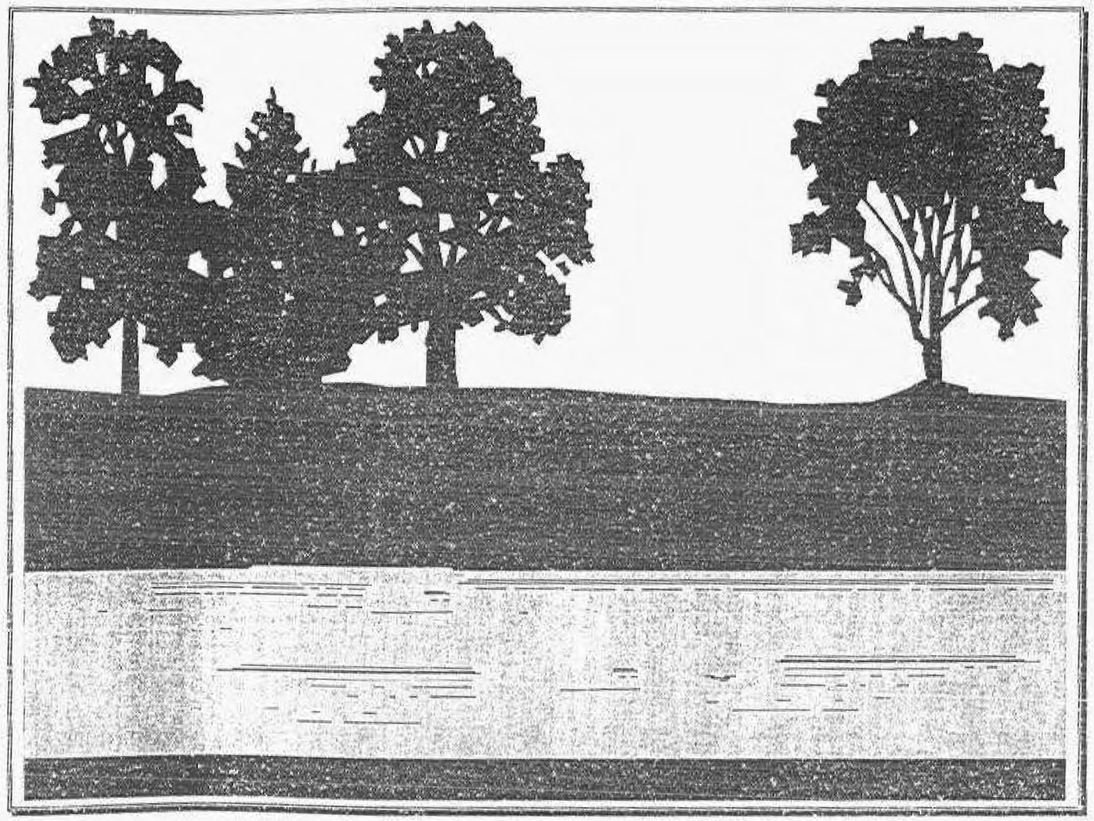
South Platte River Channel Capacity Analysis

From Hampden Avenue Upstream to Coal Mine Road (Extended)

Sponsored By:

Urban Drainage and
Flood Control District
2480 W. 26th Ave., Ste. 156-B
Denver, CO 80211

Colorado Water
Conservation Board
1313 Sherman Street, Room 721
Denver, CO 80203



Prepared by:

ICON Engineering, Inc
7108 B South Alton Way
Englewood, CO 80112

May 1998

SOUTH PLATTE RIVER
CHANNEL CAPACITY ANALYSIS

FROM HAMPDEN AVENUE UPSTREAM TO
COAL MINE ROAD (EXTENDED)

MAY 1998

Prepared for:

Urban Drainage and Flood Control District
2480 West 26th Avenue, Suite 156B
Denver, CO 80211
Contact: Mr. Bryan Kohlenberg
(303) 455-6722

and

Colorado Water Conservation Board
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Contact: Mr. Tom Browning
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May 8, 1998

Mr. Bryan Kohlenberg
Urban Drainage and Flood Control District
2480 West 26th Avenue, Suite 156B
Denver, CO 80211

Mr. Tom Browning
Colorado Water Conservation Board
1313 Sherman Street
Room 721
Denver, CO 80203

Subject: South Platte River Channel Capacity Analysis
ICON Job Number: 97-020-016-415

Dear Bryan and Tom:

ICON Engineering, Inc., is pleased to submit the attached report entitled *South Platte River Channel Capacity Analysis*, dated March 1998.

We would like to acknowledge the help and support in the preparation of this report that was furnished by your staff and the project sponsors. In particular, Ken MacKenzie of your staff have been instrumental in providing input.

This study is intended to provide the sponsors with a current conditions analysis of the South Platte River from Hampden Avenue upstream to the Brown Ditch Diversion at Coal Mine Road (extended). The results of our analysis indicate that in the reach of the Corps of Engineers project area, the current channel has adequate capacity to convey the 100-year storm flows, as well as a sustained release of 5,000 cfs from Chatfield Reservoir. This updated model has been calibrated to the current conditions using high water

mark data collected during the Summer of 1997. Manning's "n" values were determined for the channel bottom and channel bank areas. The Manning's "n" value report has been forwarded to you under separate cover. The resulting model also accounts for changes to the channel designed and built by the Corps of Engineers as a result of sedimentation, degradation, and volunteer growth of trees and willows.

We have enjoyed working with you throughout the preparation of this study and are available to assist you with any additional needs you may have in regard to this study.

Sincerely,

ICON ENGINEERING, INC.

Douglas J. Williams, P.E.
Principal

Craig Jacobson, E.I.T.
Project Engineer

/dp

Attachments

cc: file

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SECTION 1.0
INTRODUCTION

1.0 Authorization

This study was authorized by the Urban Drainage and Flood Control District (UD&FCD) and the Colorado Water Conservation Board (CWCB) under UD&FCD Agreement No. 96-10.13. ICON Engineering Inc., (ICON) was retained to complete the scope of work summarized in Subsection 1.2.

1.2 Purpose and Scope

The objective of this report is to prepare an updated hydraulic model of the U.S. Army Corps of Engineers (COE) flood control channel project on the South Platte River from Hampden Avenue upstream to the old Brown Ditch diversion at Coal Mine Road (extended).

The hydrologic analysis for the South Platte River had previously been developed by the COE for the flood control channel project. Therefore, it is not included in this report.

Water surface profiles were computed for the South Platte River using the U.S. Army Corps of Engineers' HEC-2 Water Surface profiles program (version 4.6.2). Channel cross-section data was taken from topographic mapping developed for the project. This data was provided in AutoCAD R13 format as digital, three-dimensional mapping at 1-foot contours. In addition, field survey data was taken at each cross-section to determine the channel profile beneath the water surface.

The study area consists of a 5.5 mile reach of the South Platte River, between Hampden Avenue and the old Brown Ditch diversion at Coal Mine Road (extended) in Arapahoe County.

1.3 Mapping

Mapping was provided by the CWCB through UD&FCD. Mapping consisted of 1-inch to 50 feet, 1-foot contour interval mapping of the study limits. This mapping was produced by Transvision of Santa Clara, California, under a separate agreement with the CWCB. The mapping was compiled using aerial photogrametric methods from aerial photography flown by Huntley Aerial Surveys, Inc., of Monument, Colorado, in May 1997. Control for the mapping was provided by Accurate Consultants, Inc., of Broomfield, Colorado.

1.4 Background Information

Historically, major floods have occurred along the South Platte River in 1921, 1933, 1942, 1949, 1957, and 1965. The most recent major flood, in 1965, spurred the creation of Chatfield Dam and Reservoir as a flood control facility. Chatfield Reservoir effectively controls major flood flows in the downstream reaches of the South Platte River. The maximum release discharge from Chatfield Reservoir is 5,000 cfs. The channel capacity along most of the study reach prior to the construction of Chatfield Reservoir ranged from 2,000 to 6,000 cfs. Flooding would occur in areas having inadequate capacity for the design release rate. Therefore, an improved channel was proposed,

designed, and built by the COE to help control flooding for larger storm events.

The channel improvements consisted of widening, straightening, and lowering some 4.4 miles of the South Platte River. The proposed channel was designed and modeled as a prismatic, trapezoidal channel with a design capacity varying from 5,400 cfs just downstream of Coal Mine Road (Extended) to 15,000 cfs downstream of West Oxford Avenue. The constructed channel has 2H : 1V sideslopes, and a bottom width of 100 feet from Coal Mine Road (Extended) downstream to the confluence with Dutch Creek. The bottom width widens to 130 feet from the confluence with Dutch Creek downstream to Oxford Avenue (Reference 1). Downstream of Oxford Avenue to the confluence with Bear Creek only the east bank was stabilized. Throughout the channeled reach, both side slopes were protected with graded riprap which extended up to the 5,000 cfs water surface elevation.

The channel improvements were constructed over the period beginning April 11, 1984, and ending April 25, 1988 (Reference 1).

1.5 Acknowledgments

This report was prepared by ICON under contract with the UD&FCD. ICON wishes to acknowledge the various individuals who assisted in the preparation of the study. These individuals were routinely coordinated with during the planning process. The following people participated by providing technical guidance and information during the course of the study:

Name	Representing
Bryan Kohlenberg	UD&FCD
Ben Urbonas	UD&FCD
Ken MacKenzie	UD&FCD
Tom Browning	CWCB

The following members of the project team contributed to the preparation of this report:

Doug Williams	Project Manager
Curt Neufeld	Project Engineer
Craig Jacobson	Project Engineer
Calvin Heinly	Project Surveyor

SECTION 2.0
HYDRAULIC ANALYSIS

2.1 Methodology

Water surface profiles were computed for the South Platte River using the U.S. Corps of Engineers' HEC-2 Water Surface Profiles Program (version 4.6.2). Water surface profiles were computed for

the 100-year event, as well as for a maximum release rate of 5,000 cfs from Chatfield Dam. The model was calibrated by adjusting Manning's "n" values and using high water mark information from flows taken during June of 1997 by the UD&FCD. The calibration run was approved by the project sponsors and the results incorporated into the final model. Channel cross-section data was taken from topographic mapping developed for the project. This data was provided in AutoCAD R13 format as digital, three-dimensional mapping at 1-foot contours. Additional field survey data was collected at each cross-section to determine the profile of the channel bottom beneath the water surface. The surveyed data was used in lieu of the mapping at each cross-section for the portion that was below the water surface when the mapping was flown.

Geometric measurements, low chord, and invert elevations at bridges were field surveyed and provided to the project sponsors by Accurate Engineering, Inc. Photographs were taken at each bridge crossing and a sketch of each was prepared showing the appropriate dimensions. This detailed data, in conjunction with the mapping, was used to enter the required parameters to model the bridges.

Photographs were taken to document the existing channel and bank conditions for determining roughness coefficients for use in the hydraulic analysis. This supplementary material is located in a separate report entitled *Manning's "n" Value Report for the South Platte River Channel Capacity* (Reference 2). The Manning's "n" values utilized in the hydraulic analysis were 0.025 for the channel bottom and 0.050 for the channel banks.

The hydraulic model for this study begins at Hampden Avenue and proceeds upstream 25,590 feet to the Brown Ditch Diversion at Coal Mine Road (extended). Stationing for the model was started at 1685+26 to coincide with the report *South Platte River Flood Hazard Area Delineation, Sand Creek to Oxford Avenue* (Reference 3). The channel centerline between Hampden and Oxford was correlated to the centerline depicted in the above referenced report to attempt to keep approximately the same stationing up to Oxford Avenue. Upstream of Oxford Avenue, the channel centerline and stationing were taken midway between the edge of water lines as depicted in the topographic mapping provided by the project sponsors.

A total of 75 cross-sections were sampled, with an average spacing of about 350 feet. The cross-sections are identified according to their river station and are shown on the plan and profile sheets included in this report. The starting water surface elevation for the 5,000 cfs event was determined using the slope-area option with an initial energy slope of 0.0005 and an estimated water surface elevation at Hampden Avenue. The starting water surface elevation at Hampden Avenue, as well as the 100-year flow rates downstream of Oxford Avenue were taken from the South Platte River FHAD (Reference 1). All of the remaining flows for the 100-year event were taken from the model used by the COE for their channel design. The location of the change in flows were correlated with the cross-sections used in this study. The locations and values at each change in 100-year flows are shown in the profiles.

2.2 Results

The results of the hydraulic analysis are shown on drawings and in tables in this report. Drawings include plan view maps and profiles, each indicating flood elevations and cross-section locations. A

total of 10 sheets are provided depicting the 100-year floodplain, 100-year and 5,000 cfs water surface profiles. An index of map sheets is also provided for reference.

Profiles of the left and right bank elevations were determined from the topographic mapping and were plotted on the profile sheets. The top of bank was taken to be the point at which the channel sideslope changed to a much flatter grade. Where such a grade break was not obvious, the inside edge of the pedestrian trail was sometimes used. Bank profiles were not shown downstream of Oxford Avenue since the channelization ended at that location. These profiles provide a graphical representation of the estimated available freeboard in the channel. The computed water surface elevation, east and west bank elevations, and minimum channel freeboard area are presented in Table 2-1 for the 100-year event. The minimum channel freeboard is approximately 1.4 feet near the confluence of Big Dry Creek. None of the bridges in the study reach are surcharged by the 100-year event.

For comparison purposes, the 100-year water surface and channel invert profiles generated by the Corps for the original channel design upstream of Union Avenue was superimposed on the profile sheets. The water surface elevations were taken from the Corps' HEC-2 model and adjusted to the profiles based on locations of existing bridge and roadway crossing structures. In addition, the vertical datum of the Corps water surface and channel invert profiles were raised by 2.4 feet which is the average datum difference between the 1929 map datum that the Corps used and the 1988 datum on which the new mapping was prepared. Generally, the profiles indicate that the river bottom has degraded downward (i.e. the channel section deepened) since the original construction. This is consistent with survey data which has been recorded over the past several years at various locations on the river in and adjacent to this study reach. This survey data is measured each year by the UD&FCD.

Table 2.1: Results of Hydraulic Analysis

SECTION ID	Q (CFS)	WSEL (FT)	WEST BANK ELEV.	EAST BANK ELEV.	CHANNEL * FREEBOARD (FT)	COMMENTS
168526	15000	5270.1	N.A.	N.A.	N.A.	HAMPDEN AVENUE
169528	15000	5272.0	N.A.	N.A.	N.A.	
169952	15000	5272.3	N.A.	N.A.	N.A.	PEDESTRIAN
169962	15000	5272.3	N.A.	N.A.	N.A.	BRIDGE
170204	15000	5272.7	N.A.	N.A.	N.A.	
170594	14600	5273.1	N.A.	N.A.	N.A.	D/S BEAR CREEK
171506	13500	5273.6	N.A.	N.A.	N.A.	U/S BEAR CREEK
171825	13500	5273.6	N.A.	N.A.	N.A.	
172431	13500	5273.2	N.A.	N.A.	N.A.	
173241	13500	5274.7	N.A.	N.A.	N.A.	PEDESTRIAN
173252	13500	5274.8	5282	5281	6.2	BRIDGE
173524	13500	5275.0	5284	5284	9.0	
173753	13500	5275.6	5287	5288	11.4	DROP STRUCTURE
173876	13500	5278.3	5291	5291	12.7	OXFORD AVENUE
173908	13500	5278.3	5291	5291	12.7	BRIDGE
174340	11500	5279.0	5296	5289	10.0	
174891	11500	5279.6	5296	5288	8.4	
175159	11500	5280.6	5293	5288	7.4	DROP STRUCTURE
175660	11500	5283.8	5297	5292	8.2	
176056	11500	5284.3	5298	5293	8.8	
176377	11500	5284.7	5297	5292	7.3	
176789	11500	5285.1	5292	5291	5.9	
176824	11500	5285.5	5293	5292	6.5	DROP STRUCTURE
176886	11500	5287.9	5293	5292	4.1	
177066	11500	5287.5	5292	5295	4.5	DROP STRUCTURE
177193	11500	5288.6	5291	5295	2.4	DROP STRUCTURE
177515	11500	5292.2	5298	5297	4.8	DROP STRUCTURE
177770	11500	5294.6	5299	5300	4.4	DROP STRUCTURE
178013	11500	5296.5	5302	5302	6.5	
178047	11500	5299.5	5306	5306	6.5	UNION AVENUE WEIR
178136	11500	5302.0	5306	5306	4.0	
178312	11500	5302.5	5311	5310	7.6	UNION AVENUE
178345	11500	5302.5	5311	5310	7.5	BRIDGE
178710	11500	5302.8	5306	5305	2.2	D/S BIG DRY CREEK
178929	9000	5303.6	5305	5307	1.4	U/S BIG DRY CREEK
179276	9000	5303.7	5306	5308	2.3	
180031	9000	5304.1	5307	5307	2.9	
180660	8400	5304.8	5309	5310	4.2	
181202	8400	5305.5	5309	5309	3.5	
181619	8400	5306.2	5317	5316	9.8	BELLEVIEW AVENUE
181757	8400	5306.3	5317	5316	9.7	BRIDGE
182401	8400	5307.3	5313	5311	3.7	D/S SLAUGHTERHOUSE GULCH
182911	8400	5308.5	5322	5322	13.5	PRINCE STREET
183011	8400	5308.7	5322	5322	13.3	BRIDGE
183558	8400	5310.5	5315	5317	4.5	
184118	8000	5311.5	5316	5320	4.5	
184672	8000	5312.7	5318	5320	5.3	
185084	8000	5313.2	5317	5320	3.8	
185496	8000	5314.2	5316	5317	1.8	
185835	8000	5314.6	5321	5321	6.4	PEDESTRIAN
185845	8000	5314.7	5321	5321	6.3	BRIDGE
186176	8000	5315.3	5319	5317	1.7	
186656	8000	5316.1	5327	5328	10.9	BOWLES AVENUE
186730	8000	5316.2	5327	5328	10.8	BRIDGE
187081	8000	5316.9	5320	5322	3.1	D/S LITTLE'S CREEK
187468	8000	5317.7	5321	5322	3.3	U/S LITTLE'S CREEK
187747	8000	5318.3	5324	5323	4.7	
188438	8000	5320.4	5327	5327	6.6	PEDESTRIAN
188448	8000	5320.5	5327	5327	6.5	BRIDGE
188719	8000	5320.7	5324	5324	3.3	
189118	8000	5321.9	5325	5325	3.1	
189774	8000	5323.2	5326	5326	2.8	
190130	8000	5324.0	5327	5327	3.0	
190595	8000	5325.6	5329	5328	2.4	
191191	8000	5326.9	5330	5330	3.1	D/S DUTCH CREEK
191586	5400	5328.3	5332	5332	3.7	U/S DUTCH CREEK
191994	5400	5328.7	5331	5331	2.3	
192241	5400	5329.2	5333	5333	3.8	D/S LEE GULCH
192538	5400	5329.8	5334	5335	4.2	U/S LEE GULCH
192596	5400	5329.5	5334	5335	4.5	DROP STRUCTURE
193094	5400	5332.0	5338	5335	3.0	
193152	5400	5332.4	5338	5337	4.6	DROP STRUCTURE
193769	5400	5335.4	5342	5346	6.6	
193886	5400	5338.5	5346	5346	7.5	DROP STRUCTURE
194122	5400	5340.7	5345	5346	4.3	U/S STUDY LIMIT

* Freeboard listed at bridges is at the estimated ground elevation near the bridge and does not represent the elevation of the bridge low chord.

SECTION 3.0
CONCLUSIONS

3.1 Conclusions

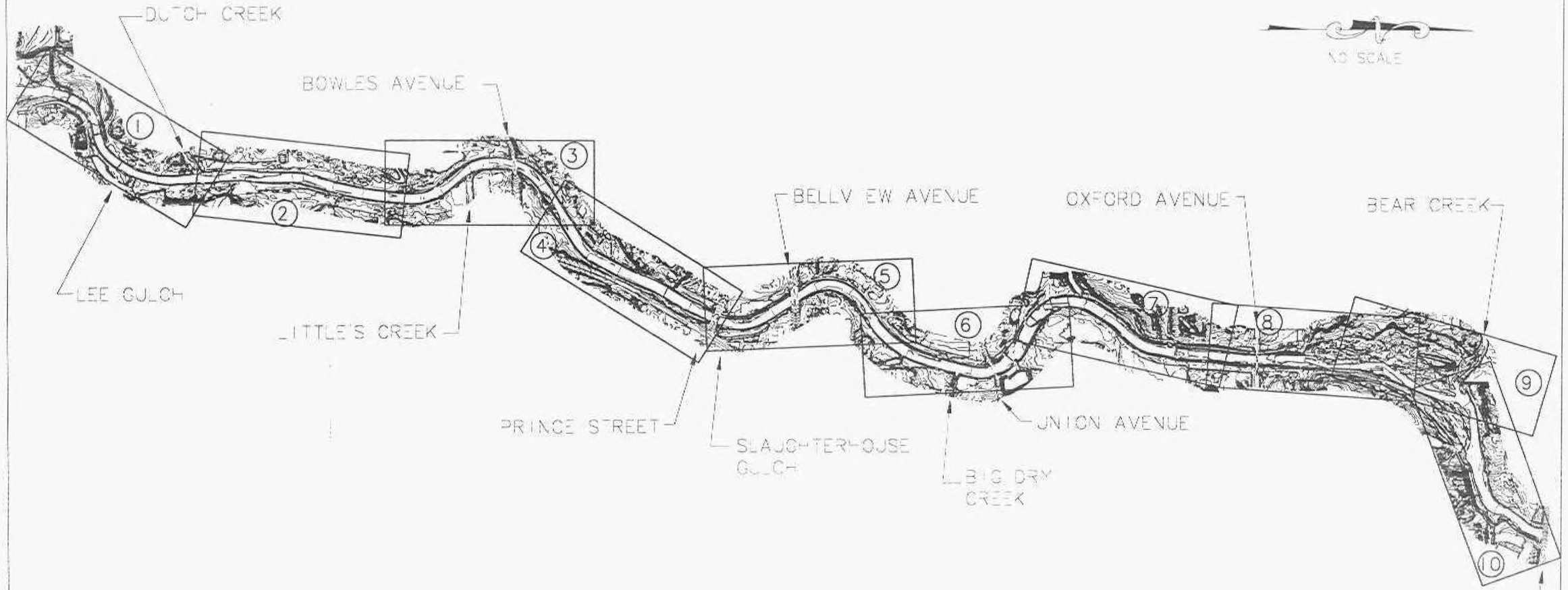
The South Platte River channel has changed somewhat from the as-constructed condition due to sedimentation, degradation and, to a lesser extent, the occurrence of volunteer willows and other trees. However, based on the information developed by this study, the capacity of the channelized portion of the South Platte River is sufficient to contain the entire 100-year discharge with sufficient freeboard to provide a safety factor to the calculated capacities. Therefore, the growth of native vegetation on the channel banks has not significantly reduced the capacity of the Corps' constructed channel.

SECTION 4.0
REFERENCES

1. *South Platte River Downstream Channel Improvements, Chatfield Lake, Colorado, Operation and Maintenance Manual*, U.S. Army Engineer District, Corps of Engineers, Omaha, Nebraska, 1990.

2. *South Platte River Channel Capacity Analysis, Manning's "n" Value Report*, ICON Engineering, Inc., April 1998.

3. *Flood Hazard Area Delineation, South Platte River, Denver Metropolitan Area, Sand Creek to Oxford Ave.*, Wright Water Engineers, Inc., September 1985.



SOUTH PLATTE RIVER

No.	DATE	REVISIONS	APPR.

GROUND CONTROL SURVEY BY ACCURATE CONSULTANTS, INC.
AERIAL PHOTOGRAPHY BY HUNTLEY AERIAL SURVEYS, INC.
TOPOGRAPHIC MAPPING BY TRANSVISION, SANTA CLARA, CA
CONTOUR INTERVAL 1' DATE FLOWN: MAY 1997

PROJECT No. 97-020-016-352

DRAWN CDJ
DESIGNED CDJ
CHECKED DJW

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
COLORADO WATER CONSERVATION BOARD

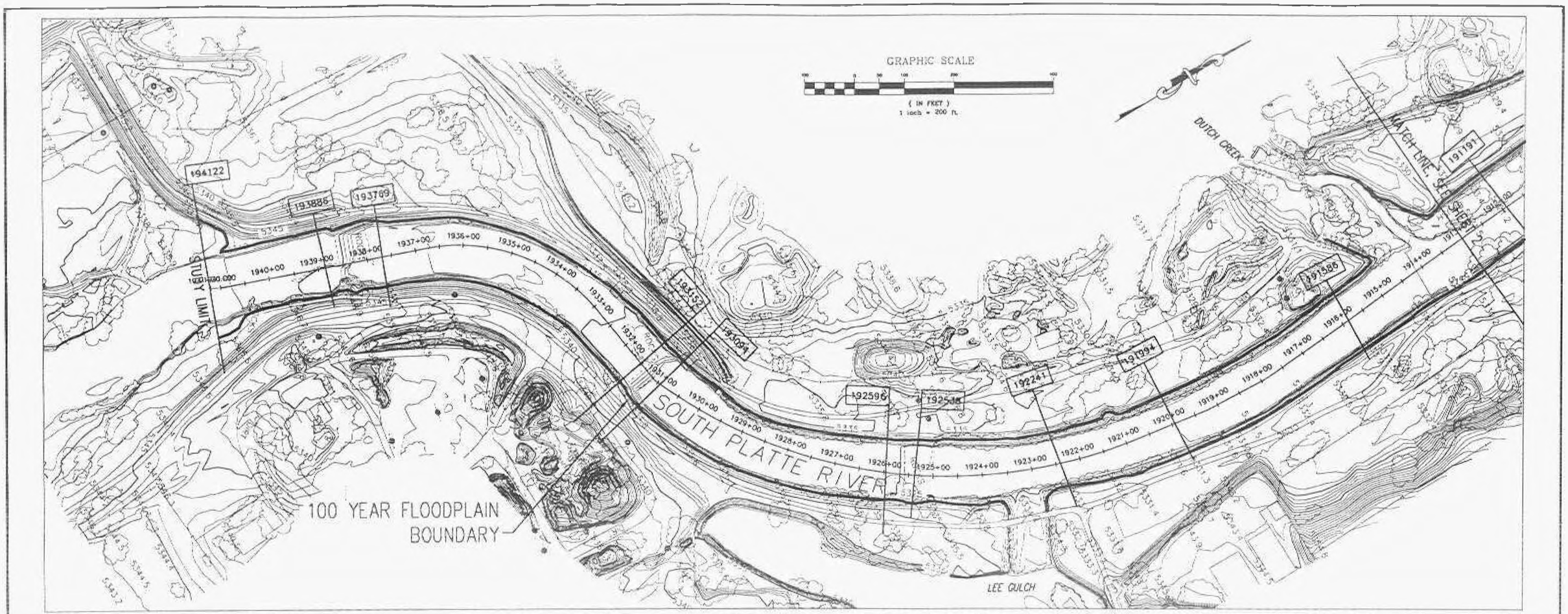
ICON ENGINEERING, INC

SOUTH PLATTE RIVER

CHANNEL CAPACITY ANALYSIS

DATE MAR 98

SHEET INDEX



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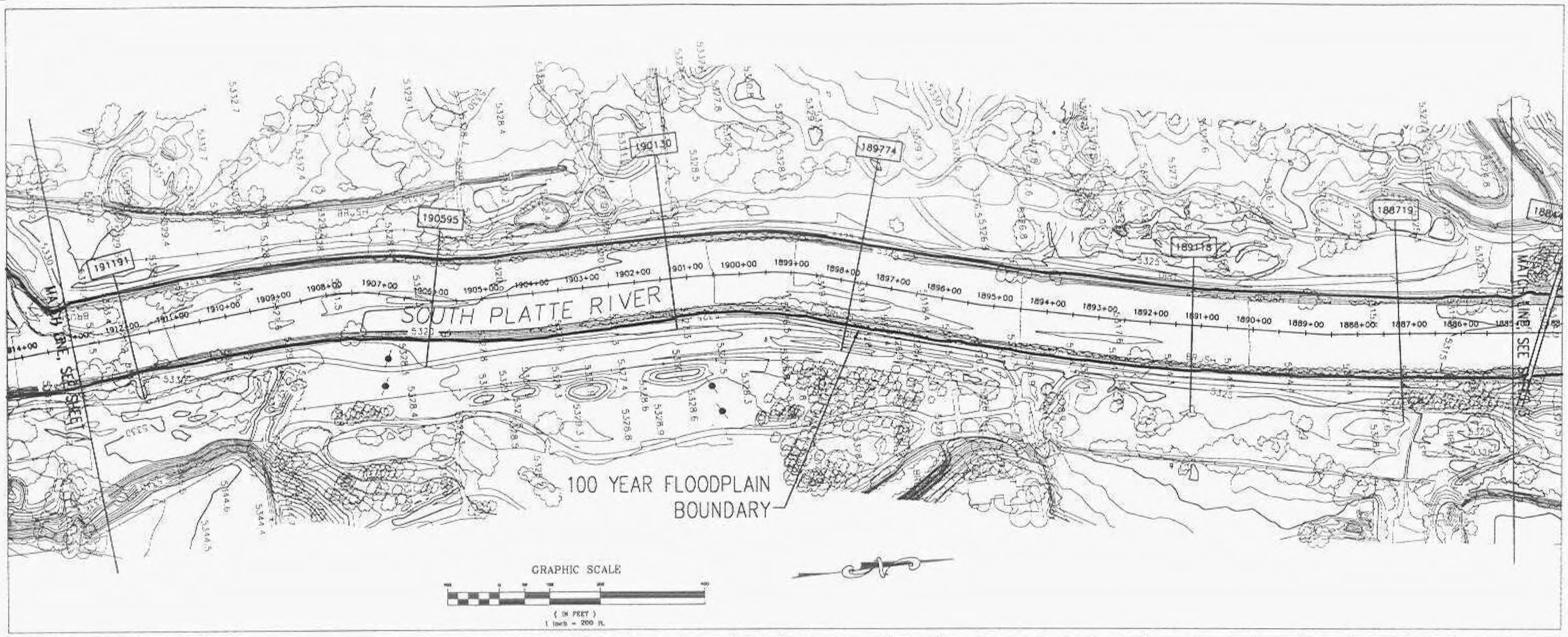
SOUTH PLATTE RIVER
CHANNEL CAPACITY ANALYSIS
STATION 1913+00 TO STATION 1941+22

DATE MAR 98

SHEET 1 OF 10



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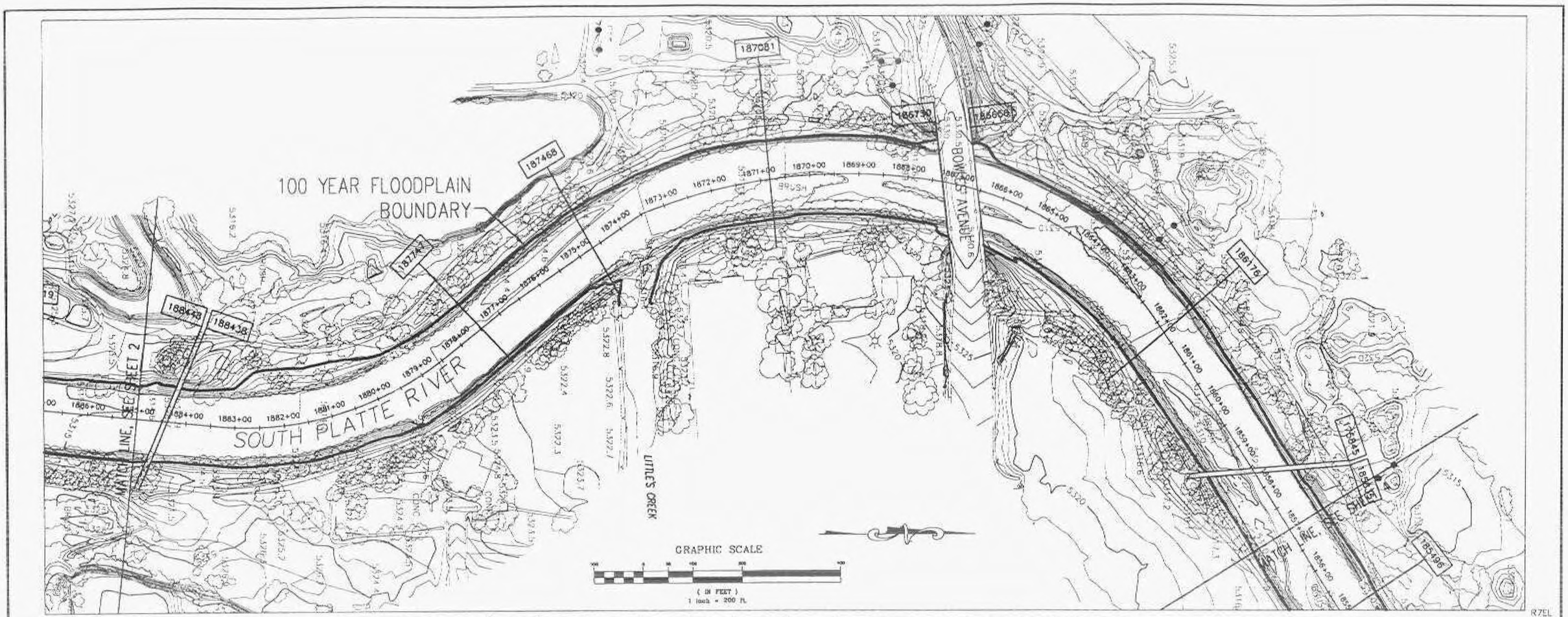
SOUTH PLATTE RIVER
CHANNEL CAPACITY ANALYIS

STATION 1885+00 TO STATION 1913+00

DATE MAR 98

SHEET 2 OF 10



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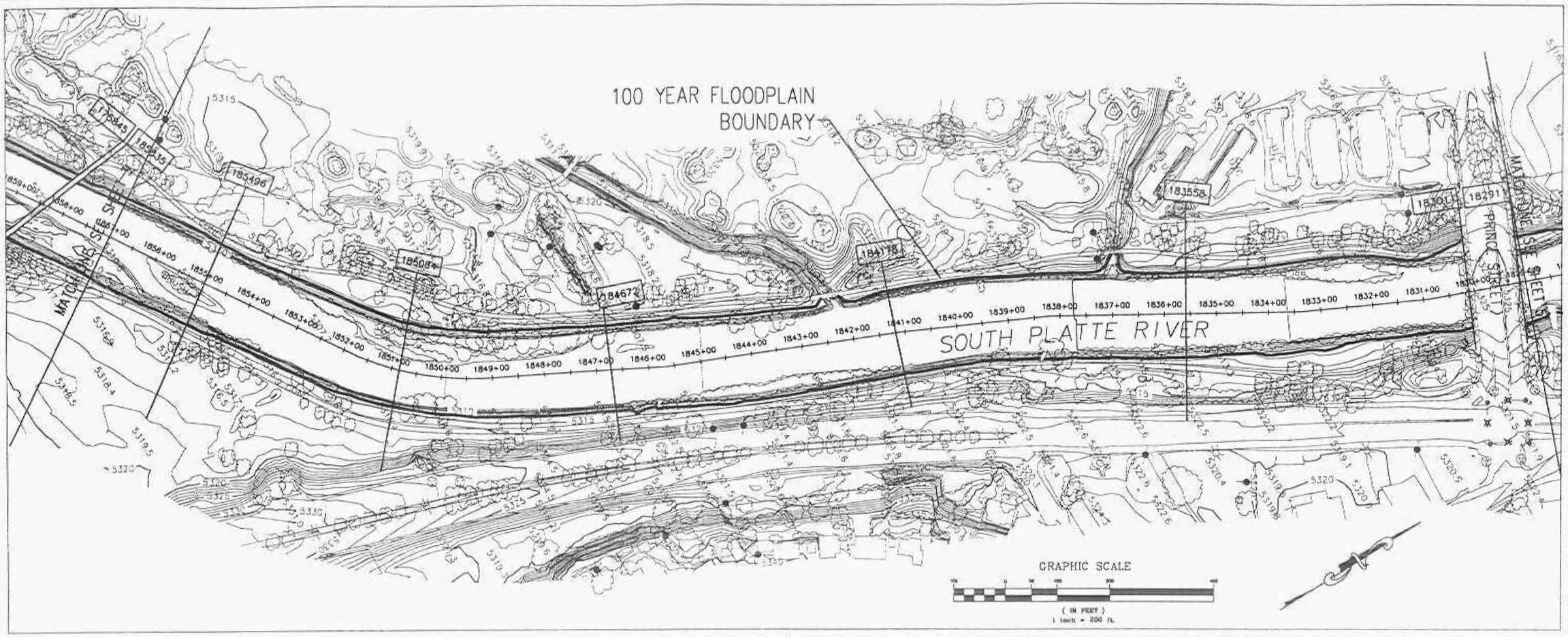
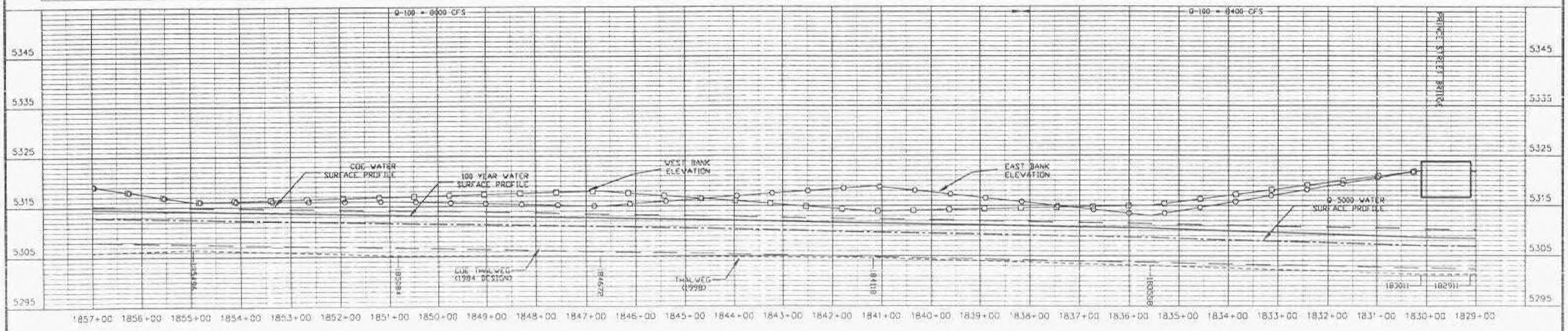
SOUTH PLATTE RIVER
CHANNEL CAPACITY ANALYSIS
STATION 1857+00 TO STATION 1885+00

DATE MAR 98

SHEET 3 OF 10





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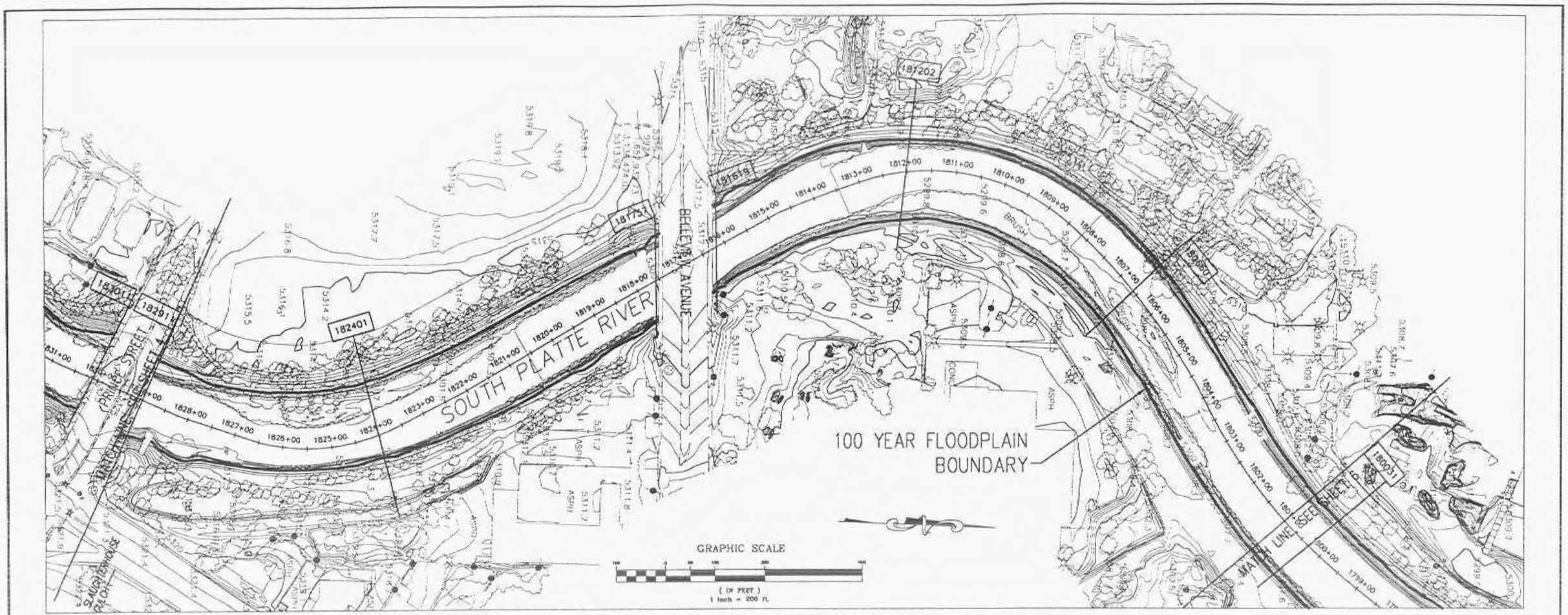
CHANNEL CAPACITY ANALYSIS
STATION 1829+00 TO STATION 1857+00

DATE MAR 98

SHEET 4 OF 10



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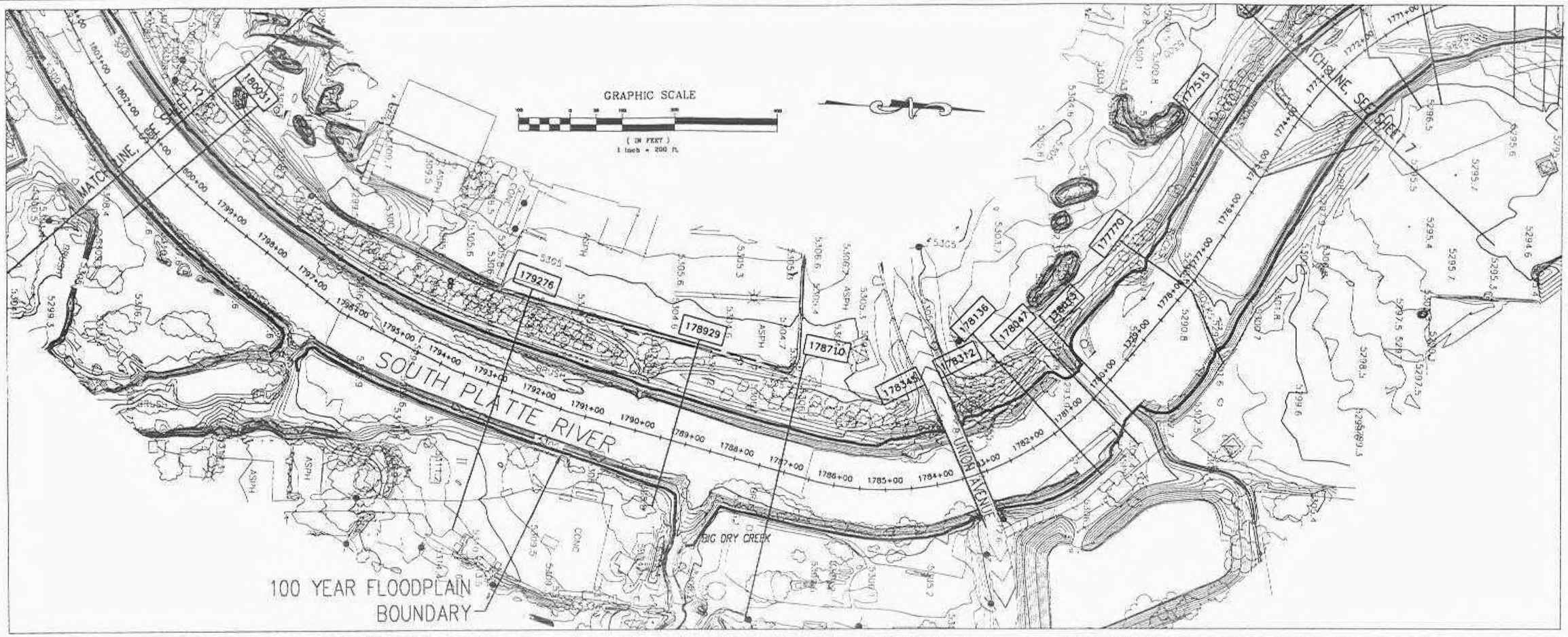
SOUTH PLATTE RIVER
CHANNEL CAPACITY ANALYSIS

STATION 1801+00 TO STATION 1829+00

DATE MAR 98

SHEET 5 OF 10



No.	DATE	REVISIONS	APPR.

GROUND CONTROL SURVEY BY ACCURATE CONSULTANTS, INC.
AERIAL PHOTOGRAPHY BY HUNTLEY AERIAL SURVEYS, INC.
TOPOGRAPHIC MAPPING BY TRANSVISION, SANTA CLARA, CA
CONTOUR INTERVAL 1' DATE FLOWN MAY 1997

PROJECT No. 97-020-016-415

DRAWN CDJ
DESIGNED CDJ
CHECKED DJW

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
COLORADO WATER CONSERVATION BOARD

ICON ENGINEERING, INC
7600 E. Orchard Road, Suite 370 S, Greenwood Village, CO 80111-2556
Phone: (303) 220-2600 Fax: (303) 220-2616

SOUTH PLATTE RIVER
CHANNEL CAPACITY ANALYSIS
STATION 1773+00 TO STATION 1801+00

DATE MAR 98

SHEET 6 OF 10

GRAPHIC SCALE

(IN FEET)
1 inch = 200 ft.

100 YEAR FLOODPLAIN BOUNDARY

SOUTH PLATTE RIVER

MATCH LINE, SEE SHEET 6

MATCH LINE, SEE SHEET 8

176789 176824 176886 176377 176056 175660 175159 174891

Q-100 = 11500 CFS

100 YEAR WATER SURFACE PROFILE

WEST BANK ELEVATION

EAST BANK ELEVATION

Q-5000 WATER SURFACE PROFILE

THALWEG ELEVATION

5310 5300 5290 5280 5270 5260

1773+00 1772+00 1771+00 1770+00 1769+00 1768+00 1767+00 1766+00 1765+00 1764+00 1763+00 1762+00 1761+00 1760+00 1759+00 1758+00 1757+00 1756+00 1755+00 1754+00 1753+00 1752+00 1751+00 1750+00 1749+00 1748+00 1747+00 1746+00 1745+00

No.	DATE	REVISIONS	APPR

GROUND CONTROL SURVEY BY ACCURATE CONSULTANTS, INC.
AERIAL PHOTOGRAPHY BY HUNTLEY AERIAL SURVEYS, INC.
TOPOGRAPHIC MAPPING BY TRANSVISION, SANTA CLARA, CA
CONTOUR INTERVAL 1' DATE FLOWN MAY 1997

PROJECT No. 97-020-016-352

DRAWN CDJ
DESIGNED DJW
CHECKED CDJ

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
COLORADO WATER CONSERVATION BOARD

ICON ENGINEERING, INC
7000-G South Alton Way, Englewood, CO 80112-2106
Phone (303) 221-2600 Fax (303) 221-1979

SOUTH PLATTE RIVER
CHANNEL CAPACITY ANALYSIS

STATION 1745+00 TO STATION 1773+00

DATE MAR 98

SHEET 7 OF 10

GRAPHIC SCALE

(IN FEET)
1 inch = 200 ft.

100 YEAR FLOODPLAIN BOUNDARY

SEE SHEET 7

SEE SHEET 9

OXFORD AVENUE

SOUTH PLATTE RIVER

173908 173878 173753 173524 173252 173241 172431 171825 174340

Q-100 = 11500 CFS

Q-100 = 13500 CFS

DETENTION POND OUTFALL

PEDESTRIAN BRIDGE

WEST BANK ELEVATION

EAST BANK ELEVATION

Q 5000 WATER SURFACE PROFILE

100 YEAR WATER SURFACE PROFILE

THALWEG (1998)

5305
5295
5285
5275
5265
5255

1745+00 1744+00 1743+00 1742+00 1741+00 1740+00 1739+00 1738+00 1737+00 1736+00 1735+00 1734+00 1733+00 1732+00 1731+00 1730+00 1729+00 1728+00 1727+00 1726+00 1725+00 1724+00 1723+00 1722+00 1721+00 1720+00

No.	DATE	REVISIONS	APPR.

GROUND CONTROL SURVEY BY ACCURATE CONSULTANTS, INC.
AERIAL PHOTOGRAPHY BY HUNTLEY AERIAL SURVEYS, INC.
TOPOGRAPHIC MAPPING BY TRANSVISION, SANTA CLARA, CA
CONTOUR INTERVAL 1' DATE FLOWN: MAY 1997

PROJECT No. 97-020-018-415

DRAWN CDJ
DESIGNED CDJ
CHECKED DJW

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
COLORADO WATER CONSERVATION BOARD

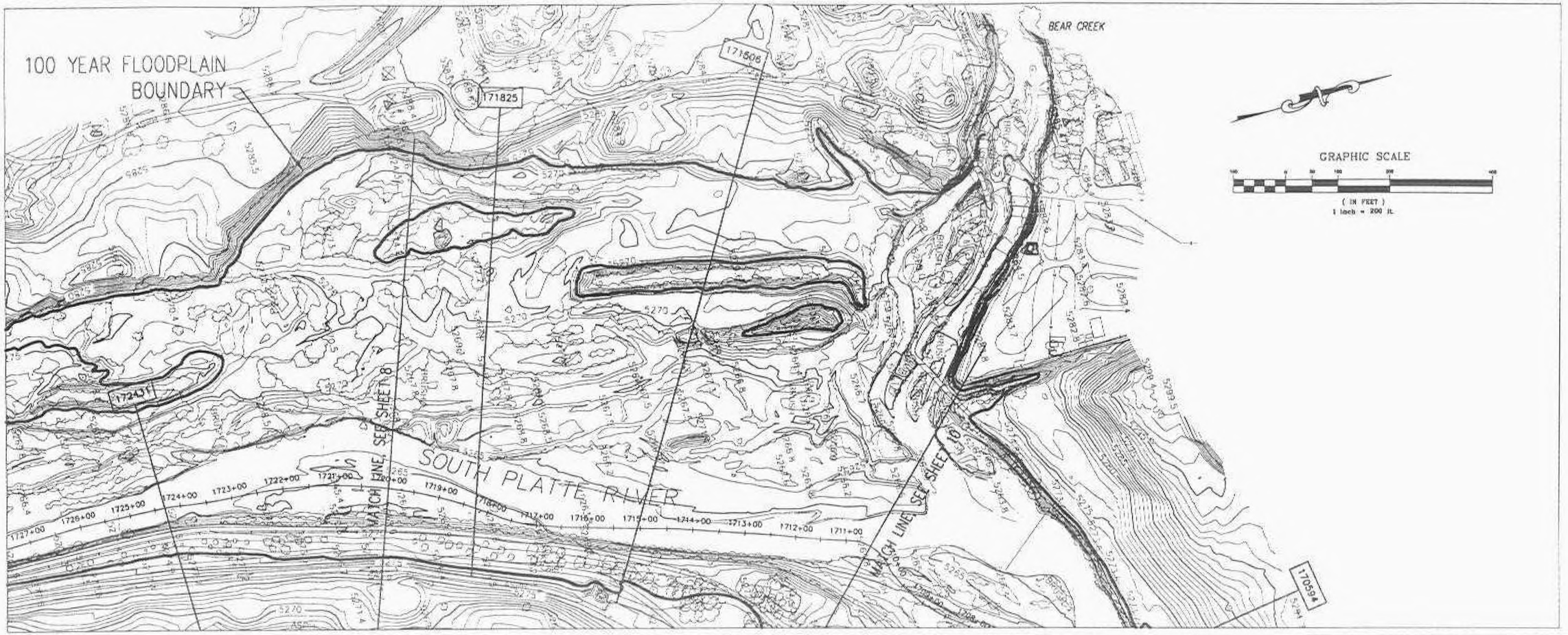
ICON ENGINEERING, INC
1100 S. South Alton Way, Englewood, CO 80111-2148
Phone: (303) 771-0900 Fax: (303) 771-1979

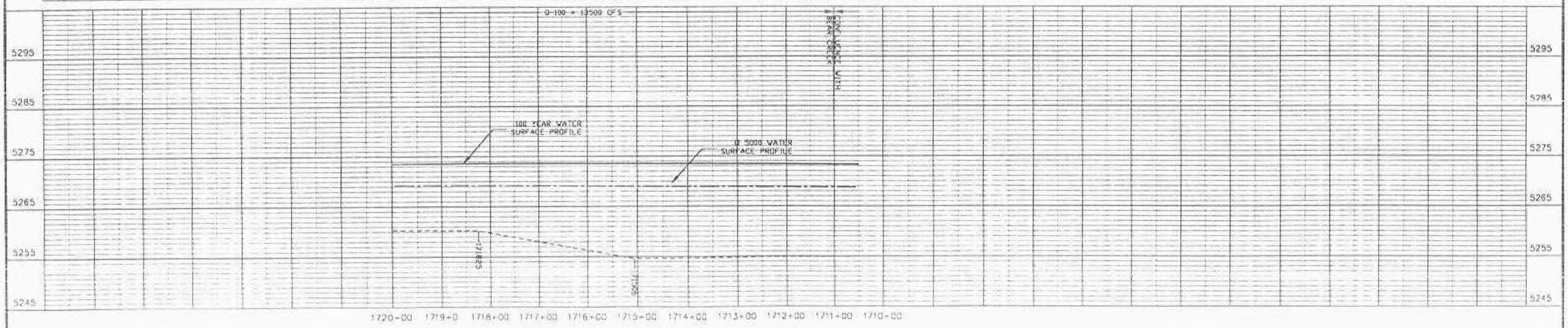
SOUTH PLATTE RIVER
CHANNEL CAPACITY ANALYSIS

STATION 1720+00 TO STATION 1745+00

DATE
MAR 98

SHEET
8 OF 10





No.	DATE	REVISIONS	APPR.

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AERIAL PHOTOGRAPHY BY HUNTLEY AERIAL SURVEYS, INC.
TOPOGRAPHIC MAPPING BY TRANSVISION, SANTA CLARA, CA
CONTOUR INTERVAL 1' DATE FLOWN MAY 1997

PROJECT No. 97-020-016-415

DRAWN CDJ
DESIGNED CDJ
CHECKED DJW

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
COLORADO WATER CONSERVATION BOARD

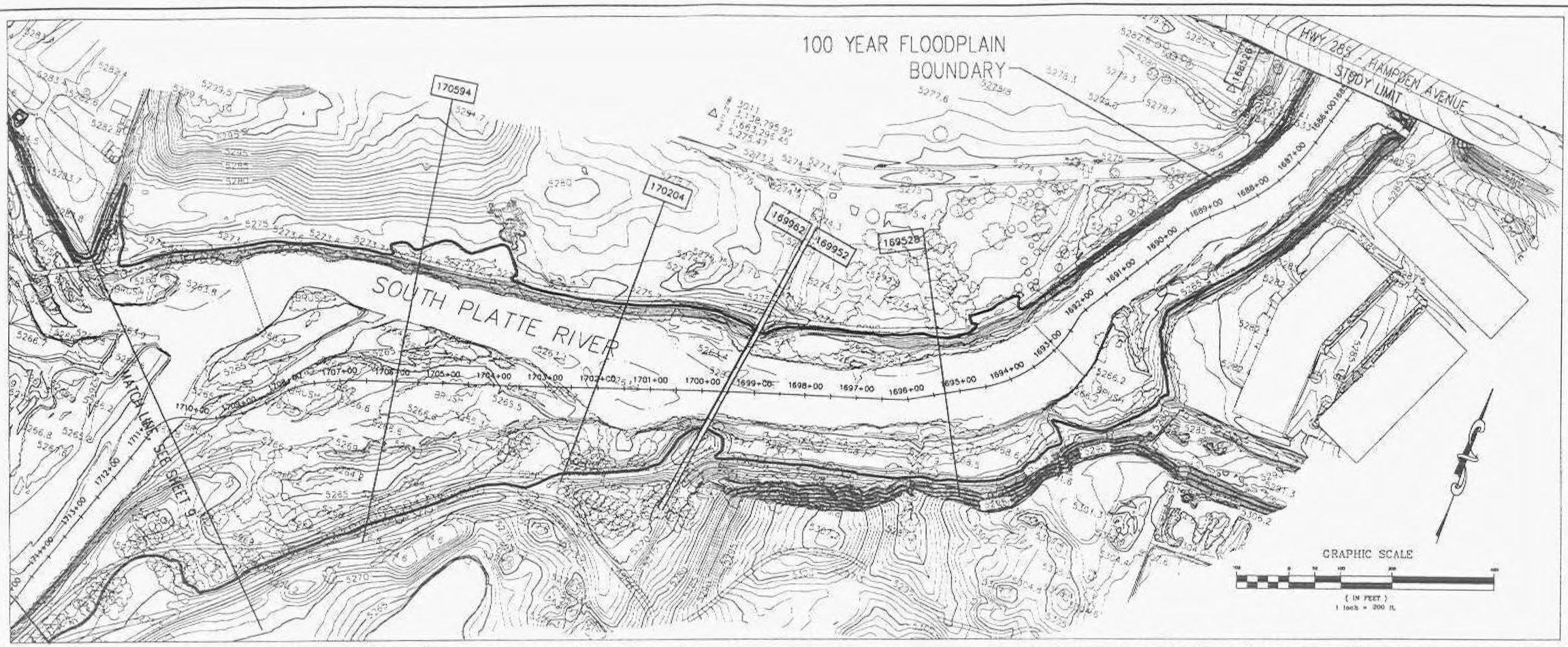
ICON ENGINEERING, INC
1100 S. South Acres Way, Englewood, CO 80112-1106
Phone: (303) 771-0900 FAX: (303) 771-1975

SOUTH PLATTE RIVER
CHANNEL CAPACITY ANALYSIS

STATION 1710+50 TO STATION 1720+00

DATE MAR 98

SHEET 9 OF 10



No.	DATE	REVISIONS	APPR.

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AERIAL PHOTOGRAPHY BY HUNTLEY AERIAL SURVEYS, INC.
TOPOGRAPHIC MAPPING BY TRANSMISSION, SANTA CLARA, CA
CONTOUR INTERVAL 1' DATE FLOWN MAY 1997

PROJECT No. 97-020-016-415

DRAWN CDJ
DESIGNED CDJ
CHECKED DJW

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
COLORADO WATER CONSERVATION BOARD

ICON ENGINEERING, INC
1768 S. South Allen Way, Englewood, CO 80112-2105
Phone: (303) 771-0900 Fax: (303) 771-4278

SOUTH PLATTE RIVER
CHANNEL CAPACITY ANALYSIS
STATION 1685+26 TO STATION 1710+50

DATE MAR 98

SHEET 10 OF 10