SEWER SERVICE AREAS

As shown in Figure 3, Service Area Map, the developable portion of the Study Area has been divided into four Service Areas, as follows:

Service Area A is comprised of approximately 1.3 square miles of the Study Area lying to the north of Kimball Avenue. It is bounded to the north by Merrill Avenue, on the east by Carpenter Avenue and County Line, and on the west by the Chino Airport. This Area will be serviced by proposed collector sewers tributary to the Kimball Interceptor Trunk Sewer

.

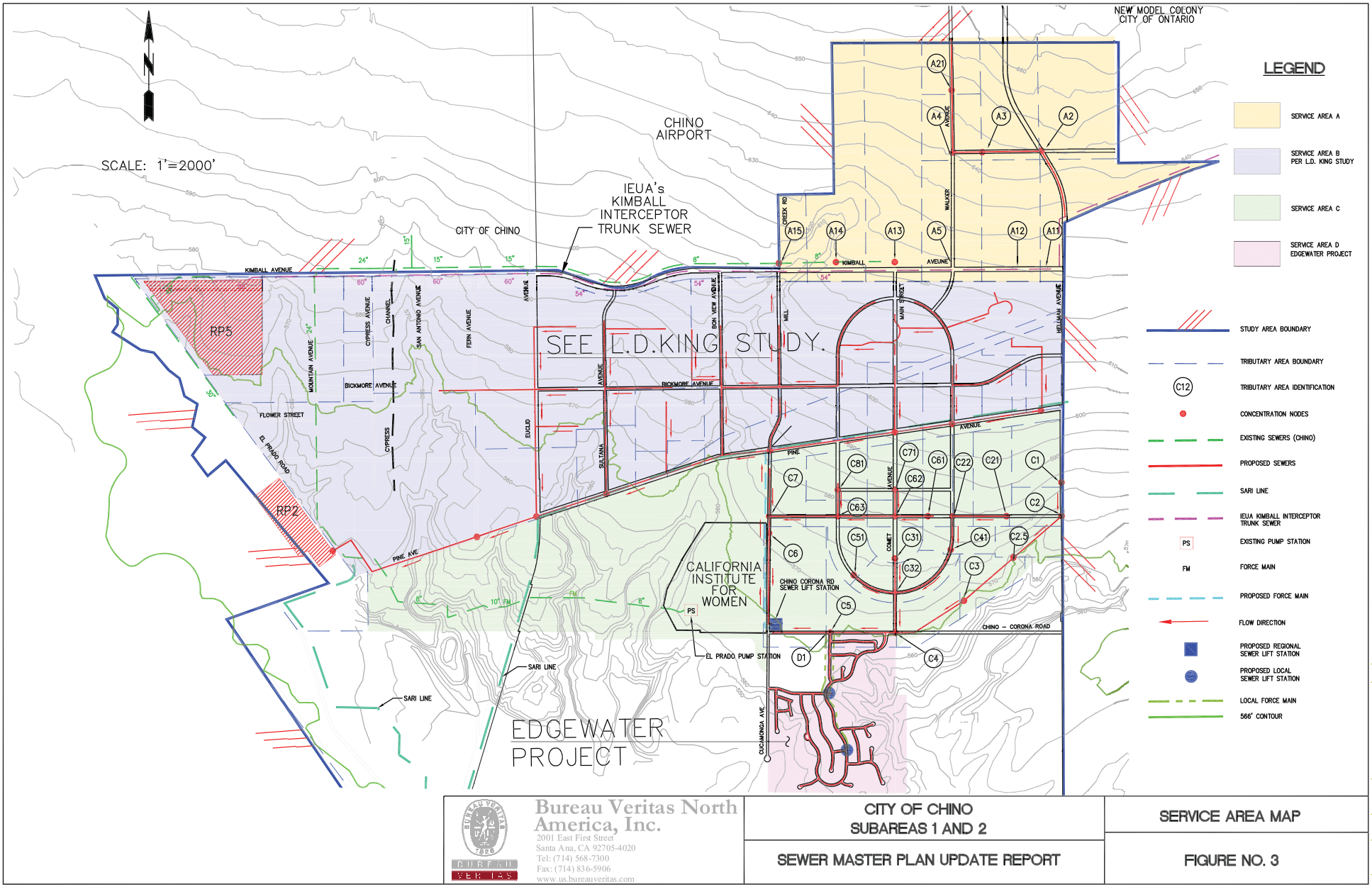
Ground surface in Service Area A is well above the 566-foot elevation and thus outside the limit of the Prado Dam's impoundment area.

The Kimball Interceptor Trunk Sewer is an existing gravity sewer pipeline that extends easterly along Kimball Avenue from RP-5 to Hellman Avenue, then runs northeast along the County Line to Archibald Avenue, thence extends north in Archibald Avenue as the City of Ontario's Eastern Trunk Sewer and IEUA's RP-1/RP-5 By-pass Sewer. It is tabled to convey flows from City of Chino areas lying to the north of Kimball Avenue, City of Ontario's New Model Colony, and to by-pass flows from IEUA's Reclamation Plant No. 1 (RP-1) to RP-5. RP-1 is located in the City of Ontario (at 2662 East Walnut Avenue) and services portion of IEUA's Service Area north of State Route 60.

The Kimball Interceptor Trunk Sewer has the capacity to convey flows generated from its tributary watershed and RP-1/RP-5 By-pass flows, for the built-out condition. In the interim this sewer has excess capacity and can be utilized to convey flows from areas south of Kimball Avenue, if needed to accommodate sequencing of piece-meal development verses scheduling of implementation of downstream master planned facilities.

Service Area B is the portion of the Study Area between Kimball Avenue and Pine Avenue, bounded by Hellman Avenue in the east and El Prado Road in the west. This Service Area is comprised of an approximately 3.4 square mile area that will be tributary to IEUA's RP-2 Regional Pumping Facility via a gravity trunk sewer along Pine Avenue (proposed Pine Avenue Trunk Sewer), as recommended in the LD King Study.

Except for the sewer sizes in Pine Avenue west of Cucamonga Avenue/Mill Creek Road (see Service Area C), sizes, alignments and flow rates for the master planned backbone facilities for Service Area B are based on the LD King Study.



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CITY OF CHINO
SUBAREAS 1 AND 2

SEWER MASTER PLAN UPDATE REPORT

SERVICE AREA MAP

FIGURE NO. 3

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Service Area C is comprised of an area of approximately 1.2 square miles lying to the south of Pine Avenue, and bounded by Chino Corona Road to the south, Cucamonga Avenue/Mill Creek Road to the west, and by the Riverside County Line to the east. As recommended in the LD King Study, this area will be serviced by the proposed gravity sewer lines which will convey flows to the proposed Chino Corona Road Sewer Lift Station to be located at the northeast corner of Chino Corona Road and Cucamonga Avenue/Mill Creek Road.

There are two alternatives for the conveyance of flows from Corona Chino Road Lift Station to RP-5, as follows:

- *Alternative 1:* As recommended in the LD King Study, flows from Chino Corona Road Sewer Lift Station are to be pumped to the existing Kimball Interceptor Trunk Sewer, in a 12-inch force-main along Cucamonga Avenue/Mill Creek Road.

  This is a viable solution if development in Service Area C is to occur prior to the construction of the proposed trunk sewer in Pine Avenue which is needed for the development in Service Area B.

- *Alternative 2:* Alternatively, flows from Chino Corona Road Sewer Lift Station can be pumped to the future Pine Avenue Trunk Sewer, which would convey the flows to RP-2 along with flows generated in Service Area B.

  This Alternative would increase the sizes for a portion of the proposed Pine Avenue Trunk Sewer, but would eliminate the need to construct the force-main between Pine Avenue and Kimball Avenue.

Comparison of preliminary construction cost estimates for the impacted portion of the proposed Pine Avenue Trunk Sewer and the proposed force-main under the two alternatives has been summarized in Table 7, included in the Cost Estimates Section of this report. Based on this evaluation, Alternative 2 is the most cost effective option.

Service Area D is comprised of approximately 0.3 square miles of the Study Area lying to the south of Chino Corona Road and east of Cucamonga Road, proposed for residential and open space development as the Edgewater Development. A significant portion of Service Area D is below the 566-foot "High Water Elevation" of the Prado Flood Control Basin.

The Edgewater Development will be serviced by local collection systems accompanying two lift stations as described per Huitt-Zollars' updated report for Edgewater Development, dated March 2007. The local Lift Stations will convey flows to the Chino Corona Road Sewer Lift Station.

At build-out condition of the Land Use Plan, approximately twenty percent (20%) of the projected average daily flows tributary to Chino Corona Road Sewer Lift Station will be generated by the Edgewater Development and eighty percent (80%) by Service Area C.

FLOW PROJECTIONS

Based on a review of unit wastewater flow generation factors used in the City of Chino's Sewer Master Plan, and those used by neighboring cities and by the Inland Empire Utilities Agency, the following factors were used for the development of average sewer flows generated within the Study Area.

Flow projections for the Residential Land Uses are based on an average daily flow generation of 80 gallons per day per person. The average estimated density in the study area is approximately 3.4 persons per dwelling unit (DU), based on The Preserve Specific Plan dated March 2003.

Projected average daily flows in gallons per day per gross acre (gpd/acre) for each Land Use type are as follows:

Residential Land Use Type	Average DUs/acre	Average Daily Flows Rate
Estate	2	536 gpd/acre
Low Density	5.25	1,412 gpd/acre
Medium Density:	9	2,395 gpd/acre
High Density:	13.5	3,642 gpd/acre

Commercial: 2,500 gpd/acre

Offices: 2,000 gpd/acre.

Industrial (Light): 1,000 gpd/acre

Public Facilities: Institutional: 2500 gpd/acre
Airport: 1000 gpd/acre

Open Space: Recreational: 100 gpd/acre
Natural: 0

Agricultural: 1,000 gpd/acre (to account for some future change in land use)

A breakdown of acreage for each Land Use type, and flow projections at build-out conditions have been summarized in Table 1 for Service Area A; and in Table 2 for Service Areas B, C, and D. Flow rates and facility sizes for Service Area B are based on the L.D. King Study report.

TABLE 1

LAND USE DISTRIBUTION - SERVICE AREA A

Land Use	Residential				Commercial				Industrial	Public Facilities		Open Space	Agricultural	TOTAL	Average
Classification	ER	LDR	MDR	HDR	RC	CC	AR	NC	LI	INS	AP	OS - R	AG	ACRES	Flows (gpd)
Flow Factors	536	1412	2395	3642	2500	3050	2500	2500	1000	2500	1000	100	1000		
Trib Areas															
A15			2.9				1.3				11.0			15.1	21,036
A14			6.2				28.0				82.3			116.5	167,221
A13			5.9				27.9				126.3			160.0	209,886
A21									18.1		18.8			36.9	36,890
A2									3.4				23.2	3.4	26,520
A4									21.0		32.6			53.6	53,610
A3									76.6					76.6	76,620
A5			6.6				22.4		25.0		20.8			74.8	117,500
A12			6.4				18.7		53.9					79.0	116,029
A11			1.0				7.2	1.8	17.0				51.6	26.9	93,271
Total	0.0	0.0	28.9	0.0	0.0	0.0	105.5	1.8	214.9	0.0	291.8	0.0	74.7	717.5	918,583

ER = ESTATE RESIDENTIAL
LDR = LOW DENSITY RESIDENTIAL
MDR = MEDIUM DENSITY RESIDENTIAL
HDR = HIGH DENSITY RESIDENTIAL

RC = REGIONAL COMMERCIAL
CC = COMMUNITY CORE
AR = AIRPORT RELATED COMMERCIAL
NC = NEIGHBORHOOD COMMERCIAL

LI = LIGHT INDUSTRIAL
INS = INSTITUTIONAL
AP = AIRPORT
OS-R = OPEN SPACE - RECREATIONAL
AG = AGRICULTURAL

TABLE 2

LAND USE DISTRIBUTION - SERVICE AREAS C AND D

Land Use	Residential				Commercial				Office	IND	Public Facilities		Open Space	Agricultural	Total	Average
Classifications	ER	LDR	MDR	HDR	RC	CC	AR	NC	BP/O	LI	INS	AP	OS - R	AG	ACRES	Flows (gpd)
Flow Factors	536	1412	2395	3642	2500	3050	2500	2500	2000	1000	2500	1000	100	1000		
Trib Areas																
C7		3.68	21.82					1.62			0.16		2.93		30.21	62,198
C81			16.25	15.77											32.02	96,353
C71						32.93									32.93	100,437
C61				27.39											27.39	99,754
C21	1.48	2.31	39												42.79	97,460
C22		2.02	18.52												20.54	47,208
C1		37.04													37.04	52,300
C2	5.38	15.79													21.17	25,179
C2.5	20.76												3.53		24.29	11,480
C63		3.17	5.24	7.67											16.08	44,960
C62						14.2									14.2	43,310
C6	25.51	50.68									4.2		3.11		83.5	96,045
C5	25.23	12.93											8.17		46.33	32,597
C51		6.45		14.4											20.85	61,552
C32		12.71	18.2	7.18											38.09	87,685
C31						18.29									18.29	55,785
C41		13.73		8.2											21.93	49,251
C3	18.58	4.93											14.25		37.76	18,345
C4	10.69	6.86											11.84		29.39	16,600
D1		63.82	28.7	15.63									41.92		150.07	219,967
D2		33.94											29.47		63.41	50,870
TOTALS	**107.63**	**270.06**	**147.73**	**96.24**	**0**	**65.42**	**0**	**1.62**	**0**	**0**	**4.36**	**0**	**115.22**	**0**	**808.28**	**1,369,337**

ER = ESTATE RESIDENTIAL
LDR = LOW DENSITY RESIDENTIAL
MDR = MEDIUM DENSITY RESIDENTIAL
HDR = HIGH DENSITY RESIDENTIAL

RC = REGIONAL COMMERCIAL
CC = COMMUNITY CORE
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NC = NEIGHBORHOOD COMMERCIAL

LI = LIGHT INDUSTRIAL
INS = INSTITUTIONAL
AP = AIRPORT
OS-R = OPEN SPACE - RECREATIONAL
AG = AGRICULTURAL

DESIGN CRITERIA

Average flows were routed in the proposed sewer facilities. The proposed backbone facilities' sizes are based on tributary peak dry weather flows using the peaking factor formula developed in the City of Chino's Sewer Master Plan:

$$\text{Dry Weather Peaking Factor (DWPF)} = 1.95 \times (\text{Average Flow [in cfs]})^{-0.038}$$

$$\text{Peak Dry Weather Flow} = (\text{DWPF}) \times (\text{Average Flow})$$

Hydraulic criteria for sizing of pipes is based on Manning's Equation with a Manning's Coefficient n = 0.013.

Pipe material for gravity sewer: Extra Strength Vitrified Clay Pipe with rubber gaskets.

Minimum velocity in gravity sewer: 2 feet per second

Minimum slopes: (gravity sewers)	For 6-inch diameter pipe	0.0100
	For 8-inch diameter pipe	0.0040
	For 10-inch diameter pipe	0.0030
	For 12-inch diameter pipe	0.0024
	For 15-inch diameter pipe	0.0017
	For 18-inch diameter pipe	0.0014
	For 21-inch diameter pipe	0.0011
	For 24-inch diameter pipe	0.0010
	For 27-inch diameter pipe	0.0010

Maximum ratio of flow depth to pipe diameter (d/D ratio) for peak flows in gravity sewer is as follows:

0.50 for pipe diameter less than 12 inches.
0.67 for pipe diameter equal to 12 inches.
0.75 for pipe diameter greater than 12 inches.

Sewer systems in the impoundment areas should be designed as sealed systems to mitigate the potential of high inflow and infiltration into the sewer system. All manhole covers and clean-out covers with elevations lower than 566 feet should have bolted covers with pressure plated assemblies. All sewer structures including wet wells, junction structures, flow splitters and manholes that extend below the 566-foot elevation shall be plastic lined, and include water-stops at all construction and expansion joints.

Summary of hydraulic parameters for the recommended sewer reaches within Service Area A is included in Table 3, and for Service Areas C and D in Table 4. Table 5 summarizes the hydraulic parameters for the Pine Avenue Trunk Sewer, from Cucamonga Avenue/Mill Creek Road to IEUA's Pumping Facility at RP-2.

BACKBONE FACILITIES

Proposed backbone facilities for the built-out condition of the Study Area are shown in Figure 4, Facilities Map. Sizes and alignments for the recommended facilities are for master planning purposes, based on preliminary evaluation of the Study Area. Final design of the proposed facilities should incorporate design details and phasing of the future developments and other infrastructure.

Proposed 8-inch sewers shown on the map are for planning purposes. Sewers with less than 10-inch diameter are not considered to be master planned backbone facilities.

TABLE 3

HYDRAULIC CALCULATION - SERVICE AREA A

REACH NO.	AREA	AVERAGE Q (GPD)	AVERAGE Q (CFS)	PEAK FACTOR	PEAK FLOW (CFS)	PEAK FLOW (MGPD)	SLOPE (%)	D/d	V (FPS)	SIZE (IN)
152	A21	36,890	0.0571	2.17	0.1241	0.0802	1	0.22	2.23	8
153	A21,A4	90,500	0.1400	2.10	0.2942	0.1902	0.7	0.37	2.51	8
154	A21,A4,A3	167,120	0.2586	2.05	0.5308	0.3431	0.4	0.43	2.37	10
155	A21,A4,A3,A2	193,640	0.2996	2.04	0.6116	0.3953	0.3	0.39	2.20	12

TABLE 4

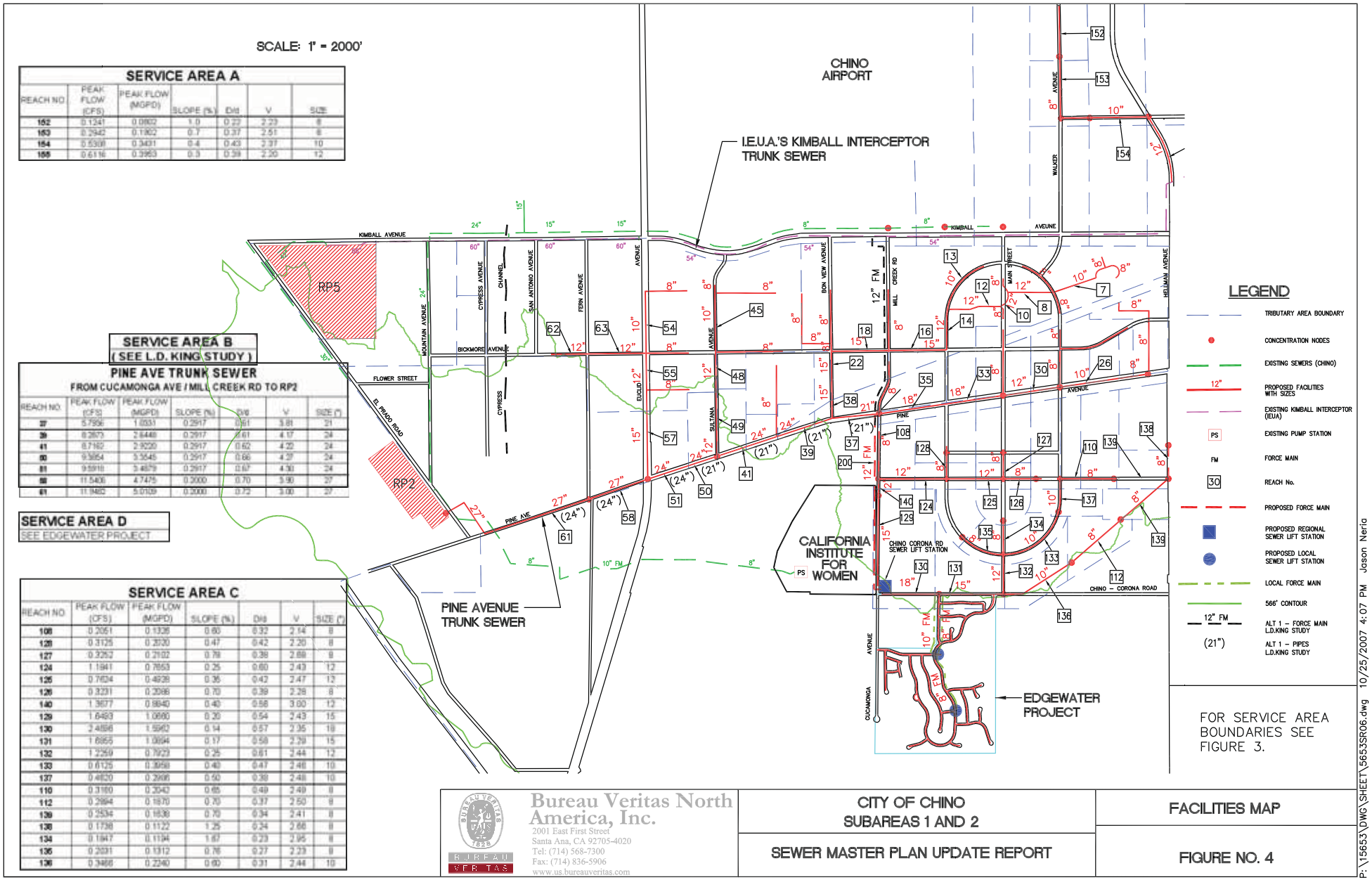
HYDRAULICS CALCULATIONS - SERVICE AREAS C AND D

REACH NO.	AREA	AVERAGE Q (GPD)	AVERAGE Q (CFS)	PEAK FACTOR	PEAK FLOW (CFS)	PEAK FLOW (MGPD)	SLOPE (%)	D/d	V (FPS)	SIZE (IN)
108	C7	62,198	0.0962	2.13	0.2051	0.1326	0.6	0.32	2.14	8
128	C81	96,353	0.1491	2.10	0.3125	0.2020	0.47	0.42	2.20	8
127	C71	100,437	0.1554	2.09	0.3252	0.2102	0.78	0.38	2.68	8
124	C61,C62,C71, C81,C63	384,814	0.5954	1.99	1.1841	0.7653	0.25	0.60	2.43	12
125	C61,C62,C71	243,501	0.3767	2.02	0.7624	0.4928	0.35	0.42	2.47	12
126	C61,	99,754	0.1543	2.09	0.3231	0.2088	0.7	0.39	2.28	8
140	C61,C62,C71,C81,C63,C7	447,012	0.6916	1.98	1.3677	0.8840	0.4	0.56	3.00	12
129	C61,C62,C71,C81,C63,C7,C6	543,057	0.8402	1.96	1.6493	1.0660	0.2	0.54	2.43	15
130	C21,C22,C41,C31,C51,C32,C1,C2,C2.5,C5,C3,C4	555,443	0.8594	1.96	2.5459	1.6455	0.14	0.59	2.36	18
	D1	219,967	0.3403	2.03						
	D2	50,870	0.0787	2.15						
131	C21,C22,C41,C31,C51,C32,C1,C2,C2.5,C5,C3,C4	555,443	0.8594	1.96	1.6855	1.0894	0.17	0.58	2.29	15
132	C21,C22,C41, C31,C51,C32	398,941	0.6172	1.99	1.2259	0.7923	0.25	0.61	2.44	12
133	C21,C22,C41	193,919	0.3000	2.04	0.6125	0.3958	0.4	0.47	2.46	10
137	C21,C22,	144,668	0.2238	2.06	0.4620	0.2986	0.5	0.38	2.48	10
110	C21,	97,460	0.1508	2.10	0.3160	0.2042	0.65	0.49	2.49	8
112	C1,C2,C2.5	88,960	0.1376	2.10	0.2894	0.1870	0.7	0.37	2.50	8
139	C1,C2	77,480	0.1199	2.11	0.2534	0.1638	0.7	0.34	2.41	8
138	C1	52,300	0.0809	2.15	0.1736	0.1122	1.25	0.24	2.66	8
134	C31	55,785	0.0863	2.14	0.1847	0.1194	1.67	0.23	2.95	8
135	C51	61,552	0.0952	2.13	0.2031	0.1312	0.76	0.27	2.23	8
136	C1,C2,C2.5,C3	107,305	0.1660	2.09	0.3466	0.2240	0.6	0.31	2.44	10
	TOTAL:	1,098,500	1.6996	1.91	3.2481	2.0993				

TABLE 5

HYDRAULICS CALCULATIONS - PINE AVE TRUNK SEWER FROM MILL CREEK ROAD TO RP2

REACH NO.	AVERAGE Q FROM LDK STUDY (GPD)	AVERAGE Q FROM LDK STUDY (CFS)	PEAK FACTOR	PEAK FLOW (CFS)	ADDITIONAL FLOW- PUMPED FLOW FROM AREAS C & D (CFS)	TOTAL PEAK FLOW (CFS)	PEAK FLOW (MGPD)	SLOPE (%)	D/d (%)	V (FPS)	SIZE (IN)
37	525,628	0.81	1.97	1.60	4.1952	5.79	1.0331	0.2917	0.61	3.81	21
39	1,396,597	2.16	1.89	4.09	4.1952	8.29	2.6448	0.2917	0.61	4.17	24
41	1,549,063	2.40	1.89	4.52	4.1952	8.72	2.9220	0.2917	0.62	4.22	24
50	1,788,084	2.77	1.88	5.19	4.1952	9.39	3.3545	0.2917	0.66	4.27	24
51	1,862,077	2.88	1.87	5.40	4.1952	9.59	3.4879	0.2917	0.67	4.30	24
58	2,565,559	3.97	1.85	7.35	4.1952	11.54	4.7475	0.2	0.70	3.90	27
61	2,713,699	4.20	1.85	7.75	4.1952	11.95	5.0109	0.2	0.72	3.92	27



SERVICE AREA A

REACH NO.	PEAK FLOW (CFS)	PEAK FLOW (MGPD)	SLOPE (%)	D/d	V	SIZE
152	0.1241	0.0802	1.0	0.27	2.23	8
153	0.2942	0.1902	0.7	0.37	2.51	8
154	0.5308	0.3431	0.4	0.43	2.37	10
155	0.6116	0.3953	0.3	0.39	2.20	12

SERVICE AREA B
(SEE L.D. KING STUDY)

PINE AVE TRUNK SEWER
FROM CUCAMONGA AVE / MILL CREEK RD TO RP2

REACH NO.	PEAK FLOW (CFS)	PEAK FLOW (MGPD)	SLOPE (%)	D/d	V	SIZE (")
37	5.7896	1.0333	0.2917	0.61	3.81	21
39	8.2673	2.6448	0.2917	0.61	4.17	24
41	8.7182	2.9220	0.2917	0.62	4.22	24
50	9.3954	3.5545	0.2917	0.66	4.27	24
51	9.5911	3.4879	0.2917	0.67	4.30	24
58	11.5406	4.7475	0.2000	0.70	3.90	27
61	11.9482	5.0109	0.2000	0.72	3.00	27

SERVICE AREA D
SEE EDGEWATER PROJECT

SERVICE AREA C

REACH NO.	PEAK FLOW (CFS)	PEAK FLOW (MGPD)	SLOPE (%)	D/d	V	SIZE (")
108	0.2051	0.1326	0.60	0.32	2.14	8
128	0.3125	0.2020	0.47	0.42	2.20	8
127	0.3252	0.2102	0.78	0.38	2.88	8
124	1.1841	0.7653	0.25	0.60	2.43	12
125	0.7624	0.4928	0.35	0.42	2.47	12
126	0.3231	0.2088	0.70	0.39	2.28	8
140	1.3677	0.8840	0.40	0.58	3.00	12
129	1.6493	1.0660	0.20	0.54	2.43	15
130	2.4856	1.5962	0.14	0.57	2.35	18
131	1.6855	1.0894	0.17	0.58	2.29	15
132	1.2259	0.7923	0.25	0.61	2.44	12
133	0.6125	0.3958	0.40	0.47	2.46	10
137	0.4820	0.2996	0.50	0.39	2.48	10
110	0.3160	0.2042	0.65	0.49	2.49	8
112	0.2894	0.1870	0.70	0.37	2.50	8
139	0.2534	0.1638	0.70	0.34	2.41	8
138	0.1738	0.1122	1.25	0.34	2.66	8
134	0.1847	0.1194	1.67	0.23	2.95	8
135	0.2031	0.1312	0.76	0.27	2.23	8
136	0.3466	0.2240	0.60	0.31	2.44	10

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CITY OF CHINO
SUBAREAS 1 AND 2

SEWER MASTER PLAN UPDATE REPORT

FACILITIES MAP

FIGURE NO. 4

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COST ESTIMATES

Estimates for construction and project costs have been developed for each reach of sewer shown on the Facilities Map, as summarized in Table 6.

Proposed 8-inch diameter sewers shown on the Facilities Map are for planning purposes only. The costs associated with 8-inch diameter sewers has not been included in the cost estimates summarized in Table 6, since construction of 8-inch diameter sewers will be the responsibility of the developers.

The construction cost estimates are based on an ENR Construction Cost Index of 7,865, and incorporate a contingency of 20%. The capital costs include 10% of construction costs for engineering and administration.

TABLE 7

COST COMPARISON OF ALTERNATIVES

		ALTERNATIVE 1				ALTERNATIVE 2			
		Pumping flows from Chino Corona Road Sewer Lift Station to existing Kimball Interceptor Trunk Sewer				Pumping flows from Chino Corona Road Sewer Lift Station to proposed Pine Avenue Trunk Sewer			
REACH		SIZE	LENGTH	UNIT	CONSTRUCTION	SIZE	LENGTH	UNIT	CONSTRUCTION
	No.	*(in)*	*(feet)*	COST	COST	*(in)*	*(feet)*	COST	COST
Pine Avenue Trunk Sewer Segment, downstream of Cucamonga Avenue.	37*	21	1090	$311	$338,990	21	1090	$311	$338,990
	39*	21	1360	$311	$422,960	24	1360	$345	$469,200
	41*	21	1450	$311	$450,950	24	1450	$345	$500,250
	50*	21	700	$311	$217,700	24	700	$345	$241,500
	51*	24	990	$345	$341,550	24	990	$345	$341,550
	58*	24	1430	$345	$493,350	27	1430	$379	$541,970
	61*	24	3860	$345	$1,331,700	27	3860	$379	$1,462,940
FM	200	12	8350	$175	$1,461,250	12	4000	$180	$720,000
		Alternative 1 Cost:			**$ 5,058,450**	**Alternative 2 Cost:**			**$ 4,616,400**

* - pipes below 566' contour

TABLE 6

COST ESTIMATES

REACH NO.	SIZE (in)	LENGTH (feet)	UNIT COSTS	CONSTRUCTION COSTS	ENGR/ ADMIN	TOTAL CAPITAL COSTS
7	10	1100	$179	$196,900	$19,690	$216,590
8	12	1070	$198	$211,860	$21,186	$233,046
10	12	450	$198	$89,100	$8,910	$98,010
12	12	1230	$198	$243,540	$24,354	$267,894
13	10	1350	$179	$241,650	$24,165	$265,815
14	12	960	$198	$190,080	$19,008	$209,088
16	15	1320	$225	$297,000	$29,700	$326,700
18	15	1340	$225	$301,500	$30,150	$331,650
22	15	800	$225	$180,000	$18,000	$198,000
38*	15	800	$250	$200,000	$20,000	$220,000
26	10	1410	$179	$252,390	$25,239	$277,629
30	12	1330	$198	$263,340	$26,334	$289,674
33	18	1330	$254	$337,820	$33,782	$371,602
35	18	1570	$254	$398,780	$39,878	$438,658
37*	21	1090	$311	$338,990	$33,899	$372,889
39*	24	1360	$345	$469,200	$46,920	$516,120
41*	24	1450	$345	$500,250	$50,025	$550,275
45	10	1360	$179	$243,440	$24,344	$267,784
48*	12	845	$223	$188,435	$18,844	$207,279
49*	12	1555	$223	$346,765	$34,677	$381,442
50*	24	700	$345	$241,500	$24,150	$265,650
51*	24	990	$345	$341,550	$34,155	$375,705
54	10	1430	$179	$255,970	$25,597	$281,567
55*	12	848	$223	$189,104	$18,910	$208,014
57*	15	2060	$250	$515,000	$51,500	$566,500
62*	12	847	$223	$188,881	$18,888	$207,769
63*	12	1357	$223	$302,611	$30,261	$332,872
58*	27	1430	$379	$541,970	$54,197	$596,167
61*	27	3860	$379	$1,462,940	$146,294	$1,609,234
137	10	770	$179	$137,830	$13,783	$151,613
133*	10	1730	$204	$352,920	$35,292	$388,212
132*	12	920	$223	$205,160	$20,516	$225,676
136*	10	1780	$204	$363,120	$36,312	$399,432
131*	15	1500	$250	$375,000	$37,500	$412,500
130*	18	1400	$279	$390,600	$39,060	$429,660
129*	15	2230	$250	$557,500	$55,750	$613,250
140*	12	390	$223	$86,970	$8,697	$95,667
124	12	1580	$198	$312,840	$31,284	$344,124
125	12	1310	$198	$259,380	$25,938	$285,318
154	10	1380	$179	$247,020	$24,702	$271,722
155	12	1620	$198	$320,760	$32,076	$352,836
200	12	4000	$180	$720,000	$72,000	$792,000
PS		LS		$3,000,000	$500,000	$3,500,000
TOTALS		**57852**		**$ 16,859,666**	**$ 1,885,967**	**$ 18,745,633**

* - pipes below 566' contour

K.5 - Storm Drain Master Plan Update Report
Prepared by Bureau Veritas - Draft Final Report November 2007

BUREAU VERITAS

Bureau Veritas North America, Inc.

Storm Drain Master Plan Update Report

Subarea 2
Chino Agricultural Preserve Area

City of Chino

Final Report
December 2007

STORM DRAIN MASTER PLAN UPDATE REPORT

CITY OF CHINO - SUBAREA 2

CHINO AGRICULTURAL PRESERVE AREA

Prepared for:

City of Chino
13220 Central Avenue
Chino, CA 91710

Prepared by:

Bureau Veritas, North America, Inc.
2001 East First Street
Santa Ana, CA 92705

Prepared Under the Supervision of:

Mohammed Rowther 12/17/07

Mohammed Rowther, P.E. Date

TABLE OF CONTENTS

PAGE

INTRODUCTION.....1

STUDY AREA.....1

LAND USE PLAN.....3

HYDROLOGIC CRITERIA 3

HYDRAULIC CRITERIA 3

OFF-SITE FLOWS 6

DRAINAGE BASINS 7

RECOMMENDED BACKBONE FACILITIES 7

COST ESTIMATES.....16

ISOHYETAL MAPS

APPENDIX A
HYDROLOGY MAPS BY L.D. KING

APPENDIX B
FACILITY DATA BY L.D. KING

STORM DRAIN MASTER PLAN UPDATE REPORT

CITY OF CHINO – SUBAREA 2
CHINO AGRICULTURAL PRESERVE

INTRODUCTION

This report is an update of the City of Chino's Master Plan of Drainage for Subarea 2 - Chino Agricultural Preserve Area, prepared by Berryman and Henigar dated October 2003. This Update Report incorporates the following:

- The proposed Edgewater Development, an approximately 272 acres residential and open space development proposed in Subarea 2 at the south east corner of Chino Corona Road and Cucamonga Avenue.

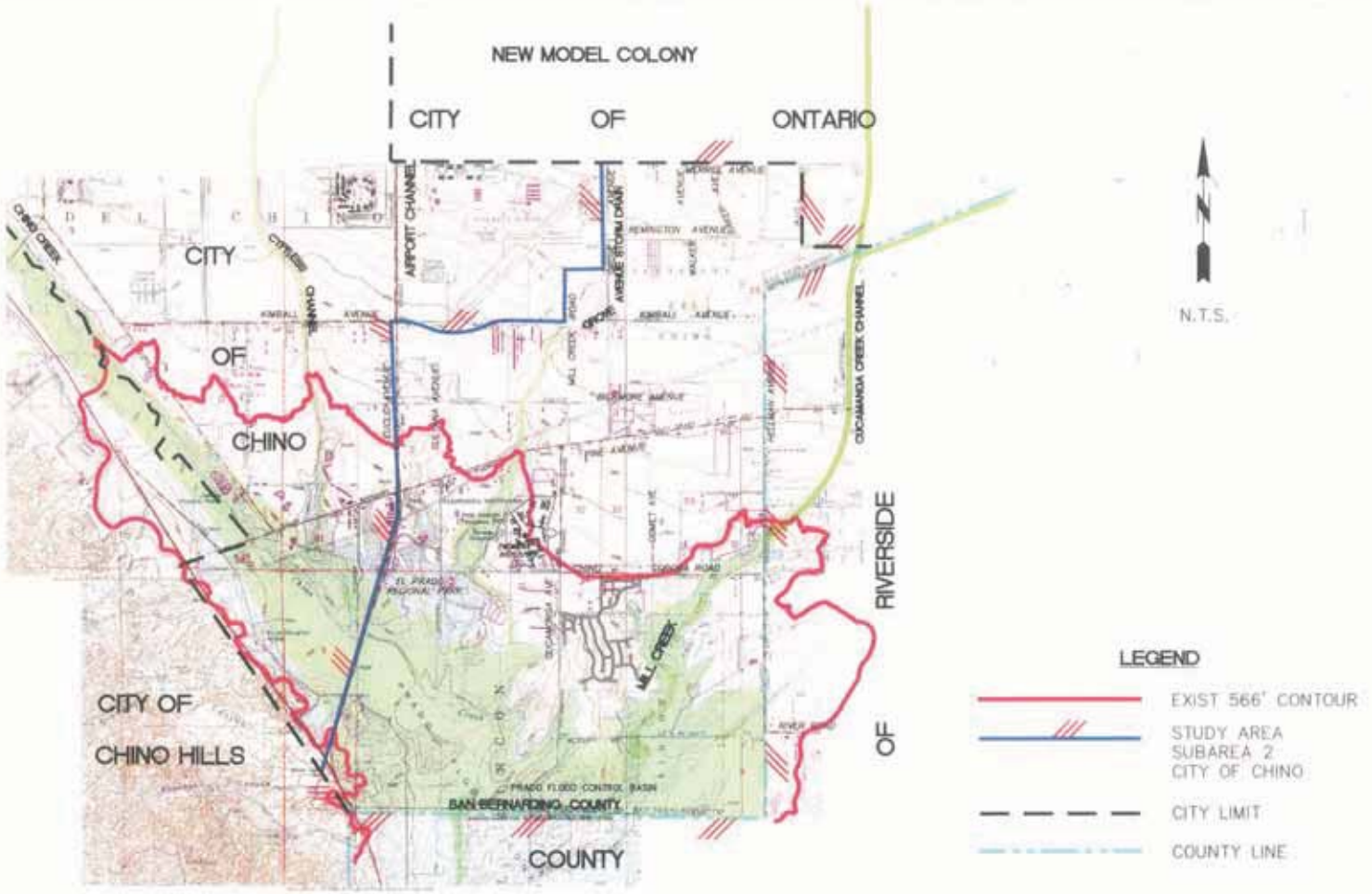
- Revisions to Master Plan Drainage Basins "B", "D" and "J", as included in the Amendment to Master Plan of Drainage for Subarea 2, prepared by L.D. King, dated July 8, 2004. The Amendment was approved by the City on September 04, 2004.

This Update Report presents preliminary sizes, alignments and cost estimates for recommended backbone drainage facilities required to support full built-out condition of the Study Area. Recommendations included herein are for master planning purposes only. Specific Plans, detailed drainage studies and final design of specific development projects could modify the recommendations of this study.

STUDY AREA

As shown in Figure 1, the Study Area is located in the southwest corner of the County of San Bernardino, and is bounded by Euclid Avenue in the City of Chino to the west, Kimball Avenue and Merrill Avenue to the north, Hellman Avenue to the east, and Riverside County Line through Prado Regional Park to the south.

The Study Area encompasses approximately 8.8 square miles of agricultural and open space property adjacent to Cucamonga Creek Channel, and upstream of the U.S. Army Corp of Engineers' Prado Flood Control Basin. The ground surface in this area generally slopes from north to south, with over half (approximately 4.5 square miles) the Study Area lying below the existing 566' High Water Elevation of the Prado Basin.



Bureau Veritas North America, Inc.	CITY OF CHINO SUBAREA 2	STUDY AREA MAP
	STORM DRAINAGE MASTER PLAN UPDATE REPORT	FIGURE NO. 1

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Portion of the Study Area that is below the 566-foot elevation is presently within the impoundment area of the Prado Dam, and therefore can potential be flooded with ponding stormwater during major storm events. However, on-site re-grading of future projects, such as the Edgewater Development, can modify the impoundment area as long as any impacts to the downstream areas or to the Prado Basin, resulting from the re-grading, are mitigated as a part of the project.

LAND USE

The study is based on ultimate built-out condition of the approved land use plan shown in Figure 2, Land Use Map.

HYDROLOGIC CRITERIA

This master plan study has been prepared in conformance with the hydrological procedures and standards set forth in the San Bernardino County Hydrology Manual, 1986 Revision.

Based on the size of each tributary drainage area, the Rational Method or the Unit Hydrograph method was used to calculate the peak runoff at each concentration node. The 100 year frequency storm events were used to determine design peak flows for sizing drainage facilities.

Surface characteristics of pervious areas were based on ultimate development (built-out according to land use maps), having good urban covers (well landscaped), and an average antecedent moisture condition (AMC) II.

Point rainfall data was based on the Isohyetal Maps for Valley Areas, as provided in San Bernardino County Hydrology Manual.

HYDRAULIC CRITERIA

The hydraulic criteria outlined in this section are to be used as a guide to be followed for the final design of storm drain facilities in the Study Area. This criteria has been used to the extent applicable in this master plan study.

1. Hydraulic calculations shall be in accordance with "Los Angeles County Flood Control District Design Manual, Hydraulic", dated March 1982.

2. Closed conduits may be designed as flowing full and may be allowed to flow under pressure if the hydraulic grade line is sufficiently below the ground surface to intercept flows with a minimum freeboard at the catch basin of six (6) inches below the gutter flow lines.

LEGEND

- ER – ESTATE RESIDENTIAL
- LDR – LOW DENSITY RESIDENTIAL
- MDR – MEDIUM DENSITY RESIDENTIAL
- HDR – HIGH DENSITY RESIDENTIAL
- NC – NEIGHBORHOOD COMMERCIAL
- RC – REGIONAL COMMERCIAL
- CC – COMMUNITY CORE
- LI – LIGHT INDUSTRIAL
- AR – AIRPORT RELATED
- PF – PUBLIC FACILITY
- OS–R – OPEN SPACE–RECREATION
- OS–N – OPEN SPACE–NATURAL
- OS–W – OPEN SPACE–WATER
- AG – AGRICULTURE
- AG/OS–N AGRICULTURE AND OPEN SPACE–NATURAL
- PROPOSED STREETS
- CHURCH – SCHOOL – AREA 8
- PRIVATE RECREATIONAL FACILITY – AREA 7

Bureau Veritas North America, Inc.

CITY OF CHINO SUBAREA 2	LAND USE MAP
STORM DRAINAGE MASTER PLAN UPDATE REPORT	FIGURE NO. 2

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3. Design velocities in the mainline storm drain conduits shall not exceed forty (40) feet per second (fps). For velocities from twenty (20) to thirty (30) fps, the minimum concrete cover over the reinforcing steel in the pipe shall be one-half (1/2) inch greater than the normal cover (1 1/2 inches minimum). For velocities from thirty (30) to forty (40) fps, the minimum concrete cover over the reinforcing steel in the pipe shall be one (1) inch greater than the normal cover (2 inches minimum).

4. Minimum spacing between manholes shall be follows:

   a. For conduit thirty (30) inches or smaller, manholes shall be spaced at intervals of approximately three hundred (300) feet. Where the proposed pipe is less than thirty (30) inches in diameter and the horizontal alignment has numerous bends or angle points, the manhole spacing shall be reduced to approximately two hundred (200) feet.

   b. For conduit diameter greater than thirty (30) inches but smaller than forty five (45) inches, manholes shall be spaced at intervals of approximately four hundred (400) feet.

   c. For conduit diameter forty-five (45) inches or larger, manholes shall be spaced at maximum intervals of five hundred (500) feet.

5. Pressure manhole shaft and pressure frame and cover shall be used whenever the design water surface (Hydraulic Grade Line) in the storm drain is at or above the finish ground elevation.

6. Covers, lids, and grates for all drainage structures including manholes, junction structures, transitions structures and catch basins, at elevations below 566 feet shall be securely bolted to their frames.

7. The minimum diameter of mainlines and lateral drains shall be 24 inches, and catch basin connector pipe shall be eighteen (18) inches. In cases where the pipe may carry significant amounts of debris, the minimum diameter of mainline pipes shall be thirty-six (36) inches.

8. Minimum slope for mainline storm drains shall be 0.1%, and 0.3% for connector pipes. In cases where the pipe may carry significant amounts of debris, the minimum slope shall be 0.3%.

9. For storm drains that outlet into earthen channels, outlet structures shall be provided to prevent erosion and property damage. Velocity of flow at

the outlet should equal as closely as possible with the existing channel velocity. When the discharge velocity is low or sub-critical, the outlet structures shall consist of a headwall, wing-walls, and apron. When the discharge velocity is high or supercritical, an appropriate energy dissipater and bank protection structure shall be designed in the vicinity of the outlet.

10. If development occurs in the upstream areas prior to construction of the downstream storm drain facilities, local detention basin(s) should be implemented to handle the additional flows generated from such development. The detention basins shall be designed to retard the discharge from the developing property to less than 80% of the peak flows calculated for pre-development conditions, and remain operational until the downstream storm drain facilities are fully constructed.

OFF-SITE FLOWS

Storm water runoff from the City of Ontario enters the Study Area from the north. Ultimate 100-year storm runoff hydrographs for Ontario's master planned storm drains, per Ontario's Master Plan of Drainage for New Model Colony prepared by L.D. King, Inc., have been incorporated in this study for conveyance to downstream regional drainage facilities. Ontario's master planned storm drains enter the Study Area at three locations as follows:

1. LINE "A": A 14'(wide) x 8'(high) RC Box storm drain is proposed to enter the Study Area at the intersection of Merrill Avenue and Baker Avenue, conveying storm runoff from approximately 1,362 acres with a peak flow of 1,620 cfs.

2. LINE "J": A 108" RCP storm drain in Grove Avenue, with a 72" RCP lateral storm drain in Merrill Avenue, is proposed to drain to the existing 10'(wide) x 6'(high) TEC Grove Avenue Storm Drain Channel. This storm drain system will have a peak design flow of 1,227 cfs as it enters the Study Area, with a tributary drainage area of approximately 850 acres.

3. LINE "I": A 10'(wide) x 8'(high) RC Box storm drain in Merrill Avenue and an 84" RCP storm drain in Euclid Avenue are proposed to confluence and drain to the existing Airport Channel along Euclid Avenue. This storm drain system will have a peak design flow of 1,443 cfs as it enters the City of Chino, with a tributary drainage area of approximately 1,840 acres. The Airport Channel enters the Study Area at the intersection of Euclid Avenue and Kimball Avenue with a peak flow of 1,845.21 cfs and a tributary drainage area of 2,277 acres.

the outlet should equal as closely as possible with the existing channel velocity. When the discharge velocity is low or sub-critical, the outlet structures shall consist of a headwall, wing-walls, and apron. When the discharge velocity is high or supercritical, an appropriate energy dissipater and bank protection structure shall be designed in the vicinity of the outlet.

10. If development occurs in the upstream areas prior to construction of the downstream storm drain facilities, local detention basin(s) should be implemented to handle the additional flows generated from such development. The detention basins shall be designed to retard the discharge from the developing property to less than 80% of the peak flows calculated for pre-development conditions, and remain operational until the downstream storm drain facilities are fully constructed.

OFF-SITE FLOWS

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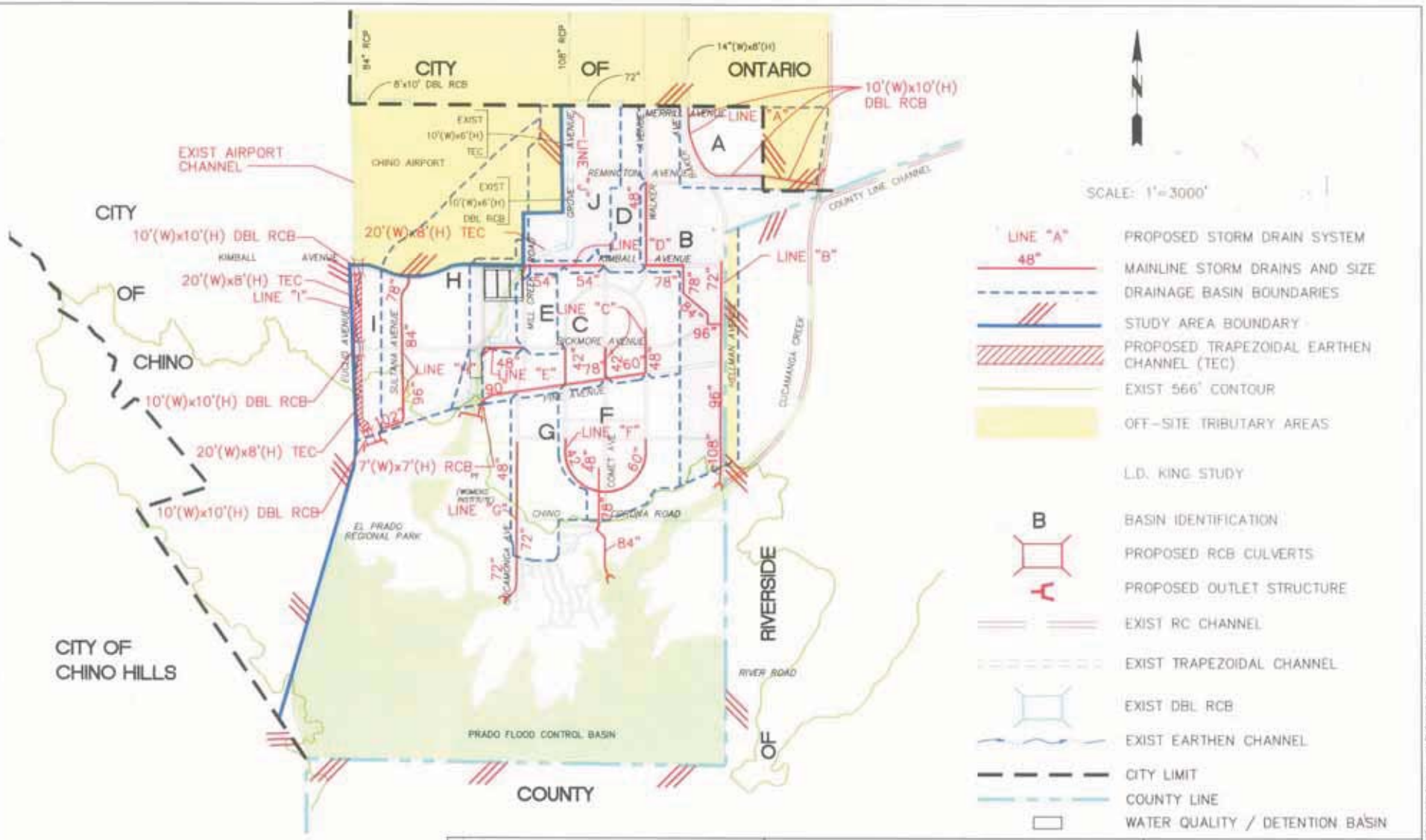
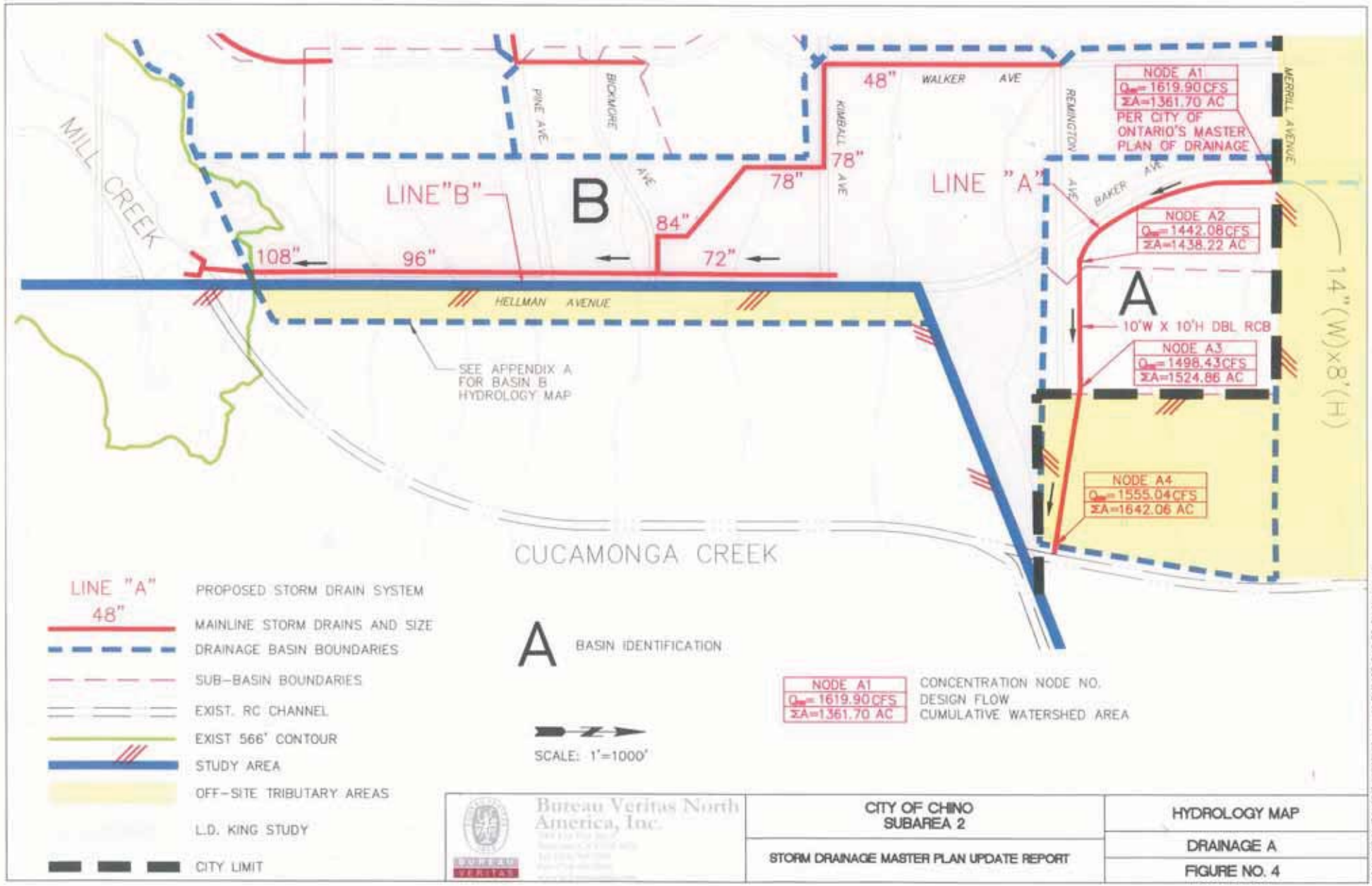


Bureau Veritas North America, Inc.

CITY OF CHINO SUBAREA 2	DRAINAGE BASIN BOUNDARY MAP
STORM DRAINAGE MASTER PLAN UPDATE REPORT	FIGURE NO. 3



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CITY OF CHINO SUBAREA 2	HYDROLOGY MAP
STORM DRAINAGE MASTER PLAN UPDATE REPORT	DRAINAGE A
	FIGURE NO. 4

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Line "A" will start at the terminus of Ontario's planned storm drain "WALK-A1" at Merrill Avenue, and run south in the proposed new alignment of Hellman Avenue from Merrill Avenue to Remington Avenue; thence turn east along Remington Avenue to the Cucamonga Creek Channel. This storm drain system will convey storm runoff from approximately 163 acres of Basin A, and runoff from approximately 1,362 acres of the City of Ontario's New Model Colony. Basin A is bounded by Merrill Avenue to the north, Chino City Limit Line to the east, Realigned Baker/Hellman Avenue to the west, and Remington Avenue to the south.

LINE "B":

Line "B" will convey storm runoff from Drainage Basin B to the Prado Basin, as shown in the Basin B Hydrology Map by L.D. King (included in Appendix A). The Basin B is comprised of approximately 580 acres bounded by Hellman Avenue to the east, Basin A and Merrill Avenue to the north, Walker Avenue and Baker Avenue to the west, and Prado Basin to the south.

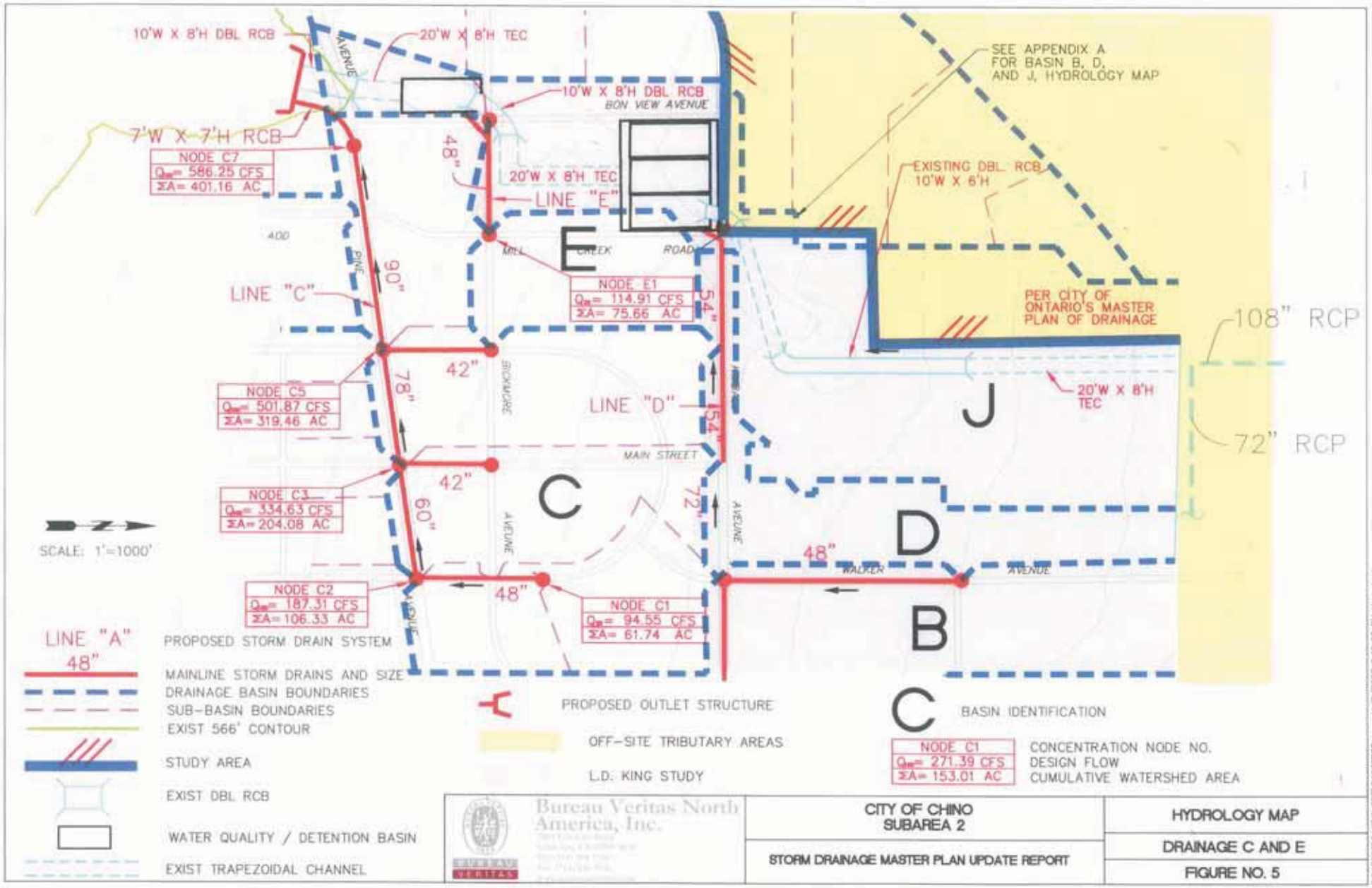
Line "B" is comprised of approximately 13,950 linear feet of 48 to 108 inch RCP storm drain total Capital Cost of $10.93 million.

LINE "C" and LINE "E":

Lines "C", and "E", as shown in Figure 5, are proposed storm drain systems serving Drainage Basins C and E bounded by Kimball Avenue to the north, Baker Avenue to the east, Pine Avenue to the south, and Cucamonga Avenue to the west. These storm drain systems convey stormwater flows in Pine Avenue and Bickmore Avenue to a watercourse in the Prado Basin.

Line "C" is comprised of approximately 7,430 feet of 48 inch RCP to 7'x7' RCB and lateral storm drains with an estimated Project Capital Cost of $6.75 million.

Line "E" is approximately 1,600 feet of 48 inch RCP storm drain in Bickmore Avenue with an estimated Project Capital Cost of $0.81 million.


10'W X 8'H DBL RCB
20'W X 8'H TEC
10'W X 8'H DBL RCB
BON VIEW AVENUE
7'W X 7'H RCB
NODE C7
Q100= 586.25 CFS
ΣA= 401.16 AC
48"
20'W X 8'H TEC
LINE "E"
SEE APPENDIX A FOR BASIN B, D, AND J, HYDROLOGY MAP
EXISTING DBL. RCB 10'W X 6'H
E
MILL CREEK
ROAD
NODE E1
Q100= 114.91 CFS
ΣA= 75.66 AC
54"
PER CITY OF ONTARIO'S MASTER PLAN OF DRAINAGE
108" RCP
LINE "C"
90"
PINE
78"
42"
NODE C5
Q100= 501.87 CFS
ΣA= 319.46 AC
BECKMAN
LINE "D"
J
20'W X 8'H TEC
72" RCP
MAIN STREET
42"
NODE C3
Q100= 334.63 CFS
ΣA= 204.08 AC
60"
C
72"
AVENUE
D
48"
WALKER
AVENUE
SCALE: 1"=1000'
NODE C2
Q100= 187.31 CFS
ΣA= 106.33 AC
48"
NODE C1
Q100= 94.55 CFS
ΣA= 61.74 AC
B
LINE "A"
48"
PROPOSED STORM DRAIN SYSTEM
MAINLINE STORM DRAINS AND SIZE
DRAINAGE BASIN BOUNDARIES
SUB-BASIN BOUNDARIES
EXIST 566' CONTOUR
STUDY AREA
EXIST DBL RCB
WATER QUALITY / DETENTION BASIN
EXIST TRAPEZOIDAL CHANNEL
PROPOSED OUTLET STRUCTURE
OFF-SITE TRIBUTARY AREAS
L.D. KING STUDY
C
BASIN IDENTIFICATION
NODE C1
Q100= 271.39 CFS
ΣA= 153.01 AC
CONCENTRATION NODE NO.
DESIGN FLOW
CUMULATIVE WATERSHED AREA
Bureau Veritas North America, Inc.
CITY OF CHINO
SUBAREA 2
STORM DRAINAGE MASTER PLAN UPDATE REPORT
HYDROLOGY MAP
DRAINAGE C AND E
FIGURE NO. 5

LINE "D" and Line "J":

Storm Drain Lines "D" and "J" are based on the L.D. King Study serving Drainage Basins D and J, as shown in the Hydrology Map by L.D. King, included in Appendix A. Drainage Basins D and J are comprised of approximately 2,610 acre area bounded by Walker Avenue, Cucamonga Avenue and Rincon Meadows Avenue (Basins B, C and E) to the east, Merrill Avenue (City of Ontario) to the north, Basins H and I to the west, and Prado Basin to the south.

Line "D" is comprised of approximately 3,280 linear feet of 54-inch RCP storm drain total Capital Cost of $1.73 million.

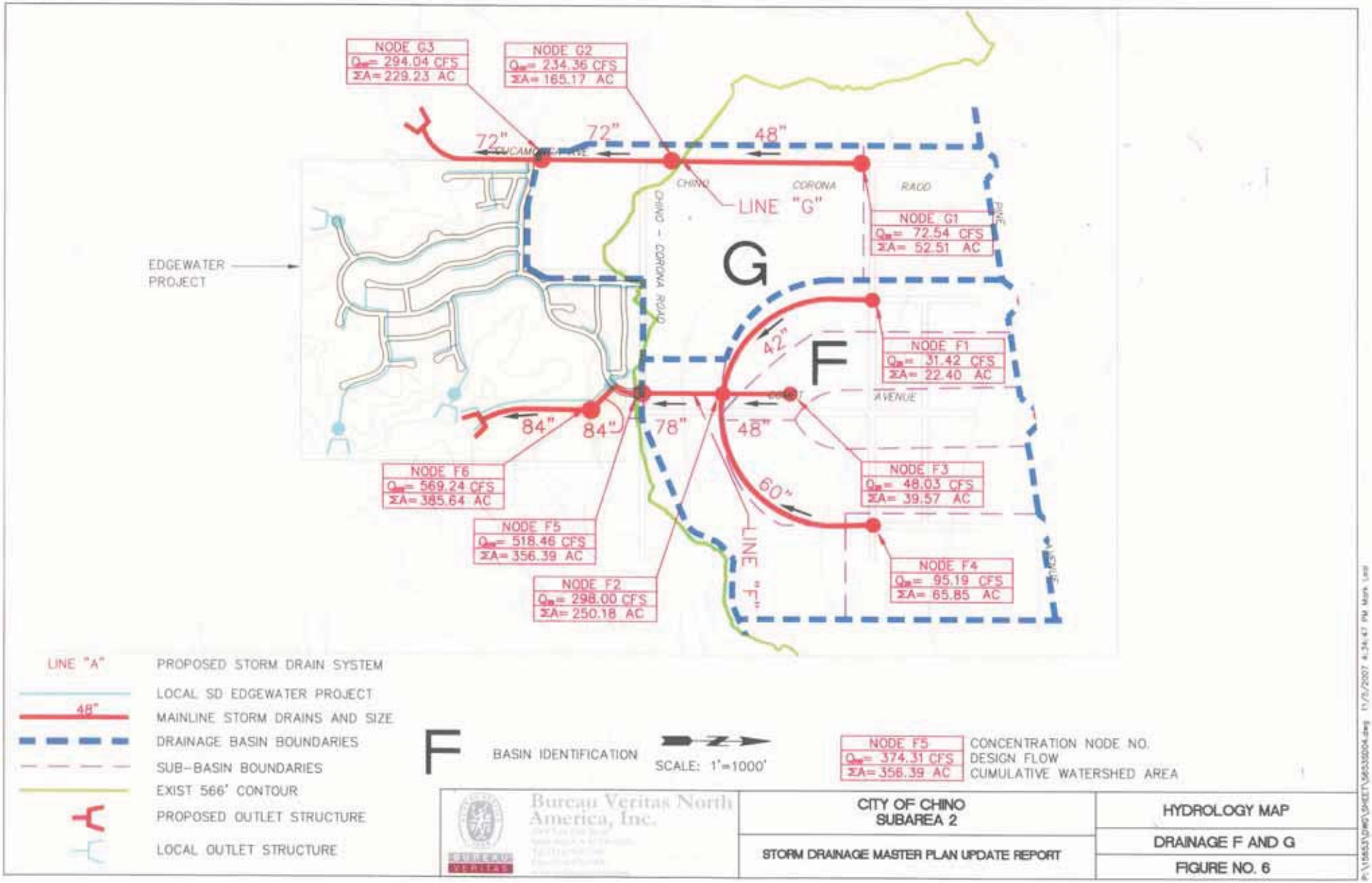
Line "J " is an existing storm drain system that begins at the Bickmore WQMP Basin adjacent to the Prado Basin, and extends north-easterly as a 8'x 5' double barrel RCB, and open trapezoidal channel to the Kimball Avenue Detention Basins located at the southwest corner of Kimball Avenue and Mill Creek Road, thence extends north through the Chino Airport as 10'x 6' double barrel RCB and open trapezoidal channel to Merrill Avenue, thence north in Grove Avenue in the City of Ontario.

LINE "F" and LINE "G":

Storm Drain Lines "F" and "G", as shown in Figure 6, are storm drain systems proposed to service the developable portions of the Study Area that lie to the south of Pine Avenue and east of Cucamonga Avenue, including portions of the proposed Edgewater Development. These storm drains convey tributary flows southerly to the Prado Basin.

Line "F" is comprised of approximately 8,700 feet of 42 to 84 inch RCP mainline and lateral storm drains with an estimated Project Capital Cost of $5.13 million.

Line "G" is approximately 5,200 feet of 48 to 72 inch RCP storm drain in Cucamonga Avenue with an estimated Project Capital Cost of $3.21 million for City of Chino.



Bureau Veritas North America, Inc.

CITY OF CHINO SUBAREA 2	HYDROLOGY MAP
STORM DRAINAGE MASTER PLAN UPDATE REPORT	DRAINAGE F AND G
	FIGURE NO. 6

LINE "H":

Storm Drain Line "H", as shown in Figure 7 is an approximately 6,000 feet, 78 to 102 inch diameter storm drain system in Pine Avenue, Bickmore Avenue and Sultana Avenue, with an estimated total Capital Cost of $5.17 million for City of Chino. Starting at Kimball Avenue, the proposed storm drain will run south in Sultana Avenue to drain into the natural watercourse south of Pine Avenue, east of Euclid Avenue. It is projected to receive flows from an approximately 287-acres area of Chino Airport and 308 acres from Drainage Basin H.

LINE "I":

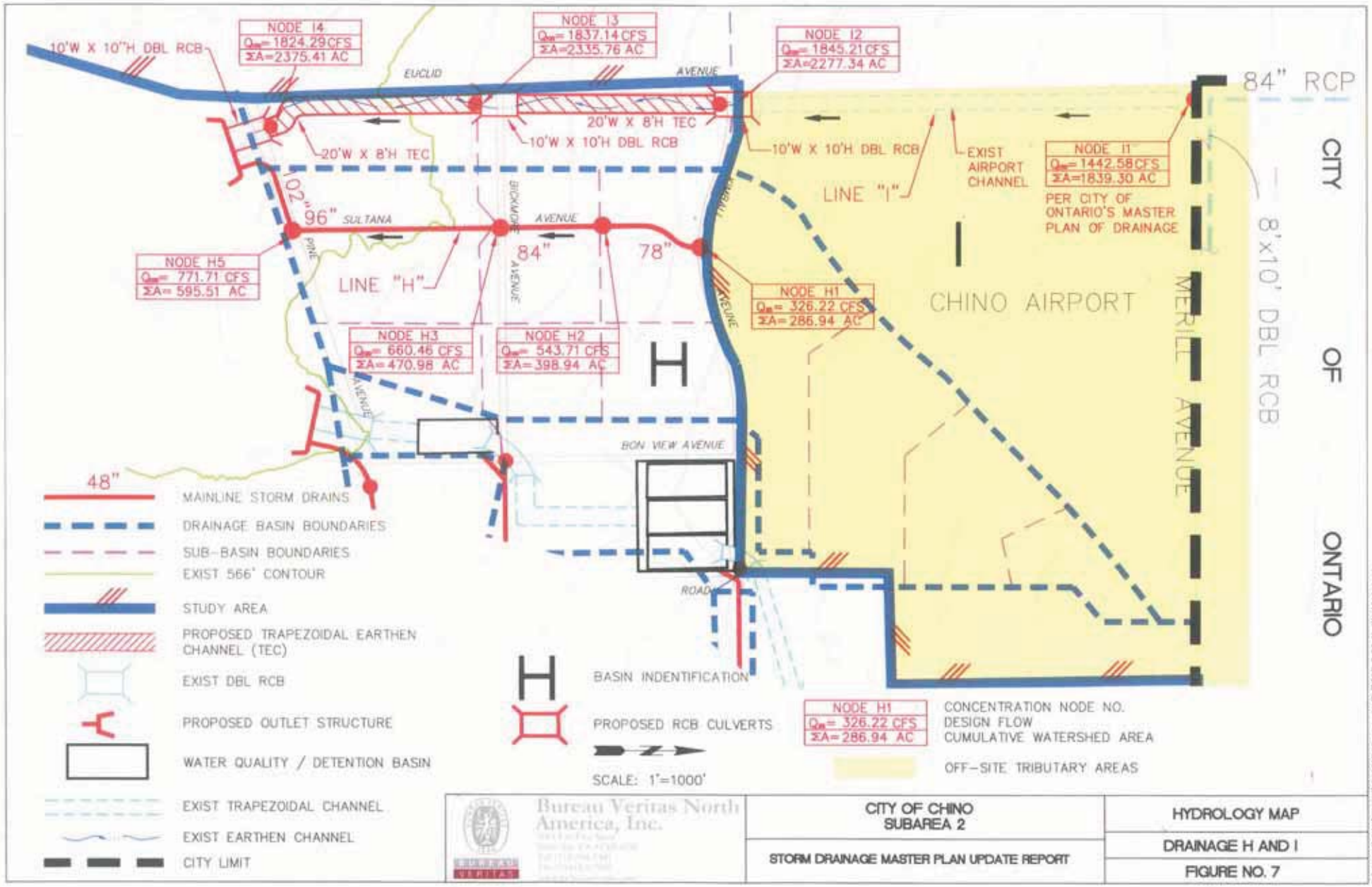
Drainage Basin "I" is presently served by an existing drain along Euclid Avenue. This drain is comprised of an unimproved, under-capacity earthen ditch along the easterly side of Euclid Avenue from Pine Avenue to Kimball Avenue, and an improved trapezoidal earthen channel (Airport Channel) from Kimball Avenue to Merrill Avenue.

Three alternative options were evaluated for this drain.

Option 1: An improved earthen trapezoidal channel, downstream from the Airport Channel, from Kimball Avenue to the natural watercourse south of Pine Avenue, with RCB culvert crossings under Kimball Avenue, Bickmore Avenue and Pine Avenue is the most cost effective and recommended option. Assuming that the channel could be constructed within the 200-foot wide existing street right-of-way, the estimated Capital Cost for this Option is $2.45 million. The estimated Capital Cost share for City of Chino and City of Ontario is $0.59 million and $1.96 million, respectively.

Option 2: A concrete-lined trapezoidal channel from the outlet south of Pine Avenue, to Merrill Avenue, with RCB crossings at Kimball Avenue, Bickmore Avenue and Pine Avenue would have a Capital Cost estimate of $10.10 million.

Option 3: An underground RCB storm drain from the outlet south of Pine Avenue to Merrill Avenue would have a total estimated Capital Cost of $15.65 million.



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CITY OF CHINO SUBAREA 2	HYDROLOGY MAP
STORM DRAINAGE MASTER PLAN UPDATE REPORT	DRAINAGE H AND I
	FIGURE NO. 7

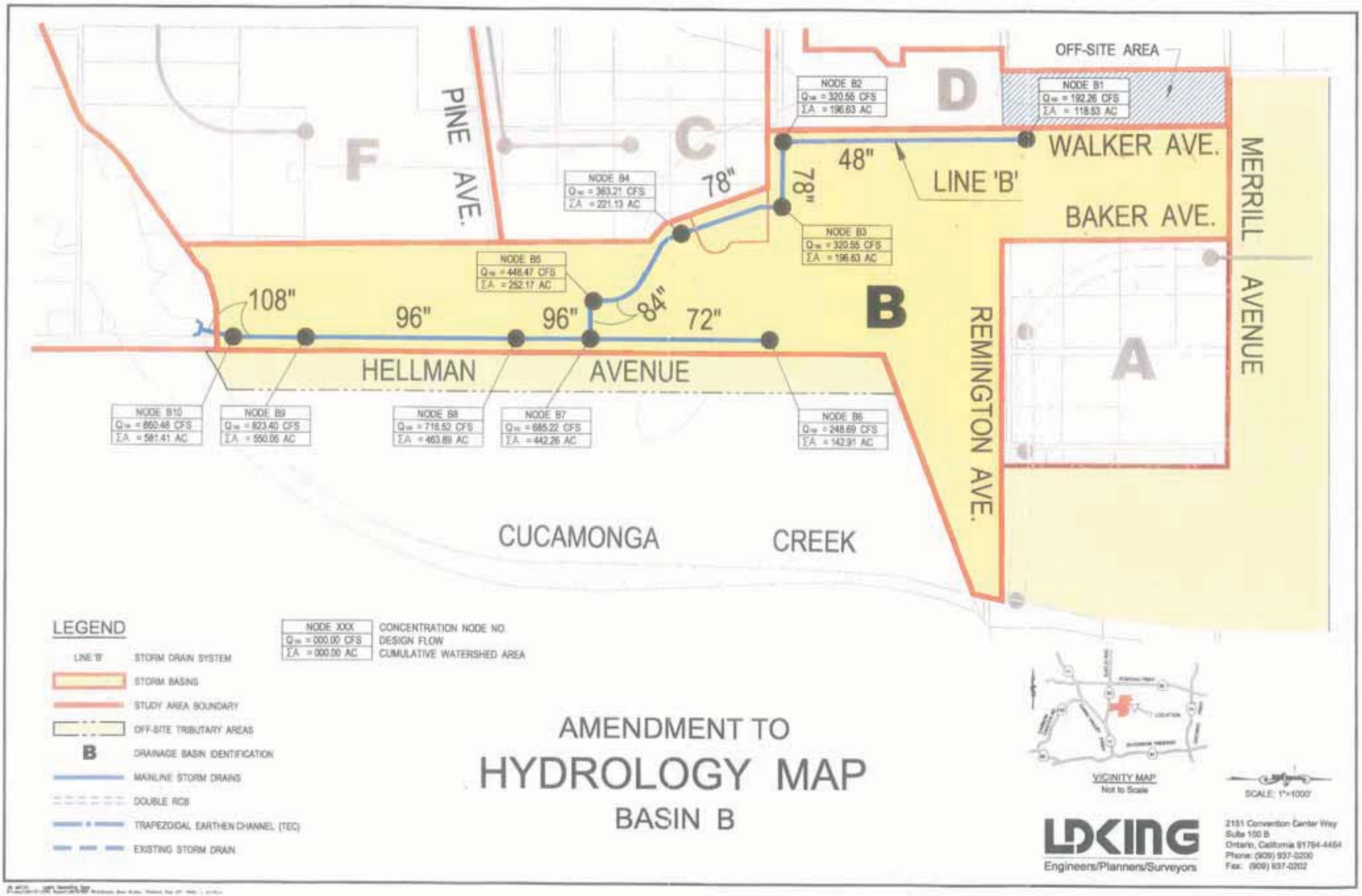
COST ESTIMATES

Presented in Appendix C is a detailed breakdown of construction quantities and capital costs for the recommended storm drain systems. Estimates for construction and project costs have been developed using February 2007 construction costs, based on ENR Construction Cost Index of 7,864.7 for the recommended storm drain facilities shown on the Basin Hydrology Maps.

The Construction Costs incorporate a contingency of 20% and the Capital Costs includes 10% of Construction Costs for engineering and administration.

APPENDIX A

HYDROLOGY MAPS BY L.D. KING


OFF-SITE AREA
NODE B2
Q_{100} = 320.56 CFS
ΣA = 196.63 AC
NODE B1
Q_{100} = 192.26 CFS
ΣA = 118.53 AC
D
WALKER AVE.
MERRILL AVENUE
48"
LINE 'B'
78"
78"
BAKER AVE.
PINE AVE.
F
C
NODE B4
Q_{100} = 363.21 CFS
ΣA = 221.13 AC
NODE B3
Q_{100} = 320.55 CFS
ΣA = 196.63 AC
NODE B5
Q_{100} = 446.47 CFS
ΣA = 252.17 AC
108"
96"
96"
84"
72"
B
A
REMINGTON AVE.
HELLMAN AVENUE
NODE B10
Q_{100} = 860.48 CFS
ΣA = 581.41 AC
NODE B9
Q_{100} = 823.40 CFS
ΣA = 550.05 AC
NODE B8
Q_{100} = 716.52 CFS
ΣA = 463.89 AC
NODE B7
Q_{100} = 685.22 CFS
ΣA = 442.26 AC
NODE B6
Q_{100} = 248.69 CFS
ΣA = 142.91 AC
CUCAMONGA CREEK
LEGEND
LINE 'B' STORM DRAIN SYSTEM
STORM BASINS
STUDY AREA BOUNDARY
OFF-SITE TRIBUTARY AREAS
B DRAINAGE BASIN IDENTIFICATION
MAINLINE STORM DRAINS
DOUBLE RCB
TRAPEZOIDAL EARTHEN CHANNEL (TEC)
EXISTING STORM DRAIN
NODE XXX CONCENTRATION NODE NO.
Q_{100} = 000.00 CFS DESIGN FLOW
ΣA = 000.00 AC CUMULATIVE WATERSHED AREA
AMENDMENT TO
HYDROLOGY MAP
BASIN B
VICINITY MAP
Not to Scale
SCALE: 1"=1000'
LDKING
Engineers/Planners/Surveyors
2151 Convention Center Way
Suite 100 B
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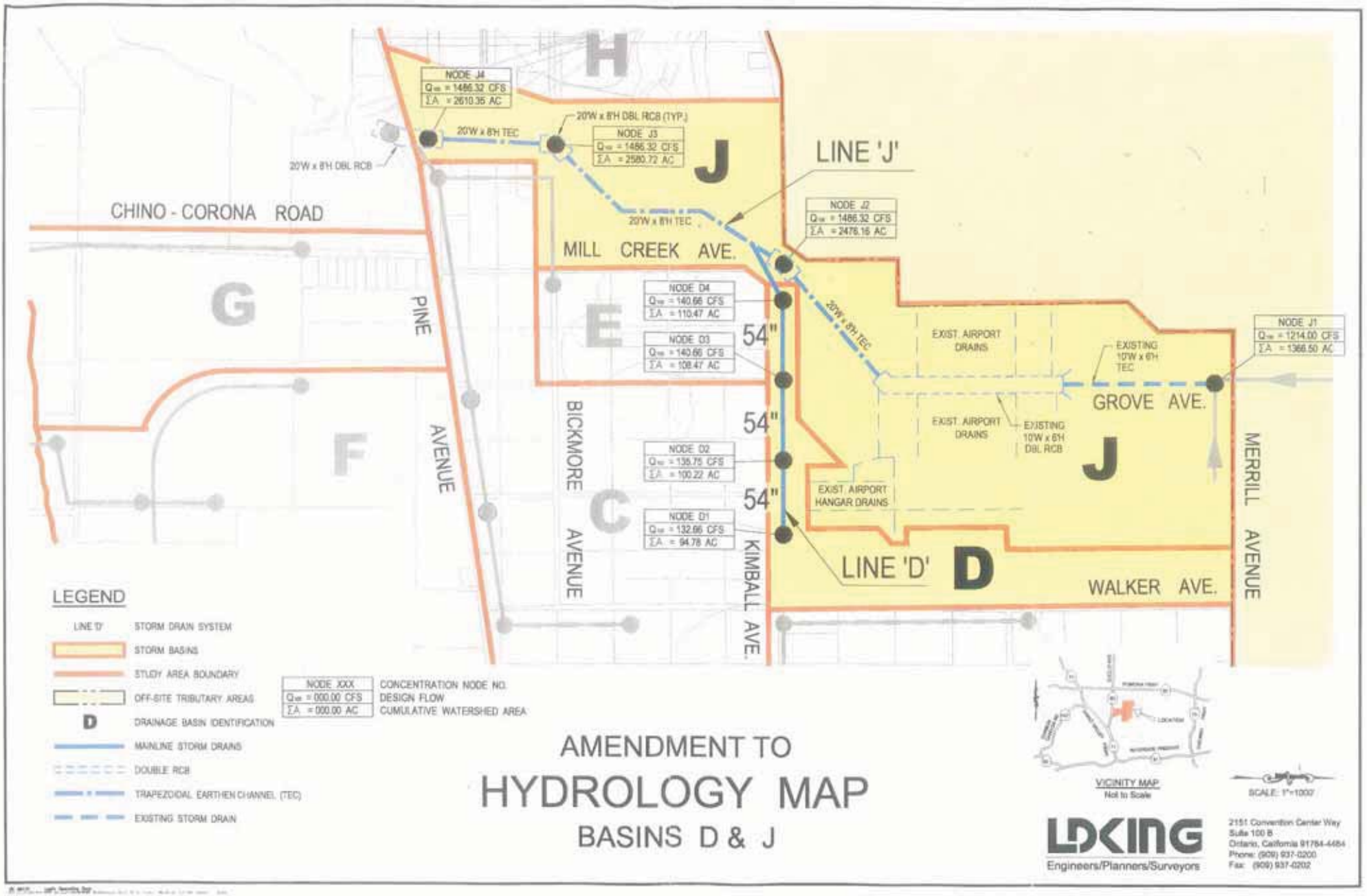

AMENDMENT TO
HYDROLOGY MAP
BASINS D & J

VICINITY MAP
Not to Scale

SCALE: 1"=1000'

LDKING
Engineers/Planners/Surveyors
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APPENDIX B

FACILITY DATA

TABLE 1: FACILITY DATA

STORM DRAIN MASTER PLAN UPDATE - CITY OF CHINO - SUBAREA 2

LINE	NODE		LENGTH	ELEVATION		GROUND	DESIGN	HYDRAULIC	Q10	Q25	Q100	DESIGN	k~Q^SF^S	PIPE	BOX SIZE	CHANNEL	VELOCITY
	FROM	TO		U/S	D/S	SLOPE	SLOPE	GRADIENT				FLOW		SIZE	DBL. RCB	SIZE	CFS
#	#	#	ft	ft	ft	ft/ft	ft/ft	ft/ft	cfs	cfs	cfs	cfs		in	ft X ft	ft X ft	fs
A	A1	A2	2800	660.5	645	0.0055357	0.0021	0.001785			1620	1620	38343.867		10' W X 10' H		9.64
	A2	A3	1400	645	643	0.0014286	0.0021	0.001785			1620	1620	38343.867		10' W X 10' H		9.64
	A3	A4	1700	643	640	0.0017647	0.0021	0.001785			1620	1620	38343.867		10' W X 10' H		9.64
	A4	OUTLET	100	640	638	0.02	0.0021	0.001785			1620	1620	38343.867		10' W X 10' H		9.64
B	SEE AMENDMENT TO MASTER PLAN OF DRAINAGE FOR SUBAREA 2, PREPARED BY L.D KING, DATED JULY 8, 2004 (INCLUDED IN APPENDIX B)																
C	C1	C2	1450	610	602	0.0055172	0.0065	0.005525		95	116	95	1278.0783	48			9.58
	C2	C3	1300	602	595	0.0053846	0.0065	0.005525		152	187	187	2515.7962	60			11.2
	C3	C5	1350	595	590	0.0037037	0.0065	0.005525		270	335	335	4506.9077	78			13.18
	C5	C7	2380	590	572	0.007563	0.0065	0.005525		405	502	502	6753.6349	90			14.54
	C7	OUTLET	950	572	570	0.0021053	0.0065	0.005525		472	586	586	7883.7251		7'W X 7'H		12.96
	C4	C3	1200	608	595	0.0108333	0.008	0.006800	58	67	88	58	703.35331	42			9.33
	C6	C5	1250	600	590	0.008	0.008	0.006800	82	96	125	82	994.39606	42			9.83
D	SEE AMENDMENT TO MASTER PLAN OF DRAINAGE FOR SUBAREA 2, PREPARED BY L.D KING, DATED JULY 8, 2004 (INCLUDED IN APPENDIX B)																

TABLE 1: FACILITY DATA

STORM DRAIN MASTER PLAN UPDATE - CITY OF CHINO - SUBAREA 2

LINE	NODE		LENGTH	ELEVATION		GROUND	DESIGN	HYDRAULIC	Q10	Q25	Q100	DESIGN	k, Q*S^.5	PIPE	BOX SIZE	CHANNEL	VELOCITY
	FROM	TO		U/S	D/S	SLOPE	SLOPE	GRADIENT				FLOW		SIZE	DBL. RCB.	SIZE	CFS
#	#	#	ft	ft	ft	ft/ft	ft/ft	ft/ft	cfs	cfs	cfs	cfs		in	ft X ft	ft X ft	fs
E	E1	OUTLET	1600	594	580	0.00875	0.0101	0.008585		115	142	115	1241.1598	48			
F	F1	F2	2500	576.5	572	0.0018	0.002	0.001700		31	41	31	751.86044	42			4.73
	F3	F2	900	575	572	0.0033333	0.002	0.001700		48	63	48	1164.171	48			5.25
	F4	F2	2500	582	572	0.004	0.002	0.001700		95	126	95	2304.0884	60			6.17
	F2	F5	900	572	566	0.0066667	0.006	0.005100		298	391	298	4172.8347	78			12.52
	F5	F6	700	566	561	0.0071429	0.008	0.006800		374	519	519	6293.7995	84			15.6
	F6	OUTLET	1200	561	545	0.0133333	0.01	0.008500			570	570	6182.518	84			17.43
G	G1	G2	2200	574.9	565	0.0045	0.003	0.002550		73	95	73	1445.6154	48			6.64
	G2	G3	1500	565	560	0.0033333	0.005	0.004250		174	235	235	3604.7354	72			10.9
	G3	OUTLET	1500	560	545	0.01	0.01	0.008500		213	294	294	3188.8777	72			15.16
H	H1	H2	1500	594	583	0.0073333	0.0075	0.006375		326	423	326	4082.9824	78			13.97
	H2	H3	1000	583	571	0.012	0.0075	0.006375		419	544	544	6813.3203	84			14.95
	H3	H5	2300	571	565	0.0026087	0.0075	0.006375		509	660	660	8266.1606	96			16.43
	H5	OUTLET	1200	565	550	0.0125	0.0075	0.006375		590	772	772	9668.9031	102			17.01
EARTHEN TRAPEZOIDAL CHANNEL (OPTION 1)																	
I	I2	I3	2900	595	570.5	0.0084483	0.007				1891	1891				20' W X 6' H	19.53
	I3	I4	2500	570.5	557	0.0054	0.007				1924	1924				20' W X 8' H	19.63
	I2		120				0.007	0.007000			1891	1891	22601.723			DBL 10 W X 10' H	16.95
	I3		100				0.007	0.007000			1924	1924	22996.198			DBL 10 W X 10' H	17.02
	I4	OUTLET	500	557	540	0.034	0.02	0.02			1932	1932	13661.303			DBL 10 W X 10' H	25.17

TABLE 1: FACILITY DATA

STORM DRAIN MASTER PLAN UPDATE - CITY OF CHINO - SUBAREA 2

LINE	NODE		LENGTH	ELEVATION		GROUND	DESIGN	HYDRAULIC	Q10	Q25	Q100	DESIGN	K = Q/Sf^.5	PIPE	BOX SIZE	CHANNEL	VELOCITY
	FROM	TO		U/S	D/S	SLOPE	SLOPE	GRADIENT				FLOW		SIZE	DBL RCB	SIZE	CFS
#	#	#	ft	ft	ft	ft/ft	ft/ft	ft/ft	cfs	cfs	cfs	cfs		in	ft X ft	ft X ft	fs
CONCRETE TRAPEZOIDAL CHANNEL (OPTION 2)																	
I	I1	I2	5250	635	595	0.007619	0.007				1443	1443				20' W X 5' H	17.93
I	I2	I3	2840	595	570.5	0.0086268	0.007				1891	1891				20' W X 8' H	19.53
	I3	I4	2190	570.5	557	0.0061644	0.007				1924	1924				20' W X 8' H	19.63
	I2 CULVER		120				0.007	0.007000			1891	1891	22601.773			DBL 10 'W X 10' H	16.95
	I3 CULVER		100				0.007	0.007000			1924	1924	22996.198			DBL 10 'W X 10' H	17.02
	I4 CULVER	OUTLET	500	557	540	0.034	0.02	0.02			1932	1932	13661.303			DBL 10 'W X 10' H	25.17
REINFORCED CONCRETE BOX (OPTION 3)																	
I	I1	I2	5300	635	595	0.0075472	0.007	0.005950			1443	1443	18707.159			DBL 11 'W X 6' H	14.92
	I2	I3	2900	595	570.5	0.0084483	0.007	0.005950			1891	1891	24515.065			DBL 11 'W X 6' H	16
	I3	I4	2500	570.5	557	0.0054	0.007	0.005950			1924	1924	24942.879			DBL 11 'W X 6' H	14.57
	I4	OUTLET	500	557	551	0.012	0.007	0.005950			1932	1932	25046.592			DBL 11 'W X 6' H	14.64

TABLE 1B: FACILITY DATA
AMENDMENT NO. 1

MASTER PLAN OF DRAINAGE – CHINO SPHERE OF INFLUENCE – SUBAREA 2

LINE	NODE		LENGTH	ELEVATION		GROUND	DESIGN	HYDRAULIC	Q10	Q25	Q100	DESIGN	K=Q/SF^.5	PIPE	BOX SIZE	CHANNEL
	FROM	TO		U/S	D/S	SLOPE	SLOPE	GRADIENT				FLOW		SIZE	DBL RCB	SIZE
#	#	#	ft	ft	ft	ft/ft	ft/ft	ft/ft	cfs	cfs	cfs	cfs		in	ftxft	ftxft
B	B1	B2	2650	642.3	622.4	0.00750	0.00625	0.0053125	130	154	192	192	2634.216268	48		
	B2	B3	900	622.4	625.4	-0.00330	0.00625	0.0053125	218	257	321	321	4404.083666	78		
	B3	B4	1350	625.4	616.6	0.00652	0.00625	0.0053125	218	257	321	321	4404.083666	78		
	B4	B5	1050	616.6	612.0	0.00438	0.00625	0.0053125	247	291	363	363	4980.318913	84		
	B5	B7	800	612.0	607.0	0.00833	0.00625	0.0053125	304	358	446	446	6119.069516	84		
	B6	B7	2300	627.0	607.0	0.00870	0.00625	0.0053125	152	179	223	223	3059.534759	72		
	B7	B8	900	607.0	602.4	0.00511	0.00625	0.0053125	431	507	632	632	8670.968465	96		
	B8	B9	2500	602.4	576.0	0.01056	0.00625	0.0053125	433	510	636	636	8725.848012	96		
	B9	B10	900	576.0	574.0	0.00222	0.00625	0.0053125	476	560	698	698	9576.480994	108		
	B10	Outlet	800	574.0	550.0	0.03000	0.00625	0.0053125	490	577	719	719	9864.598617	108		

TABLE 1J FACILITY DATA
AMENDMENT NO. 1

MASTER PLAN OF DRAINAGE – CHINO SPHERE OF INFLUENCE – SUBAREA 2

LINE	NODE FROM	NODE TO	LENGTH	ELEVATION U/S	ELEVATION D/S	GROUND SLOPE	DESIGN SLOPE	[illegible]	Q10	Q25	Q100	DESIGN FLOW	K=Q/S^1/2	PIPE SIZE	BOX SIZE (H x W)	CHANNEL SIZE
#	#	#	ft	ft	ft	ft/ft	ft/ft	ft/ft	cfs	cfs	cfs	cfs		in	(ft)	(ft)
[illegible]	J1	[illegible]	3000	602.5	601.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			20'WX8'H TEC
	CULVERT @KIMBALL AVE		[illegible]	601.1	600.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1486	20387.7518		2-10'Hx8'W	
	[illegible]	[illegible]	[illegible]	600.0	580.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1486	20387.7518			20'WX8'H TEC
	CULVERT @[illegible] AVE		[illegible]	580.0	580.0	0.02000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1486	20387.7518		2-10'Hx8'W	
	[illegible]	[illegible]	[illegible]	580.0	565.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1486	20387.7518			20'WX8'H TEC
	CULVERT @[illegible] AVE		120	565.0	560.0	0.04167	0.00625	0.0053125	152	179	223	1486	20387.7518		2-10'HX8'W	
	J4	OUTLET	60	560.0	555.0	0.10000	0.00625	0.0053125	381	448	559	1486	20387.7518			

TABLE 1D FACILITY DATA
AMENDMENT NO. 1

MASTER PLAN OF DRAINAGE – CHINO SPHERE OF INFLUENCE – SUBAREA 2

LINE	NODE		LENGTH	ELEVATION		GROUND	DESIGN	HYDRAULIC	Q10	Q25	Q100	DESIGN	k=Q/S^1.5	PIPE	BOX SIZE	CHANNEL
	FROM	TO		U/S	D/S	SLOPE	SLOPE	GRADIENT				FLOW		SIZE	DBL RCB	SIZE
#	#	#	ft	ft	ft	ft/ft	ft/ft	ft/ft	cfs	cfs	cfs	cfs		in	ftxft	ftxft
D	D1	D2	870	623.3	620.5	0.00322989	0.0025	0.002125	90	107	133	133	2885.175089	54		
	D2	D3	940	620.5	617.5	0.00317021	0.0025	0.002125	93	109	136	136	2950.254226	54		
	D3	D4	1320	617.5	600.5	0.01290909	0.0025	0.002125	96	113	141	141	3058.719455	54		
	D4	OUTLET	150	600.5	594.3	0.04146667	0.0025	0.002125	96	113	141	141	3058.719455	54		

APPENDIX C

CAPITAL COST ESTIMATES

TABLE 1: CAPITAL COST ESTIMATE SUMMARY

STORM DRAIN MASTER PLAN UPDATE
CITY OF CHINO - SUBAREA 2

LINE #	CITY OF CHINO CAPITAL COST	CITY OF ONTARIO CAPITAL COST	TOTAL CAPITAL COST
A		$ 18,302,000	$ 18,302,000
B	$ 10,928,720		$ 10,928,720
C	$ 6,745,926		$ 6,745,926
D	$ 1,728,584		$ 1,728,584
E	$ 805,200		$ 805,200
F	$ 5,126,990		$ 5,126,990
G	$ 3,204,300		$ 3,204,300
H	$ 5,167,250		$ 5,167,250
I	$ 561,255	$ 1,878,985	$ 2,440,240
TOTAL COST	$ 34,268,225	$ 20,180,985	$ 54,449,210

TABLE 2: CAPITAL COST ESTIMATE

STORM DRAIN MASTER PLAN UPDATE - CITY OF CHINO - SUBAREA 2

LINE	NODE		SIZE	LENGTH	CONST	CONST	ENGR /	TOTAL COST	TOTAL CAPITAL COST	CITY OF CHINO	CITY OF ONTARIO
	FROM	TO			COST	COST	ADMIN			CAPITAL COST	CAPITAL COST
#				ft	$/LF					0% COST	100% COST
A	MERRILL AVE	CUCAMONGA	10' (W) X 10' (H) DBL. RCB	6000	2,720	$ 16,320,000	$ 1,632,000	$ 17,952,000	$ 17,952,000		$ 17,952,000
		CREEK									
	40' WIDE DRAINAGE EASMENT							$ 350,000	$ 350,000		$ 350,000
TOTAL CAPITAL COST =									$ 18,302,000		$ 18,302,000

TABLE 3: CAPITAL COST ESTIMATE

STORM DRAIN MASTER PLAN UPDATE - CITY OF CHINO - SUBAREA 2

LINE	NODE		SIZE	LENGTH	CONST	CONST	ENGR./	TOTAL COST	TOTAL CAPITAL COST
	FROM	TO			COST	COST	ADMIN		
#			in	ft	$/LF				
B	B1	B2	48" RCP	2650	445	$ 1,178,250	$ 117,925	$ 1,297,175	
	B2	B3	78" RCP	900	693	$ 623,700	$ 62,370	$ 686,070	
	B3	B4	78" RCP	1350	693	$ 935,550	$ 93,555	$ 1,029,105	
	B4	B5	84" RCP	1050	768	$ 806,400	$ 80,640	$ 887,040	
	B5	B7	84" RCP	600	768	$ 460,800	$ 46,080	$ 506,880	
	B6	B7	72" RCP	2300	638	$ 1,467,400	$ 146,740	$ 1,614,140	
	B7	B8	96" RCP	900	828	$ 745,200	$ 74,520	$ 819,720	
	B8	B9	96" RCP	2500	828	$ 2,070,000	$ 207,000	$ 2,277,000	
	B9	B10	108" RCP	900	957	$ 861,300	$ 86,130	$ 947,430	
	B10	OUTLET	108" RCP	800	957	$ 765,600	$ 76,560	$ 842,160	
OUTLET STRUCTURE						$ 20,000	$ 2,000	$ 22,000	
									$ 10,928,720.00
C	C1	C2	48" RCP	1450	445	$ 645,250	$ 64,525	$ 709,775	
	C2	C3	60" RCP	1300	532	$ 691,600	$ 69,160	$ 760,760	
	C3	C5	78" RCP	1350	693	$ 935,550	$ 93,555	$ 1,029,105	
	C5	C7	90" RCP	2380	807	$ 1,920,660	$ 192,066	$ 2,112,726	
	C7	OUTLET	7'W X 7'H RCB	950	1020	$ 969,000	$ 96,900	$ 1,065,900	
	C4	C3	42" RCP	1200	388	$ 465,600	$ 46,560	$ 512,160	
	C6	C5	42" RCP	1250	388	$ 485,000	$ 48,500	$ 533,500	
OUTLET STRUCTURE						$ 20,000	$ 2,000	$ 22,000	
									$ 6,745,926.00
D	D1	D2	54" RCP	870	473	$ 411,510	$ 41,151	$ 452,661	
	D2	D3	54" RCP	940	473	$ 444,620	$ 44,462	$ 489,082	
	D3	D4	54" RCP	1320	473	$ 624,360	$ 62,436	$ 686,796	
	D4	OUTLET	54" RCP	150	473	$ 70,950	$ 7,095	$ 78,045	
OUTLET STRUCTURE						$ 20,000	$ 2,000	$ 22,000	
									$ 1,728,584.00

TABLE 3: CAPITAL COST ESTIMATE

STORM DRAIN MASTER PLAN UPDATE - CITY OF CHINO - SUBAREA 2

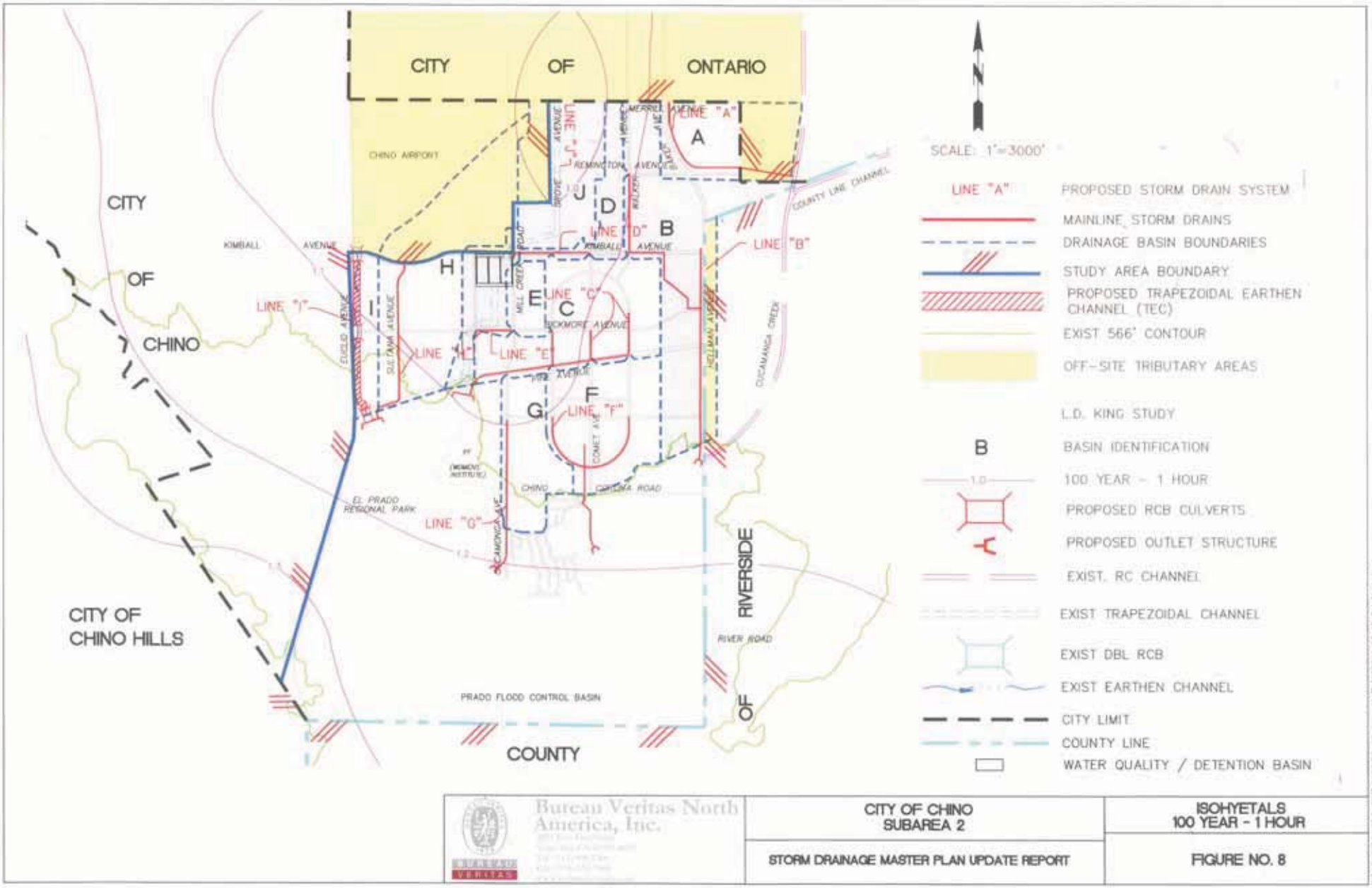
LINE	NODE		SIZE	LENGTH	CONST	CONST	ENGR /	TOTAL COST	TOTAL CAPITAL COST
	FROM	TO			COST	COST	ADMIN		
#			in	ft	$/LF				
E	E1	E2	48" RCP	1600	445	$ 712,000	$ 71,200	$ 783,200	
OUTLET STRUCTURE						$ 20,000	$ 2,000	$ 22,000	
									$ 805,200.00
F	F1	F2	42" RCP	2500	388	$ 970,000	$ 97,000	$ 1,067,000	
	F3	F2	48" RCP	900	445	$ 400,500	$ 40,050	$ 440,550	
	F4	F2	60" RCP	2500	532	$ 1,330,000	$ 133,000	$ 1,463,000	
	F2	F5	78" RCP	900	693	$ 623,700	$ 62,370	$ 686,070	
	F5	F6	84" RCP	700	693	$ 485,100	$ 48,510	$ 533,610	
	F6	OUTLET	84" RCP	1200	693	$ 831,600	$ 83,160	$ 914,760	
OUTLET STRUCTURE						$ 20,000	$ 2,000	$ 22,000	
									$ 5,126,990.00
G	G1	G2	48" RCP	2200	445	$ 979,000	$ 97,900	$ 1,076,900	
	G2	G3	72" RCP	1500	638	$ 957,000	$ 95,700	$ 1,052,700	
	G3	OUTLET	72" RCP	1500	638	$ 957,000	$ 95,700	$ 1,052,700	
OUTLET STRUCTURE						$ 20,000	$ 2,000	$ 22,000	
									$ 3,204,300.00
H	H1	H2	78" RCP	1500	693	$ 1,039,500	$ 103,950	$ 1,143,450	
	H2	H3	84" RCP	1000	693	$ 693,000	$ 69,300	$ 762,300	
	H3	H5	96" RCP	2300	828	$ 1,904,400	$ 190,440	$ 2,094,840	
	H5	OUTLET	102" RCP	1200	863	$ 1,035,600	$ 103,560	$ 1,139,160	
OUTLET STRUCTURE						$ 25,000	$ 2,500	$ 27,500	
									$ 5,167,250.00
							TOTAL CAPITAL COST =		$ 33,706,970.00

TABLE 4: CAPITAL COST ESTIMATE

STORM DRAIN MASTER PLAN UPDATE - CITY OF CHINO - SUBAREA 2

LINE	NODE		SIZE	LENGTH	CONST.	CONST.	ENGR./	TOTAL CAPITAL	CITY OF CHINO	CITY OF ONTARIO
	FROM	TO			COST	COST	ADMIN.	COST	CAPITAL COST	CAPITAL COST
#				ft	$/LF				23%COST	77% COST
EARTHEN TRAPEZOIDAL CHANNEL (OPTION 1)										
1	MERRILL	KIMBALL	EXISTING CHANNEL							
	I-2	I-3	20' (W) X8' (H).. TEC	2900	300	$ 870,000	$ 87,000	$ 957,000	$ 220,110	$ 736,890
	I-3	I-4	20' (W) X 8' (H) TEC	2500	300	$ 750,000	$ 75,000	$ 825,000	$ 189,750	$ 635,250
	I-2		10' (W) X 10' (H) DBL. RCB	120	2,720	$ 326,400	$ 32,640	$ 359,040	$ 82,579	$ 276,461
	I-3		10' (W) X 10' (H) DBL. RCB	100	2,720	$ 272,000	$ 27,200	$ 299,200	$ 68,816	$ 230,384
	I-4	OUTLET	10' (W) X 10' (H) DBL. RCB	500	2,720	$ 1,360,000	$ 136,000	$ 1,496,000	$ 344,080	$ 1,151,920
TOTAL CAPITAL COST =								$ 2,440,240	$ 561,255	$ 1,878,985
CONCRETE TRAPEZOIDAL CHANNEL (OPTION 2)										
1	I-1	I-2	20' (W) X 5' (H) TCC	5250	1,700	$ 8,925,000	$ 892,500	$ 9,817,500	$ 2,258,025	$ 7,559,475
	I-2	I-3	20' (W) X 6' (H) TCC	2840	1,700	$ 4,828,000	$ 482,800	$ 5,310,800	$ 1,221,484	$ 4,089,316
	I-3	I-4	20' (W) X 6' (H) TCC	2190	1,700	$ 3,723,000	$ 372,300	$ 4,095,300	$ 941,919	$ 3,153,381
	I-2 CULVERT		10' (W) X 10' (H) DBL. RCB	120	2,720	$ 326,400	$ 32,640	$ 359,040	$ 82,579	$ 276,461
	I-3 CULVERT		10' (W) X 10' (H) DBL. RCB	100	2,720	$ 272,000	$ 27,200	$ 299,200	$ 68,816	$ 230,384
	I-4 CULVERT		10' (W) X 10' (H) DBL. RCB	500	2,720	$ 1,360,000	$ 136,000	$ 1,496,000	$ 344,080	$ 1,151,920
TOTAL CAPITAL COST =								$ 10,064,340	$ 2,314,798	$ 7,749,542
REINFORCED CONCRETE BOX (OPTION3)										
1	I-1	I-2	11' (W) X 6' (H) DBL. RCB	5300	2,410	$ 12,773,000	$ 1,277,300	$ 14,050,300	$ 3,231,569	$ 10,818,731
	I-2	I-3	11' (W) X 6' (H) DBL. RCB	2900	2,410	$ 6,989,000	$ 698,900	$ 7,687,900	$ 1,768,217	$ 5,919,683
	I-3	I-4	11' (W) X 6' (H) DBL. RCB	2500	2,410	$ 6,025,000	$ 602,500	$ 6,627,500	$ 1,524,325	$ 5,103,175
	I-4	OUTLET	11' (W) X 6' (H) DBL. RCB	500	2,410	$ 1,205,000	$ 120,500	$ 1,325,500	$ 304,865	$ 1,020,635
TOTAL CAPITAL COST =								$ 15,640,900	$ 3,597,407	$ 12,043,493

ISOHYETAL MAPS



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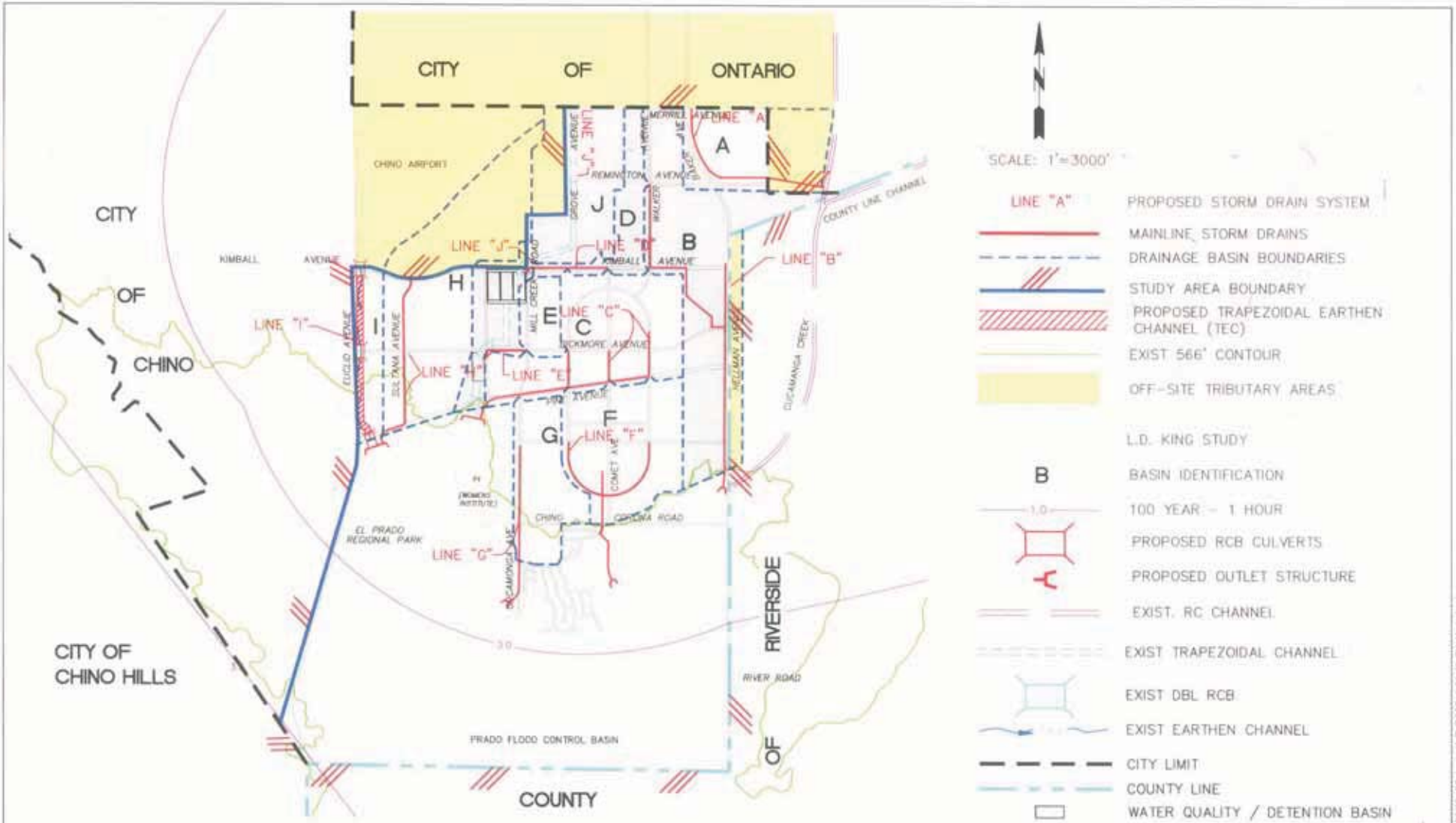
CITY OF CHINO SUBAREA 2	ISOHYETALS 100 YEAR - 1 HOUR
STORM DRAINAGE MASTER PLAN UPDATE REPORT	FIGURE NO. 8

P:\15653\CHINO\SHEET\5653S50_02.dwg 11/5/2007 4:50:45 PM Mark Lee



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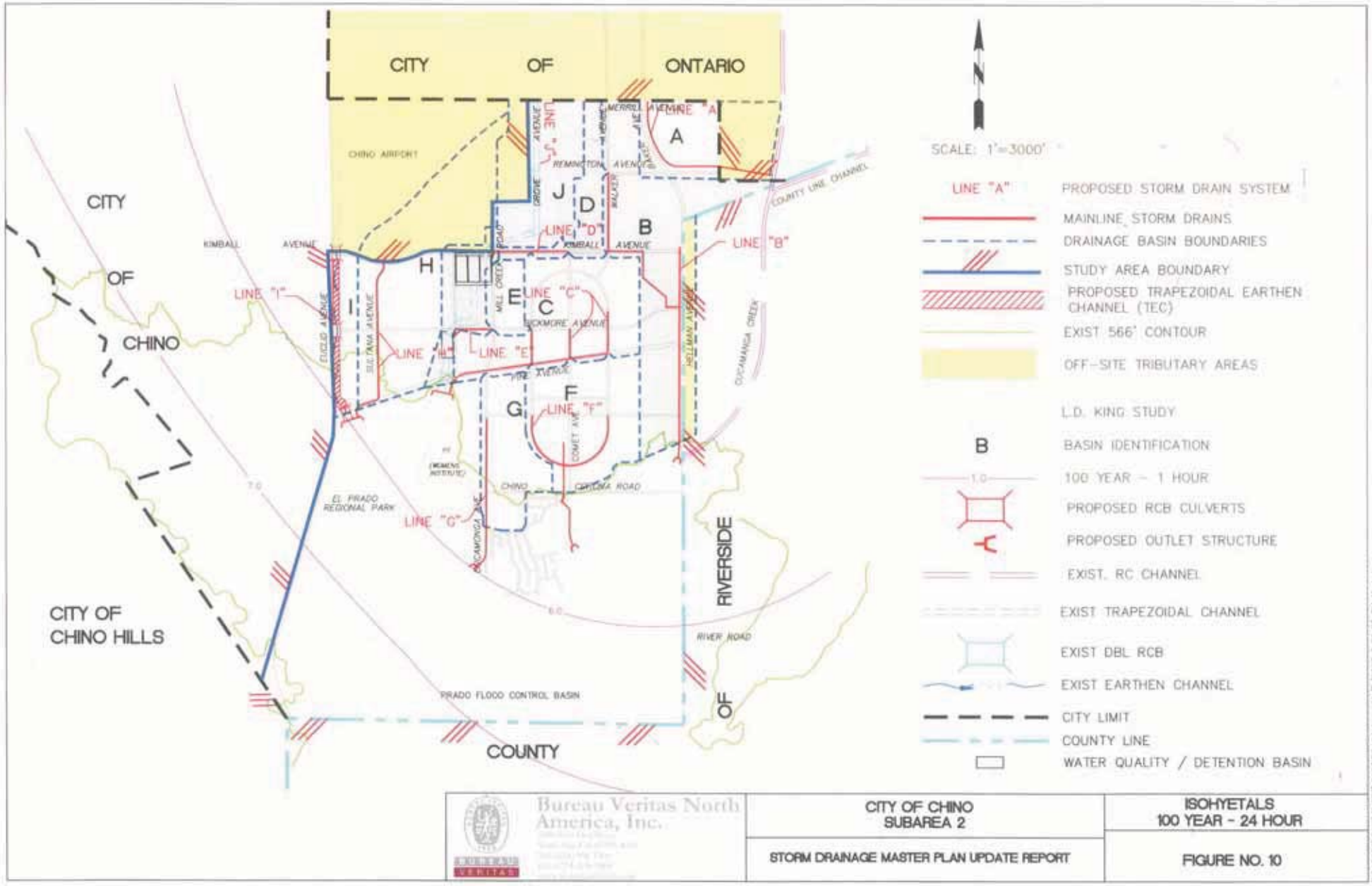
CITY OF CHINO SUBAREA 2	ISOHYETALS 100 YEAR - 6 HOUR
STORM DRAINAGE MASTER PLAN UPDATE REPORT	FIGURE NO. 9

P:\15853\DWG\SHEET\585350_03.dwg 11/5/2007 4:51:41 PM Mark Lee



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CITY OF CHINO SUBAREA 2	ISOHYETALS 100 YEAR - 24 HOUR
STORM DRAINAGE MASTER PLAN UPDATE REPORT	FIGURE NO. 10

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