432	321	60	HYDROGRAPH AT	R5A6A1	0.000	494	384
61	Routed	RT2S3S	0.28	414	316	61	ROUTED TO	5A-6A1	0.000	485	379
62	Hydrograph	3S	0.09	143	96	62	HYDROGRAPH AT	6A	0.330	401	205
63	Combined	CP3S	0.37	500	393	63	4 COMBINED AT	CP6A	6.640	1561	1206
64	Routed	RT3S4N	0.37	495	392	64	ROUTED TO	6A-7A	6.640	1544	1195
65	Hydrograph	3N	0.11	189	134	65	HYDROGRAPH AT	7A	0.130	179	94

TABLE 4.5-6
HEC-1 Peak Flow Comparison for North-South Basin Models With Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
66	Routed	RT34N1	0.11	189	134	66	2 COMBINED AT	CP7A	6.760	1544	1195
67	Hydrograph	4N1	0.05	85	57	67	DIVERSION TO	7A-4E	6.760	512	405
68	Combined	CP4N1	0.16	269	190	68	HYDROGRAPH AT	DIV7A	6.760	1033	791
69	Routed	RT4N14	0.16	234	182	69	ROUTED TO	7A-1F	6.760	1029	787
70	Hydrograph	2N	0.20	364	252	70	HYDROGRAPH AT	4IS	0.240	266	164
71	Routed	RT2N4N	0.20	312	238	71	ROUTED TO	4IS-6I	0.240	240	155
72	Hydrograph	4N	0.07	140	97	72	HYDROGRAPH AT	6IS	0.130	224	131
73	Combined	CP4N	0.81	1112	885	73	2 COMBINED AT	CP6IS	0.370	313	233
						74	ROUTED TO	6IS-8I	0.370	287	213
						75	HYDROGRAPH AT	8IS	0.220	278	162
						76	HYDROGRAPH AT	R5A	0.000	1064	857
						77	ROUTED TO	5A-8IS	0.000	1048	847
						78	3 COMBINED AT	CP8IS	0.590	1201	971
						79	DIVERSION TO	8IS-10	0.590	638	536
						80	HYDROGRAPH AT	DV8IS	0.590	563	434
						81	HYDROGRAPH AT	R6A	0.000	187	156
						82	2 COMBINED AT	COMB	0.590	747	589
						83	DIVERSION TO	8IS(2)	0.590	294	227
						84	HYDROGRAPH AT	DIV8IS	0.590	453	362
						85	ROUTED TO	8IS-1F	0.590	443	354
						86	HYDROGRAPH AT	1F	0.130	171	90
						87	3 COMBINED AT	CP1F	7.480	1471	1140

TABLE 4.5-6
HEC-1 Peak Flow Comparison for North-South Basin Models With Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						88	HYDROGRAPH AT	1IN	0.250	350	224
						89	ROUTED TO	1IN-3I	0.250	293	204
						90	HYDROGRAPH AT	3IN	0.280	381	226
						91	2 COMBINED AT	CP3IN	0.530	470	363
						92	ROUTED TO	3IN-5I	0.530	448	338
						93	HYDROGRAPH AT	5IN	0.050	84	53
						94	2 COMBINED AT	CP5IN	0.580	468	358
						95	HYDROGRAPH AT	1IS	0.190	296	186
						96	ROUTED TO	1IS-2I	0.190	263	175
						97	HYDROGRAPH AT	2IS	0.120	190	105
						98	2 COMBINED AT	CP2IS	0.300	371	260
						99	ROUTED TO	2IS-3I	0.300	350	251
						100	HYDROGRAPH AT	3IS	0.070	112	66
						101	2 COMBINED AT	CP3IS	0.370	401	293
						102	ROUTED TO	3IS-4I	0.370	391	285
						103	HYDROGRAPH AT	2IN	0.350	536	331
						104	ROUTED TO	2IN-4I	0.350	449	303
						105	HYDROGRAPH AT	4IN	0.160	222	135
						106	3 COMBINED AT	CP4IN	0.880	942	679
						107	ROUTED TO	4IN-6I	0.880	902	658
						108	HYDROGRAPH AT	6IN	0.070	90	46
						109	2 COMBINED AT	CP6IN	0.950	922	670

TABLE 4.5-6
HEC-1 Peak Flow Comparison for North-South Basin Models With Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						110	DIVERSION TO	6IN-5I	0.950	434	300
						111	HYDROGRAPH AT	DIV6IN	0.950	488	371
						112	2 COMBINED AT	CPIN	1.540	947	725
						113	ROUTED TO	IN-7IN	1.540	899	691
						114	HYDROGRAPH AT	20w6	0.000	279	150
						115	ROUTED TO	20W6-7	0.000	229	125
						116	HYDROGRAPH AT	7IN	0.290	345	222
						117	3 COMBINED AT	CP7IN	1.830	986	222
						118	ROUTED TO	7IN-8I	1.830	952	194
						119	HYDROGRAPH AT	8IN	0.140	174	93
						120	2 COMBINED AT	CP8IN	1.970	961	227
						121	ROUTED TO	8IN-9I	1.970	931	218
						122	HYDROGRAPH AT	R6IN	0.000	434	300
						123	ROUTED TO	6IN-5I	0.000	410	289
						124	HYDROGRAPH AT	5IS	0.510	544	349
						125	2 COMBINED AT	CP5IS	0.510	672	517
						126	ROUTED TO	5IS-7I	0.510	653	499
						127	HYDROGRAPH AT	7IS	0.240	338	218
						128	2 COMBINED AT	CP7IS	0.750	784	593
						129	DIVERSION TO	7IS-10	0.750	137	91
						130	HYDROGRAPH AT	D7IS	0.750	648	502
						131	ROUTED TO	7IS-9I	0.750	623	491

TABLE 4.5-6
HEC-1 Peak Flow Comparison for North-South Basin Models With Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						132	HYDROGRAPH AT	9IS	0.160	209	111
						133	2 COMBINED AT	CP9IS	0.910	642	502
						134	DIVERSION TO	9IS-11	0.910	223	165
						135	HYDROGRAPH AT	D9IS	0.910	420	337
						136	DIVERSION TO	9IS-12	0.910	261	198
						137	HYDROGRAPH AT	D9IS	0.910	159	139
						138	ROUTED TO	9IS-9I	0.910	156	138
						139	HYDROGRAPH AT	9IN	0.190	273	169
						140	3 COMBINED AT	CP9IN	3.070	1092	377
						141	DIVERSION TO	D9IN	3.070	1092	377
						142	HYDROGRAPH AT	LOOP2	3.070	0	0
						143	HYDROGRAPH AT	R8IS	0.000	638	536
						144	HYDROGRAPH AT	R8IS2	0.000	294	227
						145	2 COMBINED AT	CPDIV8	0.000	932	763
						146	ROUTED TO	8IS-10	0.000	929	760
						147	HYDROGRAPH AT	R7IS	0.000	137	91
						148	ROUTED TO	7IS-10	0.000	133	89
						149	HYDROGRAPH AT	10IS	0.200	239	132
						150	3 COMBINED AT	CP10IS	0.200	1015	816
						151	3 COMBINED AT	COMBIN	10.760	2432	1412
						152	DIVERSION TO	10IS-1	10.760	929	386
						153	HYDROGRAPH AT	D1F	10.760	1504	1026

TABLE 4.5-6
HEC-1 Peak Flow Comparison for North-South Basin Models With Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						154	ROUTED TO	1F-2F	10.760	1493	1019
						155	HYDROGRAPH AT	2F	0.190	247	131
						156	HYDROGRAPH AT	4E	0.180	251	133
						157	HYDROGRAPH AT	1E	0.200	274	180
						158	ROUTED TO	1E-2E	0.200	239	168
						159	DIVERSION TO	2E-OUT	0.200	171	110
						160	HYDROGRAPH AT	DIV2E	0.200	68	57
						161	HYDROGRAPH AT	2E	0.260	369	228
						162	2 COMBINED AT	CP2E	0.460	385	265
						163	ROUTED TO	2E-3E	0.460	355	251
						164	HYDROGRAPH AT	3E	0.080	116	60
						165	2 COMBINED AT	CP3E	0.540	402	283
						166	ROUTED TO	3E-4E	0.540	383	272
						167	HYDROGRAPH AT	R7A	0.000	512	405
						168	ROUTED TO	7A-4E	0.000	506	401
						169	3 COMBINED AT	CP4E	0.720	630	473
						170	DIVERSION TO	4E-2F	0.720	51	36
						171	HYDROGRAPH AT	DIV4E	0.720	579	438
						172	DIVERSION TO	4EOUT1	0.720	207	169
						173	HYDROGRAPH AT	DIV4E2	0.720	372	269
						174	ROUTED TO	4E-5E	0.720	361	267
						175	DIVERSION TO	4EOUT2	0.720	102	72

**TABLE 4.5-6
HEC-1 Peak Flow Comparison for North-South Basin Models With Black Hills Tank
(Updated vs. Original Models)**

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						176	HYDROGRAPH AT	DIV4E3	0.720	259	195
						177	HYDROGRAPH AT	5E	0.070	124	60
						178	2 COMBINED AT	CP5E	0.790	264	195
						179	DIVERSION TO	5E-6E	0.790	264	195
						180	HYDROGRAPH AT	DLOOP	0.790	0	0
						181	HYDROGRAPH AT	R4E	0.000	51	36
						182	ROUTED TO	4E-2F	0.000	50	35
						183	4 COMBINED AT	CP2F	11.740	1540	1054
						184	DIVERSION TO	2F-3F	11.740	519	240
						185	HYDROGRAPH AT	DIV2F	11.740	1021	814
						186	ROUTED TO	2F-6S	11.740	1021	814
						187	DIVERSION TO	6S-4F	11.740	236	160
						188	HYDROGRAPH AT	DIV6S	11.740	785	654
						189	ROUTED TO	6S-6S2	11.740	781	651
						190	DIVERSION TO	6S-8E	11.740	183	157
						191	HYDROGRAPH AT	DIV6S2	11.740	598	493
						192	ROUTED TO	6S2-6E	11.740	595	491
						193	HYDROGRAPH AT	R5E	0.000	264	195
						194	ROUTED TO	5E-6E	0.000	247	191
						195	HYDROGRAPH AT	6E	0.350	357	205
						196	HYDROGRAPH AT	D510L	4.520	148	190
						197	ROUTED TO	D510L-	4.520	144	172

TABLE 4.5-6
HEC-1 Peak Flow Comparison for North-South Basin Models With Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						198	4 COMBINED AT	CP6E	16.610	944	791
						199	DIVERSION TO	6E-8E	16.610	76	67
						200	HYDROGRAPH AT	DIV6E	16.610	867	724
						201	ROUTED TO	6E-7E	16.610	864	723
						202	HYDROGRAPH AT	7E	0.190	256	132
						203	2 COMBINED AT	CP7E	16.800	864	723
						204	HYDROGRAPH AT	R2F	0.000	519	240
						205	ROUTED TO	2F-3F	0.000	513	234
						206	HYDROGRAPH AT	3F	0.070	118	57
						207	2 COMBINED AT	CP3F	0.070	513	234
						208	DIVERSION TO	3F-13I	0.070	293	130
						209	HYDROGRAPH AT	D3F	0.070	220	104
						210	ROUTED TO	3F-4F	0.070	213	97
						211	HYDROGRAPH AT	R6S	0.000	236	160
						212	ROUTED TO	6S-4F	0.000	233	159
						213	HYDROGRAPH AT	4F	0.160	209	121
						214	3 COMBINED AT	CP4F	0.230	441	252
						215	ROUTED TO	4F-9E	0.230	439	249
						216	HYDROGRAPH AT	9E	0.160	222	130
						217	2 COMBINED AT	CP9E	0.390	439	250
						218	HYDROGRAPH AT	R10IS-	0.000	929	386
						219	ROUTED TO	10IS-1	0.000	919	380

TABLE 4.5-6
HEC-1 Peak Flow Comparison for North-South Basin Models With Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						220	HYDROGRAPH AT	11IS	0.130	188	98
						221	HYDROGRAPH AT	R9IS	0.000	223	165
						222	ROUTED TO	9IS-11	0.000	218	162
						223	3 COMBINED AT	CP11IS	0.130	1092	544
						224	ROUTED TO	11IS-1	0.130	1088	541
						225	HYDROGRAPH AT	12IS	0.120	189	106
						226	HYDROGRAPH AT	R9IS	0.000	261	198
						227	ROUTED TO	9IS-12	0.000	257	196
						228	3 COMBINED AT	CP12IS	0.250	1278	737
						229	ROUTED TO	12IS-1	0.250	1262	718
						230	HYDROGRAPH AT	R3F	0.000	293	130
						231	ROUTED TO	3F-13I	0.000	288	125
						232	HYDROGRAPH AT	R9IN	0.000	1092	377
						233	ROUTED TO	9IN-13	0.000	1077	367
						234	HYDROGRAPH AT	13IS	0.260	369	220
						235	4 COMBINED AT	CP13IS	0.510	2548	1161
						236	ROUTED TO	13IS-1	0.510	2538	1154
						237	HYDROGRAPH AT	11E	0.070	115	64
						238	HYDROGRAPH AT	12E	0.290	226	98
						239	3 COMBINED AT	CP11E	0.870	2546	1161
						240	HYDROGRAPH AT	10E	0.130	211	130
						241	HYDROGRAPH AT	R6S	0.000	183	157

TABLE 4.5-6
HEC-1 Peak Flow Comparison for North-South Basin Models With Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
(1)	(2)	(3)	(sq. mi.)	(cfs)	(cfs)	(7)	(8)	(9)	(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						242	ROUTED TO	6S-8E	0.000	181	156
						243	HYDROGRAPH AT	R6E	0.000	76	67
						244	ROUTED TO	6E-8E	0.000	76	67
						245	HYDROGRAPH AT	8E	0.200	201	114
						246	3 COMBINED AT	CP8E	0.200	259	225

TABLE 4.5-7
HEC-1 Peak Flow Comparison for North-South Basin Models Without Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	Hydrograph	1B1	0.49	794	553	1	HYDROGRAPH AT	1B	0.690	737	496
2	Routed	RT1112	0.49	497	428	2	DIVERSION TO	1B-6B	0.690	87	37
3	Hydrograph	1B2	0.16	167	129	3	HYDROGRAPH AT	DIV1B	0.690	650	459
4	Combined	CP1B2	0.65	569	500	4	ROUTED TO	1B-5B	0.690	491	388
5	Hydrograph	1B3	0.13	235	159	5	HYDROGRAPH AT	5B	0.520	584	386
6	Diversion	1B3R	0.13	230	158	6	2 COMBINED AT	CP5B	1.210	624	510
7	Hydrograph	1B3L	0.13	6	2	7	ROUTED TO	5B-9B	1.210	582	485
8	Routed	RT1314	0.13	1	0	8	HYDROGRAPH AT	9B	0.130	173	99
9	Hydrograph	1B4	0.14	183	136	9	2 COMBINED AT	CP9B	1.340	586	489
10	Combined	CP1B4	0.27	183	136	10	HYDROGRAPH AT	4B	0.610	458	313
11	Combined	CP1214	0.92	617	553	11	ROUTED TO	4B-8B	0.610	434	304
12	Routed	RT1452	0.92	591	534	12	HYDROGRAPH AT	8B	0.140	203	115
13	Hydrograph	5B2	0.12	193	142	13	2 COMBINED AT	CP8B	0.750	458	336
14	Combined	CP5B2	1.05	617	567	14	HYDROGRAPH AT	2B	1.920	1507	1072
15	Routed	RT529B	1.05	563	521	15	ROUTED TO	2B-3B	1.920	1406	1035
16	Hydrograph	5B1	0.10	170	123	16	HYDROGRAPH AT	3B	0.320	366	234
17	Routed	RT519B	0.10	100	91	17	2 COMBINED AT	CP3B	2.240	1519	1149
18	Hydrograph	9B	0.20	239	177	18	ROUTED TO	3B-7B	2.240	1471	1114
19	Combined	CP9BA	1.35	630	587	19	HYDROGRAPH AT	7B	0.130	183	105
20	Hydrograph	8B1	0.08	132	86	20	2 COMBINED AT	CP7B	2.360	1482	1125
21	Routed	RT819B	0.08	132	86	21	3 COMBINED AT	CPB	4.450	2265	1773

TABLE 4.5-7
HEC-1 Peak Flow Comparison for North-South Basin Models Without Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
22	Hydrograph	4B1	0.37	401	306	22	ROUTED TO	B-11B	4.450	2236	1757
23	Routed	RT4142	0.37	355	285	23	HYDROGRAPH AT	6B	0.170	218	143
24	Hydrograph	4B2	0.24	310	220	24	HYDROGRAPH AT	RT1B	0.000	87	37
25	Combined	CP4B2	0.61	505	439	25	ROUTED TO	1B-6B	0.000	60	27
26	Routed	RT4282	0.61	490	427	26	2 COMBINED AT	CP6B	0.170	223	148
27	Hydrograph	8B2	0.06	104	69	27	ROUTED TO	6B-10B	0.170	186	135
28	Combined	CP8B2A	0.67	510	452	28	HYDROGRAPH AT	10B	0.180	243	151
29	Hydrograph	2B1	0.47	776	531	29	2 COMBINED AT	CP10B	0.340	295	239
30	Routed	RT2122	0.47	620	479	30	ROUTED TO	10B-11	0.340	290	232
31	Hydrograph	2B2	0.53	645	486	31	HYDROGRAPH AT	11B	0.350	394	240
32	Hydrograph	2B3	0.26	361	263	32	3 COMBINED AT	CP11B	5.140	2482	1960
33	Combined	CP2223	1.26	1552	1200	33	DIVERSION TO	11B-12	5.140	895	684
34	Routed	RT2226	1.26	1498	1176	34	HYDROGRAPH AT	DIV11B	5.140	1587	1276
35	Hydrograph	2B4	0.21	253	192	35	ROUTED TO	11B-5A	5.140	1562	1258
36	Hydrograph	2B5	0.13	257	170	36	HYDROGRAPH AT	2A	0.030	55	31
37	Combined	CP2425	0.34	436	331	37	ROUTED TO	2A-3A	0.030	30	22
38	Routed	RT4526	0.34	349	296	38	HYDROGRAPH AT	3A	0.210	285	170
39	Hydrograph	2B6	0.31	483	353	39	2 COMBINED AT	CP3A	0.240	285	170
40	Combined	CP2B6	1.91	2090	1721	40	ROUTED TO	3A-5A	0.240	176	126
41	Routed	RT2632	1.91	1646	1472	41	HYDROGRAPH AT	1A	0.150	178	118
42	Hydrograph	3B1	0.10	126	90	42	ROUTED TO	1A-4A	0.150	138	102
43	Routed	RT3132	0.10	88	70	43	HYDROGRAPH AT	4A	0.170	177	111

TABLE 4.5-7
HEC-1 Peak Flow Comparison for North-South Basin Models Without Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
44	Hydrograph	3B2	0.34	416	315	44	2 COMBINED AT	CP4A	0.320	198	154
45	Combined	CP3B2	2.35	1838	1664	45	ROUTED TO	4A-5A	0.320	185	146
46	Routed	RT3282	2.35	1835	1661	46	HYDROGRAPH AT	5A	0.370	401	253
47	Combined	CP8B2	3.02	2254	2039	47	4 COMBINED AT	CP5A	6.070	1952	1559
48	Routed	RT829B	3.02	2257	2045	48	DIVERSION TO	5A-8IS	6.070	1064	857
49	Combined	CP9B	4.44	2819	2572	49	HYDROGRAPH AT	DIV5A	6.070	887	702
50	Hydrograph	1B36B	0.00	230	158	50	DIVERSION TO	5A-6A1	6.070	494	384
51	Routed	RT136B	0.00	166	135	51	HYDROGRAPH AT	DIV5A	6.070	393	318
52	Hydrograph	6B	0.20	263	206	52	ROUTED TO	5A-6A2	6.070	386	314
53	Combined	CP6B	0.20	301	283	53	DIVERSION TO	6A-1F	6.070	187	156
54	Hydrograph	1N	0.13	331	201	54	HYDROGRAPH AT	DIV6A	6.070	199	158
55	Hydrograph	4A	0.08	125	89	55	HYDROGRAPH AT	12B	0.230	359	207
56	Hydrograph	2A	0.03	58	38	56	HYDROGRAPH AT	R11B	0.000	895	684
57	Hydrograph	1S	0.19	364	248	57	ROUTED TO	11B-12	0.000	887	676
58	Routed	RT1S2S	0.19	309	229	58	2 COMBINED AT	CP12B	0.230	895	684
59	Hydrograph	2S	0.09	152	102	59	ROUTED TO	12B-6A	0.230	870	666
60	Combined	CP2S	0.28	432	321	60	HYDROGRAPH AT	R5A6A1	0.000	494	384
61	Routed	RT2S3S	0.28	414	316	61	ROUTED TO	5A-6A1	0.000	485	379
62	Hydrograph	3S	0.09	143	96	62	HYDROGRAPH AT	6A	0.330	401	205
63	Combined	CP3S	0.37	500	393	63	4 COMBINED AT	CP6A	6.640	1561	1206
64	Routed	RT3S4N	0.37	495	392	64	ROUTED TO	6A-7A	6.640	1544	1195
65	Hydrograph	3N	0.11	189	134	65	HYDROGRAPH AT	7A	0.130	179	94

TABLE 4.5-7
HEC-1 Peak Flow Comparison for North-South Basin Models Without Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
66	Routed	RT34N1	0.11	189	134	66	2 COMBINED AT	CP7A	6.760	1544	1195
67	Hydrograph	4N1	0.05	85	57	67	DIVERSION TO	7A-4E	6.760	512	405
68	Combined	CP4N1	0.16	269	190	68	HYDROGRAPH AT	DIV7A	6.760	1033	791
69	Routed	RT4N14	0.16	234	178	69	ROUTED TO	7A-1F	6.760	1029	787
70	Hydrograph	2N	0.20	364	252	70	HYDROGRAPH AT	4IS	0.240	266	164
71	Routed	RT2N4N	0.20	312	234	71	ROUTED TO	4IS-6I	0.240	240	155
72	Hydrograph	4N	0.07	140	97	72	HYDROGRAPH AT	6IS	0.130	224	131
73	Combined	CP4N	0.81	1112	876	73	2 COMBINED AT	CP6IS	0.370	313	233
						74	ROUTED TO	6IS-8I	0.370	287	213
						75	HYDROGRAPH AT	8IS	0.220	278	162
						76	HYDROGRAPH AT	R5A	0.000	1064	857
						77	ROUTED TO	5A-8IS	0.000	1048	847
						78	3 COMBINED AT	CP8IS	0.590	1201	971
						79	DIVERSION TO	8IS-10	0.590	638	536
						80	HYDROGRAPH AT	DV8IS	0.590	563	434
						81	HYDROGRAPH AT	R6A	0.000	187	156
						82	2 COMBINED AT	COMB	0.590	747	589
						83	DIVERSION TO	8IS(2)	0.590	294	227
						84	HYDROGRAPH AT	DIV8IS	0.590	453	362
						85	ROUTED TO	8IS-1F	0.590	443	354
						86	HYDROGRAPH AT	1F	0.130	171	90
						87	3 COMBINED AT	CP1F	7.480	1471	1140

TABLE 4.5-7
HEC-1 Peak Flow Comparison for North-South Basin Models Without Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						88	HYDROGRAPH AT	1IN	0.250	350	224
						89	ROUTED TO	1IN-3I	0.250	293	204
						90	HYDROGRAPH AT	3IN	0.280	381	226
						91	2 COMBINED AT	CP3IN	0.530	470	363
						92	ROUTED TO	3IN-5I	0.530	448	338
						93	HYDROGRAPH AT	5IN	0.050	84	53
						94	2 COMBINED AT	CP5IN	0.580	468	358
						95	HYDROGRAPH AT	1IS	0.190	296	186
						96	ROUTED TO	1IS-2I	0.190	263	175
						97	HYDROGRAPH AT	2IS	0.120	190	105
						98	2 COMBINED AT	CP2IS	0.300	371	260
						99	ROUTED TO	2IS-3I	0.300	350	251
						100	HYDROGRAPH AT	3IS	0.070	112	66
						101	2 COMBINED AT	CP3IS	0.370	401	293
						102	ROUTED TO	3IS-4I	0.370	391	285
						103	HYDROGRAPH AT	2IN	0.350	536	331
						104	ROUTED TO	2IN-4I	0.350	449	303
						105	HYDROGRAPH AT	4IN	0.160	222	135
						106	3 COMBINED AT	CP4IN	0.880	942	679
						107	ROUTED TO	4IN-6I	0.880	902	658
						108	HYDROGRAPH AT	6IN	0.070	90	46
						109	2 COMBINED AT	CP6IN	0.950	922	670

TABLE 4.5-7
HEC-1 Peak Flow Comparison for North-South Basin Models Without Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						110	DIVERSION TO	6IN-5I	0.950	434	300
						111	HYDROGRAPH AT	DIV6IN	0.950	488	371
						112	2 COMBINED AT	CPIN	1.540	947	725
						113	ROUTED TO	IN-7IN	1.540	899	691
						114	HYDROGRAPH AT	20w6	0.000	279	150
						115	ROUTED TO	20W6-7	0.000	229	125
						116	HYDROGRAPH AT	7IN	0.290	345	222
						117	3 COMBINED AT	CP7IN	1.830	986	222
						118	ROUTED TO	7IN-8I	1.830	952	194
						119	HYDROGRAPH AT	8IN	0.140	174	93
						120	2 COMBINED AT	CP8IN	1.970	961	227
						121	ROUTED TO	8IN-9I	1.970	931	218
						122	HYDROGRAPH AT	R6IN	0.000	434	300
						123	ROUTED TO	6IN-5I	0.000	410	289
						124	HYDROGRAPH AT	5IS	0.510	544	349
						125	2 COMBINED AT	CP5IS	0.510	672	517
						126	ROUTED TO	5IS-7I	0.510	653	499
						127	HYDROGRAPH AT	7IS	0.240	338	218
						128	2 COMBINED AT	CP7IS	0.750	784	593
						129	DIVERSION TO	7IS-10	0.750	137	91
						130	HYDROGRAPH AT	D7IS	0.750	648	502
						131	ROUTED TO	7IS-9I	0.750	623	491

TABLE 4.5-7
HEC-1 Peak Flow Comparison for North-South Basin Models Without Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						132	HYDROGRAPH AT	9IS	0.160	209	111
						133	2 COMBINED AT	CP9IS	0.910	642	502
						134	DIVERSION TO	9IS-11	0.910	223	165
						135	HYDROGRAPH AT	D9IS	0.910	420	337
						136	DIVERSION TO	9IS-12	0.910	261	198
						137	HYDROGRAPH AT	D9IS	0.910	159	139
						138	ROUTED TO	9IS-9I	0.910	156	138
						139	HYDROGRAPH AT	9IN	0.190	273	169
						140	3 COMBINED AT	CP9IN	3.070	1092	377
						141	DIVERSION TO	D9IN	3.070	1092	377
						142	HYDROGRAPH AT	LOOP2	3.070	0	0
						143	HYDROGRAPH AT	R8IS	0.000	638	536
						144	HYDROGRAPH AT	R8IS2	0.000	294	227
						145	2 COMBINED AT	CPDIV8	0.000	932	763
						146	ROUTED TO	8IS-10	0.000	929	760
						147	HYDROGRAPH AT	R7IS	0.000	137	91
						148	ROUTED TO	7IS-10	0.000	133	89
						149	HYDROGRAPH AT	10IS	0.200	239	132
						150	3 COMBINED AT	CP10IS	0.200	1015	816
						151	3 COMBINED AT	COMBIN	10.760	2432	1412
						152	DIVERSION TO	10IS-1	10.760	929	386
						153	HYDROGRAPH AT	D1F	10.760	1504	1026

TABLE 4.5-7
HEC-1 Peak Flow Comparison for North-South Basin Models Without Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						154	ROUTED TO	1F-2F	10.760	1493	1019
						155	HYDROGRAPH AT	2F	0.190	247	131
						156	HYDROGRAPH AT	4E	0.180	251	133
						157	HYDROGRAPH AT	1E	0.200	274	180
						158	ROUTED TO	1E-2E	0.200	239	168
						159	DIVERSION TO	2E-OUT	0.200	171	110
						160	HYDROGRAPH AT	DIV2E	0.200	68	57
						161	HYDROGRAPH AT	2E	0.260	369	228
						162	2 COMBINED AT	CP2E	0.460	385	265
						163	ROUTED TO	2E-3E	0.460	355	251
						164	HYDROGRAPH AT	3E	0.080	116	60
						165	2 COMBINED AT	CP3E	0.540	402	283
						166	ROUTED TO	3E-4E	0.540	383	272
						167	HYDROGRAPH AT	R7A	0.000	512	405
						168	ROUTED TO	7A-4E	0.000	506	401
						169	3 COMBINED AT	CP4E	0.720	630	473
						170	DIVERSION TO	4E-2F	0.720	51	36
						171	HYDROGRAPH AT	DIV4E	0.720	579	438
						172	DIVERSION TO	4EOUT1	0.720	207	169
						173	HYDROGRAPH AT	DIV4E2	0.720	372	269
						174	ROUTED TO	4E-5E	0.720	361	267
						175	DIVERSION TO	4EOUT2	0.720	102	72

TABLE 4.5-7
HEC-1 Peak Flow Comparison for North-South Basin Models Without Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						176	HYDROGRAPH AT	DIV4E3	0.720	259	195
						177	HYDROGRAPH AT	5E	0.070	124	60
						178	2 COMBINED AT	CP5E	0.790	264	195
						179	DIVERSION TO	5E-6E	0.790	264	195
						180	HYDROGRAPH AT	DLOOP	0.790	0	0
						181	HYDROGRAPH AT	R4E	0.000	51	36
						182	ROUTED TO	4E-2F	0.000	50	35
						183	4 COMBINED AT	CP2F	11.740	1540	1054
						184	DIVERSION TO	2F-3F	11.740	519	240
						185	HYDROGRAPH AT	DIV2F	11.740	1021	814
						186	ROUTED TO	2F-6S	11.740	1021	814
						187	DIVERSION TO	6S-4F	11.740	236	160
						188	HYDROGRAPH AT	DIV6S	11.740	785	654
						189	ROUTED TO	6S-6S2	11.740	781	651
						190	DIVERSION TO	6S-8E	11.740	183	157
						191	HYDROGRAPH AT	DIV6S2	11.740	598	493
						192	ROUTED TO	6S2-6E	11.740	595	491
						193	HYDROGRAPH AT	R5E	0.000	264	195
						194	ROUTED TO	5E-6E	0.000	247	191
						195	HYDROGRAPH AT	6E	0.350	357	205
						196	HYDROGRAPH AT	D510L	4.520	148	190
						197	ROUTED TO	D510L-	4.520	144	172

TABLE 4.5-7
HEC-1 Peak Flow Comparison for North-South Basin Models Without Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						198	4 COMBINED AT	CP6E	16.610	944	791
						199	DIVERSION TO	6E-8E	16.610	76	67
						200	HYDROGRAPH AT	DIV6E	16.610	867	724
						201	ROUTED TO	6E-7E	16.610	864	723
						202	HYDROGRAPH AT	7E	0.190	256	132
						203	2 COMBINED AT	CP7E	16.800	864	723
						204	HYDROGRAPH AT	R2F	0.000	519	240
						205	ROUTED TO	2F-3F	0.000	513	234
						206	HYDROGRAPH AT	3F	0.070	118	57
						207	2 COMBINED AT	CP3F	0.070	513	234
						208	DIVERSION TO	3F-13I	0.070	293	130
						209	HYDROGRAPH AT	D3F	0.070	220	104
						210	ROUTED TO	3F-4F	0.070	213	97
						211	HYDROGRAPH AT	R6S	0.000	236	160
						212	ROUTED TO	6S-4F	0.000	233	159
						213	HYDROGRAPH AT	4F	0.160	209	121
						214	3 COMBINED AT	CP4F	0.230	441	252
						215	ROUTED TO	4F-9E	0.230	439	249
						216	HYDROGRAPH AT	9E	0.160	222	130
						217	2 COMBINED AT	CP9E	0.390	439	250
						218	HYDROGRAPH AT	R10IS-	0.000	929	386
						219	ROUTED TO	10IS-1	0.000	919	380

TABLE 4.5-7
HEC-1 Peak Flow Comparison for North-South Basin Models Without Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						220	HYDROGRAPH AT	11IS	0.130	188	98
						221	HYDROGRAPH AT	R9IS	0.000	223	165
						222	ROUTED TO	9IS-11	0.000	218	162
						223	3 COMBINED AT	CP11IS	0.130	1092	544
						224	ROUTED TO	11IS-1	0.130	1088	541
						225	HYDROGRAPH AT	12IS	0.120	189	106
						226	HYDROGRAPH AT	R9IS	0.000	261	198
						227	ROUTED TO	9IS-12	0.000	257	196
						228	3 COMBINED AT	CP12IS	0.250	1278	737
						229	ROUTED TO	12IS-1	0.250	1262	718
						230	HYDROGRAPH AT	R3F	0.000	293	130
						231	ROUTED TO	3F-13I	0.000	288	125
						232	HYDROGRAPH AT	R9IN	0.000	1092	377
						233	ROUTED TO	9IN-13	0.000	1077	367
						234	HYDROGRAPH AT	13IS	0.260	369	220
						235	4 COMBINED AT	CP13IS	0.510	2548	1161
						236	ROUTED TO	13IS-1	0.510	2538	1154
						237	HYDROGRAPH AT	11E	0.070	115	64
						238	HYDROGRAPH AT	12E	0.290	226	98
						239	3 COMBINED AT	CP11E	0.870	2546	1161
						240	HYDROGRAPH AT	10E	0.130	211	130
						241	HYDROGRAPH AT	R6S	0.000	183	157

TABLE 4.5-7
HEC-1 Peak Flow Comparison for North-South Basin Models Without Black Hills Tank
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	2001 Study by DEA				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						242	ROUTED TO	6S-8E	0.000	181	156
						243	HYDROGRAPH AT	R6E	0.000	76	67
						244	ROUTED TO	6E-8E	0.000	76	67
						245	HYDROGRAPH AT	8E	0.200	201	114
						246	3 COMBINED AT	CP8E	0.200	259	225

TABLE 4.5-8
HEC-1 Peak Flow Comparison for South Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	1995 Study by MKE				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	HYDROGRAPH	511A1	0.29	382	272	1	HYDROGRAPH AT	WP504	0.26	193	162
2	HYDROGRAPH	511A2	0.06	109	68	2	HYDROGRAPH AT	WP581	3.92	267	208
3	ROUTED TO	RTA2A3	0.06	80	57	3	2 COMBINED AT	CLEAR	4.18	278	240
4	HYDROGRAPH	511A3	0.29	391	276	4	HYDROGRAPH AT	511A	0.65	704	941
5	3 COMBINED	CP11A	0.65	849	605	5	ROUTED TO	524526	0.65	638	871
6	ROUTED TO	RTA1D	0.65	732	564	6	HYDROGRAPH AT	511B	1.1	792	948
7	HYDROGRAPH	511D	0.12	190	132	7	ROUTED TO	525526	1.1	788	943
8	2 COMBINED	CP11D	0.77	824	656	8	HYDROGRAPH AT	511D	0.13	140	195
9	HYDROGRAPH	511B4	0.19	337	230	9	3 COMBINED AT	C526	1.88	1472	1594
10	HYDROGRAPH	511B1	0.58	616	476	10	ROUTED TO	526527	1.88	1432	1562
11	HYDROGRAPH	511B2	0.22	272	199	11	HYDROGRAPH AT	511E	0.57	430	579
12	2 COMBINED	CPB1B2	0.81	874	671	12	HYDROGRAPH AT	511F	0.15	225	340
13	ROUTED TO	RT12B4	0.81	811	642	13	3 COMBINED AT	C527	2.6	1709	1780
14	HYDROGRAPH	511B3	0.08	143	94	14	ROUTED TO	527528	2.6	1686	1764
15	ROUTED TO	RTB3B4	0.08	122	86	15	HYDROGRAPH AT	511C	1.2	747	878
16	3 COMBINED	CP11B	1.08	1021	855	16	2 COMBINED AT	C528	3.8	2257	2229
17	ROUTED TO	RTB4D	1.08	1019	854	17	ROUTED TO	528529	3.8	2188	2180
18	2 COMBINED	CP11DF	1.85	1844	1510	18	HYDROGRAPH AT	511H	0.31	312	458
19	ROUTED TO	RTDF	1.85	1815	1462	19	2 COMBINED AT	C529	4.11	2211	2175
20	HYDROGRAPH	511F	0.16	265	177	20	HYDROGRAPH AT	511G	0.87	768	961

TABLE 4.5-8
HEC-1 Peak Flow Comparison for South Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	1995 Study by MKE				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
21	2 COMBINED	CP11F	2.00	1888	1536	21	2 COMBINED AT	C530	4.97	2387	2274
22	HYDROGRAPH	511C1	0.33	387	282	22	ROUTED TO	530531	4.97	2337	2238
23	DIVERSION	DIC1C4	0.33	201	146	23	HYDROGRAPH AT	511I	0.21	236	382
24	HYDROGRAPH	DIC1E2	0.33	186	136	24	2 COMBINED AT	C531	5.18	2337	2232
25	ROUTED TO	RTC1E2	0.33	142	117	25	DIVERSION TO	D531L	5.18	551	528
26	HYDROGRAPH	511E1	0.30	364	262	26	HYDROGRAPH AT	D531R	5.18	1779	1694
27	ROUTED TO	RTE1E2	0.30	307	236	27	ROUTED TO	531532	5.18	1769	1687
28	HYDROGRAPH	511E2	0.28	342	259	28	DIVERSION TO	D532R	5.18	921	877
29	2 COMBINED	CPE1E2	0.57	586	460	29	HYDROGRAPH AT	D532L	5.18	848	810
30	HYDROGRAPH	511C4	0.02	46	26	30	DIVERSION TO	D532AL	5.18	494	468
31	HYDROGRAPH	DRC1C4	0.00	201	146	31	HYDROGRAPH AT	D532AR	5.18	353	341
32	ROUTED TO	RTC1C4	0.00	194	143	32	ROUTED TO	532580	5.18	350	339
33	2 COMBINED	CP11C4	0.02	202	155	33	HYDROGRAPH AT	B532AL	5.18	494	468
34	DIVERSION	DIC4C5	0.02	140	109	34	DIVERSION TO	D578L	5.18	247	234
35	HYDROGRAPH	DIC4E2	0.02	62	46	35	HYDROGRAPH AT	D578R	5.18	247	234
36	ROUTED TO	RTC4E2	0.02	42	33	36	ROUTED TO	578573	5.18	244	232
37	3 COMBINED	CP11E2	0.92	661	568	37	DIVERSION TO	D573L	5.18	57	53
38	HYDROGRAPH	511C5	0.11	195	131	38	HYDROGRAPH AT	D573R	5.18	188	179
39	HYDROGRAPH	DRC4C5	0.00	140	109	39	ROUTED TO	573580	5.18	186	179
40	ROUTED TO	RTC4C5	0.00	133	106	40	2 COMBINED AT	C580	5.18	536	518
41	HYDROGRAPH	511C3	0.14	217	144	41	ROUTED TO	580535	5.18	526	511
42	ROUTED TO	RTC3C5	0.14	198	138	42	HYDROGRAPH AT	B531L	5.18	551	528

TABLE 4.5-8
HEC-1 Peak Flow Comparison for South Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	1995 Study by MKE				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
43	HYDROGRAPH	511C2	0.39	434	322	43	ROUTED TO	531533	5.18	544	523
44	DIVERSION	DIC2A2	0.39	167	120	44	HYDROGRAPH AT	B578L	5.18	247	234
45	HYDROGRAPH	DIC2C5	0.39	267	202	45	2 COMBINED AT	C533	5.18	791	757
46	ROUTED TO	RTC2C5	0.39	244	191	46	ROUTED TO	533579	5.18	788	754
47	4 COMBINED	CP11C5	0.64	626	510	47	HYDROGRAPH AT	B573L	5.18	57	53
48	DIVERSION	DIC5C6	0.64	448	384	48	2 COMBINED AT	C579	5.18	845	807
49	HYDROGRAPH	DIC5E2	0.64	215	126	49	ROUTED TO	579534	5.18	839	803
50	ROUTED TO	RTC5E2	0.64	171	123	50	HYDROGRAPH AT	511J	0.12	136	238
51	2 COMBINED	CP11EF	1.56	830	691	51	2 COMBINED AT	C534	5.3	839	800
52	2 COMBINED	CPEF	3.57	2712	2221	52	DIVERSION TO	D534L	5.3	251	240
53	ROUTED TO	RTEFC8	3.57	2678	2209	53	HYDROGRAPH AT	D534R	5.3	586	560
54	HYDROGRAPH	511C8	0.04	88	50	54	ROUTED TO	534535	5.3	571	550
55	2 COMBINED	CP11C8	3.61	2681	2215	55	HYDROGRAPH AT	511K	0.79	788	1001
56	ROUTED TO	RTC8C7	3.61	2680	2213	56	3 COMBINED AT	C535	6.09	1107	1055
57	HYDROGRAPH	511C7	0.12	182	127	57	DIVERSION TO	D535R	6.09	941	896
58	HYDROGRAPH	511C6	0.04	68	44	58	HYDROGRAPH AT	D535L	6.09	166	158
59	HYDROGRAPH	DRC5C6	0.00	448	384	59	ROUTED TO	535515	6.09	164	156
60	ROUTED TO	RTC5C6	0.00	406	351	60	HYDROGRAPH AT	511L	0.19	221	336
61	2 COMBINED	CP11C6	0.04	417	368	61	2 COMBINED AT	C515	6.28	278	214
62	ROUTED TO	RTC6C7	0.04	409	362	62	DIVERSION TO	D515L	6.28	223	166
63	3 COMBINED	CP11C7	3.76	3149	2639	63	HYDROGRAPH AT	D515R	6.28	61	49
64	ROUTED TO	RTC7H	3.76	3029	2577	64	ROUTED TO	515575	6.28	57	49

TABLE 4.5-8
HEC-1 Peak Flow Comparison for South Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	1995 Study by MKE				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
65	HYDROGRAPH	511H	0.30	333	223	65	HYDROGRAPH AT	511M	0.08	116	182
66	2 COMBINED	CP11H	4.07	3135	2673	66	HYDROGRAPH AT	B535R	6.09	941	896
67	ROUTED TO	RTHG4	4.07	3129	2670	67	DIVERSION TO	D574R	6.09	223	211
68	HYDROGRAPH	511G1	0.31	505	329	68	HYDROGRAPH AT	D574L	6.09	717	685
69	ROUTED TO	RTG1G2	0.31	417	298	69	ROUTED TO	574575	6.09	710	680
70	HYDROGRAPH	511G2	0.16	228	151	70	3 COMBINED AT	C575	6.36	741	705
71	2 COMBINED	CP11G2	0.47	594	429	71	ROUTED TO	575536	6.36	737	702
72	ROUTED TO	RTG2G4	0.47	565	422	72	HYDROGRAPH AT	511Q	0.09	106	164
73	HYDROGRAPH	511G3	0.10	138	90	73	HYDROGRAPH AT	511N	0.07	85	132
74	ROUTED TO	RTG3G4	0.10	122	85	74	3 COMBINED AT	C536	6.52	743	703
75	HYDROGRAPH	511G4	0.30	348	238	75	ROUTED TO	536545	6.52	735	696
76	3 COMBINED	CPG_G4	0.86	975	720	76	HYDROGRAPH AT	511O	0.05	49	78
77	2 COMBINED	CP11G4	4.93	3612	3129	77	2 COMBINED AT	C545L	6.56	735	695
78	ROUTED TO	RTG4I	4.93	3586	3115	78	HYDROGRAPH AT	B532R	5.18	921	877
79	HYDROGRAPH	511I	0.20	254	158	79	ROUTED TO	532538	5.18	901	866
80	2 COMBINED	CP11I	5.13	3627	3155	80	HYDROGRAPH AT	510A	0.91	806	994
81	HYDROGRAPH	510A	0.92	866	707	81	DIVERSION TO	D537R	0.91	631	746
82	HYDROGRAPH	509A5	0.02	46	26	82	HYDROGRAPH AT	D537L	0.91	175	248
83	DIVERSION	DIA5S	0.02	1	1	83	ROUTED TO	537538	0.91	165	237
84	HYDROGRAPH	DIA59B	0.02	45	25	84	HYDROGRAPH AT	510B	0.36	374	518
85	ROUTED TO	RTA59B	0.02	13	11	85	3 COMBINED AT	C538	6.45	913	863
86	HYDROGRAPH	509B	0.65	497	384	86	ROUTED TO	538540	6.45	884	840

TABLE 4.5-8
HEC-1 Peak Flow Comparison for South Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	1995 Study by MKE				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
87	2 COMBINED	CP09B	0.67	497	385	87	HYDROGRAPH AT	B537R	0.91	631	746
88	HYDROGRAPH	509A1	0.19	265	192	88	ROUTED TO	537577	0.91	619	735
89	ROUTED TO	RTA1A2	0.19	250	187	89	HYDROGRAPH AT	509D	0.34	324	453
90	HYDROGRAPH	509A2	0.13	195	140	90	DIVERSION TO	D539R	0.34	113	158
91	HYDROGRAPH	DRC2A2	0.00	167	120	91	HYDROGRAPH AT	D539L	0.34	211	295
92	ROUTED TO	RTC2A2	0.00	145	111	92	ROUTED TO	539577	0.34	208	292
93	3 COMBINED	CP09A2	0.32	475	386	93	2 COMBINED AT	C577	1.25	812	908
94	ROUTED TO	RTA2A4	0.32	453	377	94	ROUTED TO	577540	1.25	772	881
95	HYDROGRAPH	509A3	0.16	258	176	95	HYDROGRAPH AT	510C	0.85	675	850
96	ROUTED TO	RTA3A4	0.16	249	174	96	3 COMBINED AT	C540	7.64	1409	1277
97	HYDROGRAPH	509A4	0.06	133	81	97	ROUTED TO	540542	7.64	1402	1271
98	3 COMBINED	CP09A4	0.55	668	554	98	HYDROGRAPH AT	510F	0.12	134	207
99	ROUTED TO	RTA4A6	0.55	652	547	99	2 COMBINED AT	C542	7.75	1425	1289
100	HYDROGRAPH	DRA5A6	0.00	1	1	100	ROUTED TO	542543	7.75	1419	1283
101	ROUTED TO	RTA5A6	0.00	1	1	101	HYDROGRAPH AT	B574R	6.09	223	211
102	HYDROGRAPH	509A6	0.03	75	45	102	ROUTED TO	574541	6.09	220	208
103	3 COMBINED	CP09A6	0.58	666	565	103	HYDROGRAPH AT	510D	0.06	75	126
104	HYDROGRAPH	509D	0.38	394	304	104	2 COMBINED AT	C541	6.15	220	208
105	HYDROGRAPH	500A	0.20	288	191	105	ROUTED TO	541543	6.15	215	205
106	ROUTED TO	RTAB	0.20	266	185	106	HYDROGRAPH AT	510E	0.18	195	282
107	HYDROGRAPH	500B	0.19	233	171	107	3 COMBINED AT	C543	8.91	1599	1429
108	2 COMBINED	CP500B	0.40	493	355	108	ROUTED TO	543545	8.91	1585	1414

TABLE 4.5-8
HEC-1 Peak Flow Comparison for South Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	1995 Study by MKE				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						109	HYDROGRAPH AT	510G	0.18	208	316
						110	2 COMBINED AT	C545R	9.09	1618	1440
						111	2 COMBINED AT	C545	9.56	2132	1876
						112	ROUTED TO	545546	9.56	2116	1866
						113	HYDROGRAPH AT	511P	0.31	353	493
						114	HYDROGRAPH AT	502A	0.04	69	113
						115	3 COMBINED AT	C546	9.91	2224	1961
						116	HYDROGRAPH AT	509A	0.57	498	674
						117	ROUTED TO	552553	0.57	458	626
						118	HYDROGRAPH AT	509B	0.64	479	638
						119	2 COMBINED AT	C553	1.21	649	779
						120	DIVERSION TO	D553R	1.21	305	367
						121	HYDROGRAPH AT	D553L	1.21	344	411
						122	ROUTED TO	553554	1.21	339	408
						123	HYDROGRAPH AT	509C	0.15	193	279
						124	2 COMBINED AT	C554	1.36	347	410
						125	DIVERSION TO	D554R	1.36	227	261
						126	HYDROGRAPH AT	D554L	1.36	120	149
						127	ROUTED TO	554555	1.36	119	148
						128	HYDROGRAPH AT	509E	0.19	241	340
						129	HYDROGRAPH AT	B539R	0.34	113	158
						130	ROUTED TO	539555	0.34	108	152

TABLE 4.5-8
HEC-1 Peak Flow Comparison for South Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	1995 Study by MKE				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						131	3 COMBINED AT	C555	1.88	387	394
						132	ROUTED TO	555557	1.88	371	392
						133	HYDROGRAPH AT	B553R	1.21	305	367
						134	ROUTED TO	553556	1.21	301	365
						135	HYDROGRAPH AT	B554R	1.36	227	261
						136	2 COMBINED AT	C556	1.36	528	618
						137	ROUTED TO	556558	1.36	521	613
						138	HYDROGRAPH AT	509F	0.2	257	367
						139	2 COMBINED AT	C558	1.56	531	612
						140	DIVERSION TO	D558R	1.56	223	263
						141	HYDROGRAPH AT	D558L	1.56	308	348
						142	ROUTED TO	558557	1.56	307	347
						143	HYDROGRAPH AT	509G	0.09	134	196
						144	3 COMBINED AT	C557	2.18	722	755
						145	DIVERSION TO	D557L	2.18	131	144
						146	HYDROGRAPH AT	D557R	2.18	591	610
						147	ROUTED TO	557565	2.18	584	606
						148	HYDROGRAPH AT	509M	0.1	101	150
						149	2 COMBINED AT	C565	2.28	637	657
						150	ROUTED TO	565566	2.28	635	655
						151	HYDROGRAPH AT	B557L	2.18	131	144
						152	ROUTED TO	557559	2.18	129	143

TABLE 4.5-8
HEC-1 Peak Flow Comparison for South Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	1995 Study by MKE				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						153	HYDROGRAPH AT	509H	0.07	72	109
						154	2 COMBINED AT	C559	2.25	178	192
						155	DIVERSION TO	D559L	2.25	70	76
						156	HYDROGRAPH AT	D559R	2.25	108	116
						157	ROUTED TO	559560	2.25	107	115
						158	HYDROGRAPH AT	509I	0.03	36	61
						159	2 COMBINED AT	C560	2.28	121	127
						160	DIVERSION TO	D560L	2.28	39	40
						161	HYDROGRAPH AT	D560R	2.28	82	86
						162	ROUTED TO	560566	2.28	80	85
						163	HYDROGRAPH AT	509L	0.08	125	209
						164	3 COMBINED AT	C566	2.46	746	759
						165	ROUTED TO	566567	2.46	742	757
						166	HYDROGRAPH AT	B559L	2.25	70	76
						167	ROUTED TO	559561	2.25	69	76
						168	HYDROGRAPH AT	B560L	2.28	39	40
						169	ROUTED TO	560561	2.28	39	40
						170	HYDROGRAPH AT	509K	0.03	36	60
						171	3 COMBINED AT	C561	2.31	122	128
						172	ROUTED TO	561562	2.31	121	128
						173	HYDROGRAPH AT	509J	0.1	106	161
						174	2 COMBINED AT	C562	2.41	189	199

TABLE 4.5-8
HEC-1 Peak Flow Comparison for South Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	1995 Study by MKE				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						175	ROUTED TO	562567	2.41	188	198
						176	HYDROGRAPH AT	509P	0.11	193	325
						177	3 COMBINED AT	C567	2.7	961	967
						178	ROUTED TO	567568	2.7	958	966
						179	HYDROGRAPH AT	509Q	0.11	148	244
						180	2 COMBINED AT	C568	2.81	1009	1007
						181	ROUTED TO	568569	2.81	996	1003
						182	HYDROGRAPH AT	509R	0.1	147	245
						183	2 COMBINED AT	C569	2.9	1013	1010
						184	ROUTED TO	569570	2.9	1008	1008
						185	HYDROGRAPH AT	509O	0.04	59	100
						186	HYDROGRAPH AT	509N	0.11	151	250
						187	2 COMBINED AT	C564	0.15	209	347
						188	ROUTED TO	564570	0.15	195	326
						189	HYDROGRAPH AT	509S	0.19	273	431
						190	3 COMBINED AT	C570	3.25	1152	1134
						191	3 COMBINED AT	CLEAR	17.34	3366	2767
						192	HYDROGRAPH AT	B558R	1.56	223	263
						193	ROUTED TO	558571	1.56	219	260
						194	HYDROGRAPH AT	505A	0.18	237	341
						195	2 COMBINED AT	C571	1.74	303	325
						196	ROUTED TO	571572	1.74	294	321

TABLE 4.5-8
HEC-1 Peak Flow Comparison for South Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	1995 Study by MKE				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						197	HYDROGRAPH AT	505B	0.14	228	378
						198	2 COMBINED AT	C572	1.88	423	443
						199	HYDROGRAPH AT	500A	0.21	280	421
						200	ROUTED TO	501502	0.21	240	365
						201	HYDROGRAPH AT	500B	0.2	227	325
						202	2 COMBINED AT	C502	0.42	406	491
						203	DIVERSION TO	D502L	0.42	239	299
						204	HYDROGRAPH AT	D502R	0.42	166	192
						205	ROUTED TO	502506	0.42	164	189
						206	HYDROGRAPH AT	B534L	5.3	251	240
						207	ROUTED TO	534506	5.3	250	239
						208	2 COMBINED AT	C506	5.72	277	265
						209	ROUTED TO	506507	5.72	275	264
						210	HYDROGRAPH AT	500H	0.21	226	340
						211	2 COMBINED AT	C507	5.93	346	279
						212	ROUTED TO	507508	5.93	324	273
						213	HYDROGRAPH AT	B502L	0.42	239	299
						214	ROUTED TO	502503	0.42	233	294
						215	HYDROGRAPH AT	500C	0.12	160	248
						216	2 COMBINED AT	C503	0.54	297	395
						217	ROUTED TO	503508	0.54	271	356
						218	HYDROGRAPH AT	500I	0.41	430	644

TABLE 4.5-8
HEC-1 Peak Flow Comparison for South Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	1995 Study by MKE				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						219	3 COMBINED AT	C508	6.88	682	528
						220	DIVERSION TO	D508L	6.88	380	277
						221	HYDROGRAPH AT	D508R	6.88	303	251
						222	ROUTED TO	508517	6.88	291	249
						223	HYDROGRAPH AT	B515L	6.28	223	166
						224	ROUTED TO	515517	6.28	204	159
						225	HYDROGRAPH AT	500L	0.16	190	292
						226	3 COMBINED AT	C517	7.6	517	424
						227	ROUTED TO	517518	7.6	511	423
						228	HYDROGRAPH AT	500J	0.09	124	204
						229	ROUTED TO	514518	0.09	121	199
						230	2 COMBINED AT	C518	7.69	550	463
						231	ROUTED TO	518519	7.69	542	455
						232	HYDROGRAPH AT	500M	0.12	142	228
						233	2 COMBINED AT	C519	7.81	606	513
						234	HYDROGRAPH AT	C504	0.26	193	162
						235	ROUTED TO	504509	0.26	181	155
						236	HYDROGRAPH AT	500D	0.23	250	371
						237	2 COMBINED AT	TEMP1	0.49	249	371
						238	HYDROGRAPH AT	C509	0.49	249	442
						239	ROUTED TO	509510	0.49	236	438
						240	HYDROGRAPH AT	500E	0.11	137	219

TABLE 4.5-8
HEC-1 Peak Flow Comparison for South Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	1995 Study by MKE				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						241	HYDROGRAPH AT	C581	3.92	267	208
						242	ROUTED TO	581510	3.92	265	206
						243	3 COMBINED AT	TEMP2	4.52	365	442
						244	HYDROGRAPH AT	C510	4.52	365	429
						245	DIVERSION TO	D510L	4.52	148	175
						246	HYDROGRAPH AT	D510R	4.52	216	254
						247	ROUTED TO	510511	4.52	215	253
						248	HYDROGRAPH AT	B508L	6.88	380	277
						249	ROUTED TO	508511	6.88	357	271
						250	HYDROGRAPH AT	500F	0.44	442	647
						251	3 COMBINED AT	C511	11.42	645	513
						252	ROUTED TO	511512	11.42	622	505
						253	HYDROGRAPH AT	500K	0.1	144	219
						254	ROUTED TO	513512	0.1	130	201
						255	HYDROGRAPH AT	500G	0.2	228	349
						256	3 COMBINED AT	C512	11.72	727	566
						257	HYDROGRAPH AT	BB519	7.81	606	683
						258	2 COMBINED AT	C520	13.08	1264	1140
						259	ROUTED TO	520576	13.08	1260	1139
						260	HYDROGRAPH AT	500O	0.1	120	182
						261	ROUTED TO	521522	0.1	114	175
						262	HYDROGRAPH AT	500P	0.08	125	201

TABLE 4.5-8
HEC-1 Peak Flow Comparison for South Basin Models
(Updated vs. Original Models)

Line No.	This Study (Updated Model)					Line No.	1995 Study by MKE				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						263	2 COMBINED AT	C522	0.18	209	307
						264	2 COMBINED AT	C576	13.26	1369	1205
						265	ROUTED TO	576523	13.26	1367	1204
						266	HYDROGRAPH AT	500N	0.11	138	228
						267	2 COMBINED AT	C523	13.38	1402	1214
						268	HYDROGRAPH AT	501A	0.04	63	111
						269	HYDROGRAPH AT	501B	0.07	89	151
						270	5 COMBINED AT	CLEAR	18.5	1751	1633
						271	HYDROGRAPH AT	502B	0.05	86	139
						272	HYDROGRAPH AT	502C	0.05	63	100
						273	HYDROGRAPH AT	503A	0.22	292	458
						274	ROUTED TO	549550	0.22	283	445
						275	HYDROGRAPH AT	503C	0.12	176	278
						276	2 COMBINED AT	C550L	0.34	456	717
						277	HYDROGRAPH AT	503B	0.11	115	171
						278	2 COMBINED AT	C550	0.45	570	886
						279	HYDROGRAPH AT	504A	0.24	290	428

TABLE 4.5-9
HEC-1 Peak Flow Comparison Between Existing and Future Condition Models for the North-North Basin Area
(Without Development Guidelines)

Line No.	Existing Condition Models					Line No.	Future Condition Models (Without Development Guidelines)				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	Hydrograph	B1W1	0.33	358	261	1	Hydrograph	B1W1	0.33	358	261
2	Hydrograph	B2W1	0.12	159	110	2	Hydrograph	B2W1	0.12	159	110
3	Combined	CB2W1	0.45	504	366	3	Combined	CB2W1	0.45	504	366
4	Routed	RB6W1	0.45	458	349	4	Routed	RB6W1	0.45	458	349
5	Hydrograph	B6W1	0.11	151	93	5	Hydrograph	B6W1	0.11	152	95
6	Combined	CB6W1	0.56	504	391	6	Combined	CB6W1	0.56	505	393
7	Hydrograph	B8W1	0.15	200	138	7	Hydrograph	B8W1	0.15	200	138
8	Hydrograph	B3W1	0.14	203	134	8	Hydrograph	B3W1	0.14	203	134
9	Hydrograph	B4W1	0.14	223	147	9	Hydrograph	B4W1	0.14	223	147
10	Combined	CB3W1	0.28	426	280	10	Combined	CB3W1	0.28	426	280
11	Routed	RB7W1	0.28	381	263	11	Routed	RB7W1	0.28	381	263
12	Hydrograph	B7W1	0.14	226	143	12	Hydrograph	B7W1	0.14	226	143
13	Combined	CB7W1	0.42	510	374	13	Combined	CB7W1	0.42	510	374
14	Combined	CB9W1A	1.14	1037	850	14	Combined	CB9W1A	1.14	1039	852
15	Routed	RB9W1A	1.14	1016	825	15	Routed	RB9W1A	1.14	1018	826
16	Hydrograph	B10W1	0.12	199	127	16	Hydrograph	B10W1	0.12	204	133
17	Routed	RB9W1B	0.12	198	127	17	Routed	RB9W1B	0.12	203	132
18	Hydrograph	B9W1	0.11	137	76	18	Hydrograph	B9W1	0.11	152	90
19	Combined	CB9W1	1.36	1109	904	19	Combined	CB9W1	1.36	1116	916
20	Hydrograph	B5W1	0.38	356	271	20	Hydrograph	B5W1	0.38	356	271
21	Combined	CB13WA	1.75	1434	1148	21	Combined	CB13WA	1.75	1439	1160

TABLE 4.5-9
HEC-1 Peak Flow Comparison Between Existing and Future Condition Models for the North-North Basin Area
(Without Development Guidelines)

Line No.	Existing Condition Models					Line No.	Future Condition Models (Without Development Guidelines)				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
22	Routed	RB13WA	1.75	1373	1128	22	Routed	RB13WA	1.75	1381	1140
23	Hydrograph	B13W1	0.21	255	171	23	Hydrograph	B13W1	0.21	255	171
24	Hydrograph	B14W1	0.14	218	145	24	Hydrograph	B14W1	0.14	218	145
25	Routed	RB13WB	0.14	218	145	25	Routed	RB13WB	0.14	218	145
26	Combined	CB13W1	2.10	1481	1239	26	Combined	CB13W1	2.10	1489	1251
27	Hydrograph	B15W1	0.02	58	32	27	Hydrograph	B15W1	0.02	58	32
28	Hydrograph	B16W1	0.01	37	20	28	Hydrograph	B16W1	0.01	37	20
29	Hydrograph	B17W1	0.01	25	13	29	Hydrograph	B17W1	0.01	25	13
30	Hydrograph	B18W1	0.05	98	59	30	Hydrograph	B18W1	0.05	98	59
31	Hydrograph	B1W2	0.08	118	78	31	Hydrograph	B1W2	0.08	124	82
32	Hydrograph	B2W2	0.10	143	95	32	Hydrograph	B2W2	0.10	143	96
33	Combined	CB2W2	0.18	261	173	33	Combined	CB2W2	0.18	265	177
34	Hydrograph	B4W2	0.10	172	105	34	Hydrograph	B4W2	0.10	172	105
35	Hydrograph	B3W5	0.08	138	82	35	Hydrograph	B3W5	0.08	138	82
36	Routed	RB6W5	0.08	110	73	36	Routed	RB6W5	0.08	110	73
37	Hydrograph	B6W5	0.10	156	96	37	Hydrograph	B6W5	0.10	156	96
38	Combined	CB6W5	0.18	191	147	38	Combined	CB6W5	0.18	191	147
39	Hydrograph	B4W5	0.07	118	71	39	Hydrograph	B4W5	0.07	118	71
40	Routed	RB7W5	0.07	112	69	40	Routed	RB7W5	0.07	112	69
41	Hydrograph	B7W5	0.14	189	125	41	Hydrograph	B7W5	0.14	189	125
42	Combined	CB7W5	0.21	297	193	42	Combined	CB7W5	0.21	297	193
43	Combined	CB67W5	0.40	487	334	43	Combined	CB67W5	0.40	487	334

TABLE 4.5-9
HEC-1 Peak Flow Comparison Between Existing and Future Condition Models for the North-North Basin Area
(Without Development Guidelines)

Line No.	Existing Condition Models					Line No.	Future Condition Models (Without Development Guidelines)				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
44	Hydrograph	B5W5	0.09	118	78	44	Hydrograph	B5W5	0.09	118	78
45	Hydrograph	B5W5A	0.10	142	91	45	Hydrograph	B5W5A	0.10	142	91
46	Hydrograph	B1W5	0.21	303	205	46	Hydrograph	B1W5	0.21	303	205
47	Hydrograph	B1W6	0.52	758	505	47	Hydrograph	B1W6	0.52	875	592
48	Routed	RB2W6	0.52	620	460	48	Routed	RB2W6	0.52	708	541
49	Hydrograph	B2W6	0.96	917	670	49	Hydrograph	B2W6	0.96	1029	783
50	Combined	CB2W6	1.48	1525	1128	50	Combined	CB2W6	1.48	1724	1322
51	Hydrograph	B3W6	0.36	420	303	51	Hydrograph	B3W6	0.36	489	361
52	Combined	CB3W6	1.84	1901	1413	52	Combined	CB3W6	1.84	2150	1661
53	Routed	RB6W6	1.84	1855	1390	53	Routed	RB6W6	1.84	2102	1636
54	Hydrograph	B6W6	0.22	335	219	54	Hydrograph	B6W6	0.22	375	253
55	Combined	CB6W6	2.05	1958	1502	55	Combined	CB6W6	2.05	2245	1776
56	Routed	RB9W6A	2.05	1884	1474	56	Routed	RB9W6A	2.05	2172	1750
57	Hydrograph	B5W6	0.38	462	351	57	Hydrograph	B5W6	0.38	528	406
58	Hydrograph	B4W6A	0.24	346	233	58	Hydrograph	B4W6A	0.24	397	272
59	Hydrograph	B4W6B	0.19	315	211	59	Hydrograph	B4W6B	0.19	335	230
60	Combined	CB4W6	0.43	654	443	60	Combined	CB4W6	0.43	731	501
61	Routed	RB7W6	0.43	636	436	61	Routed	RB7W6	0.43	708	495
62	Hydrograph	B7W6	0.26	437	302	62	Hydrograph	B7W6	0.26	461	322
63	Combined	CB7W6A	0.69	987	712	63	Combined	CB7W6A	0.69	1094	793
64	Combined	CB7W6	1.08	1449	1057	64	Combined	CB7W6	1.08	1622	1198
65	Routed	RB9W6	1.08	1308	1011	65	Routed	RB9W6	1.08	1466	1152

TABLE 4.5-9
HEC-1 Peak Flow Comparison Between Existing and Future Condition Models for the North-North Basin Area
(Without Development Guidelines)

Line No.	Existing Condition Models					Line No.	Future Condition Models (Without Development Guidelines)				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
66	Hydrograph	B9W6	0.55	589	411	66	Hydrograph	B9W6	0.55	697	507
67	Combined	CB9W6	3.68	3301	2696	67	Combined	CB9W6	3.68	3826	3203
68	Hydrograph	B8W6	0.11	211	134	68	Hydrograph	B8W6	0.11	224	145
69	Routed	RB12W6	0.11	171	122	69	Routed	RB12W6	0.11	183	133
70	Hydrograph	B12W6	0.23	316	207	70	Hydrograph	B12W6	0.23	367	247
71	Combined	CB12W6	0.34	397	304	71	Combined	CB12W6	0.34	441	352
72	Combined	CB9W6A	4.02	3522	2907	72	Combined	CB9W6A	4.02	4084	3468
73	Routed	RB13WC	4.02	3515	2906	73	Routed	RB13WC	4.02	4084	3464
74	Hydrograph	B13W6A	0.11	232	128	74	Hydrograph	B13W6A	0.11	235	132
75	Combined	C13W6A	4.13	3524	2922	75	Combined	C13W6A	4.13	4097	3489
76	Routed	RB13W3	4.13	3522	2918	76	Routed	RB13W3	4.13	4091	3485
77	Hydrograph	B10W6A	0.16	311	199	77	Hydrograph	B10W6A	0.16	331	215
78	Routed	RB11WA	0.16	256	177	78	Routed	RB11WA	0.16	274	192
79	Hydrograph	B11W6	0.16	262	170	79	Hydrograph	B11W6	0.16	300	198
80	Hydrograph	B10W6B	0.16	282	183	80	Hydrograph	B10W6B	0.16	316	207
81	Routed	RB11WB	0.16	251	169	81	Routed	RB11WB	0.16	286	191
82	Combined	CB11W6	0.49	652	467	82	Combined	CB11W6	0.49	723	516
83	Routed	RB13W1	0.49	596	460	83	Routed	RB13W1	0.49	660	508
84	Hydrograph	B14W6	0.11	177	107	84	Hydrograph	B14W6	0.11	204	128
85	Routed	RB13W2	0.11	156	101	85	Routed	RB13W2	0.11	181	120
86	Hydrograph	B13W6B	0.19	265	175	86	Hydrograph	B13W6B	0.19	290	194
87	Combined	C13W6B	4.91	4192	3509	87	Combined	C13W6B	4.91	4830	4171

TABLE 4.5-9
HEC-1 Peak Flow Comparison Between Existing and Future Condition Models for the North-North Basin Area
(Without Development Guidelines)

Line No.	Existing Condition Models					Line No.	Future Condition Models (Without Development Guidelines)				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
88	Hydrograph	B1W3	0.45	472	332	88	Hydrograph	B1W3	0.45	474	334
89	Hydrograph	B1W4A	0.13	210	132	89	Hydrograph	B1W4A	0.13	237	154
90	Routed	RB1W4B	0.13	190	125	90	Routed	RB1W4B	0.13	217	146
91	Hydrograph	B1W4B	0.12	178	110	91	Hydrograph	B1W4B	0.12	201	132
92	Combined	CB1W4	0.25	349	231	92	Combined	CB1W4	0.25	405	273
93	Routed	RB2W4B	0.25	339	227	93	Routed	RB2W4B	0.25	391	269
94	Hydrograph	B2W4B	0.10	161	99	94	Hydrograph	B2W4B	0.10	183	117
95	Combined	CB2W4B	0.35	459	312	95	Combined	CB2W4B	0.35	528	373
96	Hydrograph	B2W4A	0.12	148	100	96	Hydrograph	B2W4A	0.12	173	122
97	Combined	CB2W4	0.48	607	412	97	Combined	CB2W4	0.48	700	495
98	Routed	RB4W4A	0.48	469	358	98	Routed	RB4W4A	0.48	547	438
99	Hydrograph	B4W4	0.19	205	137	99	Hydrograph	B4W4	0.19	205	137
100	Hydrograph	B1W4C	0.10	149	95	100	Hydrograph	B1W4C	0.10	174	115
101	Routed	RB2W4C	0.10	85	66	101	Routed	RB2W4C	0.10	105	87
102	Hydrograph	B2W4C	0.13	143	99	102	Hydrograph	B2W4C	0.13	149	104
103	Combined	CB2W4C	0.24	165	133	103	Combined	CB2W4C	0.24	202	166
104	Routed	RB4W4B	0.24	164	132	104	Routed	RB4W4B	0.24	201	166
105	Combined	CB4W4	0.90	728	579	105	Combined	CB4W4	0.90	847	703
106	Hydrograph	B3W4	0.09	151	93	106	Hydrograph	B3W4	0.09	173	109
107	Routed	RB5W4A	0.09	120	82	107	Routed	RB5W4A	0.09	139	98
108	Hydrograph	B5W4A	0.08	134	84	108	Hydrograph	B5W4A	0.08	140	89
109	Combined	CB5W4A	0.18	182	139	109	Combined	CB5W4A	0.18	211	165

TABLE 4.5-9
HEC-1 Peak Flow Comparison Between Existing and Future Condition Models for the North-North Basin Area
(Without Development Guidelines)

Line No.	Existing Condition Models					Line No.	Future Condition Models (Without Development Guidelines)				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
110	Routed	RB5W4B	0.18	149	118	110	Routed	RB5W4B	0.18	176	141
111	Hydrograph	B5W4B	0.15	188	121	111	Hydrograph	B5W4B	0.15	188	121
112	Combined	CB5W4B	0.33	206	170	112	Combined	CB5W4B	0.33	238	198
113	Combined	DUMMY	9.87	7176	6159	113	Combined	DUMMY	9.87	7984	7006

TABLE 4.5-10
HEC-1 Peak Flow Comparison Between Existing and Future Condition Models for the North-South Basin Area With Black Hills Tank
(Without Development Guidelines)

Line No.	Existing Condition Models					Line No.	Future Condition Models (Without Development Guidelines)				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	Hydrograph	1B1	0.49	794	553	1	Hydrograph	1B1	0.49	882	631
2	Routed	RT1112	0.49	497	428	2	Routed	RT1112	0.49	577	510
3	Hydrograph	1B2	0.16	167	129	3	Hydrograph	1B2	0.16	194	156
4	Combined	CP1B2	0.65	569	500	4	Combined	CP1B2	0.65	664	604
5	Hydrograph	1B3	0.13	235	159	5	Hydrograph	1B3	0.13	263	181
6	Diversion	1B3R	0.13	230	158	6	Diversion	1B3R	0.13	256	178
7	Hydrograph	1B3L	0.13	6	2	7	Hydrograph	1B3L	0.13	7	3
8	Routed	RT1314	0.13	1	0	8	Routed	RT1314	0.13	1	1
9	Hydrograph	1B4	0.14	183	136	9	Hydrograph	1B4	0.14	208	158
10	Combined	CP1B4	0.27	183	136	10	Combined	CP1B4	0.27	208	158
11	Combined	CP1214	0.92	617	553	11	Combined	CP1214	0.92	727	677
12	Routed	RT1452	0.92	591	534	12	Routed	RT1452	0.92	699	660
13	Hydrograph	5B2	0.12	193	142	13	Hydrograph	5B2	0.12	211	158
14	Combined	CP5B2	1.05	617	567	14	Combined	CP5B2	1.05	735	707
15	Routed	RT529B	1.05	563	521	15	Routed	RT529B	1.05	688	674
16	Hydrograph	5B1	0.10	170	123	16	Hydrograph	5B1	0.10	185	136
17	Routed	RT519B	0.10	100	91	17	Routed	RT519B	0.10	112	103
18	Hydrograph	9B	0.20	239	177	18	Hydrograph	9B	0.20	274	208
19	Hydrograph	8B1	0.08	132	86	19	Hydrograph	8B1	0.08	144	97
20	Routed	RT819B	0.08	132	86	20	Routed	RT819B	0.08	143	97
21	Hydrograph	4B1	0.37	401	306	21	Hydrograph	4B1	0.37	470	370

TABLE 4.5-10
HEC-1 Peak Flow Comparison Between Existing and Future Condition Models for the North-South Basin Area With Black Hills Tank
(Without Development Guidelines)

Line No.	Existing Condition Models					Line No.	Future Condition Models (Without Development Guidelines)				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
22	Routed	RT4142	0.37	355	285	22	Routed	RT4142	0.37	420	349
23	Hydrograph	4B2	0.24	310	220	23	Hydrograph	4B2	0.24	362	266
24	Combined	CP4B2	0.61	505	439	24	Combined	CP4B2	0.61	604	545
25	Routed	RT4282	0.61	490	427	25	Routed	RT4282	0.61	592	535
26	Hydrograph	8B2	0.06	104	69	26	Hydrograph	8B2	0.06	117	80
27	Hydrograph	2B1	0.47	776	531	27	Hydrograph	2B1	0.47	861	609
28	Routed	RT2122	0.47	620	479	28	Routed	RT2122	0.47	690	551
29	Hydrograph	2B2	0.53	645	486	29	Hydrograph	2B2	0.53	732	568
30	Hydrograph	2B3	0.26	361	263	30	Hydrograph	2B3	0.26	403	301
31	Combined	CP2223	1.26	1552	1200	31	Combined	CP2223	1.26	1749	1394
32	Routed	RT2226	1.26	1498	1176	32	Routed	RT2226	1.26	1681	1371
33	Hydrograph	2B4	0.21	253	192	33	Hydrograph	2B4	0.21	293	228
34	Hydrograph	2B5	0.13	257	170	34	Hydrograph	2B5	0.13	273	184
35	Combined	CP2425	0.34	436	331	35	Combined	CP2425	0.34	503	386
36	Routed	RT4526	0.34	349	296	36	Routed	RT4526	0.34	400	347
37	Hydrograph	2B6	0.31	483	353	37	Hydrograph	2B6	0.31	551	404
38	Combined	CP2B6	1.91	2090	1721	38	Combined	CP2B6	1.91	2353	2004
39	Routed	RS2B6	1.91	761	700	39	Routed	RS2B6	1.91	1267	1174
40	Routed	RT2631	1.91	743	688	40	Routed	RT2631	1.91	1237	1149
41	Hydrograph	3B1	0.10	126	90	41	Hydrograph	3B1	0.10	148	108
42	Combined	CP3B1	2.01	751	693	42	Combined	CP3B1	2.01	1256	1168
43	Routed	RT3132	2.01	717	664	43	Routed	RT3132	2.01	1197	1118

TABLE 4.5-10
HEC-1 Peak Flow Comparison Between Existing and Future Condition Models for the North-South Basin Area With Black Hills Tank
(Without Development Guidelines)

Line No.	Existing Condition Models					Line No.	Future Condition Models (Without Development Guidelines)				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
44	Hydrograph	3B2	0.34	416	315	44	Hydrograph	3B2	0.34	472	367
45	Combined	CP3B2	2.35	722	676	45	Combined	CP3B2	2.35	1259	1174
46	Routed	RT3282	2.35	721	677	46	Routed	RT3282	2.35	1262	1177
47	Combined	CP8B2	3.02	869	805	47	Combined	CP8B2	3.02	1531	1431
48	Routed	RT829B	3.02	871	804	48	Routed	RT829B	3.02	1519	1423
49	Combined	CP9B	4.44	1478	1356	49	Combined	CP9B	4.44	2301	2193
50	Hydrograph	1B36B	0.00	230	158	50	Hydrograph	1B36B	0.00	256	178
51	Routed	RT136B	0.00	166	135	51	Routed	RT136B	0.00	184	153
52	Hydrograph	6B	0.20	263	206	52	Hydrograph	6B	0.20	293	233
53	Combined	CP6B	0.20	301	283	53	Combined	CP6B	0.20	333	325
54	Hydrograph	1N	0.13	331	201	54	Hydrograph	1N	0.13	352	217
55	Hydrograph	4A	0.08	125	89	55	Hydrograph	4A	0.08	139	101
56	Hydrograph	2A	0.03	58	38	56	Hydrograph	2A	0.03	63	43
57	Hydrograph	1S	0.19	364	248	57	Hydrograph	1S	0.19	403	277
58	Routed	RT1S2S	0.19	309	229	58	Routed	RT1S2S	0.19	339	258
59	Hydrograph	2S	0.09	152	102	59	Hydrograph	2S	0.09	171	118
60	Combined	CP2S	0.28	432	321	60	Combined	CP2S	0.28	477	367
61	Routed	RT2S3S	0.28	414	316	61	Routed	RT2S3S	0.28	465	360
62	Hydrograph	3S	0.09	143	96	62	Hydrograph	3S	0.09	156	109
63	Combined	CP3S	0.37	500	393	63	Combined	CP3S	0.37	563	451
64	Routed	RT3S4N	0.37	495	392	64	Routed	RT3S4N	0.37	562	449
65	Hydrograph	3N	0.11	189	134	65	Hydrograph	3N	0.11	208	151

TABLE 4.5-10
HEC-1 Peak Flow Comparison Between Existing and Future Condition Models for the North-South Basin Area With Black Hills Tank
(Without Development Guidelines)

Line No.	Existing Condition Models					Line No.	Future Condition Models (Without Development Guidelines)				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
66	Routed	RT34N1	0.11	189	134	66	Routed	RT34N1	0.11	206	150
67	Hydrograph	4N1	0.05	85	57	67	Hydrograph	4N1	0.05	97	66
68	Combined	CP4N1	0.16	269	190	68	Combined	CP4N1	0.16	301	215
69	Routed	RT4N14	0.16	234	182	69	Routed	RT4N14	0.16	262	201
70	Hydrograph	2N	0.20	364	252	70	Hydrograph	2N	0.20	393	278
71	Routed	RT2N4N	0.20	312	238	71	Routed	RT2N4N	0.20	340	262
72	Hydrograph	4N	0.07	140	97	72	Hydrograph	4N	0.07	148	103
73	Combined	CP4N	0.81	1112	885	73	Combined	CP4N	0.81	1242	993

TABLE 4.5-11
HEC-1 Peak Flow Comparison Between Existing and Future Condition Models for the North-South Basin Area Without Black Hills Tank
(Without Development Guidelines)

Line No.	Existing Condition Models					Line No.	Future Condition Models (Without Development Guidelines)				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	Hydrograph	1B1	0.49	794	553	1	Hydrograph	1B1	0.49	882	631
2	Routed	RT1112	0.49	497	428	2	Routed	RT1112	0.49	577	510
3	Hydrograph	1B2	0.16	167	129	3	Hydrograph	1B2	0.16	194	156
4	Combined	CP1B2	0.65	569	500	4	Combined	CP1B2	0.65	664	604
5	Hydrograph	1B3	0.13	235	159	5	Hydrograph	1B3	0.13	263	181
6	Diversion	1B3R	0.13	230	158	6	Diversion	1B3R	0.13	256	178
7	Hydrograph	1B3L	0.13	6	2	7	Hydrograph	1B3L	0.13	7	3
8	Routed	RT1314	0.13	1	0	8	Routed	RT1314	0.13	1	1
9	Hydrograph	1B4	0.14	183	136	9	Hydrograph	1B4	0.14	208	158
10	Combined	CP1B4	0.27	183	136	10	Combined	CP1B4	0.27	208	158
11	Combined	CP1214	0.92	617	553	11	Combined	CP1214	0.92	727	677
12	Routed	RT1452	0.92	591	534	12	Routed	RT1452	0.92	699	660
13	Hydrograph	5B2	0.12	193	142	13	Hydrograph	5B2	0.12	211	158
14	Combined	CP5B2	1.05	617	567	14	Combined	CP5B2	1.05	735	707
15	Routed	RT529B	1.05	563	521	15	Routed	RT529B	1.05	688	674
16	Hydrograph	5B1	0.10	170	123	16	Hydrograph	5B1	0.10	185	136
17	Routed	RT519B	0.10	100	91	17	Routed	RT519B	0.10	112	103
18	Hydrograph	9B	0.20	239	177	18	Hydrograph	9B	0.20	274	208
19	Combined	CP9BA	1.35	630	587	19	Combined	CP9BA	1.35	777	778
20	Hydrograph	8B1	0.08	132	86	20	Hydrograph	8B1	0.08	144	97
21	Routed	RT819B	0.08	132	86	21	Routed	RT819B	0.08	143	97

TABLE 4.5-11
HEC-1 Peak Flow Comparison Between Existing and Future Condition Models for the North-South Basin Area Without Black Hills Tank
(Without Development Guidelines)

Line No.	Existing Condition Models					Line No.	Future Condition Models (Without Development Guidelines)				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
22	Hydrograph	4B1	0.37	401	306	22	Hydrograph	4B1	0.37	470	370
23	Routed	RT4142	0.37	355	285	23	Routed	RT4142	0.37	420	349
24	Hydrograph	4B2	0.24	310	220	24	Hydrograph	4B2	0.24	362	266
25	Combined	CP4B2	0.61	505	439	25	Combined	CP4B2	0.61	604	545
26	Routed	RT4282	0.61	490	427	26	Routed	RT4282	0.61	592	535
27	Hydrograph	8B2	0.06	104	69	27	Hydrograph	8B2	0.06	117	80
28	Combined	CP8B2A	0.67	510	452	28	Combined	CP8B2A	0.67	617	571
29	Hydrograph	2B1	0.47	776	531	29	Hydrograph	2B1	0.47	861	609
30	Routed	RT2122	0.47	620	479	30	Routed	RT2122	0.47	690	551
31	Hydrograph	2B2	0.53	645	486	31	Hydrograph	2B2	0.53	732	568
32	Hydrograph	2B3	0.26	361	263	32	Hydrograph	2B3	0.26	403	301
33	Combined	CP2223	1.26	1552	1200	33	Combined	CP2223	1.26	1749	1394
34	Routed	RT2226	1.26	1498	1176	34	Routed	RT2226	1.26	1681	1371
35	Hydrograph	2B4	0.21	253	192	35	Hydrograph	2B4	0.21	293	228
36	Hydrograph	2B5	0.13	257	170	36	Hydrograph	2B5	0.13	273	184
37	Combined	CP2425	0.34	436	331	37	Combined	CP2425	0.34	503	386
38	Routed	RT4526	0.34	349	296	38	Routed	RT4526	0.34	400	347
39	Hydrograph	2B6	0.31	483	353	39	Hydrograph	2B6	0.31	551	404
40	Combined	CP2B6	1.91	2090	1721	40	Combined	CP2B6	1.91	2353	2004
41	Routed	RT2632	1.91	1646	1472	41	Routed	RT2632	1.91	1920	1759
42	Hydrograph	3B1	0.10	126	90	42	Hydrograph	3B1	0.10	148	108
43	Routed	RT3132	0.10	88	70	43	Routed	RT3132	0.10	107	91

TABLE 4.5-11
HEC-1 Peak Flow Comparison Between Existing and Future Condition Models for the North-South Basin Area Without Black Hills Tank
(Without Development Guidelines)

Line No.	Existing Condition Models					Line No.	Future Condition Models (Without Development Guidelines)				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
44	Hydrograph	3B2	0.34	416	315	44	Hydrograph	3B2	0.34	472	367
45	Combined	CP3B2	2.35	1838	1664	45	Combined	CP3B2	2.35	2156	2011
46	Routed	RT3282	2.35	1835	1661	46	Routed	RT3282	2.35	2159	2009
47	Combined	CP8B2	3.02	2254	2039	47	Combined	CP8B2	3.02	2665	2499
48	Routed	RT829B	3.02	2257	2045	48	Routed	RT829B	3.02	2658	2501
49	Combined	CP9B	4.44	2819	2572	49	Combined	CP9B	4.44	3329	3167
50	Hydrograph	1B36B	0.00	230	158	50	Hydrograph	1B36B	0.00	256	178
51	Routed	RT136B	0.00	166	135	51	Routed	RT136B	0.00	184	153
52	Hydrograph	6B	0.20	263	206	52	Hydrograph	6B	0.20	293	233
53	Combined	CP6B	0.20	301	283	53	Combined	CP6B	0.20	333	325
54	Hydrograph	1N	0.13	331	201	54	Hydrograph	1N	0.13	352	217
55	Hydrograph	4A	0.08	125	89	55	Hydrograph	4A	0.08	139	101
56	Hydrograph	2A	0.03	58	38	56	Hydrograph	2A	0.03	63	43
57	Hydrograph	1S	0.19	364	248	57	Hydrograph	1S	0.19	403	277
58	Routed	RT1S2S	0.19	309	229	58	Routed	RT1S2S	0.19	339	258
59	Hydrograph	2S	0.09	152	102	59	Hydrograph	2S	0.09	171	118
60	Combined	CP2S	0.28	432	321	60	Combined	CP2S	0.28	477	367
61	Routed	RT2S3S	0.28	414	316	61	Routed	RT2S3S	0.28	465	360
62	Hydrograph	3S	0.09	143	96	62	Hydrograph	3S	0.09	156	109
63	Combined	CP3S	0.37	500	393	63	Combined	CP3S	0.37	563	451
64	Routed	RT3S4N	0.37	495	392	64	Routed	RT3S4N	0.37	562	449
65	Hydrograph	3N	0.11	189	134	65	Hydrograph	3N	0.11	208	151

TABLE 4.5-11
HEC-1 Peak Flow Comparison Between Existing and Future Condition Models for the North-South Basin Area Without Black Hills Tank
(Without Development Guidelines)

Line No.	Existing Condition Models					Line No.	Future Condition Models (Without Development Guidelines)				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
66	Routed	RT34N1	0.11	189	134	66	Routed	RT34N1	0.11	206	150
67	Hydrograph	4N1	0.05	85	57	67	Hydrograph	4N1	0.05	97	66
68	Combined	CP4N1	0.16	269	190	68	Combined	CP4N1	0.16	301	215
69	Routed	RT4N14	0.16	234	178	69	Routed	RT4N14	0.16	262	201
70	Hydrograph	2N	0.20	364	252	70	Hydrograph	2N	0.20	393	278
71	Routed	RT2N4N	0.20	312	234	71	Routed	RT2N4N	0.20	340	262
72	Hydrograph	4N	0.07	140	97	72	Hydrograph	4N	0.07	148	103
73	Combined	CP4N	0.81	1112	876	73	Combined	CP4N	0.81	1242	993

TABLE 4.5.12
HEC-1 Peak Flow Comparison Between Existing and Future Condition Models for the South Basin Area
(Without Development Guidelines)

Line No.	Existing Condition Models					Line No.	Future Condition Models (Without Guidelines)				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	HYDROGRAPH	511A1	0.29	382	272	1	HYDROGRAPH	511A1	0.29	436	318
2	HYDROGRAPH	511A2	0.06	109	68	2	HYDROGRAPH	511A2	0.06	122	78
3	ROUTED TO	RTA2A3	0.06	80	57	3	ROUTED TO	RTA2A3	0.06	90	67
4	HYDROGRAPH	511A3	0.29	391	276	4	HYDROGRAPH	511A3	0.29	447	324
5	3 COMBINED	CP11A	0.65	849	605	5	3 COMBINED	CP11A	0.65	967	707
6	ROUTED TO	RTA1D	0.65	732	564	6	ROUTED TO	RTA1D	0.65	830	661
7	HYDROGRAPH	511D	0.12	190	132	7	HYDROGRAPH	511D	0.12	209	147
8	2 COMBINED	CP11D	0.77	824	656	8	2 COMBINED	CP11D	0.77	933	767
9	HYDROGRAPH	511B4	0.19	337	230	9	HYDROGRAPH	511B4	0.19	370	256
10	HYDROGRAPH	511B1	0.58	616	476	10	HYDROGRAPH	511B1	0.58	709	562
11	HYDROGRAPH	511B2	0.22	272	199	11	HYDROGRAPH	511B2	0.22	309	233
12	2 COMBINED	CPB1B2	0.81	874	671	12	2 COMBINED	CPB1B2	0.81	1005	790
13	ROUTED TO	RT12B4	0.81	811	642	13	ROUTED TO	RT12B4	0.81	933	764
14	HYDROGRAPH	511B3	0.08	143	94	14	HYDROGRAPH	511B3	0.08	159	105
15	ROUTED TO	RTB3B4	0.08	122	86	15	ROUTED TO	RTB3B4	0.08	135	97
16	3 COMBINED	CP11B	1.08	1021	855	16	3 COMBINED	CP11B	1.08	1173	1013
17	ROUTED TO	RTB4D	1.08	1019	854	17	ROUTED TO	RTB4D	1.08	1169	1012
18	2 COMBINED	CP11DF	1.85	1844	1510	18	2 COMBINED	CP11DF	1.85	2102	1779
19	ROUTED TO	RTDF	1.85	1815	1462	19	ROUTED TO	RTDF	1.85	2071	1764
20	HYDROGRAPH	511F	0.16	265	177	20	HYDROGRAPH	511F	0.16	291	196
21	2 COMBINED	CP11F	2.00	1888	1536	21	2 COMBINED	CP11F	2	2160	1869

TABLE 4.5.12
HEC-1 Peak Flow Comparison Between Existing and Future Condition Models for the South Basin Area
(Without Development Guidelines)

Line No.	Existing Condition Models					Line No.	Future Condition Models (Without Guidelines)				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
22	HYDROGRAPH	511C1	0.33	387	282	22	HYDROGRAPH	511C1	0.33	451	336
23	DIVERSION	DIC1C4	0.33	201	146	23	DIVERSION	DIC1C4	0.33	235	174
24	HYDROGRAPH	DIC1E2	0.33	186	136	24	HYDROGRAPH	DIC1E2	0.33	216	162
25	ROUTED TO	RTC1E2	0.33	142	117	25	ROUTED TO	RTC1E2	0.33	164	142
26	HYDROGRAPH	511E1	0.30	364	262	26	HYDROGRAPH	511E1	0.3	415	307
27	ROUTED TO	RTE1E2	0.30	307	236	27	ROUTED TO	RTE1E2	0.3	352	284
28	HYDROGRAPH	511E2	0.28	342	259	28	HYDROGRAPH	511E2	0.28	383	293
29	2 COMBINED	CPE1E2	0.57	586	460	29	2 COMBINED	CPE1E2	0.57	667	548
30	HYDROGRAPH	511C4	0.02	46	26	30	HYDROGRAPH	511C4	0.02	50	29
31	HYDROGRAPH	DRC1C4	0.00	201	146	31	HYDROGRAPH	DRC1C4	0	235	174
32	ROUTED TO	RTC1C4	0.00	194	143	32	ROUTED TO	RTC1C4	0	227	172
33	2 COMBINED	CP11C4	0.02	202	155	33	2 COMBINED	CP11C4	0.02	238	188
34	DIVERSION	DIC4C5	0.02	140	109	34	DIVERSION	DIC4C5	0.02	163	131
35	HYDROGRAPH	DIC4E2	0.02	62	46	35	HYDROGRAPH	DIC4E2	0.02	75	57
36	ROUTED TO	RTC4E2	0.02	42	33	36	ROUTED TO	RTC4E2	0.02	54	46
37	3 COMBINED	CP11E2	0.92	661	568	37	3 COMBINED	CP11E2	0.92	767	683
38	HYDROGRAPH	511C5	0.11	195	131	38	HYDROGRAPH	511C5	0.11	215	145
39	HYDROGRAPH	DRC4C5	0.00	140	109	39	HYDROGRAPH	DRC4C5	0	163	131
40	ROUTED TO	RTC4C5	0.00	133	106	40	ROUTED TO	RTC4C5	0	155	127
41	HYDROGRAPH	511C3	0.14	217	144	41	HYDROGRAPH	511C3	0.14	243	166
42	ROUTED TO	RTC3C5	0.14	198	138	42	ROUTED TO	RTC3C5	0.14	223	160
43	HYDROGRAPH	511C2	0.39	434	322	43	HYDROGRAPH	511C2	0.39	493	379

TABLE 4.5.12
HEC-1 Peak Flow Comparison Between Existing and Future Condition Models for the South Basin Area
(Without Development Guidelines)

Line No.	Existing Condition Models					Line No.	Future Condition Models (Without Guidelines)				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
44	DIVERSION	DIC2A2	0.39	167	120	44	DIVERSION	DIC2A2	0.39	194	143
45	HYDROGRAPH	DIC2C5	0.39	267	202	45	HYDROGRAPH	DIC2C5	0.39	299	235
46	ROUTED TO	RTC2C5	0.39	244	191	46	ROUTED TO	RTC2C5	0.39	275	226
47	4 COMBINED	CP11C5	0.64	626	510	47	4 COMBINED	CP11C5	0.64	718	604
48	DIVERSION	DIC5C6	0.64	448	384	48	DIVERSION	DIC5C6	0.64	446	454
49	HYDROGRAPH	DIC5E2	0.64	215	126	49	HYDROGRAPH	DIC5E2	0.64	310	157
50	ROUTED TO	RTC5E2	0.64	171	123	50	ROUTED TO	RTC5E2	0.64	288	142
51	2 COMBINED	CP11EF	1.56	830	691	51	2 COMBINED	CP11EF	1.56	1053	825
52	2 COMBINED	CPEF	3.57	2712	2221	52	2 COMBINED	CPEF	3.57	3201	2694
53	ROUTED TO	RTEFC8	3.57	2678	2209	53	ROUTED TO	RTEFC8	3.57	3177	2677
54	HYDROGRAPH	511C8	0.04	88	50	54	HYDROGRAPH	511C8	0.04	96	56
55	2 COMBINED	CP11C8	3.61	2681	2215	55	2 COMBINED	CP11C8	3.61	3182	2690
56	ROUTED TO	RTC8C7	3.61	2680	2213	56	ROUTED TO	RTC8C7	3.61	3181	2686
57	HYDROGRAPH	511C7	0.12	182	127	57	HYDROGRAPH	511C7	0.12	199	140
58	HYDROGRAPH	511C6	0.04	68	44	58	HYDROGRAPH	511C6	0.04	75	49
59	HYDROGRAPH	DRC5C6	0.00	448	384	59	HYDROGRAPH	DRC5C6	0	446	454
60	ROUTED TO	RTC5C6	0.00	406	351	60	ROUTED TO	RTC5C6	0	399	426
61	2 COMBINED	CP11C6	0.04	417	368	61	2 COMBINED	CP11C6	0.04	409	446
62	ROUTED TO	RTC6C7	0.04	409	362	62	ROUTED TO	RTC6C7	0.04	404	439
63	3 COMBINED	CP11C7	3.76	3149	2639	63	3 COMBINED	CP11C7	3.76	3646	3207
64	ROUTED TO	RTC7H	3.76	3029	2577	64	ROUTED TO	RTC7H	3.76	3509	3119
65	HYDROGRAPH	511H	0.30	333	223	65	HYDROGRAPH	511H	0.3	403	283

TABLE 4.5.12
HEC-1 Peak Flow Comparison Between Existing and Future Condition Models for the South Basin Area
(Without Development Guidelines)

Line No.	Existing Condition Models					Line No.	Future Condition Models (Without Guidelines)				
	Type	ID	Drainage Area (sq. mi.)	100-Year Event			Type	ID	Drainage Area (sq. mi.)	100-Year Event	
				24-hour (cfs)	6-hour (cfs)					24-hour (cfs)	6-hour (cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
66	2 COMBINED	CP11H	4.07	3135	2673	66	2 COMBINED	CP11H	4.07	3638	3257
67	ROUTED TO	RTHG4	4.07	3129	2670	67	ROUTED TO	RTHG4	4.07	3629	3254
68	HYDROGRAPH	511G1	0.31	505	329	68	HYDROGRAPH	511G1	0.31	567	381
69	ROUTED TO	RTG1G2	0.31	417	298	69	ROUTED TO	RTG1G2	0.31	471	350
70	HYDROGRAPH	511G2	0.16	228	151	70	HYDROGRAPH	511G2	0.16	258	176
71	2 COMBINED	CP11G2	0.47	594	429	71	2 COMBINED	CP11G2	0.47	674	508
72	ROUTED TO	RTG2G4	0.47	565	422	72	ROUTED TO	RTG2G4	0.47	642	499
73	HYDROGRAPH	511G3	0.10	138	90	73	HYDROGRAPH	511G3	0.1	162	109
74	ROUTED TO	RTG3G4	0.10	122	85	74	ROUTED TO	RTG3G4	0.1	142	103
75	HYDROGRAPH	511G4	0.30	348	238	75	HYDROGRAPH	511G4	0.3	406	290
76	3 COMBINED	CPG_G4	0.86	975	720	76	3 COMBINED	CPG_G4	0.86	1118	866
77	2 COMBINED	CP11G4	4.93	3612	3129	77	2 COMBINED	CP11G4	4.93	4225	3851
78	ROUTED TO	RTG4I	4.93	3586	3115	78	ROUTED TO	RTG4I	4.93	4192	3828
79	HYDROGRAPH	511I	0.20	254	158	79	HYDROGRAPH	511I	0.2	292	192
80	2 COMBINED	CP11I	5.13	3627	3155	80	2 COMBINED	CP11I	5.13	4245	3891
81	HYDROGRAPH	510A	0.92	866	707	81	HYDROGRAPH	510A	0.92	914	754
82	HYDROGRAPH	509A5	0.02	46	26	82	HYDROGRAPH	509A5	0.02	47	27
83	DIVERSION	DIA5S	0.02	1	1	83	DIVERSION	DIA5S	0.02	1	1
84	HYDROGRAPH	DIA59B	0.02	45	25	84	HYDROGRAPH	DIA59B	0.02	45	27
85	ROUTED TO	RTA59B	0.02	13	11	85	ROUTED TO	RTA59B	0.02	13	12
86	HYDROGRAPH	509B	0.65	497	384	86	HYDROGRAPH	509B	0.65	594	482
87	2 COMBINED	CP09B	0.67	497	385	87	2 COMBINED	CP09B	0.67	594	483

TABLE 4.5.12
HEC-1 Peak Flow Comparison Between Existing and Future Condition Models for the South Basin Area
(Without Development Guidelines)

Line No.	Existing Condition Models					Line No.	Future Condition Models (Without Guidelines)				
	Type	ID	Drainage Area	100-Year Event			Type	ID	Drainage Area	100-Year Event	
				24-hour	6-hour					24-hour	6-hour
			(sq. mi.)	(cfs)	(cfs)				(sq. mi.)	(cfs)	(cfs)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
88	HYDROGRAPH	509A1	0.19	265	192	88	HYDROGRAPH	509A1	0.19	288	212
89	ROUTED TO	RTA1A2	0.19	250	187	89	ROUTED TO	RTA1A2	0.19	272	207
90	HYDROGRAPH	509A2	0.13	195	140	90	HYDROGRAPH	509A2	0.13	204	149
91	HYDROGRAPH	DRC2A2	0.00	167	120	91	HYDROGRAPH	DRC2A2	0	194	143
92	ROUTED TO	RTC2A2	0.00	145	111	92	ROUTED TO	RTC2A2	0	168	134
93	3 COMBINED	CP09A2	0.32	475	386	93	3 COMBINED	CP09A2	0.32	535	445
94	ROUTED TO	RTA2A4	0.32	453	377	94	ROUTED TO	RTA2A4	0.32	505	432
95	HYDROGRAPH	509A3	0.16	258	176	95	HYDROGRAPH	509A3	0.16	283	195
96	ROUTED TO	RTA3A4	0.16	249	174	96	ROUTED TO	RTA3A4	0.16	274	192
97	HYDROGRAPH	509A4	0.06	133	81	97	HYDROGRAPH	509A4	0.06	142	88
98	3 COMBINED	CP09A4	0.55	668	554	98	3 COMBINED	CP09A4	0.55	727	628
99	ROUTED TO	RTA4A6	0.55	652	547	99	ROUTED TO	RTA4A6	0.55	712	620
100	HYDROGRAPH	DRA5A6	0.00	1	1	100	HYDROGRAPH	DRA5A6	0	1	1
101	ROUTED TO	RTA5A6	0.00	1	1	101	ROUTED TO	RTA5A6	0	1	1
102	HYDROGRAPH	509A6	0.03	75	45	102	HYDROGRAPH	509A6	0.03	80	49
103	3 COMBINED	CP09A6	0.58	666	565	103	3 COMBINED	CP09A6	0.58	727	640
104	HYDROGRAPH	509D	0.38	394	304	104	HYDROGRAPH	509D	0.38	436	345
105	HYDROGRAPH	500A	0.20	288	191	105	HYDROGRAPH	500A	0.2	333	227
106	ROUTED TO	RTAB	0.20	266	185	106	ROUTED TO	RTAB	0.2	306	220
107	HYDROGRAPH	500B	0.19	233	171	107	HYDROGRAPH	500B	0.19	246	184
108	2 COMBINED	CP500B	0.40	493	355	108	2 COMBINED	CP500B	0.4	549	404

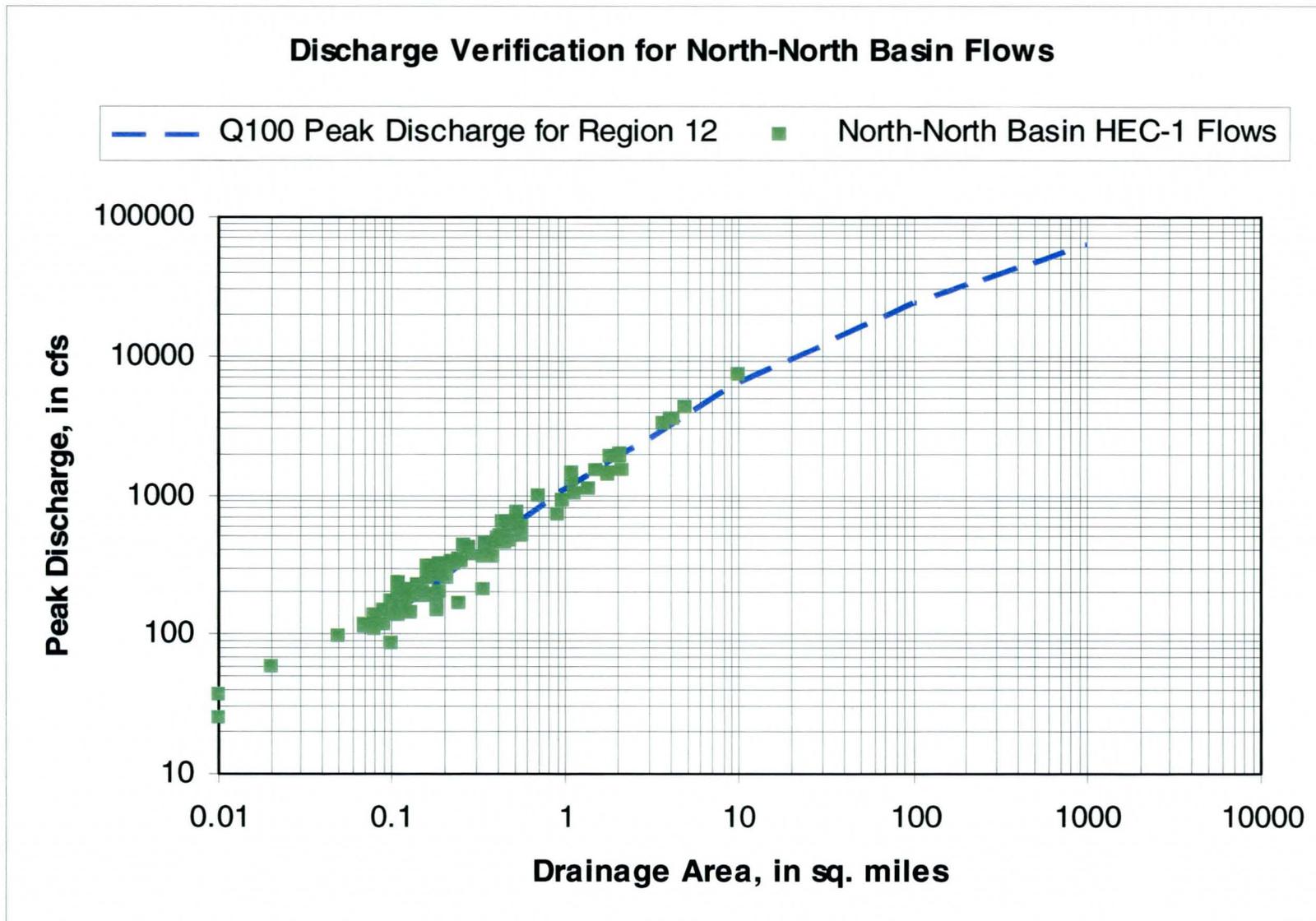


FIGURE 4.5-1 Discharge Verification for North-North Basin HEC-1 Flows

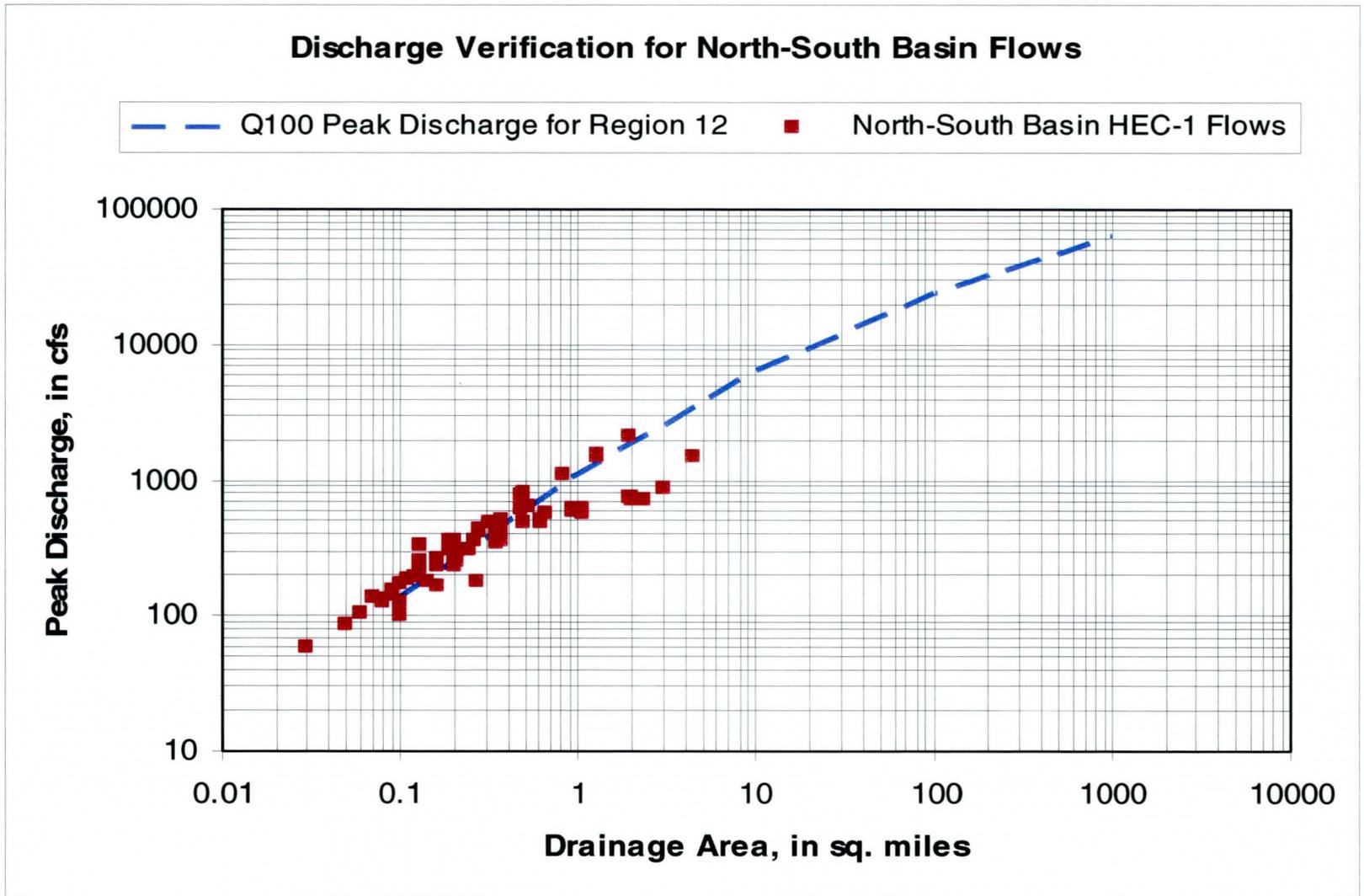
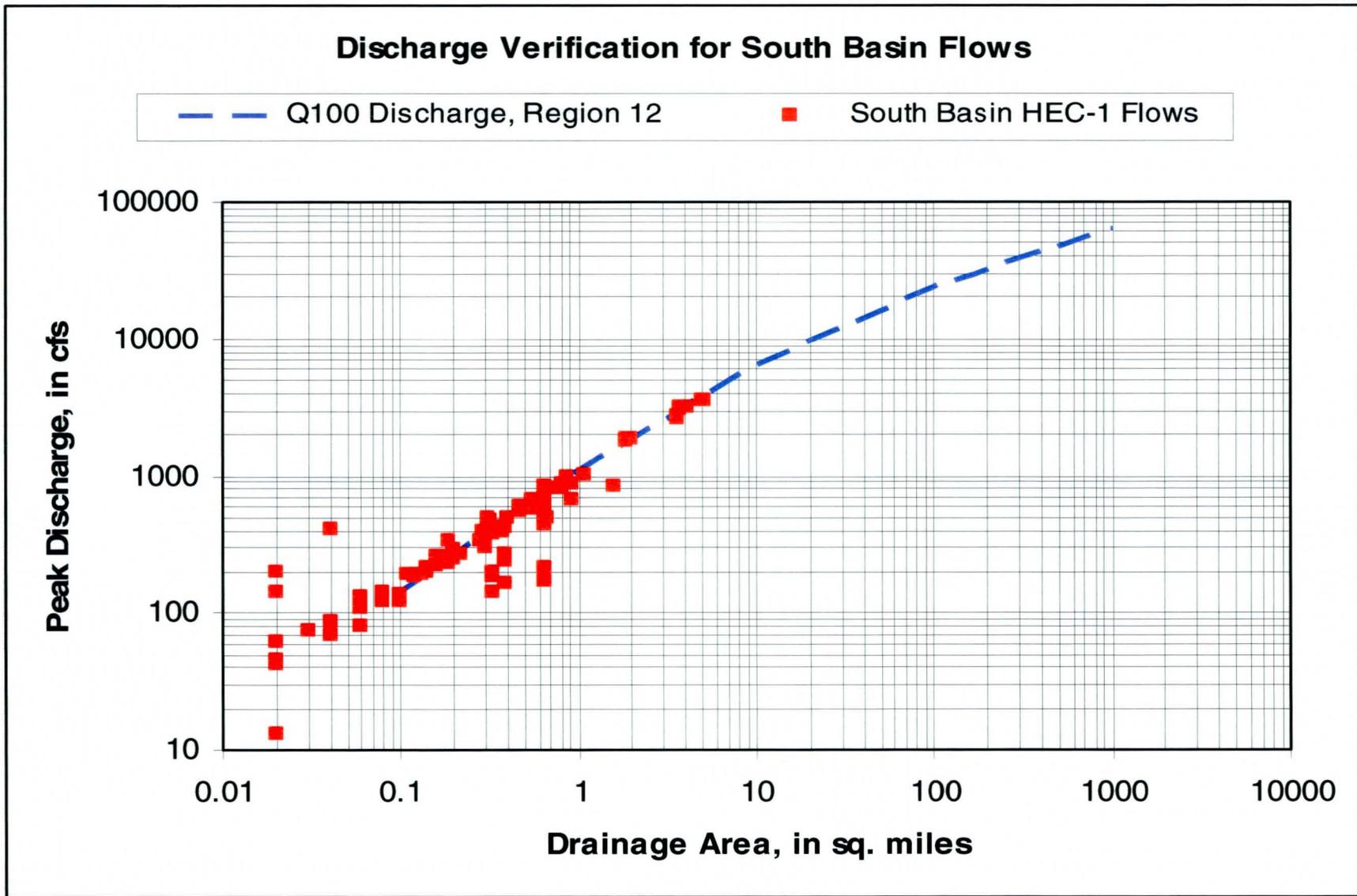


FIGURE 4.5-2 Discharge Verification for North-South Basin HEC-1 Flows



SECTION 4.6
DIGITAL FILES

4.6 DIGITAL FILES

The CD contains all the digital files developed for the hydrologic evaluation of the Rio Verde ADMP. The data files are in various folders as listed below:

(1) **PDF Folder** – This contains the digital files of the following documents.

- (a) Section 4.0 – Hydrology
- (b) Appendix A – References
- (c) Appendix B – General Documentation and Correspondence
- (d) Appendix D – Hydrological Analysis Supporting Documentation

(2) **DDMSW Folder** – This folder contains all the DDMSW files for the three basins identified as follows:

- (a) *NN_6EX.zip* – North-North Basin, Existing Condition, 100-year 6-hour flood event.
- (b) *NN_6FC.zip* – North-North Basin, Future Condition (Without Guidelines), 100-year 6-hour flood event.
- (c) *NN_24EX.zip* – North-North Basin, Existing Condition, 100-year 24-hour flood event.
- (d) *NN_24FC.zip* – North-North Basin, Future Condition (Without Guidelines), 100-year 24-hour flood event.
- (e) *NS_6EX.zip* – North-South Basin, Existing Condition, 100-year 6-hour flood event, with Black Hills Tank.
- (f) *NS_6FC.zip* – North-South Basin, Future Condition (Without Guidelines), 100-year 6-hour flood event, with Black Hills Tank.
- (g) *NS_24EX.zip* – North-South Basin, Existing Condition, 100-year 24-hour flood event, with Black Hills Tank.
- (h) *NS_24FC.zip* – North-South Basin, Future Condition (Without Guidelines), 100-year 24-hour flood event, with Black Hills Tank.
- (i) *NS_6EN.zip* – North-South Basin, Existing Condition, 100-year 6-hour flood event, No Black Hills Tank.
- (j) *NS_6FN.zip* – North-South Basin, Future Condition (Without Guidelines), 100-year 6-hour flood event, No Black Hills Tank.
- (k) *NS_24EN.zip* – North-South Basin, Existing Condition, 100-year 24-hour flood event, No Black Hills Tank.
- (l) *NS_24FN.zip* – North-South Basin, Future Condition (Without Guidelines), 100-year 24-hour flood event, No Black Hills Tank.

- (m) *S_6EX.zip* – South Basin, Existing Condition, 100-year 6-hour flood event.
- (n) *S_6FC.zip* – South Basin, Future Condition (Without Guidelines), 100-year 6-hour flood event.
- (o) *S_24EX.zip* – South Basin, Existing Condition, 100-year 24-hour flood event.
- (p) *S_24FC.zip* – South Basin, Future Condition (Without Guidelines), 100-year 24-hour flood event.

(3) **HEC-1 Folder** – This folder contains four sub-folders for the three basins identified as follows:

- (a) **NN Basin Sub-Folder** – Contains the HEC-1 model files (*.DAT, *.OUT) developed for the North-North basin.
 - *NN_6EX.DAT, NN_6EX.OUT* – North-North Basin, Existing Condition, 100-year 6-hour flood event.
 - *NN_6FC.DAT, NN_6FC.OUT* – North-North Basin, Future Condition (Without Development Guidelines), 100-year 6-hour flood event.
 - *NN_24EX.DAT, NN_24EX.OUT* – North-North Basin, Existing Condition, 100-year 24-hour flood event.
 - *NN_24FC.DAT, NN_24FC.OUT* – North-North Basin, Future Condition (Without Development Guidelines), 100-year 24-hour flood event.
- (b) **NS Basin - With Tank Sub-Folder** – Contains the HEC-1 model files (*.DAT, *.OUT) developed for the North-South Basin with Black Hills Tank.
 - *NS_6EX.DAT, NS_6EX.OUT* – North-South Basin, Existing Condition, 100-year 6-hour flood event, with Black Hills Tank.
 - *NS_6FC.DAT, NS_6FC.OUT* – North-South Basin, Future Condition (Without Development Guidelines), 100-year 6-hour flood event, with Black Hills Tank.
 - *NS_24EX.DAT, NS_24EX.OUT* – North-South Basin, Existing Condition, 100-year 24-hour flood event, with Black Hills Tank.
 - *NS_24FC.DAT, NS_24FC.OUT* – North-South Basin, Future Condition (Without Development Guidelines), 100-year 24-hour flood event, with Black Hills Tank.
- (c) **NS Basin - Without Tank Sub-Folder** – Contains the HEC-1 model files (*.DAT, *.OUT) developed for the North-South Basin without Black Hills Tank.
 - *NS_6EN.DAT, NS_6EN.OUT* – North-South Basin, Existing Condition, 100-year 6-hour flood event, no Black Hills Tank.

- *NS_6FN.DAT, NS_6FN.OUT* – North-South Basin, Future Condition (Without Development Guidelines), 100-year 6-hour flood event, no Black Hills Tank.
 - *NS_24EN.DAT, NS_24EN.OUT* – North-South Basin, Existing Condition, 100-year 24-hour flood event, no Black Hills Tank.
 - *NS_24FN.DAT, NS_24FN.OUT* – North-South Basin, Future Condition (Without Development Guidelines), 100-year 24-hour flood event, no Black Hills Tank.
- (d) **S Basin Sub-Folder** – Contains the HEC-1 model files (*.DAT, *.OUT) developed for the South Basin.
- *S_6EX.DAT, S_6EX.OUT* – South Basin, Existing Condition, 100-year 6-hour flood event.
 - *S_6FC.DAT, S_6FC.OUT* – South Basin, Future Condition (Without Development Guidelines), 100-year 6-hour flood event.
 - *S_24EX.DAT, S_24EX.OUT* – South Basin, Existing Condition, 100-year 24-hour flood event.
 - *S_24FC.DAT, S_24FC.OUT* – South Basin, Future Condition (Without Development Guidelines), 100-year 24-hour flood event.
- (4) **HEC-RAS Folder** – This folder contains all split flow distribution analyses identified as follows:
- (a) *S_SpQ1.f01, S_SpQ1.g01, S_SpQ1.o01, S_SpQ1.p01, S_SpQ1.prj, S_SpQ1.r01* – HEC-RAS files developed to generate the flow distribution for the split flow located at concentration point 511C2 (Location # 1), in the South Basin.
 - (b) *S_SpQ2.f01, S_SpQ2.g01, S_SpQ2.o01, S_SpQ2.p01, S_SpQ2.prj, S_SpQ2.r01* – HEC-RAS files developed to generate the flow distribution for the split flow located at concentration point 509A5 (Location #2), in the South Basin.
 - (c) *S_SpQ3.f01, S_SpQ3.g01, S_SpQ3.o01, S_SpQ3.p01, S_SpQ3.prj, S_SpQ3.r01* – HEC-RAS files developed to generate the flow distribution for the split flow located at concentration point 511C1 (Location #3), in the South Basin.
 - (d) *S_SpQ4.f01, S_SpQ4.g01, S_SpQ4.o01, S_SpQ4.p01, S_SpQ4.prj, S_SpQ4.r01* – HEC-RAS files developed to generate the flow distribution for the split flow located at concentration point 511C4 (Location #4), in the South Basin.
 - (e) *S_SpQ5A.f01, S_SpQ5A.g01, S_SpQ5A.o01, S_SpQ5A.p01, S_SpQ5A.prj, S_SpQ5A.r01* – HEC-RAS files developed to generate the flow distribution for the split flow located at concentration point 511C5 (Location # 5), in the South Basin.

(5) **GIS Folder** – This folder contains all the shapefiles (*.shp) and associated files (*.dbf, *.shx, and *.prj) developed for the three basins. Common datasets from the three basins have been combined to have one dataset layer (instead of three) for the project. The naming conventions used for standard datasets follow the **Data Delivery Specifications** (H.I.S.), Rev. 3.0, adopted June 1, 1998. There were, however, datasets that were not in the H.I.S. that the team has to adopt some naming conventions with root names adopted from H.I.S. For example, flow concentration points or subbasin outlets were named as DRNCPT (Drainage Concentration Points) borrowing the standard DRN from Drainage, which is one of the standard layer names. The datasets created for the entire project are listed as follows:

- *SOIL* (*.dbf, *.shp, *.shx, *.prj) – soil map information within the north-north watershed area.
- *DRNBSN* (*.dbf, *.shp, *.shx, *.prj) – sub-basin boundaries.
- *DRNPTH* (*.dbf, *.shp, *.shx, *.prj) – sub-basin flow paths.
- *DRNCPT* (*.dbf, *.shp, *.shx, *.prj) – sub-basin flow concentration points or drainage concentration points.
- *DRNCTRD* (*.dbf, *.shp, *.shx, *.prj) – sub-basin or drainage centroids.
- *DRNCCPT* (*.dbf, *.shp, *.shx, *.prj) – flow concentration points for combined hydrographs.
- *ECLDUSE* (*.dbf, *.shp, *.shx, *.prj) – existing condition land use data set.
- *FCLDUSE* (*.dbf, *.shp, *.shx, *.prj) – future condition land use data set.
- *DRNLCA* (*.dbf, *.shp, *.shx, *.prj) – sub-basin Lca.
- *DRNRT* (*.dbf, *.shp, *.shx, *.prj) – routing reaches,
- *DRNBNDY* (*.dbf, *.shp, *.shx, *.prj) – drainage boundary.
- *DRNRTXS* (*.dbf, *.shp, *.shx, *.prj) – drainage routing sections
- *DRNDV* (*.dbf, *.shp, *.shx, *.prj) – drainage diversions
- *DRNDVXS* (*.dbf, *.shp, *.shx, *.prj) – drainage diversion cross-section stations.