IFC Submittal

ReTRAC Drainage Report
Reno, Nevada

VOLUME 2

Prepared for:

RENO

Prepared by:

Stantec

80100603
December 2004

IFC SUBMITTAL

ReTRAC Drainage Report
Reno, Nevada

Prepared for:

RENO

Prepared by:

Stantec

TRINA M.
MAGOON
CIVIL
No 13963
Trina Magoon
12/1[illegible]
exp 12/31/05

December 2004

Project No. 80100603

Volume 2

W. Second St.

IFC SUBMITTAL

January 20, 2004
Project No. 80100603

Mr. Avrum Loewenstein
ReTRAC
Parsons Transportation Group
264 Keystone Avenue
Reno, Nevada 89503

Reference: **ReTRAC Hydrologic Design Memorandum for the Dickerson Road Street Improvements**

Dear Mr. Loewenstein:

This letter report is to document the design parameters and assumptions for the Dickerson Road Extension. The proposed extension will link Chism Street to the existing Dickerson Road/West Second Street intersection.

The Rational Method was used to develop the 100-year, existing and proposed conditions, onsite and offsite peak flow rates. The Dickerson Road Extension watershed was delineated utilizing the ReTRAC 1-foot contour interval topographic mapping and the proposed improvements for the extension and the ReTRAC proposed improvement plans.

The existing conditions contributing watershed for the Dickerson Road Extension has been delineated and is shown on Figure 1, Existing Conditions Dickerson Extension Watershed Map located in the Appendix. The existing basins cover approximately 4.1 acres of land that is bounded by the south half of the existing rail to the north, the West Second Street Underpass to the west, Chism Street to the east and the proposed Dickerson Road right-of-way to the south. Existing land cover is predominantly vacant. Flows from basins E1 and E2 are conveyed south via sheet flow toward West Second Street. The concentration points for basins E1 and E2 are located at the intersection of West Second Street and Dickerson Road and the intersection of Dickerson Road and Chism Street, respectively. The existing conditions 5-year and 100-year peak flow rate at concentration points E1 and E2 were found to be 0.7cfs and 1.8cfs and 1.1cfs and 2.9cfs, respectively. The existing conditions Rational Method calculations and backup data are located in the Appendix.

Proposed improvements will consist of approximately 1240-feet of roadway improvements for the Dickerson Extension and approximately 900-feet of rail side ditch. The rail side ditch will convey a portion of flows easterly to the ReTRAC trench storm drain system that historically were conveyed south to West Second Street. The proposed improvements are shown on the Reno ReTRAC Dickerson Street Improvements Plans located in the Appendix.

The proposed conditions watersheds, Basins P1, P2 and P3, have been delineated and are shown on Figure 2, Proposed Conditions Dickerson Extension Watershed Map located in the Appendix. Flows from Basin P1 drain the westerly portion of the south half of the rail and a portion of the Dickerson Road Extension to a concentration point at the intersection of West Second Street and Dickerson Road. Flows from Basin P2 are conveyed easterly to a concentration point at the intersection of Dickerson Road and Chism Street. Flows from Basin P3 are conveyed easterly in the ReTRAC rail side ditch to an inlet that connects to the trench storm drain system. The proposed conditions 5-year and 100-year peak flow rate at concentration points P1, P2 and P3 were found to be 0.9 cfs and 2.4cfs, 1.3cfs and 3.5cfs and 1.3cfs and 3.5cfs, respectively. The proposed conditions Rational Method calculations and backup data are located in the Appendix.

The proposed rail-side ditch that conveys flows to the ReTRAC trench storm drain system reduces the amount of flow that historically flowed south to West Second Street. The increase in 100-year peak flow rate south to West Second Street is 1.2cfs. The proposed roadway improvements will not require a subsurface storm drain to convey flows as the road section conveys the peak flow event at an acceptable spread width for both the 5-year and 100-year events. Both events are conveyed without extending more than half way into the lane adjacent from the curb, per City of Reno requirements. Typical gutter section spread flow calculations are located in the Appendix.

Sincerely,

STANTEC CONSULTING INC.

Trina Magoon

Trina M. Magoon, PE
Project Manager, Water Resources

PROFESSIONAL ENGINEER-STATE OF NEVADA
TRINA M.
MAGOON
CIVIL
1/20/04
No. 13963
Exp 12/31/05

TMM:ac

Enclosure(s)
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RATIONAL METHOD - Existing Conditions															
							Washoe County, Figure: 701, "Travel Time Velocity"			Reno Public Works, "Rainfall Intensity Chart," (10min. Minimum)		See Weighted Cvalues Worksheet			
BASIN	**A (ft²)**	**A (acre)**	**L (ft)**	**Hi (ft)**	**Lo (ft)**	**S (%)**	**Land Type**	**V (ft/s)**	**Tc (min)**	**i5 (in/hr)**	**i100 (in/hr)**	**C5weight**	**C100weight**	**Q5 (cfs)**	**Q100 (cfs)**
E1	58290	1.34	1940	4918	4822	4.9	Nearly Bare and Untilled	2.5	12.9	1.4	3.8	0.00	0.35	0.66	1.78
E2	120224	2.76	1378	5014	4950	4.6	Nearly Bare and Untilled	2.2	10.4	1.1	3	0.00	0.35	1.06	2.90
	178514	*4.1*	*Check Total Project Area*										**Total:**	1.72	4.68

RATIONAL METHOD - Proposed Conditions															
							Washoe County, Figure: 701, "Travel Time Velocity"			Reno Public Works, "Rainfall Intensity Chart," (10min. Minimum)		See Weighted Cvalues Worksheet			
BASIN	**A (ft²)**	**A (acre)**	**L (ft)**	**Hi (ft)**	**Lo (ft)**	**S (%)**		**V (ft/s)**	**Tc (min)**	**i5 (in/hr)**	**i100 (in/hr)**	**C5weight**	**C100weight**	**Q5 (cfs)**	**Q100 (cfs)**
P1	41325	0.95	674	4875	4822	7.9	Paved	2.2	10.0	1.4	3.8	0.00	0.66	0.87	2.37
P2	63998	1.47	775	4994	4934	7.7	Paved	1.8	10.0	1.4	3.8	0.00	0.63	1.30	3.54
P3	73191	1.68	340	5007	4951	16.5	Paved	2.0	12.0	1.25	3.4	0.00	0.61	1.27	3.46
	178514	*4.1*	*Check Total Project Area*										**Total:**	3.45	9.37
													***Increased:**	0.45	1.23
		*Increase south													

TIME OF CONCENTRATION

SUB-BASIN DATA			INITIAL/OVERLAND TIME (Ti)					TRAVEL TIME (Tt)						$T_{c\ (Ti+Tt)}$	Tc Urbanized Basins Check		Final Tc	REMARKS
BASIN	R=C5	AREA Ac	L_i (ft)	Hi_i	Lo_i	S_i (%)	T_i	L_1 (ft)	Hi_1	Lo_1	S_1 (%)	V_1 (f/s)	Tt	Tc Min	Total L Ft	Tc=(L/180)+10 Min	Min	
E1	0.35	1.34	48	4529.7	4528.0	3.5	6.2	211.0	4528.0	4520.2	3.7	2.0	1.8	**7.9**	259	**11.4**	7.9	Tc=10
E2	0.35	2.76	130	4531.0	4528.0	2.3	11.7	757.0	4528.0	4522.9	0.7	0.9	14.8	**26.5**	887	**14.9**	14.9	Tc=14.9
P1	0.66	0.9	22	4530.0	4529.0	4.5	2.3	546.0	4529.0	4522.5	1.2	2.2	4.1	**6.4**	568	**13.2**	6.4	Tc=10
P2	0.63	1.5	24	4531.0	4529.0	8.3	2.1	708.0	4529.0	4522.9	0.9	1.8	6.6	**8.6**	732	**14.1**	8.6	Tc=10
P3	0.61	1.7	41	4469.5	4468.7	2.0	4.5	900.0	4522.0	4513.0	1.0	2.0	7.5	**12.0**	941	**15.2**	12.0	Tc=12

CALCULATONS: WEIGHTED Cvalues

WEIGHTED CVALUES BY AREA

					City of Reno Public Works Design Manual p.209 & Washoe County, Runoff Coefficients Table 701						
EXISTING CONDITIONS											
BASIN		**A (ft^2)**	**A (acre)**	**% Cover By Area**	**Land Use**	**C5**	**C100**	**C5(%A)**	**C100(A%)**	**C5 Weight**	**C100 Weight**
E1		983896	22.59	100.00	Range		0.35		0.35		0.35
E2		781066	17.93	100.00	Range		0.35		0.35		0.35
PROPOSED CONDITIONS											
P1		9462	0.22	18.6	Rail (subbase)		0.50		0.09		
		16834	0.39	33.1	Range		0.35		0.12		
		24497	0.56	48.2	Paved		0.93		0.45		
	total	50793		100.00							0.66
P2		32669	0.75	51.0	Range		0.35		0.18		
		31329	0.72	49.0	Paved		0.93		0.46		
	total	63998		100.00							0.63
P3		28124	0.65	44.1	Rail (paved)		0.93		0.41		
		35598	0.82	55.9	Excavated Channel		0.35		0.20		
	total	63723		100.00							0.61

Dickerson Road Extension West 100-year
Worksheet for Gutter Section

Project Description	
Worksheet	Dickerson West - 10(
Type	Gutter Section
Solve For	Spread

P1

Input Data		
Slope	.020180	ft/ft
Discharge	2.37	cfs
Gutter Width	2.00	ft
Gutter Cross Slo|	020000	ft/ft
Road Cross Slop	020000	ft/ft
Mannings Coeffic	0.013	

Results		
Spread	8.08	ft
Flow Area	0.7	ft^2
Depth	0.16	ft
Gutter Depres	0.0	in
Velocity	3.63	ft/s

Dickerson Road Extension West 5-year
Worksheet for Gutter Section

Project Description	
Worksheet	Dickerson West - 5-
Type	Gutter Section
Solve For	Spread

P1

Input Data		
Slope	.020180	ft/ft
Discharge	0.87	cfs
Gutter Width	2.00	ft
Gutter Cross Slo|	020000	ft/ft
Road Cross Slop	020000	ft/ft
Mannings Coeffic	0.013	

Results		
Spread	5.55	ft
Flow Area	0.3	ft²
Depth	0.11	ft
Gutter Depress	0.0	in
Velocity	2.83	ft/s

Dickerson Road Extension East 100-year
Worksheet for Gutter Section

P2

Project Description	
Worksheet	Dickerson East - 100
Type	Gutter Section
Solve For	Spread

Input Data		
Slope	.013410	ft/ft
Discharge	3.54	cfs
Gutter Width	2.00	ft
Gutter Cross Slo|	020000	ft/ft
Road Cross Slop	020000	ft/ft
Mannings Coeffic	0.013	

Results		
Spread	10.14	ft
Flow Area	1.0	ft²
Depth	0.20	ft
Gutter Depres:	0.0	in
Velocity	3.44	ft/s

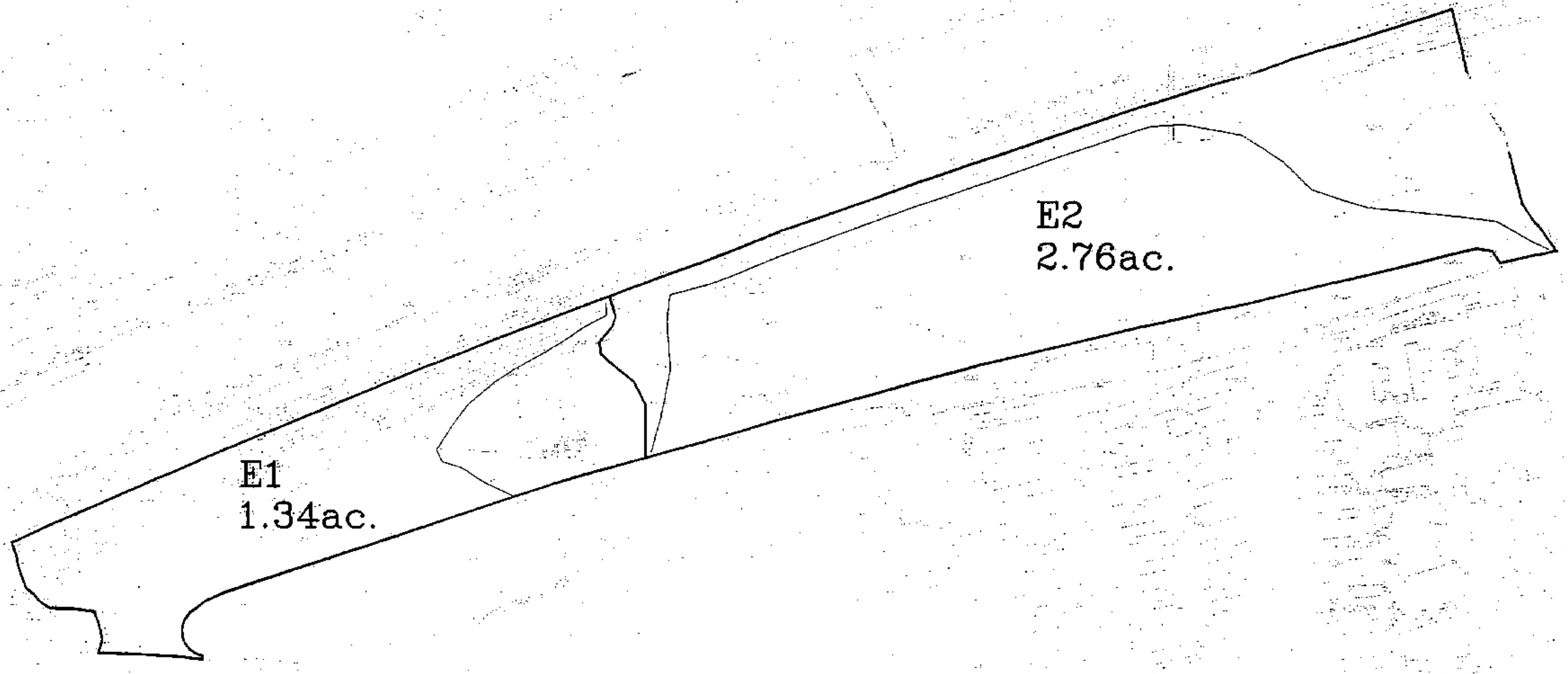
Dickerson Road Extension East 5-year
Worksheet for Gutter Section

Project Description	
Worksheet	Dickerson East - 5-:
Type	Gutter Section
Solve For	Spread

P2

Input Data		
Slope	.013410	ft/ft
Discharge	1.30	cfs
Gutter Width	2.00	ft
Gutter Cross Slo|	020000	ft/ft
Road Cross Slop	020000	ft/ft
Mannings Coeffic	0.013	

Results		
Spread	6.96	ft
Flow Area	0.5	ft²
Depth	0.14	ft
Gutter Depres:	0.0	in
Velocity	2.66	ft/s



REFERENCE
NOT FOR
CONSTRUCTION

RENO ReTRAC
RENO WASHOE COUNTY NEVADA

ReTRAC THE GRANITE TEAM

SUBMITTED
APPROVED

RENO ReTRAC
DICKERSON ROAD EXTENSION
EXISTING CONDITIONS
WATERSHED MAP

DESIGNED BY
DRAWN BY
CHECKED BY
IN CHARGE
DATE

CONTRACT NO.
DRAWING NO.
REV
SCALE
SHEET NO.

REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION
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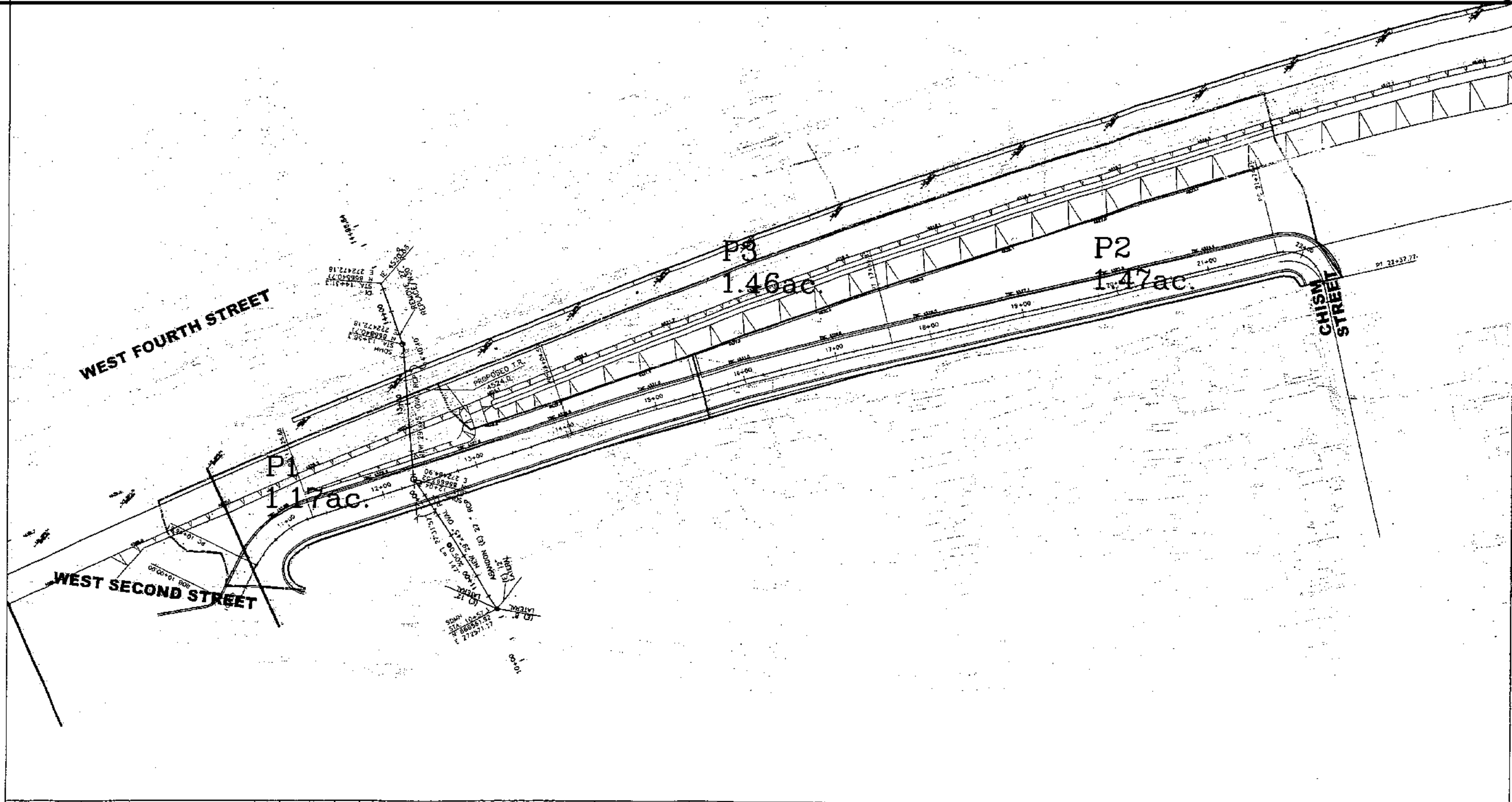
4						10					
3						9					
2						8					
1						7					
0						6					



REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION
5						11					
4						10					
3						9					
2						8					
1						7					
0						6					

DESIGNED BY
DRAWN BY
CHECKED BY
IN CHARGE
DATE

REFERENCE
NOT FOR
CONSTRUCTION

RENO ReTRAC
RENO WASHOE COUNTY NEVADA

ReTRAC THE GRANITE TEAM
SUBMITTED ____________
APPROVED ____________

RENO ReTRAC
DICKERSON ROAD EXTENSION
PROPOSED CONDITIONS
WATERSHED MAP

CONTRACT NO.
DRAWING NO.
REV
SCALE
SHEET NO.

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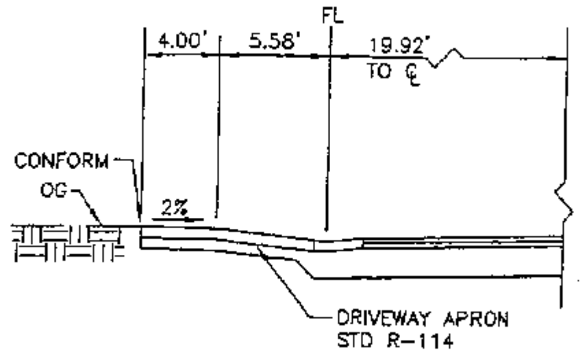
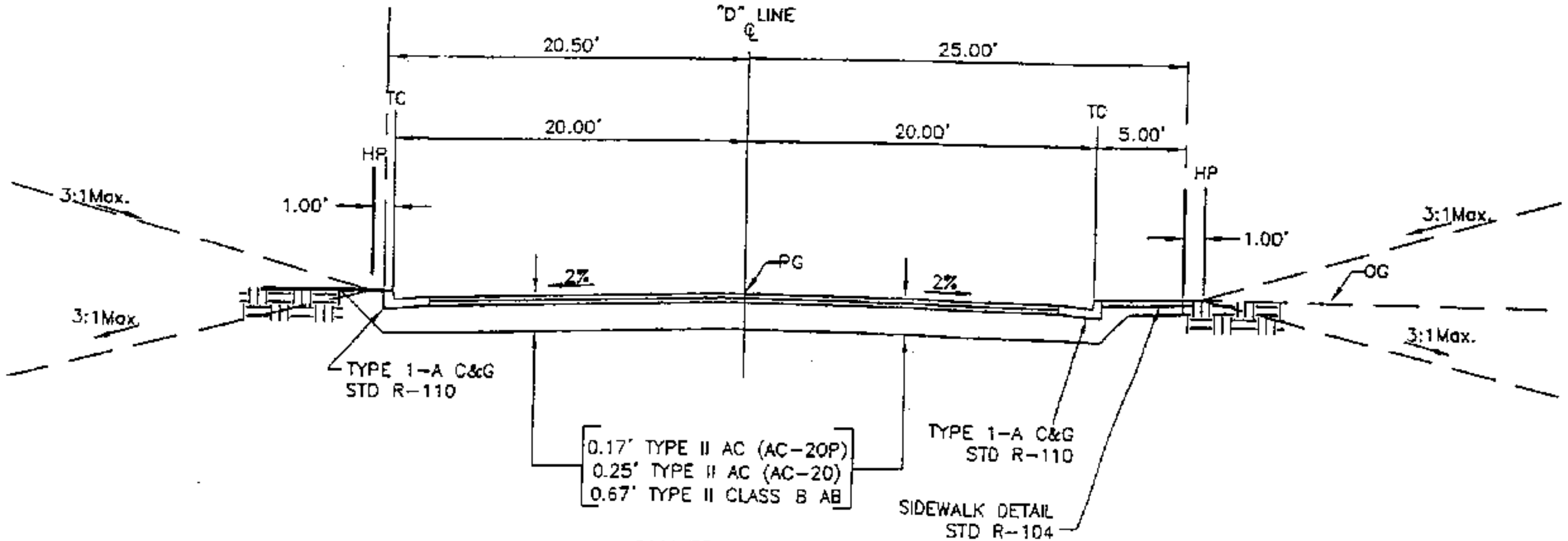


DICKERSON ROAD
DRIVEWAY SECTION

"D" STA 13+27.62 LT



DICKERSON ROAD
TYPICAL SECTION

"D" STA 10+21.11 TO 22+47.77

JON S. ERB
1/7/04
CIVIL
Exp 12/31/04

REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION
0	12/23/03	JSE	AL	MRC	ISSUED FOR CONSTRUCTION						

DESIGNED BY J. ERB
DRAWN BY J. ERB
CHECKED BY S. WHITFIELD
IN CHARGE A. LOEWENSTEIN
DATE 12/23/03

ISSUED FOR CONSTRUCTION

RENO ReTRAC
RENO WASHOE COUNTY NEVADA

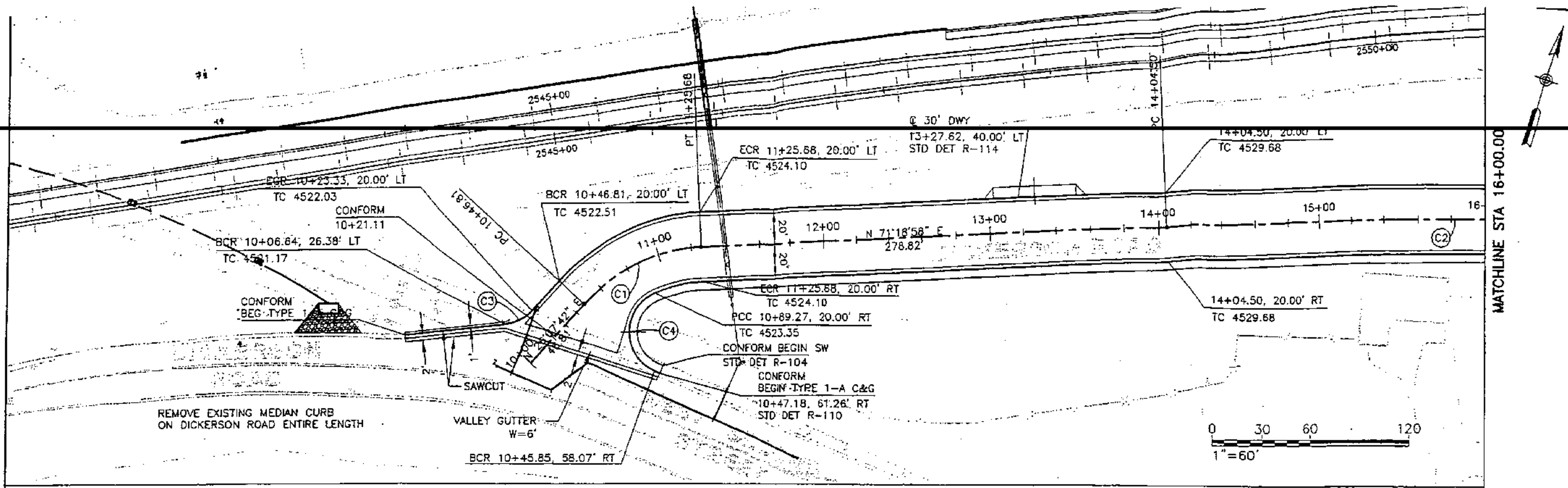
ReTRAC THE GRANITE TEAM

SUBMITTED
APPROVED

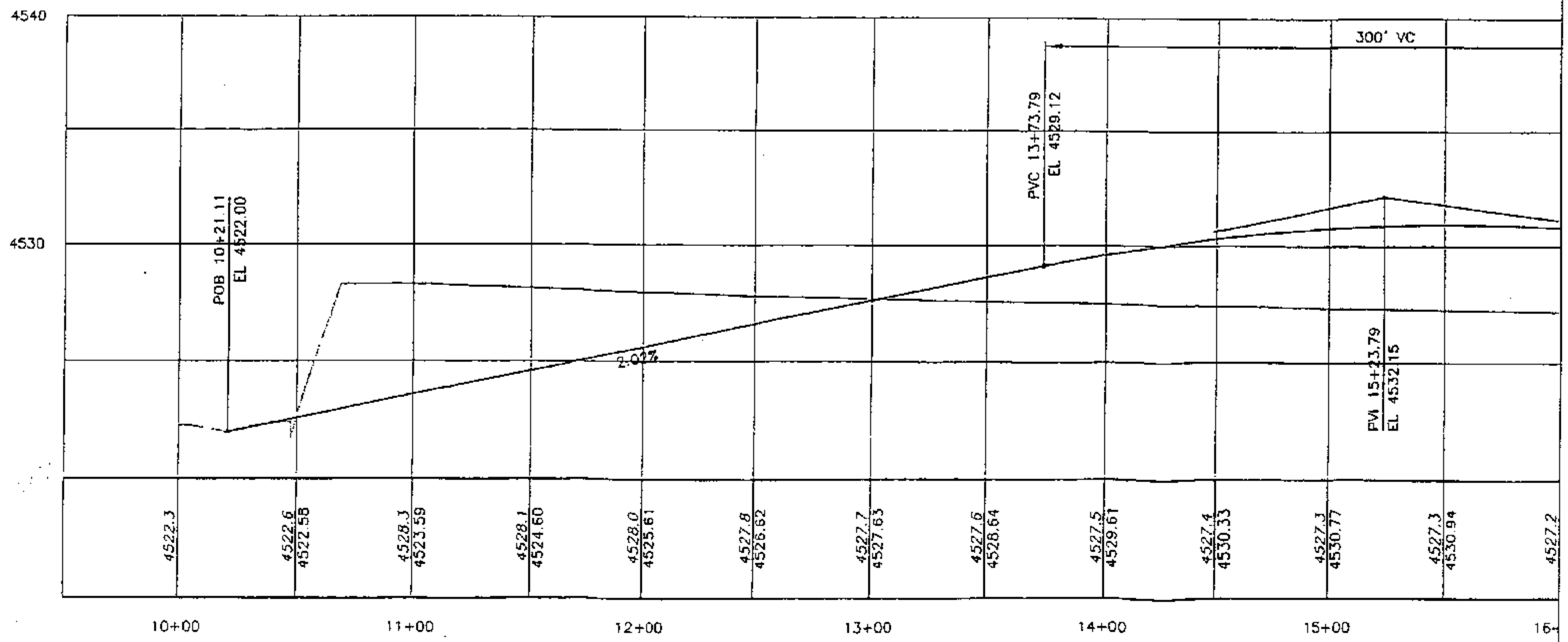
RENO ReTRAC
DICKERSON ROAD EXTENSION
DICKERSON ROAD
TYPICAL SECTION

CONTRACT NO.
DRAWING NO. C-001
REV 0
SCALE NTS

P:\19100 Dickerson\ \Sheet\C-002.dwg, 01/07/2004 05:07:18 PM



CURVE	RADIUS	DELTA	TANGENT	LENGTH
C1	100.00'	45°11'15"	41.61'	78.87'
C2	4000.00'	5°05'25"	177.80'	355.37'
C3	25.00'	41°52'00"	9.56'	18.27'
C4	25.00'	133°26'17"	58.10'	58.22'



JON S. ERB
1/7/04
CIVIL
No. 11287
EXP 12/31/04

REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION
0	12/23/03	JSE	AL	MRC	ISSUED FOR CONSTRUCTION						

DESIGNED BY J. ERB
DRAWN BY K. VAN EATON
CHECKED BY A. LOEWENSTEIN
IN CHARGE M. CHRISTENSEN
DATE 12/23/03

ISSUED FOR CONSTRUCTION

RENO ReTRAC
RENO WASHOE COUNTY NEVADA

ReTRAC THE GRANITE TEAM

SUBMITTED ______
APPROVED ______

RENO ReTRAC
DICKERSON ROAD EXTENSION
PLAN AND PROFILE
STA 10+00 TO STA 16+00

CONTRACT NO.
DRAWING NO. C-002
REV 0
SCALE H:1"=60', V:1"=6'

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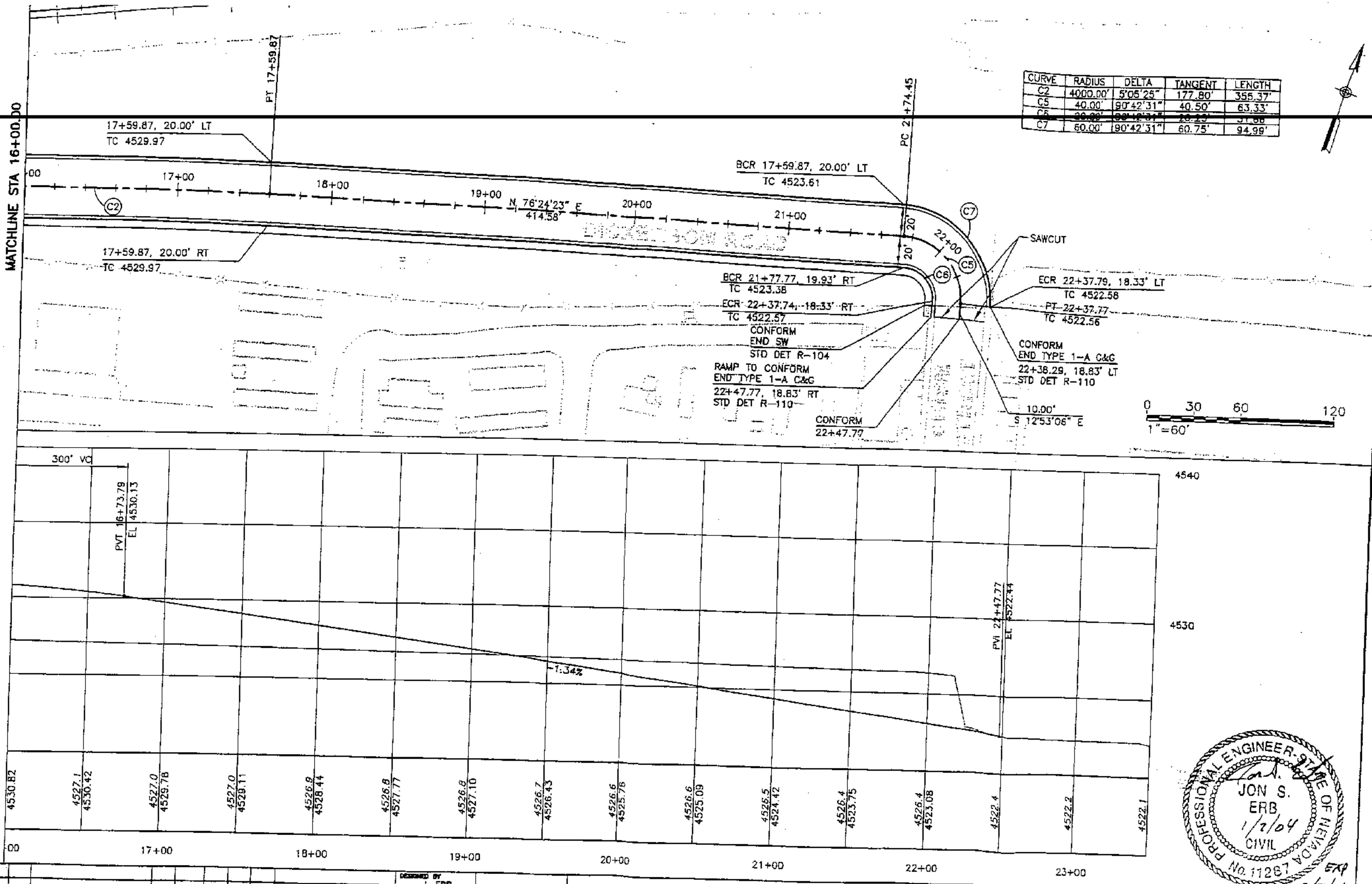

CURVE	RADIUS	DELTA	TANGENT	LENGTH
C2	4000.00'	5°05'25"	177.80'	355.37'
C5	40.00'	90°42'31"	40.50'	63.33'
C6	20.00'	90°42'31"	20.25'	31.66'
C7	60.00'	90°42'31"	60.75'	94.99'

PROFESSIONAL ENGINEER
JON S. ERB
1/7/04
CIVIL
No. 11267
EXP 12/31/04

REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION
0	12/23/03	JSE	AL	MRC	ISSUED FOR CONSTRUCTION						

DESIGNED BY J. ERB

DRAWN BY K. VAN EATON

CHECKED BY A. LOEWENSTEIN

IN CHARGE M. CHRISTENSEN

DATE 12/23/03

ISSUED FOR CONSTRUCTION

RENO ReTRAC

RENO WASHOE COUNTY NEVADA

ReTRAC THE GRANITE TEAM

SUBMITTED

APPROVED

RENO ReTRAC
DICKERSON ROAD EXTENSION
PLAN AND PROFILE
STA 16+00 TO STA 22+47.76

CONTRACT NO.

DRAWING NO. C-003

REV 0

SCALE H:1"=60', V:1"=6'

IFC SUBMITTAL

June 13, 2003
Project No. 80100603

Mr. Mike Christensen
ReTRAC
Parsons Transportation Group
264 Keystone Avenue
Reno, Nevada 89503

Reference: **ReTRAC Hydrologic and Hydraulic Design Memorandum for the West 2nd Street Storm Drain System**

Dear Mr. Christensen:

This letter report is to document the design parameters and assumptions for the West Second Street crossing at the Union Pacific Railroad (UPRR) and the interim condition shoofly.

The contributing watershed for the West Second Street area has been delineated and is shown on Figure 1, West Second Street Strom Drain System Watershed Basin Map located in the Appendix. Overland flows from the basin combine at the intersection of Stoker Street and West Fourth Street. At this location flows split east on West Fourth Street and south on West Second Street. A portion of the overland flows on West Fourth Street is retained in a sump located on the north side of West Fourth Street just east of the West Second Street underpass. Flow exceeding the detention volume is conveyed overland to the West Second Street underpass.

The existing system conveys flow to the Truckee River through a 24-inch Reinforced Concrete Pipe (RCP) storm drain located on West Fourth Street, a 36-in RCP storm drain in West Second and Stoker Streets and via the West Second Street underpass. In high flow events the underpass fills with water and acts as a conveyance structure under the UPRR to the Truckee River. The remaining water that collects in the West Second Street underpass is eventually pumped to the Truckee River via an existing pump and storm drain system.

The methodology used for the preparation of the hydrologic models was based upon the Technical Provisions (TP's) for the ReTRAC project, discussions with the City of Reno staff and current engineering standard practices.

The U.S. Army Corp of Engineer's (COE) Flood Hydrograph package, HEC-1, Version 4.1 was used to perform the hydrologic modeling for the study area. The HEC-1 models were prepared based upon the Soil Conservation Service's (SCS) Unit Hydrograph method outlined in the Washoe County Hydrologic Criteria and Drainage Design Manual (HC&DDM).

The West Second Street watershed was delineated utilizing United States Geological Survey (USGS) 7.5-minute quadrangle maps for the Reno area. Boundaries were then drawn and exported into Geographic Information Systems (GIS) format, where all sub-basin area calculations were performed.

Precipitation within the HEC-1 program was modeled using a balanced storm distribution (PH card). Precipitation values were obtained from the National Weather Service's NOAA Atlas 2. The Soil Conservation Service (SCS), U.S. Department of Agriculture curve number method was used to determine curve number values for use in the hydrologic models. Hydrologic soil groups for each basin were determined using information from the SCS Soil Survey of Washoe County, Nevada, South Part. Land uses were obtained from Washoe County for the entire watershed. An Antecedent Moisture Condition II was used per the Washoe County HCDDM. Runoff curve numbers for each applicable land use, according to soil group, were taken from SCS Technical Release 55.

The lag time was determined according to the SCS dimensionless unit hydrograph method. The lag parameter is equal to the lag (in hours) between the center of mass of rainfall excess and the peak of the unit hydrograph. For drainage basins less than one square mile and whose slopes are less than ten percent, the lag time parameter equals 60% of the time of concentration for the individual basin. The concentration time is composed of an initial overland flow time plus a travel time. The initial time was calculated according to Equation 702 of the Washoe County HCDDM, while the following travel time was estimated by measuring the travel length and dividing by an estimated flow velocity.

The West Second Street watershed covers approximately 0.52 square miles of land with a concentration point at the West Second Street railroad underpass. The area is predominately residential, with scattered park areas and cemeteries. Storm runoff originates behind the Albertson's shopping center on the southeast corner of N. McCarran Blvd. and Mae Anne Pkwy. Runoff in the residential areas is conveyed via gutter flow in a south-east direction to Interstate 80. At Interstate 80 flow is channelized in a V-ditch running along the north side of Interstate 80 until it outlets at the Stoker Avenue overpass. Flow then travels south on Stoker Avenue to the intersection at Fourth Street where it splits, traveling east on Fourth Street and south on West Second Street. In larger events flow is detained in a natural detention area located several hundred feet east of the intersection of Fourth Street and Stoker Avenue. Flow exceeding the detention area travels overland to the West Second Street railroad underpass where all overland flow is conveyed south to the Truckee River.

The 100-year peak flow rate at West Second Street was found to be 416 cfs. The flow is conveyed overland and in two existing storm drain systems. The collection points for the 100-year event are located in the West Fourth Street sump and on West Second Street just west of the West Second Street underpass. Using the water surface elevation where the West Fourth Street sump retention fails, pipe flow was calculated and subtracted from the total 100-year peak flow. The West Fourth Street sump storm drain system conveys 38.5 cfs, in a 24-inch RCP that conveys flow to a double 18-inch RCP, south to the Truckee River. The West Second Street storm drain system conveys 91.2 cfs in a 36-inch RCP, south to the Truckee River. The resulting overland flow through the West Second Street underpass is 116.4 cfs with a peak storage of 169.9 cfs in the natural detention area north of West Fourth Street at a 100-year water surface elevation of 4528.35. The existing conditions HEC-1 hydrologic model and the StormCad hydraulic analyses for the storm drain conveyance capacities are located in the appendix.

Proposed improvements will consist of 287-feet of 48-inch RCP culvert to be placed along West Second Street. The proposed culvert will convey the resulting 100-year flow (116.4cfs) under the West Second Street Bridge and proposed shoofly. The culvert will have a design slope of 0.7%. It is assumed the storm drain systems in West Second Street and West Fourth Street are designed for the 5-year event. Therefore a low flow design will not be required. A velocity dissipation structure will be required at the outlet of the proposed culvert. The outlet structure will be connected to a proposed storm drain in Dickerson Road to drain residual water. Flow released from the outlet structure in the 100-year event will return to its historic flow pattern before entering the Truckee River.

Sincerely,

STANTEC CONSULTING INC.

Trina M. Magoon, PE
Project Manager, Water Resources

TMM:ac

Enclosure(s)
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1****************************************                                            ****************************************
 *                                      *                                            *                                      *
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 *              JUN   1998              *                                            *   HYDROLOGIC ENGINEERING CENTER      *
 *              VERSION 4.1             *                                            *         609 SECOND STREET            *
 *                                      *                                            *     DAVIS, CALIFORNIA 95616          *
 * RUN DATE   16DEC04  TIME  10:52:38   *                                            *         (916) 756-1104               *
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                                        X     X  XXXXXXX   XXXXX          XXX




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

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


1                                                 HEC-1 INPUT                                                  PAGE  1

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

                         *DIAGRAM
              1          ID        STANTEC CONSULTING INC.    RENO, NEVADA
              2          ID
              3          ID        RENO RETRAC
              4          ID
              5          ID        WEST SECOND STREET, WEST FOURTH STREET, STOKER AND DICKERSON
              6          ID        WITH DETENTION TO BE PROVIDED SOUTH OF WEST FOURTH STREET
              7          ID
              8          ID        FILE:  W2ND_EX.DAT
              9          ID        JOB#:  80100603
             10          ID        DATE:  APRIL 2003
             11          ID
             12          ID
             13          IT       5                300
             14          IO       3       0

             15          KK    W2ND       HYDROGRAPH FOR WEST SECOND STREET UNDERPASS
             16          BA     .52
             17          PH          0.001    0.48    0.87    1.45    1.57    1.66    1.85    2.33    2.80
             18          LS             90
             19          UD      .5
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        20          KK     DET  NATURAL DETENTION AREA NORTH OF W. FOURTH ST AND EAST OF CEMETARY RD
        21          RS       1    STOR       0
        22          SA    0.05     1.0    2.09     4.0    5.87    6.66    7.17    7.68    8.20    9.67
        23          SE    4523    4524    4525    4526    4527    4528 4528.25  4528.5 4528.75  4529.5
        24          SQ       0       0       0       0   109.4   124.9   195.6   321.8   484.3  1132.3
        25          KO               2
        26          ZZ
1
            SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

   15        W2ND
               V
               V
   20         DET

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                                         ****************************************
 *                                      *                                         *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                         *   U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998              *                                         *   HYDROLOGIC ENGINEERING CENTER      *
 *            VERSION 4.1               *                                         *         609 SECOND STREET            *
 *                                      *                                         *      DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   16DEC04  TIME  10:52:38  *                                         *          (916) 756-1104              *
 *                                      *                                         *                                      *
 ****************************************                                         ****************************************



                                  STANTEC CONSULTING INC.   RENO, NEVADA

                                  RENO RETRAC

                                  WEST SECOND STREET, WEST FOURTH STREET, STOKER AND DICKERSON
                                  WITH DETENTION TO BE PROVIDED SOUTH OF WEST FOURTH STREET

                                  FILE:  W2ND_EX.DAT
                                  JOB#:  80100603
                                  DATE:  APRIL 2003



   14 IO          OUTPUT CONTROL VARIABLES
                        IPRNT          3  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT           HYDROGRAPH TIME DATA
                         NMIN          5  MINUTES IN COMPUTATION INTERVAL
                        IDATE      1   0  STARTING DATE
                        ITIME       0000  STARTING TIME
                           NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE      2   0  ENDING DATE
                       NDTIME       0055  ENDING TIME
                        ICENT         19  CENTURY MARK
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                   COMPUTATION INTERVAL      .08 HOURS
                        TOTAL TIME BASE   24.92 HOURS

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



*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  15 KK     *     W2ND   *            HYDROGRAPH FOR WEST SECOND STREET UNDERPASS
            *            *
            **************

               SUBBASIN RUNOFF DATA

  16 BA          SUBBASIN CHARACTERISTICS
                       TAREA           .52  SUBBASIN AREA

                 PRECIPITATION DATA

     PH                                 DEPTHS FOR   0-PERCENT HYPOTHETICAL STORM
                 ..... HYDRO-35 ......   ................ TP-40 ................   ........... TP-49 ...........
                 5-MIN  15-MIN  60-MIN    2-HR    3-HR    6-HR   12-HR   24-HR   2-DAY   4-DAY   7-DAY  10-DAY
                   .48     .87    1.45    1.57    1.66    1.85    2.33    2.80     .00     .00     .00     .00

                                                   STORM AREA =       .00

  18 LS          SCS LOSS RATE
                       STRTL           .22  INITIAL ABSTRACTION
                      CRVNBR         90.00  CURVE NUMBER
                       RTIMP           .00  PERCENT IMPERVIOUS AREA

  19 UD          SCS DIMENSIONLESS UNITGRAPH
                        TLAG           .50  LAG

                                                                ***

                                                          UNIT HYDROGRAPH
                                                     32 END-OF-PERIOD ORDINATES
                   31.       92.      189.      318.      416.      460.      460.      421.      368.      294.
                  217.      168.      130.      104.       81.       62.       49.       38.       29.       23.
                   18.       14.       11.        8.        7.        5.        4.        3.        3.        2.
                    1.        0.

      ***             ***             ***             ***             ***

                         HYDROGRAPH AT STATION     W2ND

    TOTAL RAINFALL =     2.80, TOTAL LOSS =     1.00, TOTAL EXCESS =     1.80
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  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     24.92-HR
+    (CFS)       (HR)
                          (CFS)
      416.      12.58                   80.          25.          24.          24.
                        (INCHES)     1.424        1.800        1.800        1.800
                         (AC-FT)       39.          50.          50.          50.

                         CUMULATIVE AREA =      .52 SQ MI



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          *            *
   20 KK  *      DET   *      NATURAL DETENTION AREA NORTH OF W. FOURTH ST AND EAST OF CEMETARY RD
          *            *
          **************

   25 KO          OUTPUT CONTROL VARIABLES
                       IPRNT          3  PRINT CONTROL
                       IPLOT          2  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

                HYDROGRAPH ROUTING DATA

      RS          STORAGE ROUTING
                       NSTPS          1  NUMBER OF SUBREACHES
                        ITYP       STOR  TYPE OF INITIAL CONDITION
                      RSVRIC        .00  INITIAL CONDITION
                           X        .00 WORKING R AND D COEFFICIENT

   22 SA             AREA        .1       1.0       2.1       4.0       5.9       6.7       7.2       7.7       8.2       9.7


   23 SE          ELEVATION   4523.00   4524.00   4525.00   4526.00   4527.00   4528.00   4528.25   4528.50   4528.75   4529.50


   24 SQ          DISCHARGE        0.        0.        0.        0.      109.      125.      196.      322.      484.     1132.


                                                             ***

                                                COMPUTED STORAGE-ELEVATION DATA

            STORAGE       .00       .42      1.94      4.93      9.84     16.10     17.82     19.68     21.67     28.36
          ELEVATION   4523.00   4524.00   4525.00   4526.00   4527.00   4528.00   4528.25   4528.50   4528.75   4529.50


       ***            ***            ***            ***            ***

                         HYDROGRAPH AT STATION       DET

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     24.92-HR
+    (CFS)       (HR)
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                             (CFS)
+     246.     12.92                   75.         23.         22.          22.
                        (INCHES)     1.345       1.612       1.612        1.612
                        (AC-FT)        37.         45.         45.          45.

   STORAGE   TIME                            MAXIMUM AVERAGE STORAGE
                                      6-HR       24-HR       72-HR     24.92-HR
+  (AC-FT)    (HR)
       19.    12.92                      9.          4.          4.           4.

  PEAK STAGE  TIME                             MAXIMUM AVERAGE STAGE
                                      6-HR       24-HR       72-HR     24.92-HR
+   (FEET)    (HR)
   4528.35    12.92                4526.84     4525.15     4525.07      4525.07

                         CUMULATIVE AREA =     .52 SQ MI

1                                                          STATION      DET

                         (I) INFLOW,   (O) OUTFLOW
         0.       50.      100.      150.      200.      250.      300.      350.      400.      450.        0.        0.        0.
                                                                                (S) STORAGE
         0.        0.        0.        0.        0.        0.        0.        5.       10.       15.       20.        0.        0.
DAHRMN PER
 10000   1I---------.---------.---------.---------.---------.---------S---------.---------.---------.---------.---------.---------.
 10005   2I         .         .         .         .         .         S         .         .         .         .         .         .
 10010   3I         .         .         .         .         .         S         .         .         .         .         .         .
 10015   4I         .         .         .         .         .         S         .         .         .         .         .         .
 10020   5I         .         .         .         .         .         S         .         .         .         .         .         .
 10025   6I         .         .         .         .         .         S         .         .         .         .         .         .
     0   7I         .         .         .         .         .         S         .         .         .         .         .         .
    35   8I         .         .         .         .         .         S         .         .         .         .         .         .
 10040   9I         .         .         .         .         .         S         .         .         .         .         .         .
 10045  10I         .         .         .         .         .         S         .         .         .         .         .         .
 10050  11I . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 10055  12I         .         .         .         .         .         S         .         .         .         .         .         .
 10100  13I         .         .         .         .         .         S         .         .         .         .         .         .
 10105  14I         .         .         .         .         .         S         .         .         .         .         .         .
 10110  15I         .         .         .         .         .         S         .         .         .         .         .         .
 10115  16I         .         .         .         .         .         S         .         .         .         .         .         .
 10120  17I         .         .         .         .         .         S         .         .         .         .         .         .
 10125  18I         .         .         .         .         .         S         .         .         .         .         .         .
 10130  19I         .         .         .         .         .         S         .         .         .         .         .         .
 10135  20I         .         .         .         .         .         S         .         .         .         .         .         .
 10140  21I . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 10145  22I         .         .         .         .         .         S         .         .         .         .         .         .
 10150  23I         .         .         .         .         .         S         .         .         .         .         .         .
 10155  24I         .         .         .         .         .         S         .         .         .         .         .         .
 10200  25I         .         .         .         .         .         S         .         .         .         .         .         .
 10205  26I         .         .         .         .         .         S         .         .         .         .         .         .
 10210  27I         .         .         .         .         .         S         .         .         .         .         .         .
 10215  28I         .         .         .         .         .         S         .         .         .         .         .         .
 10220  29I         .         .         .         .         .         S         .         .         .         .         .         .
 10225  30I         .         .         .         .         .         S         .         .         .         .         .         .
 10230  31I . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
    35  32I         .         .         .         .         .         S         .         .         .         .         .         .
     0  33I         .         .         .         .         .         S         .         .         .         .         .         .
 10245  34I         .         .         .         .         .         S         .         .         .         .         .         .
 10250  35I         .         .         .         .         .         S         .         .         .         .         .         .
 10255  36I         .         .         .         .         .         S         .         .         .         .         .         .
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10300  37I        .          .          .          .          .         S          .          .          .          .          .          .
10305  38I        .          .          .          .          .         S          .          .          .          .          .          .
10310  39I        .          .          .          .          .         S          .          .          .          .          .          .
10315  40I        .          .          .          .          .         S          .          .          .          .          .          .
  320  41I . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .  S . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   25  42I        .          .          .          .          .         S          .          .          .          .          .          .
10330  43I        .          .          .          .          .         S          .          .          .          .          .          .
10335  44I        .          .          .          .          .         S          .          .          .          .          .          .
10340  45I        .          .          .          .          .         S          .          .          .          .          .          .
10345  46I        .          .          .          .          .         S          .          .          .          .          .          .
10350  47I        .          .          .          .          .         S          .          .          .          .          .          .
10355  48I        .          .          .          .          .         S          .          .          .          .          .          .
10400  49I        .          .          .          .          .         S          .          .          .          .          .          .
10405  50I        .          .          .          .          .         S          .          .          .          .          .          .
10410  51I . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .  S . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
10415  52I        .          .          .          .          .         S          .          .          .          .          .          .
10420  53I        .          .          .          .          .         S          .          .          .          .          .          .
10425  54I        .          .          .          .          .         S          .          .          .          .          .          .
10430  55I        .          .          .          .          .         S          .          .          .          .          .          .
10435  56I        .          .          .          .          .         S          .          .          .          .          .          .
10440  57I        .          .          .          .          .         S          .          .          .          .          .          .
10445  58I        .          .          .          .          .         S          .          .          .          .          .          .
10450  59I        .          .          .          .          .         S          .          .          .          .          .          .
10455  60I        .          .          .          .          .         S          .          .          .          .          .          .
10500  61I . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .  S . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
10505  62I        .          .          .          .          .         S          .          .          .          .          .          .
10510  63I        .          .          .          .          .         S          .          .          .          .          .          .
10515  64I        .          .          .          .          .         S          .          .          .          .          .          .
10520  65I        .          .          .          .          .         S          .          .          .          .          .          .
10525  66I        .          .          .          .          .         S          .          .          .          .          .          .
    0  67I        .          .          .          .          .         S          .          .          .          .          .          .
   35  68I        .          .          .          .          .         S          .          .          .          .          .          .
10540  69I        .          .          .          .          .         S          .          .          .          .          .          .
10545  70I        .          .          .          .          .         S          .          .          .          .          .          .
10550  71I . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .  S . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
10555  72I        .          .          .          .          .         S          .          .          .          .          .          .
10600  73I        .          .          .          .          .         S          .          .          .          .          .          .
10605  74I        .          .          .          .          .         S          .          .          .          .          .          .
10610  75I        .          .          .          .          .         S          .          .          .          .          .          .
10615  76I        .          .          .          .          .         S          .          .          .          .          .          .
10620  77I        .          .          .          .          .         S          .          .          .          .          .          .
10625  78I        .          .          .          .          .         S          .          .          .          .          .          .
10630  79I        .          .          .          .          .         S          .          .          .          .          .          .
10635  80I        .          .          .          .          .         S          .          .          .          .          .          .
10640  81I . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .  S . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
10645  82I        .          .          .          .          .         S          .          .          .          .          .          .
10650  83I        .          .          .          .          .         S          .          .          .          .          .          .
10655  84I        .          .          .          .          .         S          .          .          .          .          .          .
10700  85I        .          .          .          .          .         S          .          .          .          .          .          .
10705  86I        .          .          .          .          .         S          .          .          .          .          .          .
10710  87I        .          .          .          .          .         S          .          .          .          .          .          .
10715  88I        .          .          .          .          .         S          .          .          .          .          .          .
10720  89I        .          .          .          .          .         S          .          .          .          .          .          .
10725  900I       .          .          .          .          .         S          .          .          .          .          .          .
10730  910I . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .  S . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   35  920I       .          .          .          .          .         S          .          .          .          .          .          .
    )  930I       .          .          .          .          .         S          .          .          .          .          .          .
10745  940I       .          .          .          .          .         S          .          .          .          .          .          .
10750  950I       .          .          .          .          .         S          .          .          .          .          .          .
10755  960I       .          .          .          .          .         S          .          .          .          .          .          .
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10800  970I         .         .         .         .         .         .S        .         .         .         .         .         .
10805  980I         .         .         .         .         .         .S        .         .         .         .         .         .
10810  990I         .         .         .         .         .         .S        .         .         .         .         .         .
10815 1000I         .         .         .         .         .         .S        .         .         .         .         .         .
10820 1010I. . . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . . . . . . . . . . . .
    5 1020I         .         .         .         .         .         .S        .         .         .         .         .         .
   30 1030I         .         .         .         .         .         .S        .         .         .         .         .         .
10835 1040I         .         .         .         .         .         .S        .         .         .         .         .         .
10840 1050I         .         .         .         .         .         .S        .         .         .         .         .         .
10845 1060I         .         .         .         .         .         .S        .         .         .         .         .         .
10850 1070I         .         .         .         .         .         .S        .         .         .         .         .         .
10855 1080 I        .         .         .         .         .         .S        .         .         .         .         .         .
10900 1090 I        .         .         .         .         .         . S       .         .         .         .         .         .
10905 1100 I        .         .         .         .         .         . S       .         .         .         .         .         .
10910 1110 I . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . . . . . . . . . . . . . . . . .
10915 1120 I        .         .         .         .         .         . S       .         .         .         .         .         .
10920 1130 I        .         .         .         .         .         . S       .         .         .         .         .         .
10925 1140 I        .         .         .         .         .         . S       .         .         .         .         .         .
10930 1150 I        .         .         .         .         .         . S       .         .         .         .         .         .
10935 1160 I        .         .         .         .         .         . S       .         .         .         .         .         .
10940 1170 I        .         .         .         .         .         . S       .         .         .         .         .         .
10945 1180I         .         .         .         .         .         .  S      .         .         .         .         .         .
10950 1190I         .         .         .         .         .         .  S      .         .         .         .         .         .
10955 1200I         .         .         .         .         .         .  S      .         .         .         .         .         .
11000 1210I. . . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . . . . . . . . . . . .
11005 1220I         .         .         .         .         .         .  S      .         .         .         .         .         .
11010 1230I         .         .         .         .         .         .  S      .         .         .         .         .         .
11015 1240 I        .         .         .         .         .         .  S      .         .         .         .         .         .
11020 1250 I        .         .         .         .         .         .  S      .         .         .         .         .         .
11025 1260 I        .         .         .         .         .         .  S      .         .         .         .         .         .
   30 1270 I        .         .         .         .         .         .   S     .         .         .         .         .         .
    5 1280 I        .         .         .         .         .         .   S     .         .         .         .         .         .
11040 1290 I        .         .         .         .         .         .   S     .         .         .         .         .         .
11045 1300 I        .         .         .         .         .         .   S     .         .         .         .         .         .
11050 1310 I . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . . . . . . . . . . . . . . . .
11055 1320 I        .         .         .         .         .         .   S     .         .         .         .         .         .
11100 1330 I        .         .         .         .         .         .   S     .         .         .         .         .         .
11105 1340 I        .         .         .         .         .         .   S     .         .         .         .         .         .
11110 1350 I        .         .         .         .         .         .    S    .         .         .         .         .         .
11115 1360 I        .         .         .         .         .         .    S    .         .         .         .         .         .
11120 1370   I      .         .         .         .         .         .    S    .         .         .         .         .         .
11125 1380   I      .         .         .         .         .         .    S    .         .         .         .         .         .
11130 1390   I      .         .         .         .         .         .    S    .         .         .         .         .         .
11135 1400   I      .         .         .         .         .         .     S   .         .         .         .         .         .
11140 1410 . I . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . . . . . . . . . . . . . . .
11145 1420    I     .         .         .         .         .         .     S   .         .         .         .         .         .
11150 1430      I   .         .         .         .         .         .     S   .         .         .         .         .         .
11155 1440        I .         .         .         .         .         .      S  .         .         .         .         .         .
11200 1450          . I       .         .         .         .         .       S .         .         .         .         .         .
11205 1460          .         I         .         .         .         .        S.         .         .         .         .         .
11210 147.0         .         .         .I        .         .         .         S         .         .         .         .         .
11215 148.      O   .         .         .         .    I    .         .         .  S      .         .         .         .         .
11220 149.          .  O      .         .         .         .         .I        .     S   .         .         .         .         .
11225 150.          .         .O        .         .         .         .         .   I    S.         .         .         .         .
11230 151. . . . . . . . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . .I.S. . . . . . . . . . . . . . . . . . .
11235 152.          .         .   O     .         .         .         .         .         .  I   S  .         .         .         .
    ) 153.          .         .    O    .         .         .         .         .         I         .S        .         .         .
..245 154.          .         .         .   O     .         .         .         .  I      .         .   S     .         .         .
11250 155.          .         .         .         .   O     .         .  I      .         .         .     S   .         .         .
11255 156.          .         .         .         .        O.  I      .         .         .         .      S  .         .         .
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11300 157.         .         .         .         .   I    O.         .         .         .         .      S  .         .         .
11305 158.         .         .         .     I   .     O   .         .         .         .         .      S  .         .         .
11310 159.         .         .         I         .O        .         .         .         .         .     S   .         .         .
11315 160.         .         .    I    .      O  .         .         .         .         .         .    S    .         .         .
11320 161. . . . . . . . . .I. . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . .
   25 162.         .      I  .         O         .         .         .         .         .         .  S      .         .         .
11330 163.         .    I    .     O   .         .         .         .         .         .         .  S      .         .         .
11335 164.         .  I      .    O    .         .         .         .         .         .         . S       .         .         .
11340 165.         .I        .    O    .         .         .         .         .         .         .S        .         .         .
11345 166.         I         .   O     .         .         .         .         .         .         S         .         .         .
11350 167.        I.         .   O     .         .         .         .         .         .        S.         .         .         .
11355 168.       I .         .   O     .         .         .         .         .         .       S .         .         .         .
11400 169.      I  .         .   O     .         .         .         .         .         .      S  .         .         .         .
11405 170.      I  .         .  O      .         .         .         .         .         .    S    .         .         .         .
11410 171. . . . I . . . . . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . . . . . . .
11415 172.     I   .         .  O      .         .         .         .         .         .  S      .         .         .         .
11420 173.    I    .         . O       .         .         .         .         .         . S       .         .         .         .
11425 174.    I    .         . O       .         .         .         .         .         .S        .         .         .         .
11430 175.    I    .         . O       .         .         .         .         .         S         .         .         .         .
11435 176.   I     .        O.         .         .         .         .         .        S.         .         .         .         .
11440 177.   I     .      O  .         .         .         .         .         .       S .         .         .         .         .
11445 178.   I     .    O    .         .         .         .         .         .      S  .         .         .         .         .
11450 179.   I     .   O     .         .         .         .         .         .     S   .         .         .         .         .
11455 180.   I     . O       .         .         .         .         .         .    S    .         .         .         .         .
11500 181. . I . . .O. . . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . . . . . . .
11505 182.   I     O         .         .         .         .         .         .   S     .         .         .         .         .
11510 183.  I     O.         .         .         .         .         .         .   S     .         .         .         .         .
11515 184.   I   O .         .         .         .         .         .         .   S     .         .         .         .         .
11520 185.   I   O .         .         .         .         .         .         .  S      .         .         .         .         .
11525 186.   I  O  .         .         .         .         .         .         .  S      .         .         .         .         .
   30 187.   I  O  .         .         .         .         .         .         .  S      .         .         .         .         .
   35 188.   I O   .         .         .         .         .         .         .  S      .         .         .         .         .
11540 189.    IO   .         .         .         .         .         .         .  S      .         .         .         .         .
11545 190.    IO   .         .         .         .         .         .         .  S      .         .         .         .         .
11550 191. . .IO . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . . . . . . . .
11555 192.    IO   .         .         .         .         .         .         .S        .         .         .         .         .
11600 193.    IO   .         .         .         .         .         .         .S        .         .         .         .         .
11605 194.    IO   .         .         .         .         .         .         .S        .         .         .         .         .
11610 195.    IO   .         .         .         .         .         .         .S        .         .         .         .         .
11615 196.    I    .         .         .         .         .         .         .S        .         .         .         .         .
11620 197.    I    .         .         .         .         .         .         .S        .         .         .         .         .
11625 198.    I    .         .         .         .         .         .         .S        .         .         .         .         .
11630 199.    I    .         .         .         .         .         .         .S        .         .         .         .         .
11635 200.    I    .         .         .         .         .         .         .S        .         .         .         .         .
11640 201. . .I. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . . . . . . . .
11645 202.    I    .         .         .         .         .         .         .S        .         .         .         .         .
11650 203.    I    .         .         .         .         .         .         .S        .         .         .         .         .
11655 204.    I    .         .         .         .         .         .         .S        .         .         .         .         .
11700 205.    I    .         .         .         .         .         .         .S        .         .         .         .         .
11705 206.    I    .         .         .         .         .         .         .S        .         .         .         .         .
11710 207.    I    .         .         .         .         .         .         .S        .         .         .         .         .
11715 208.    I    .         .         .         .         .         .         .S        .         .         .         .         .
11720 209.    I    .         .         .         .         .         .         .S        .         .         .         .         .
11725 210.    I    .         .         .         .         .         .         .S        .         .         .         .         .
11730 211. . IO. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . . . . . . . .
11735 212.   IO    .         .         .         .         .         .         .S        .         .         .         .         .
    0 213.   IO    .         .         .         .         .         .         .S        .         .         .         .         .
11745 214.   IO    .         .         .         .         .         .         .S        .         .         .         .         .
11750 215.   IO    .         .         .         .         .         .         .S        .         .         .         .         .
11755 216.   IO    .         .         .         .         .         .         .S        .         .         .         .         .
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11800 217.   IO     .         .         .         .         .         .        . S        .         .         .         .         .
11805 218.   I      .         .         .         .         .         .        . S        .         .         .         .         .
11810 219.   I      .         .         .         .         .         .        . S        .         .         .         .         .
11815 220.   I      .         .         .         .         .         .        . S        .         .         .         .         .
11820 221. . I . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . . . . . . . . . . . . . .
   25 222.   I      .         .         .         .         .         .        . S        .         .         .         .         .
11830 223.   I      .         .         .         .         .         .        . S        .         .         .         .         .
11835 224.   I      .         .         .         .         .         .        . S        .         .         .         .         .
11840 225.  IO      .         .         .         .         .         .        . S        .         .         .         .         .
11845 226.  IO      .         .         .         .         .         .        . S        .         .         .         .         .
11850 227.  IO      .         .         .         .         .         .        . S        .         .         .         .         .
11855 228.  IO      .         .         .         .         .         .        . S        .         .         .         .         .
11900 229.  IO      .         .         .         .         .         .        . S        .         .         .         .         .
11905 230.  IO      .         .         .         .         .         .        .S         .         .         .         .         .
11910 231. .I. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . . . . . . . .
11915 232.  I       .         .         .         .         .         .        .S         .         .         .         .         .
11920 233.  I       .         .         .         .         .         .        .S         .         .         .         .         .
11925 234.  I       .         .         .         .         .         .        .S         .         .         .         .         .
11930 235.  I       .         .         .         .         .         .        .S         .         .         .         .         .
11935 236.  I       .         .         .         .         .         .        .S         .         .         .         .         .
11940 237.  I       .         .         .         .         .         .        .S         .         .         .         .         .
11945 238.  I       .         .         .         .         .         .        .S         .         .         .         .         .
11950 239.  I       .         .         .         .         .         .        .S         .         .         .         .         .
11955 240.  I       .         .         .         .         .         .        .S         .         .         .         .         .
12000 241. .I. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . . . . . . . .
12005 242.  I       .         .         .         .         .         .        .S         .         .         .         .         .
12010 243.  I       .         .         .         .         .         .        .S         .         .         .         .         .
12015 244.  I       .         .         .         .         .         .        .S         .         .         .         .         .
12020 245.  I       .         .         .         .         .         .        .S         .         .         .         .         .
12025 246.  I       .         .         .         .         .         .        .S         .         .         .         .         .
   30 247.  I       .         .         .         .         .         .        .S         .         .         .         .         .
   35 248.  I       .         .         .         .         .         .        .S         .         .         .         .         .
12040 249.  I       .         .         .         .         .         .        .S         .         .         .         .         .
12045 250.  I       .         .         .         .         .         .        .S         .         .         .         .         .
12050 251. IO. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . . . . . . . .
12055 252. IO       .         .         .         .         .         .        .S         .         .         .         .         .
12100 253. IO       .         .         .         .         .         .        .S         .         .         .         .         .
12105 254. IO       .         .         .         .         .         .        .S         .         .         .         .         .
12110 255. IO       .         .         .         .         .         .        .S         .         .         .         .         .
12115 256. IO       .         .         .         .         .         .        .S         .         .         .         .         .
12120 257. IO       .         .         .         .         .         .        .S         .         .         .         .         .
12125 258. I        .         .         .         .         .         .        .S         .         .         .         .         .
12130 259. I        .         .         .         .         .         .        .S         .         .         .         .         .
12135 260. I        .         .         .         .         .         .        .S         .         .         .         .         .
12140 261. I . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . . . . . . . .
12145 262. I        .         .         .         .         .         .        .S         .         .         .         .         .
12150 263. I        .         .         .         .         .         .        .S         .         .         .         .         .
12155 264. I        .         .         .         .         .         .        .S         .         .         .         .         .
12200 265. I        .         .         .         .         .         .        .S         .         .         .         .         .
12205 266. I        .         .         .         .         .         .        .S         .         .         .         .         .
12210 267. I        .         .         .         .         .         .        .S         .         .         .         .         .
12215 268. I        .         .         .         .         .         .        .S         .         .         .         .         .
12220 269. I        .         .         .         .         .         .        .S         .         .         .         .         .
12225 270. I        .         .         .         .         .         .        .S         .         .         .         .         .
12230 271. I . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . . . . . . . .
  235 272. I        .         .         .         .         .         .        .S         .         .         .         .         .
    0 273. I        .         .         .         .         .         .        .S         .         .         .         .         .
12245 274. I        .         .         .         .         .         .        .S         .         .         .         .         .
12250 275. I        .         .         .         .         .         .        .S         .         .         .         .         .
12255 276. I        .         .         .         .         .         .        .S         .         .         .         .         .
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  12300 277. I        .         .         .         .         .         .         .S        .         .         .         .         .
  12305 278. I        .         .         .         .         .         .         .S        .         .         .         .         .
  12310 279. I        .         .         .         .         .         .         .S        .         .         .         .         .
  12315 280. I        .         .         .         .         .         .         .S        .         .         .         .         .
     20 281. I ....................................................................S.................................................
     25 282. I        .         .         .         .         .         .         .S        .         .         .         .         .
  12330 283. I        .         .         .         .         .         .         .S        .         .         .         .         .
  12335 284. I        .         .         .         .         .         .         .S        .         .         .         .         .
  12340 285. I        .         .         .         .         .         .         .S        .         .         .         .         .
  12345 286. I        .         .         .         .         .         .         .S        .         .         .         .         .
  12350 287. I        .         .         .         .         .         .         .S        .         .         .         .         .
  12355 288. I        .         .         .         .         .         .         .S        .         .         .         .         .
  20000 289. I        .         .         .         .         .         .         .S        .         .         .         .         .
  20005 290. I        .         .         .         .         .         .         .S        .         .         .         .         .
  20010 291. I ....................................................................S.................................................
  20015 292. I        .         .         .         .         .         .         .S        .         .         .         .         .
  20020 293. I        .         .         .         .         .         .         .S        .         .         .         .         .
  20025 294.IO        .         .         .         .         .         .         .S        .         .         .         .         .
  20030 295.IO        .         .         .         .         .         .         .S        .         .         .         .         .
  20035 296.IO        .         .         .         .         .         .         .S        .         .         .         .         .
  20040 297.IO        .         .         .         .         .         .         .S        .         .         .         .         .
  20045 298.I         .         .         .         .         .         .         .S        .         .         .         .         .
  20050 29910         .         .         .         .         .         .          S        .         .         .         .         .
  20055 30010---------.---------.---------.---------.---------.---------.----------S--------.---------.---------.---------.---------.
1
1

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

                                       PEAK  TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION       STATION      FLOW    PEAK                                            AREA      STAGE     MAX STAGE
+                                                          6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
+                            W2ND       416.   12.58          80.         25.         24.        .52

          ROUTED TO
+                             DET       246.   12.92          75.         23.         22.        .52
+                                                                                                        4528.35       12.92


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

Worksheet 2: Runoff curve number

Project: ReTRAC By: ZRB Date: 3/4/200

Location: Basin 2ND STREET Chk Date:

Mark One Existing X Developed X

Runoff curve number (CN)

Soil Name and hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connectiod impervious area ratio)	CN 1 per line			Area Mark 1 acres sq. mi. percent	Product of CN X area
		Table 2-2	Fig. 2-3	Fig. 2-4		
A	SEE COMPOSITE CURVE NUMBER LAND USE SHEETS	74.1			0%	0.00
B		83.2			19%	16.18
C		88.3			2%	1.55
D		91.1			79%	71.78
			Totals =		100%	89.514579

CN (weighted) = (total product) / (total area) = 89.514579 Use CN = 90

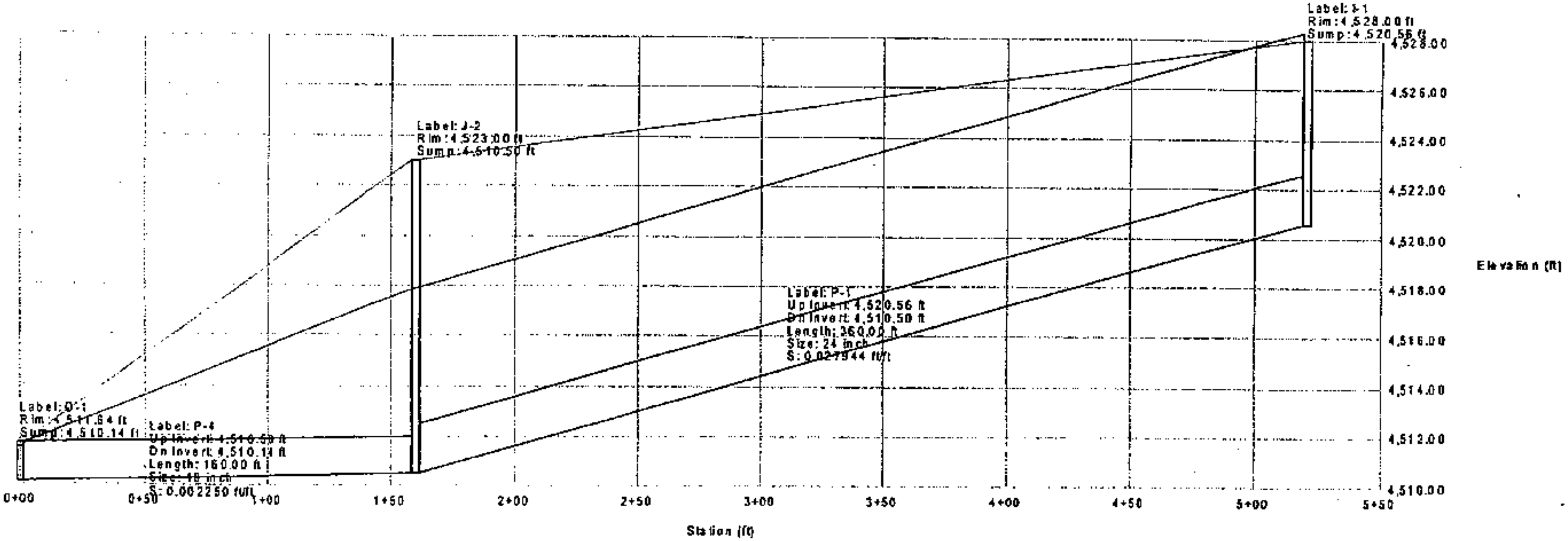
			% cover	Curve number				Product CN*Area			
Field description	CN designation	Area	by area	A	B	C	D	CN*A·	CN*B	CN*C	CN*D
014	Gravel	18328.33	0.13	76	85	89	91	0.1	0.1	0.1	0.1
015	Gravel	272984.05	1.89	76	85	89	91	1.4	1.6	1.7	1.7
016	Mixed Grass and Shrubs	13289.05	0.09	39	61	73	82	0.0	0.1	0.1	0.1
017	Mixed Grass and Shrubs	72361.21	0.50	39	61	73	82	0.2	0.3	0.4	0.4
018	Mixed Grass and Shrubs	806294.59	5.60	39	61	73	82	2.2	3.4	4.1	4.6
020	1/4 Acre Res.	5060868.72	35.13	61	75	83	87	21.4	26.3	29.2	30.6
030	Multi Res.	2025.97	0.01	77	85	90	92	0.0	0.0	0.0	0.0
034	Multi Res.	87977.06	0.61	77	85	90	92	0.5	0.5	0.5	0.6
035	Multi Res.	455882.3	3.16	77	85	90	92	2.4	2.7	2.8	2.9
040	Neighborhood Comm.	3131714.95	21.74	80	87	91	93	17.4	18.9	19.8	20.2
041	Neighborhood Comm.	19685.98	0.14	80	87	91	93	0.1	0.1	0.1	0.1
043	Neighborhood Comm.	221785.26	1.54	80	87	91	93	1.2	1.3	1.4	1.4
050	Industrial	109366.05	0.76	81	88	91	93	0.6	0.7	0.7	0.7
051	Industrial	68505.89	0.48	81	88	91	93	0.4	0.4	0.4	0.4
070	Drainage Ditch, Imperv	54914.55	0.38	98	98	98	98	0.4	0.4	0.4	0.4
Freeway	50% Paved, 50% Mixed Gr	784080	5.44	69	80	86	90	3.7	4.3	4.7	4.9
Right of Way	100% Paved	3225831.78	22.39	98	98	98	98	21.9	21.9	21.9	21.9
			100.00					74.1	83.2	88.3	91.1
Total Area		14405895.75									

Scenario: Base

Combined Pipe/Node Report

Label	Upstream Node	Downstream Node	Length (ft)	Section Size	Capacity (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Calculated Headloss (ft)	Energy Grade In (ft)	Energy Grade Ou (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Ou (ft)	Total System Flow (cfs)
P-1	I-1	J-2	360.00	24 inch	37.81	12.25	4,520.56	4,510.50	0.027944	10.41	,530.68	4,520.27	4,528.35	4,517.94	38.47
P-4	J-2	O-1	160.00	18 inch	9.25	10.92	4,510.50	4,510.14	0.002250	6.25	,519.69	4,513.47	4,517.85	4,511.60	38.47

Scenario: Base



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Stantec Consulting Inc
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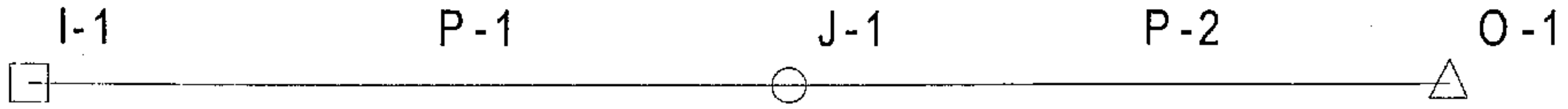
Project Engineer: Stantec
StormCAD v3.0 [319]

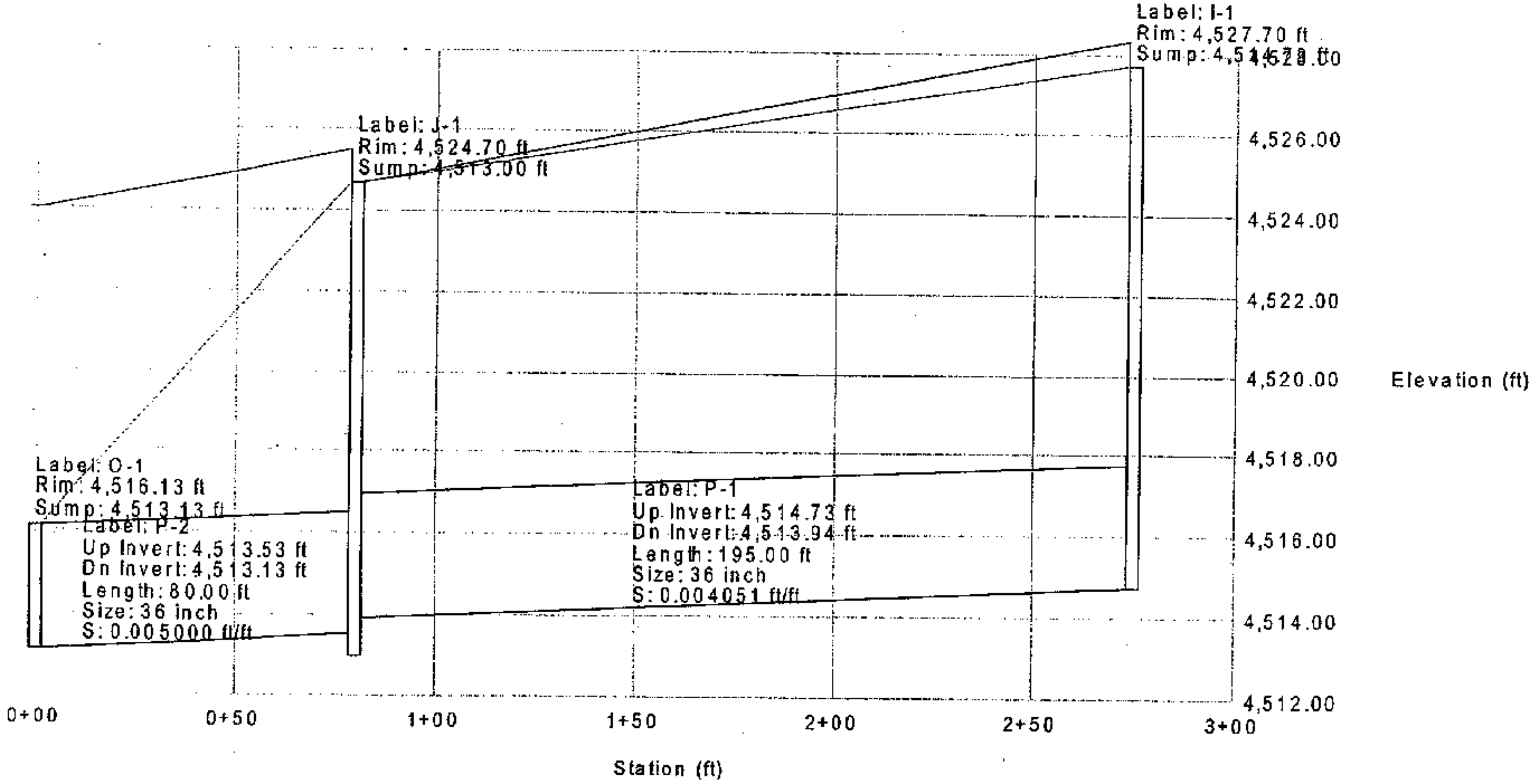
Scenario: Base



Combined Pipe/Node Report

Label	Upstream Node	Downstream Node	Length (ft)	Section Size	Capacity (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Calculated Headloss (ft)	Energy Grade In (ft)	Energy Grade Ou (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Ou (ft)	Total System Flow (cfs)
P-1	I-1	J-1	195.00	36 inch	42.45	12.91	4,514.73	4,513.94	0.004051	3.65	4,530.94	4,527.29	4,528.35	4,524.70	91.24
P-2	J-1	O-1	80.00	36 inch	47.16	12.91	4,513.53	4,513.13	0.005000	1.50	4,528.09	4,526.59	4,525.50	4,524.00	91.24

ofile
Scenario: Base



Title: ReTRAC
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Project Engineer: Stantec
StormCAD v3.0 [319]

Stantec

ReTRAC
West Second & West Fourth Storm Drain
Existing Conditions

80100603

Elev	24" Storm Drain	36" Storm Drain	Overland Weir	Total
26	0	0	0	0
27	36.9	72.5	0	109.4
28	38.1	86.8	0	124.9
28.25	38.35	90.0	67.2	195.6
28.50	38.64	93.1	190.1	321.8
28.75	38.92	96.1	349.3	484.3
29.	39.21	99	537.7	675.9
29.5	39.77	104.6	987.9	1132.3
28.55	38.47	91.24	116.36	246.07
28.65	38.51	94.9		133.7

Designed by: Checked by:

Stantec

Existing		Proposed	
416		416	
- 38.47	24"	38.8	24"
- 91.24	36"	94.9	36"
-116.36	Weir	146.4	48"
169.9 cfs		280.1	

246.1 detained

Designed by:

Checked by:

CSR
Hydro
Conduit
999 Marietta Way • Sparks, Nevada 89431-6031
Bus. (775) 358-4430 • Fax (775) 355-1982

DATE

PAGE _____ OF _____ PAGES

PROJECT

Elevation	Area	
4528	6.66	
4528.25	7.17	
4528.50	7.68	3.07
4528.75	8.20	
4529 5	9.67	

Project____________________
Project No.____________________
Sheet No._________of_________
Calculated by______Date______

WEIR FLOW COMPUTATIONS

OCATION/DESCRIPTION:

ROSS SECTION PARAMETERS: FILENAME: W2NDWEIR.SEC

```
No. of Cross Section Points:      4  Bed Slope:0.00500 Max Elev.:4528.00
Bank Stations..........Left:  1000.0  Right....: 1215.1 Min Elev.:4528.00
Encroachment Stations..Left:          Right....:         Weir Coef:  2.500
ROSS SECTION POINTS - Elevations & Stations in feet:
o.    Elev.       Sta.  No.    Elev.       Sta.  No.    Elev.       Sta.

1)  4528.00    1000.00   2)  4528.00    1000.01   3)  4528.00   1215.00
4)  4528.00    1215.10
```

OMPUTED PARAMETERS:

SEL(ft)	Q(cfs)	H:max(ft)	H:ave(ft)	TW(ft)	A(sf)
4528.25	67.2	0.25	0.25	215.1	53.8
4528.50	190.1	0.50	0.50	215.1	107.5
28.75	349.3	0.75	0.75	215.1	161.3
4529.00	537.7	1.00	1.00	215.1	215.1
4529.50	987.9	1.50	1.50	215.1	322.6

OTES:

Culvert Calculator Report
48" RCP PROPOSED 100-YEAR Q=120cfs

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	4,528.35 ft	Headwater Depth/ Height	1.83
Computed Headwater Elevation	4,526.33 ft	Discharge	120.00 cfs
Inlet Control HW Elev	4,525.30 ft	Tailwater Elevation	4,522.20 ft
Outlet Control HW Elev	4,526.33 ft	Control Type	Outlet Control

Grades

Upstream Invert	4,519.00 ft	Downstream Invert	4,517.00 ft
Length	287.00 ft	Constructed Slope	0.006969 ft/ft

Hydraulic Profile

Profile	Pressure	Depth, Downstream	5.20 ft
Slope Type	N/A	Normal Depth	3.28 ft
Flow Regime	N/A	Critical Depth	3.30 ft
Velocity Downstream	9.55 ft/s	Critical Slope	0.006905 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	4.00 ft
Section Size	48 inch	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev	4,526.33 ft	Upstream Velocity Head	1.42 ft
Ke	0.50	Entrance Loss	0.71 ft

Inlet Control Properties

Inlet Control HW Elev	4,525.30 ft	Flow Control	Submerged
Inlet Type	Square edge w/headwall	Area Full	12.6 ft^2
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Rating Table Report
48" RCP PROPOSED 100-YEAR Q=120cfs

Range Data:

	Minimum	Maximum	Increment
Allowable HW Elev:	4,527.00	4,529.50	0.25 ft

HW Elev (ft)	Discharge (cfs)
4,527.00	129.39
4,527.25	132.71
4,527.50	135.96
4,527.75	139.13
4,528.00	142.23
4,528.25	145.26
4,528.50	148.23
4,528.75	151.14
4,529.00	154.00
4,529.25	156.81
4,529.50	159.56

COMP. INDEX NO. | REV. NO.

SUBJECT RETRAC SHEET NO.____ OF____
W. 2ND ST SD @ 4TH ST.
36" RCP EXTENSION INLET CALCS.

MADE BY ZRB DATE 6/11/03 CHECKED BY____ DATE____

– TYPE V MANHOLE

– RIM = 4525

60" OPENNING

WS = 4525 + 1 = 4526'

$A = 19.6$ SQ FT

$92_{cfs} = 0.6(19.6)\sqrt{64.4h}$

$h = 1'$

1' OF HEAD

– DEBRIS RISER 3.7' BAR SPACING
48 BARS ½" ⌀

25% CLOGGING FACTOR

CIRCUM = 201 in
– BAR WIDTH = 177 in

132.75" w/ CLOGGING FACTOR = 11.1'

$Q = 0.6A\sqrt{2gh}$

$92 = 0.6(11.1)h\sqrt{64.4h}$

$13.8 = h\sqrt{64.4h}$

$h = 1.4'$

– RISER IE = 4525'

W.S. = 4525' + 1.4 + .25 = 4526.65'
↑ 3" BAND

– 36" RCP PIPE REQUIRED HEAD = 13.45'

W.S. ELEV = 4538.3

PIPE CONTROLS

Weir & Orifice Flow Comparison

SILVER STATE LODGE
24" RCP

$Q^{*} = 0.6A\sqrt{2gh}$

rifice Flow Equation)

Q = Capacity in CFS
ree open area of grate in sq. ft.
g = 32.2 (feet per sec/sec)
h = Head in feet

Orifice Information

Instructions:

- Either Select catalog number (will automatically fill in Open Area and Perimeter) or enter your own values
- Enter head value
- Press CALCULATE

The results will determine automatically if your situation falls into a Weir, Transitional or Orifice flow. Additionally, a pop-up window will offer Neenah grates which fall within the parameters chosen.

$Q = 3.3P(h)^{1.5}$

(Weir Equation)

Q = Capacity in CFS
P = Feet perimeter
h = Head in feet

Weir Information

alog number and grate type: R-3560 L

Head in feet (h): 2

t perimeter (P):

Calculate

Free open area in sq. ft. (A): 1.5

ir capacity in cfs:

Transitional flow in cfs:

Orifice capacity in cfs: 10.2

(Results assume no debris restriction.)

NOTE: The above results do not account for the dome height of Beehive-type grates. Please take note of this when determining the Head (h) value.

For additional information regarding Neenah Inlet Grate Capacities, please contact our Product Engineer, Steve Akkala, at 920-725-7000 or at sakkala@nfco.com.

Weir & Orifice Flow Comparison

SILVER STATE LODGE
24" RCP

$Q = 0.6A\sqrt{2gh}$
Orifice Flow Equation)

Q = Capacity in CFS
Free open area of grate in sq. ft.
g = 32.2 (feet per sec/sec)
h = Head in feet

Orifice Information

Instructions:

- Either Select catalog number (will automatically fill in Open Area and Perimeter) or enter your own values
- Enter head value
- Press CALCULATE

The results will determine automatically if your situation falls into a Weir, Transitional or Orifice flow. Additionally, a pop-up window will offer Neenah grates which fall within the parameters chosen.

$Q = 3.3P(h)^{1.5}$
(Weir Equation)

Q = Capacity in CFS
P = Feet perimeter
h = Head in feet

Weir Information

alog number and grate type: R-3260-A A

Head in feet (h): 2

et perimeter (P):

Calculate

Free open area in sq. ft. (A): 3.2

ir capacity in cfs:

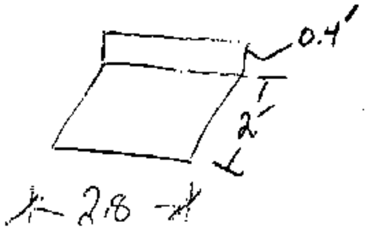
Transitional flow in cfs:

Orifice capacity in cfs: 21.8

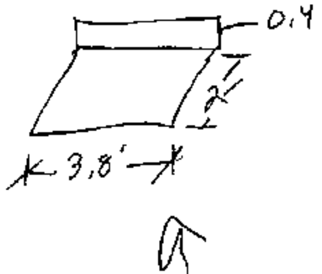
(Results assume no debris restriction.)

NOTE: The above results do not account for the dome height of Beehive-type grates. Please take note of this when determining the Head (h) value.

For additional information regarding Neenah Inlet Grate Capacities, please contact our Product Engineer, Steve Akkala, at 920-725-7000 or at sakkala@nfco.com.



6"×1" OPENNING
15×6



0.6'×1" OPENNING
15×6

SAME ACR[illegible] REET
EXCEPT NO CURB INLET
ON ONE

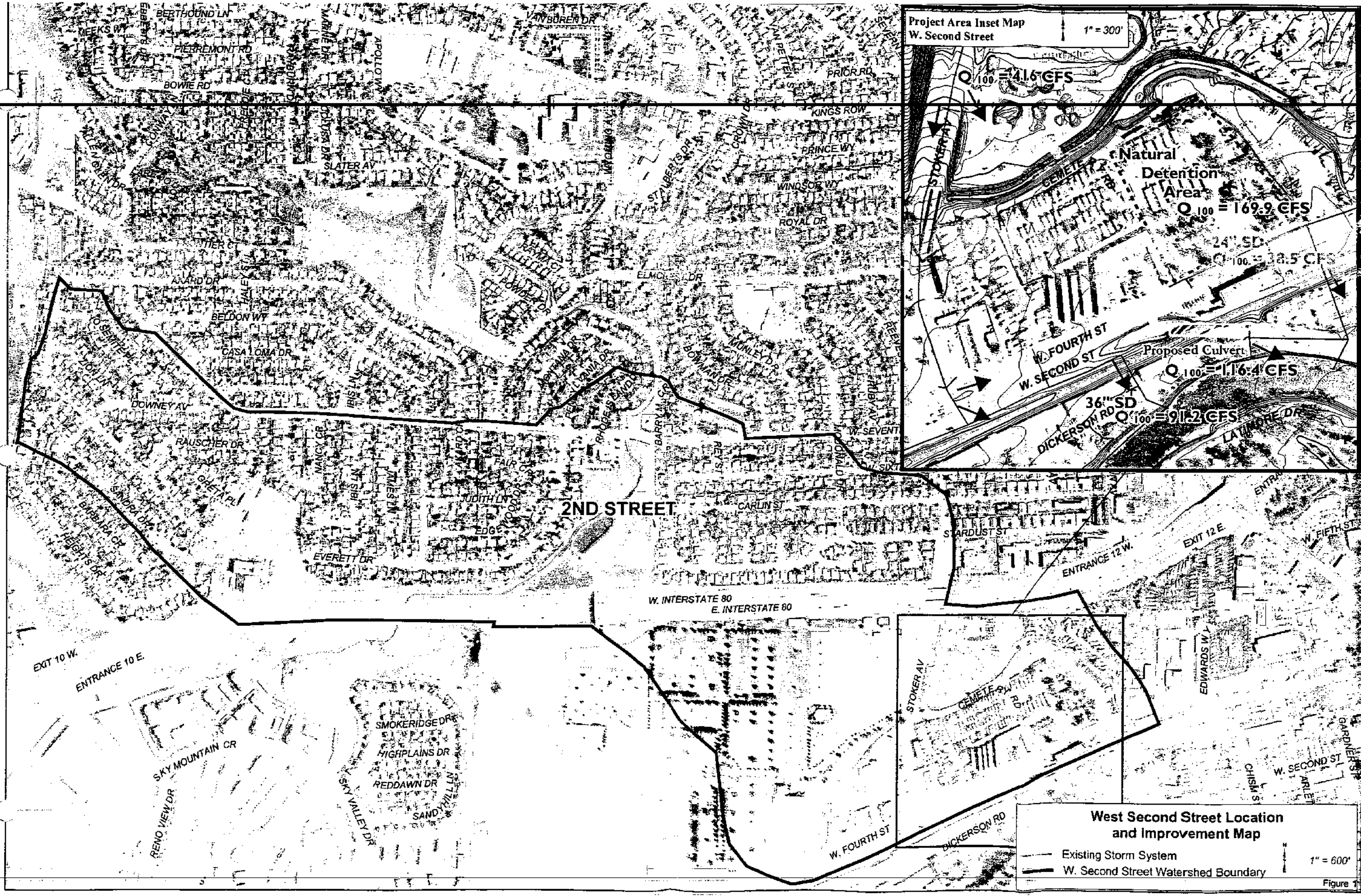
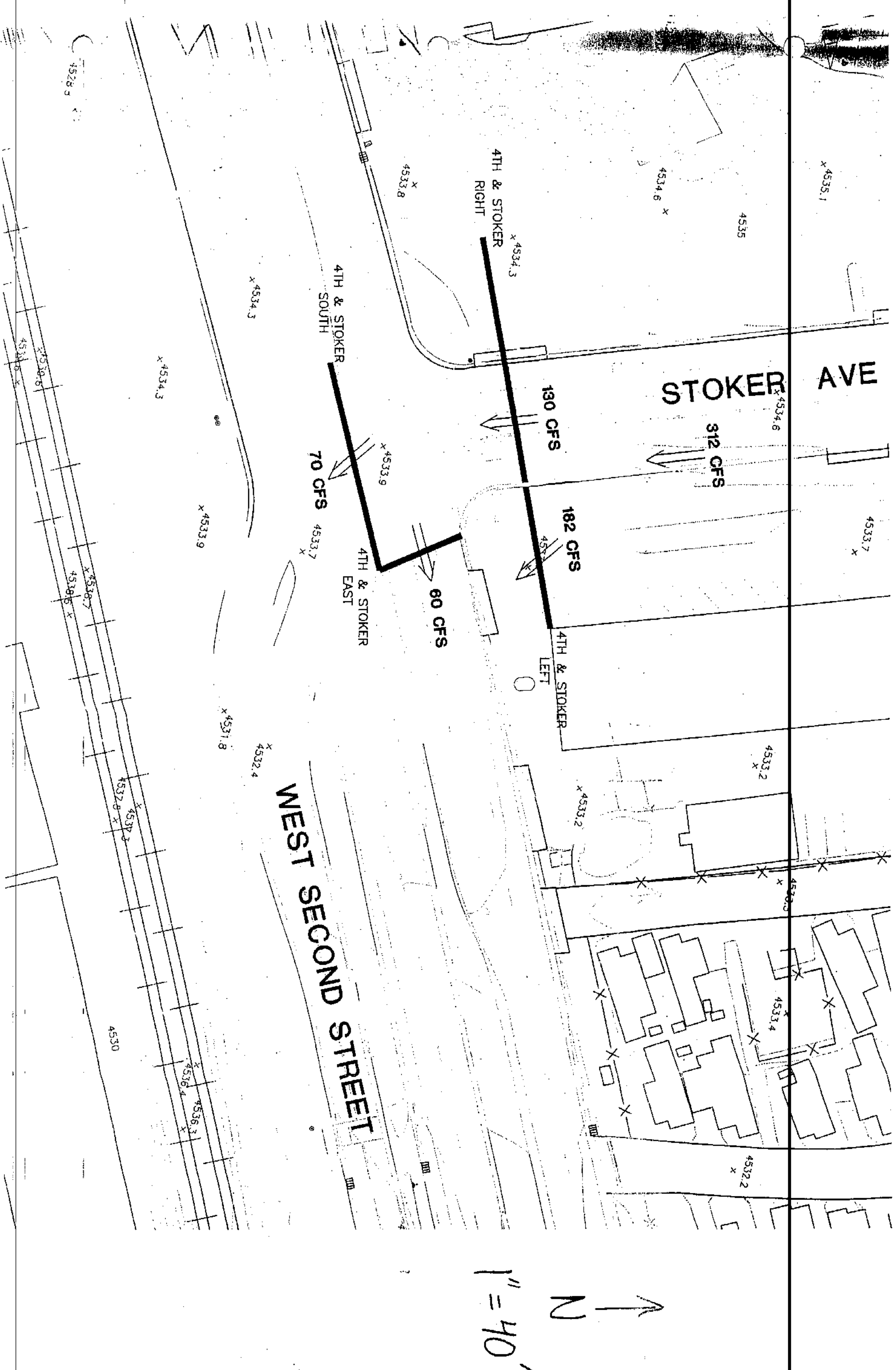

West Second Street Location and Improvement Map
Existing Storm System
W. Second Street Watershed Boundary
1" = 600'
Project Area Inset Map
W. Second Street
1" = 300'
Q 100 = 41.6 CFS
Natural Detention Area
Q 100 = 169.9 CFS
24" SD
Q 100 = 18.5 CFS
Proposed Culvert
Q 100 = 116.4 CFS
36" SD
Q 100 = 91.2 CFS
STOKER AV
CEMETERY RD
W. FOURTH ST
W. SECOND ST
DICKERSON RD
LATIMORE DR
2ND STREET
W. INTERSTATE 80
E. INTERSTATE 80
EXIT 10 W.
ENTRANCE 10 E.
ENTRANCE 12 W.
EXIT 12 E.
W. FIFTH ST
W. SEVENTH
SIXTH
STARDUST ST
CARLIN ST
REY ST
BARRY M CR
RHODE ISLAND
PENNSYLVANIA DR
MONTANA DR
FAIR CT
JUDITH LN
EDGEWOOD DR
EVERETT DR
JAMES LN
IBIS LN
NANCY CR
AKARD CT
GRETA PL
RAUSCHER DR
DOWNEY AV
ZION LN
YOSEMITE AV
SANDRA DR
BARBARA CR
HEIGHTS DR
CASA LOMA DR
BELDON WY
AKARD DR
HALEY ST
TIER CT
ALLEN GLEN DR
POWDER DR
BOWMAN DR
MUNLEY DR
ELMCREST DR
RUBY AV
REEVES
MCDONALD DR
ST ALBERTS DR
CROWN DR
ROYAL DR
WINDSOR WY
PRINCE WY
KINGS ROW
PRIOR RD
VAN PETTEN ST
VAN BUREN DR
WYOMING AV
SLATER AV
COLUSA DR
RAMBOUILLET DR
MARINE DR
APOLLO WY
BOWIE RD
PIERREMONT RD
BERTHOUD LN
MEEKS WY
EBBETTS DR
CONWAY
RENO VIEW DR
SKY MOUNTAIN CR
SKY VALLEY DR
SMOKERIDGE DR
HIGHPLAINS DR
REDDAWN DR
SANDYHILL LN
EDWARDS WY
CHISM ST
ARLENE
GARDNER ST

Figure 1


STOKER AVE
WEST SECOND STREET
4TH & STOKER RIGHT
4TH & STOKER SOUTH
4TH & STOKER EAST
4TH & STOKER LEFT
130 CFS
312 CFS
182 CFS
70 CFS
60 CFS
4528.5
4533.8
4534.6
4535.1
4535
4534.3
4534.3
4534.3
4534.6
4533.9
4533.9
4533.7
4533.7
4531.8
4532.4
4533.2
4533.2
4533.4
4532.2
4530
N
1" = 40'

4th & Stoker Ave. Right
Worksheet for Irregular Channel

Project Description	
Worksheet	4th & Stoker N. Ri
Flow Element	Irregular Channel
Method	Manning's Formul
Solve For	Discharge

Input Data		
Slope	003750	ft/ft
Water Surface Elev.	,534.34	ft

Options	
Current Roughness Metho	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coeffic	0.016	
Elevation Range	33.70 to 4,534.30	
Discharge	131.66	cfs
Flow Area	44.1	ft²
Wetted Perimete	115.82	ft
Top Width	115.00	ft
Actual Depth	0.64	ft
Critical Elevation	4,534.30	ft
Critical Slope	0.005366	ft/ft
Velocity	2.99	ft/s
Velocity Head	0.14	ft
Specific Energy	4,534.47	ft
Froude Number	0.85	
Flow Type	Subcritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.435 ft.

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+70	11+85	0.016

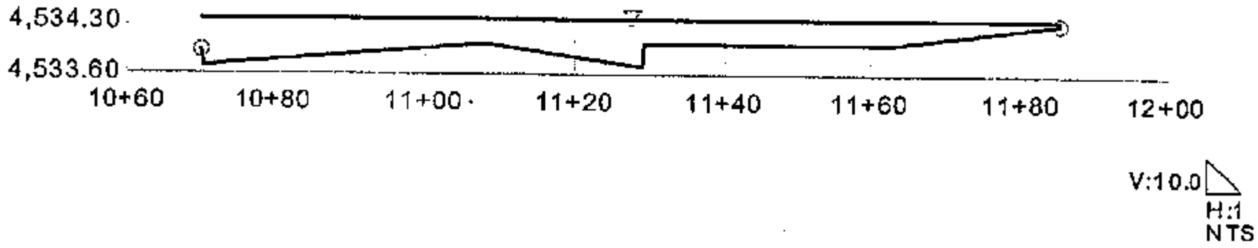
Natural Channel Points

Station (ft)	Elevation (ft)
10+70	4,533.90
10+70	4,533.70
11+08	4,534.00
11+29	4,533.70
11+29	4,534.00
11+63	4,534.00
11+85	4,534.30

4th & Stoker Ave. Right
Cross Section for Irregular Channel

Project Description	
Worksheet	4th & Stoker N. Ri
Flow Element	Irregular Channel
Method	Manning's Formul
Solve For	Discharge

Section Data		
Mannings Coefficie	0.016	
Slope	0.003750	ft/ft
Water Surface Elev	4,534.34	ft
Elevation Range	33.70 to 4,534.30	
Discharge	131.66	cfs



4th & Stoker Ave. Left

Worksheet for Irregular Channel

Project Description	
Worksheet	4th & Stoker N. L
Flow Element	Irregular Channel
Method	Manning's Formu
Solve For	Discharge

Input Data		
Slope	003750	ft/ft
Water Surface Elev.	,534.34	ft

Options	
Current Roughness Methc	›ved Lotter's Method
Open Channel Weighting	›ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coeffic	0.016	
Elevation Range	33.70 to 4,533.90	
Discharge	181.97	cfs
Flow Area	44.1	ft²
Wetted Perimeter	71.19	ft
Top Width	70.00	ft
Actual Depth	0.64	ft
Critical Elevation	4,534.30	ft
Critical Slope	0.004532	ft/ft
Velocity	4.13	ft/s
Velocity Head	0.27	ft
Specific Energy	4,534.60	ft
Froude Number	0.92	
Flow Type	Subcritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.535 ft.

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	10+70	0.016

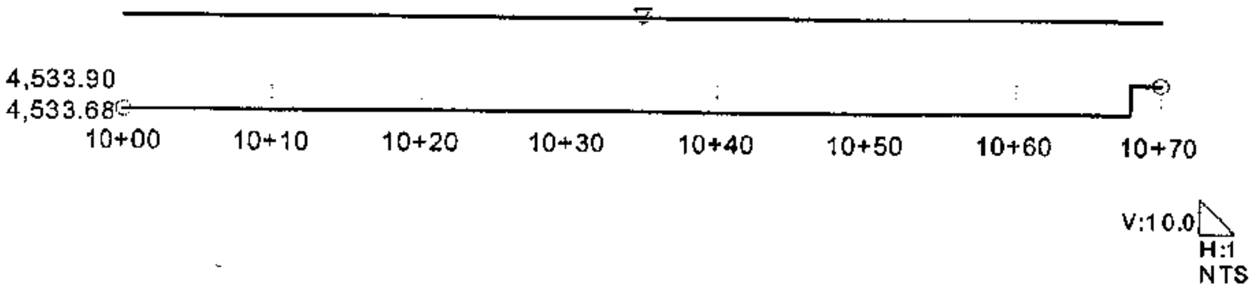
Natural Channel Points

Station (ft)	Elevation (ft)
10+00	4,533.70
10+68	4,533.70
10+68	4,533.90
10+70	4,533.90

4th & Stoker Ave. Left
Cross Section for Irregular Channel

Project Description	
Worksheet	4th & Stoker N. L
Flow Element	Irregular Channel
Method	Manning's Formu
Solve For	Discharge

Section Data		
Mannings Coefficiel	0.016	
Slope	0.003750	ft/ft
Water Surface Elev	4,534.34	ft
Elevation Range	33.70 to 4,533.90	
Discharge	181.97	cfs



Worksheet for Irregular Channel

Project Description	
Worksheet	4th & Stoker E
Flow Element	Irregular Chan‹
Method	Manning's Forr
Solve For	Discharge

Input Data		
Slope	003170	ft/ft
Water Surface Elev.	,534.21	ft

Options	
Current Roughness Methc	wed Lotter's Method
Open Channel Weighting	›ved Lotter's Method
Closed Channel Weightin‹	Horton's Method

Results		
Mannings Coeffic	0.016	
Elevation Range	33.50 to 4,534.00	
Discharge	59.32	cfs
Flow Area	19.3	ft²
Wetted Perimetei	43.03	ft
Top Width	42.50	ft
Actual Depth	0.70	ft
Critical Elevation	4,534.14	ft
Critical Slope	0.005159	ft/ft
Velocity	3.07	ft/s
Velocity Head	0.15	ft
Specific Energy	4,534.35	ft
Froude Number	0.80	
Flow Type	Subcritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.205 ft.

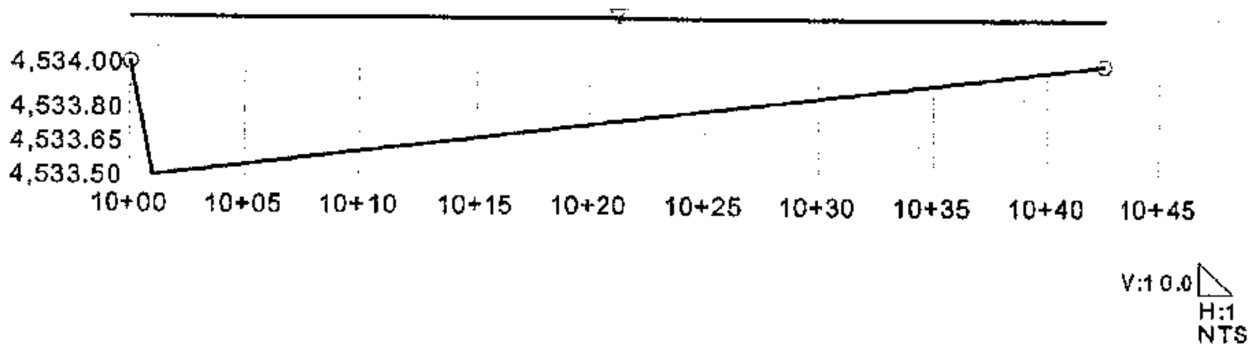
Roughness Segments		
Start Station	End Station	Mannings Coefficient
10+00	10+43	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
10+00	4,534.00
10+01	4,533.50
10+43	4,534.00

4th & Stoker Ave. East
Cross Section for Irregular Channel

Project Description	
Worksheet	4th & Stoker E
Flow Element	Irregular Chan
Method	Manning's Forr
Solve For	Discharge

Section Data		
Mannings Coefficie	0.016	
Slope	0.003170	ft/ft
Water Surface Elev	4,534.21	ft
Elevation Range	33.50 to 4,534.00	
Discharge	59.32	cfs



4th & Stoker Ave. South
Worksheet for Irregular Channel

Project Description

Worksheet	4th & Stoker S
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Discharge

Input Data

Slope	009000	ft/ft
Water Surface Elev	,534.21	ft

Options

Current Roughness Methc	›ved Lotter's Method
Open Channel Weighting	›ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results

Mannings Coeffic	0.016	
Elevation Range	33.85 to 4,535.00	
Discharge	69.29	cfs
Flow Area	19.2	ft²
Wetted Perimeter	73.18	ft
Top Width	72.97	ft
Actual Depth	0.35	ft
Critical Elevation	4,534.25	ft
Critical Slope	0.005599	ft/ft
Velocity	3.61	ft/s
Velocity Head	0.20	ft
Specific Energy	4,534.41	ft
Froude Number	1.24	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.205 ft.

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	11+00	0.016

Natural Channel Points

Station (ft)	Elevation (ft)
10+00	4,534.00
10+42	4,533.85
10+66	4,534.00
11+00	4,535.00

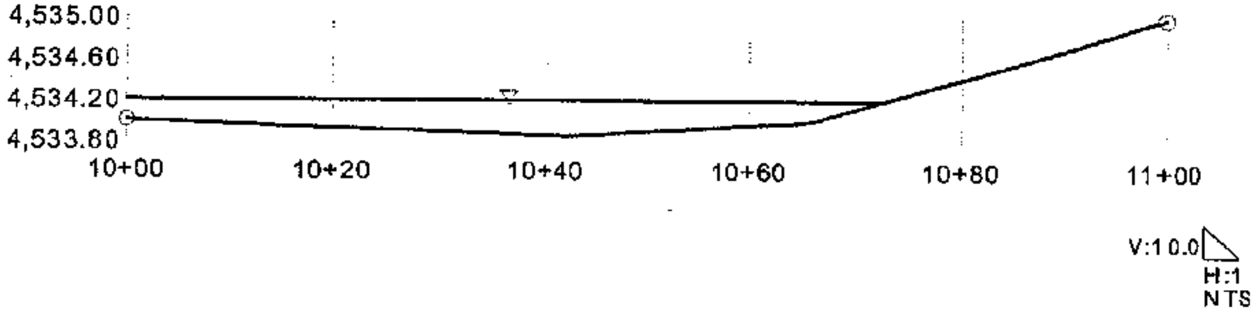
4th & Stoker Ave. South
Cross Section for Irregular Channel

Project Description

Worksheet	4th & Stoker S
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Discharge

Section Data

Mannings Coefficie	0.016	
Slope	0.009000	ft/ft
Water Surface Elev	4,534.21	ft
Elevation Range	33.85 to 4,535.00	
Discharge	69.29	cfs



DNS TRANSPORTATION GROUP INC.
schman • De Leuw, Cather • Steinman

7TH & STOKER X-S SHEET NO. ______ OF ______

MADE BY ZACH DATE 5/13/05 CHECKED BY ______ DATE ______

℄
KER N.
0.00375

$\frac{1000}{4533.7}$ $\frac{1068}{4533.7}$ $\frac{1068.1}{4533.9}$ $\frac{1070}{4533.9}$ $\frac{1070.1}{4533.7}$

$\frac{1108}{4534}$ $\frac{1128.9}{4533.7}$ $\frac{1129}{4534}$ $\frac{1163}{4534}$ $\frac{1185}{4534.3}$

ER ℄
E.
.60317

$\frac{1000}{4534}$ $\frac{1001}{4533.5}$ $\frac{1042.5}{4534}$

KER ℄
S.
0.009

$\frac{1000}{4534}$ $\frac{1092}{4533.85}$ $\frac{1066}{4534}$ $\frac{1100}{4535}$

TOTAL Q = 312 CFS 182 CFS SPLIT EAST ON 4TH THROUGH PARKING LOT.

$Q_{INTERSECTION}$ = 130 CFS 60 CFS SPLIT EAST

70 CFS SPLIT SOUTH

Keystone Ave.

IFC Submittal
NDC-028

September 5, 2003
Project No. 80100603

Mr. Mike Christiansen
ReTRAC
Parsons Transportation Group
264 Keystone Avenue
Reno, Nevada 89503

Reference: **ReTRAC Drainage Memorandum for the Keystone Avenue Storm Drain System**

Dear Mr. Christiansen:

This letter report is to document the storm drain design and assumptions for the Keystone Avenue area between West Fourth Street and the ReTRAC train trench. The existing storm drain system runs north-south within Keystone Avenue to a junction within Fourth Street. The storm drain then continues east, down Fourth Street and connects into the Vine Street storm drain system. The existing storm drain system within Keystone Avenue, north of the tracks, consists of two Type 1 catch basins connecting to a 15-inch lateral.

Existing ground from West Fourth Street south along Keystone Avenue drains south. The proposed Keystone Avenue street improvements and associated fill will alter the existing drainage pattern in a small, localized area between the Union Pacific Railroad (UPRR) crossing and the West Fourth Street crossing.

The proposed roadway improvements for Keystone Avenue will effectively change the direction of flow in the gutter line between the trench and West Fourth Street from flowing south to flowing north. Additionally the roadway improvements will require additional catch basins to intercept flows on existing properties adjacent to Keystone Avenue. These additional catch basins will intercept flow that in existing conditions, drained to Keystone Avenue.

Existing pipe sizes, inverts, slopes and elevations were taken from the *City of Reno Keystone Avenue/West 2nd Street Reconstruction, Overlay, Storm Drain Project* plans, prepared by the City of Reno, dated (revised) June 1993 and ReTRAC 1-foot contour interval topographic mapping prepared for the EIS phase of the project. Additional information was taken from site visits and the City of Reno 2-foot contour interval topography.

The 100-year watershed basin has been delineated and is shown in the *IFC ReTRAC Drainage Report, Volume 1*, as well as in the attached Figure 1 titled Keystone Avenue Location and Improvement Map. The 100-year peak flow rate affecting the Keystone Avenue area at the existing tracks is 91cfs. This flow combines along Fourth Street and ponds in an area approximately 600-feet west of Keystone Avenue on Fourth Street. Flow exceeding the curb height is conveyed south to the existing railroad track and then travels east along the tracks to Keystone Avenue, where a portion of the flow splits over the tracks and travels south on Keystone Avenue and a portion continues east in the UPRR right of way. The existing Keystone Avenue Storm Drain System collects and conveys 37.5cfs to the Vine Street Storm Drain system.

In proposed conditions the 100-year event flow will be intercepted by the proposed storm drain system. Proposed improvements will consist of 6 new catch basins and laterals to connect to the existing 15-inch storm drain in Keystone Avenue and removal and abandonment of the two existing Type 1 catch basin inlets and associated laterals. Basin A will need to be graded to drain to the catch basin at Basin B.

The proposed system will convey 37.5 cfs to the Vine Street storm drain system and will reduce the amount of overland flow at the trench. The remaining flow of 53.5 cfs will be conveyed east via a drop inlet to a 36-inch Reinforced Concrete Pipe under the Keystone Avenue roadway improvements to the Vine Street Siphon.

The times of concentration for the Vine Street and Keystone Avenue peak flow rates do not coincide. The Keystone Avenue system does not therefore assume a tail water elevation of the Vine Street system at its full flow elevation. The 50-year event hydraulic grade line of the Vine Street Siphon at the Keystone system inlet structure is at an approximate elevation of 4522. During high flow events in the Vine Street system, flow will back up into the Keystone system to an elevation of approximately 4522. This elevation is below the capacity elevation of 4525 and will not impact upstream or downstream properties. See the attached Appendix for the proposed storm drain design and hydraulic backup calculations.

Sincerely,

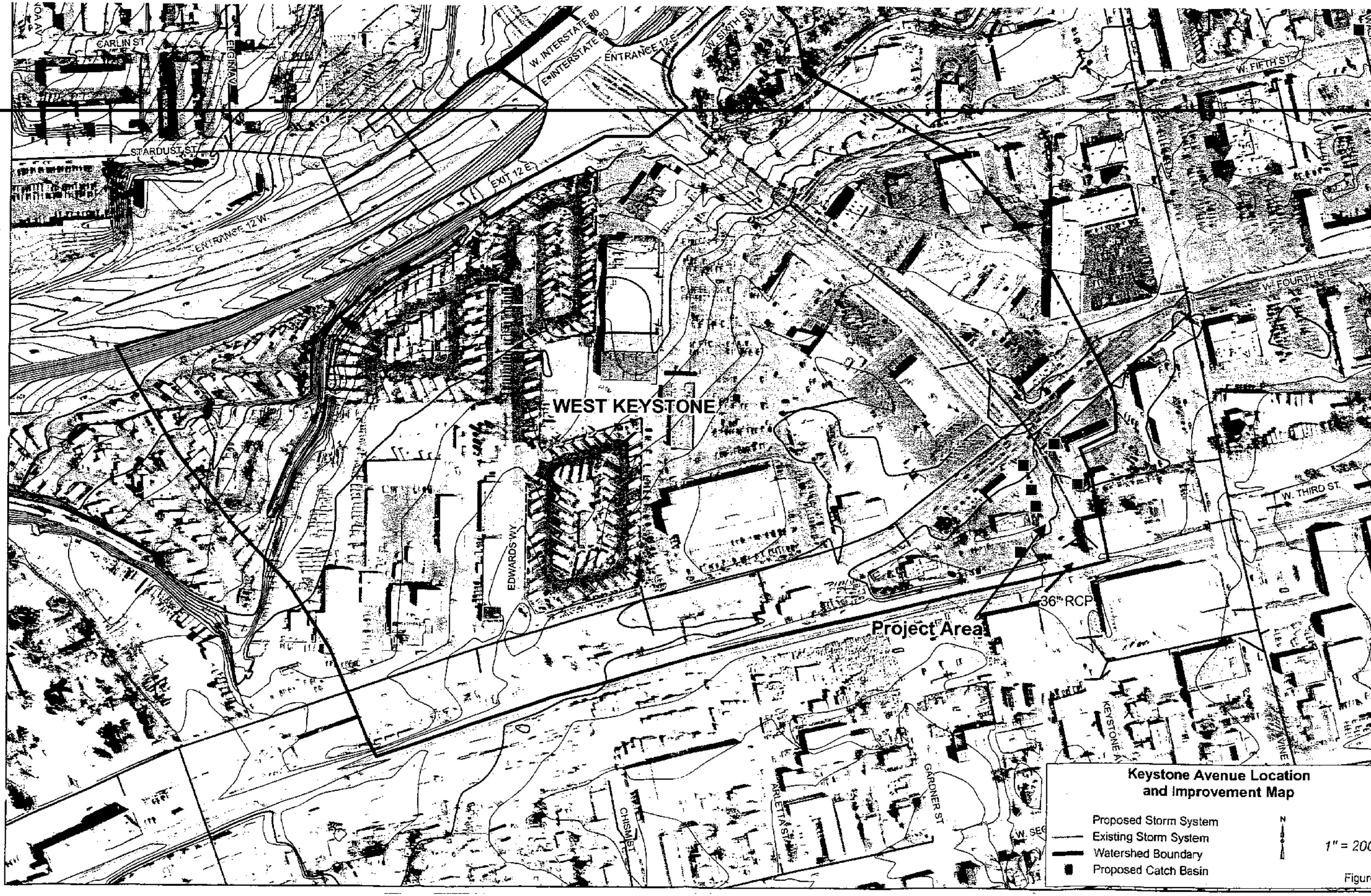
STANTEC CONSULTING INC.

Trina M. Magoon, PE
Water Resources Project Manager

TMM:zrb

Enclosure(s)

P:\Misc\80100603\H&H\Design Memorandums\MEMO H&H Keystone Ave Design (IFC) REV 1.doc


CARLIN ST
ELGIN AV
STARDUST ST
ENTRANCE 12 W
EXIT 12 E
W. INTERSTATE 80
E. INTERSTATE 80
ENTRANCE 12 E
W. SIXTH ST
W. FIFTH ST
W. FOURTH ST
W. THIRD ST
WEST KEYSTONE
EDWARDS WY
36" RCP
Project Area
CHISM ST
ARLETTA ST
GARDNER ST
W. SEC
KEYSTONE A
VINE S
Keystone Avenue Location and Improvement Map
Proposed Storm System
Existing Storm System
Watershed Boundary
Proposed Catch Basin
N
1" = 20
Figur

Stantec

DEIKAC
West Keystone Watershed

HEC-1

Q_{100} = 91 cfs

Keystone at 4th Street Storm Drain

$Q_{capacity}$ = 37.44 cfs

$$\begin{array}{r} \overset{2}{30}, \\ 1.4 \\ 1.4 \\ 0.2 \\ 0.41 \\ 0.14 \\ \underline{3.29} \\ 37.44 \end{array}$$

Culvert under Keystone

36" RCP
L ≈ 150'
S = .0033
IE_{up} = 4520
IE_{DN} = 4519.5

$$\begin{array}{r} 91 \\ \underline{37.5} \\ 53.5 \text{ cfs} \end{array}$$

Channel from Keystone to Vine

BW = 2'
SS = 2:1
Long S = .005
L ≈ 300'

D = 2.32'
FB = 1'
TD = 3.32'
req'd

TW = 20 - 24'

NG ≈ 4524
IE - 19.5 to 18

Designed by:
Checked by:

Stantec

Keno KeTRAC
Keystone Ave

80100603

For Storm Drain System

BASIN	C	A(ac)	i_5	i_{100}	Q_5(cfs)	Q_{100} (cfs)
A	0.4	1.84	0.9	2.5	0.66	1.84
B	0.85	0.71	0.88	2.4	0.53	1.45
E	↓	0.38	0.85	2.3	0.27	0.74
C	↓	0.21	0.84	2.28	0.15	0.41
D	↓	0.73	0.84	2.26	0.52	1.40
F	↓	0.73	0.83	2.25	0.52	1.40
	Maximum Q_{100} in SD pipe				2.65	7.24

For Catch Basins

BASIN	C	i_5	i_{100}	A (ac)	Q_5(cfs)	Q_{100} (cfs)
A	0.4	0.9	2.5	1.84	0.66	1.84
B	0.85	1.4	3.8	0.71	0.85	2.29
C	↓	↓	↓	0.21	0.25	0.68
D	↓	↓	↓	0.73	0.87	2.36
E	↓	↓	↓	0.38	0.45	1.23
F	↓	↓	↓	0.73	0.87	2.36
					3.75	10.76

Designed by: JNC

Checked by:

WASHOE COUNTY

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

DEVELOPMENT Keystone Avenue

CALCULATED BY TMO **DATE** 1/20/03

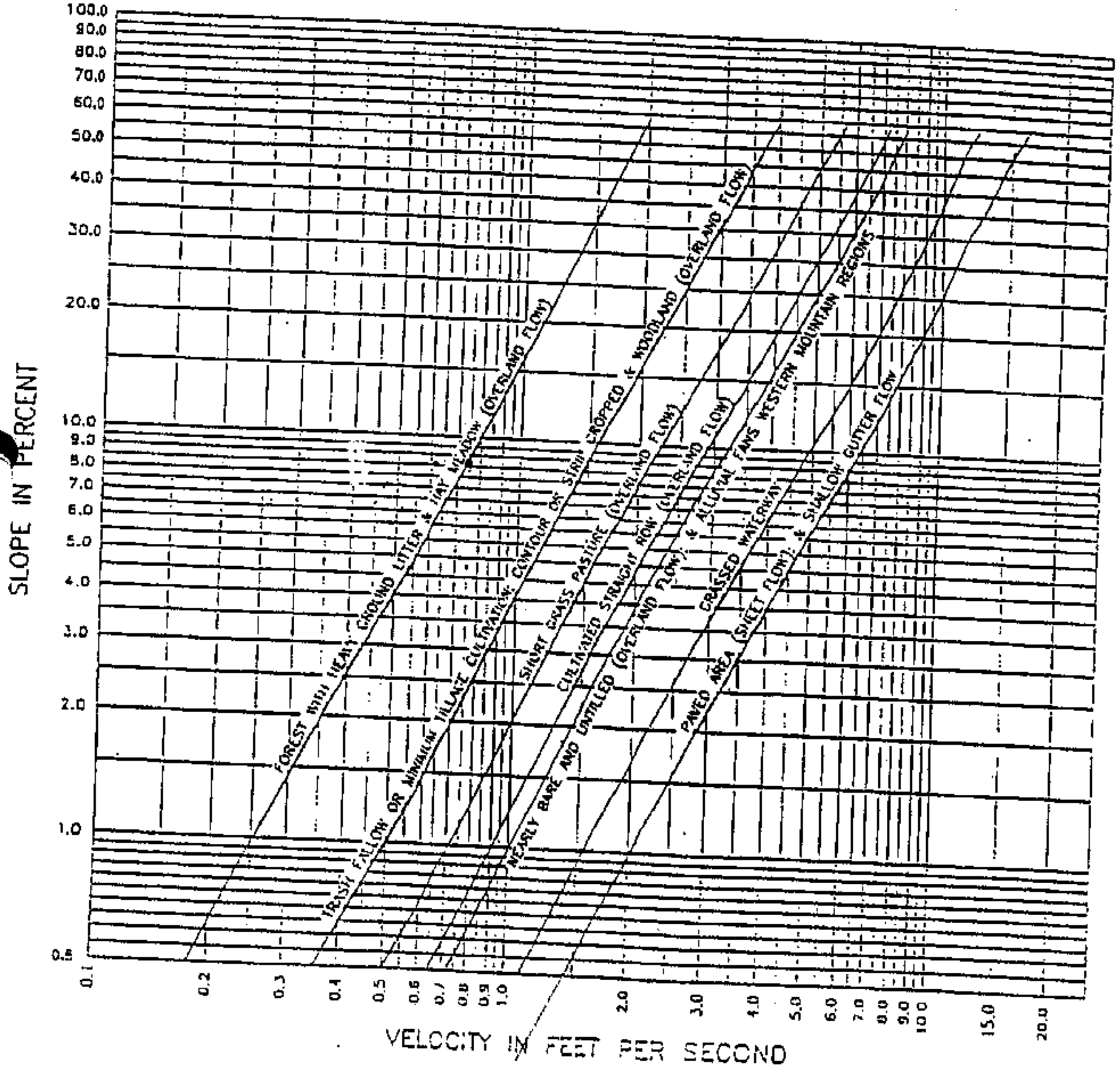
SUB-BASIN DATA			INITIAL/OVERLAND TIME (t_i)			TRAVEL TIME (t_t)				t_c ($t_i + t_t$)	t_c URBANIZED BASINS CHECK		FINAL t_c	REMARKS
DESIG: (1)	R C_5 (2)	AREA Ac (3)	LENGTH Ft (4)	SLOPE % (5)	t_i Min (6)	LENGTH Ft (7)	SLOPE % (8)	VEL. FPS (9)	t_t Min (10)	t_c Min (11)	TOTAL LENGTH Ft (12)	$t_c=(L/180)+10$ Min (13)	Min (14)	
A	0.4	1.84	20	2	4.47	1646	0.4	1.4	19.6	24.09	1666	19.26	19.26	i_5=0.92 ; i_m=2.50
A to B						100	0.3	1.1	1.5				20.76	overland Flow
B	.85	0.71	45	0.9	3.13	275	1.1	2.2	2.08	5.21	320	11.78	20.76	Use10 for CB
B to E						218	0.14	3.3	1.1				21.86	pipe flow V from storm
E	.85	0.38	45	2	2.4	178	1.1	2.2	1.35	3.75	223	11.24	21.86	use 10 for CB
E to C						28	3.4	3.3	6.14				22.00	pipe flow
C	.85	0.21	20	2	1.6	76	6.1	4.9	0.26	1.86	96	10.53	22.00	use 10 for CB
C to D						52	1.2	6	0.14				22.14	pipe flow
D	.85	073	70	2	3.0	227	2	2.7	1.4	4.40	297	11.65	22.14	use 10 for CB
D to F						22	.64	6.0	.06				22.2	pipe flow
F	.85	0.73	60	2	2.77	156	1.75	2.6	1.0	3.77	216	11.20	22.2	use10 for CB

$$t_i = 1.8\ (1.1 - R)\ L^{1/2} / S_{\%}^{1/3}$$

<

6.72

TRAVEL TIME VELOCITY



RATIONAL FORMULA METHOD RUNOFF COEFFICIENTS

Land Use or Surface Characteristics	Aver. % Impervious Area	Runoff Coefficients	
		5-Year (C_5)	100-Year (C_{100})
Business/Commercial:			
Downtown Areas	85	.82	.85
Neighborhood Areas	70	.65	.80
Residential:			
(Average Lot Size)			
⅛ Acre or Less (Multi-Unit)	65	.60	.78
¼ Acre	38	.50	.65
⅓ Acre	30	.45	.60
½ Acre	25	.40	.55
1 Acre	20	.35	.50
strial:	72	.68	.82
Space:			
(s, Parks, Golf Courses)	5	.05	.30
Undeveloped Areas:			
Range	0	.20	.50
Forest	0	.05	.30
Streets/Roads:			
Paved	100	.88	.93
Gravel	20	.25	.50
Drives/Walks:	95	.87	.90
Roofs:	90	.85	.87

Notes:

Composite runoff coefficients shown for Residential, Industrial, and Business/Commercial Areas assume irrigated grass landscaping for all previous areas. For development with landscaping other than irrigated grass, the designer must develop project specific composite runoff coefficients from the surface characteristics presented in this table.

3. The Rational Method:

a. The design flow for the Rational Method is expressed as:

$$Q = CiA.$$

where:

Q = peak rate of runoff, cubic feet per second

C = runoff coefficient

i = average rainfall intensity, inches per hour

A = watershed area, acres

b. The following listed runoff coefficients, depending on future use, shall be used:

NOTE: A "build up" C valve may be required in special conditions such as very small lots with large houses or duplexes.

RUNOFF COEFFICIENTS "C"

Land Use Type	Runoff Coefficient "C"
Rural	0.25-0.35
Single Family Residential	0.45-0.60
Multi-Residential	0.60-0.70
Neighborhood Commercial	0.85
Community Commercial	0.85
Tourist Commercial	0.85
Office	0.85
Manufacturing	0.85-0.90
Distribution and Warehousing	0.85-0.90

Public Facility	0.50-0.85
Pavement and Concrete Surfaces	0.90-0.95
Park	0.25
Open Space (0-5% grade - vegetated)	0.20-0.30
Open Space (0-5% grade - no vegetation)	0.30-0.40
Open Space (5-15% grade - vegetated or unvegetated)	0.40-0.50
Open Space (Over 15% grade - sparsely vegetated, rock or clay soils)	0.40-0.60

c. The rainfall intensity curve shall be used for determining the average intensity. The time of concentration, with a minimum build up time of 10 minutes is expressed as:

$$tc_1 = 10 \text{ or } \frac{L}{V \times 60}, \text{ whichever is greater}$$

where:

tc_1 = time of concentration at initial inlet, minutes
L = length from uppermost point of watershed inlet, feet
V = channel or overland velocity, feet per second

Given the time of concentration at a design point, the time of concentration at the next design point is determined by adding travel time, expressed as:

$$t = \frac{L}{V \times 60}$$

where:

t = travel time, minutes
L = length of channel or conduit between design points, feet
V = channel or conduit velocity, feet per second

4. Minimum design velocity shall be 3 feet per second for storm drains.

Combine [illegible]Node Report

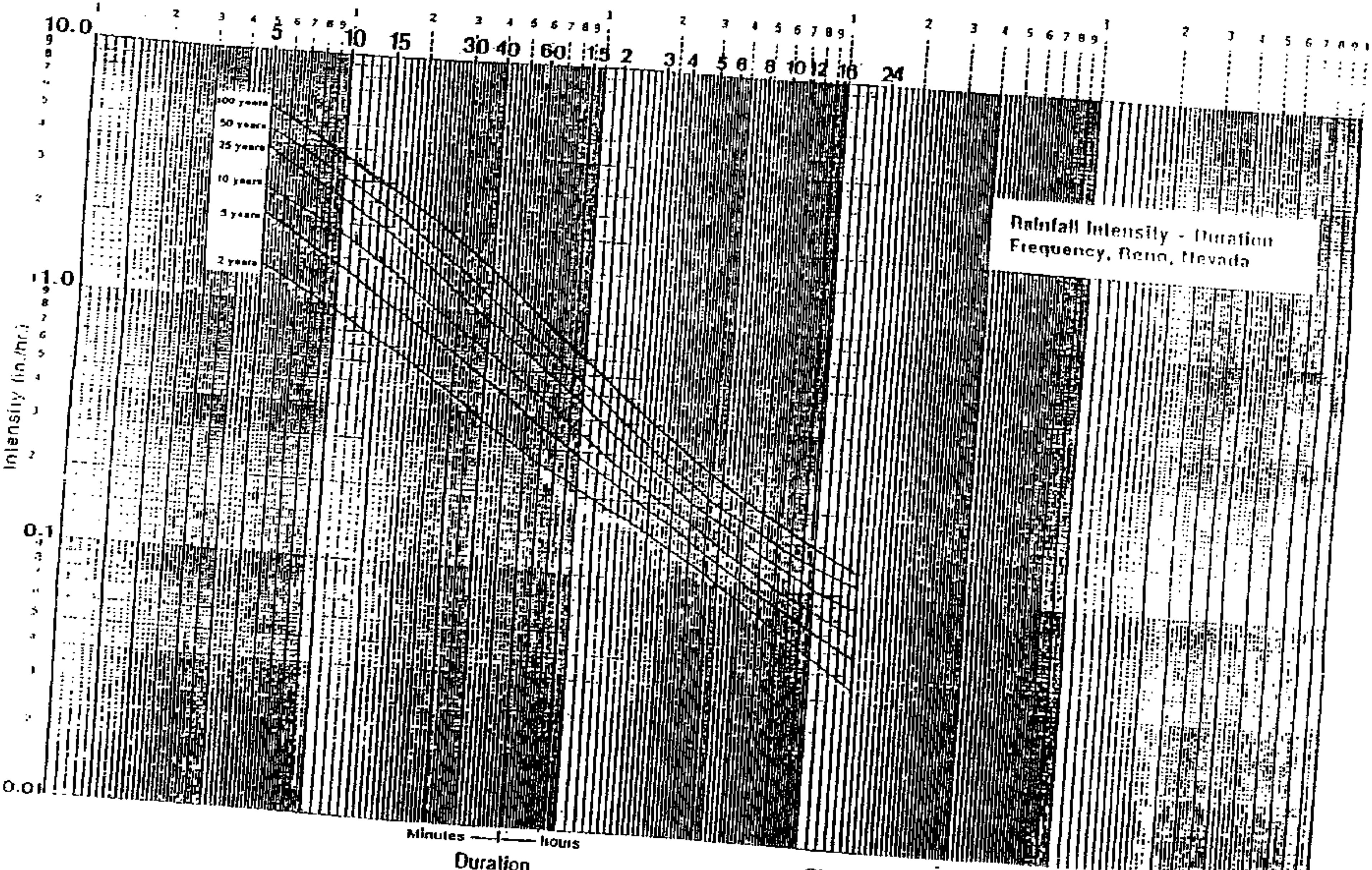
Label	Upstream Node	Downstream Node	Length (ft)	Section Size	Capacity (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Calculated Headloss (ft)	Energy Grade In (ft)	Energy Grade Ou (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Ou (ft)	Total System Flow (cfs)
P-7	I-2	J-10	80.00	10 inch	3.17	6.03	4,522.74	4,521.75	0.012375	1.07	4,524.77	4,523.70	4,524.20	4,523.14	3.29
P-10	J-10	J-7	111.40	15 inch	5.41	2.68	4,521.75	4,520.97	0.007002	0.29	4,523.10	4,522.81	4,522.99	4,522.70	3.29
P-13	I-3	J-7	46.00	10 inch	5.23	2.21	4,522.52	4,520.97	0.033696	0.20	4,523.05	4,522.73	4,522.90	4,522.70	0.74
P-15	I-5	I-4	35.00	10 inch	2.64	1.67	4,524.03	4,523.73	0.008571	0.21	4,524.29	4,524.03	4,524.22	4,524.01	0.20
P-11	J-7	J-8	20.00	15 inch	5.40	3.28	4,520.97	4,520.83	0.007000	0.08	4,522.83	4,522.75	4,522.66	4,522.58	4.03
P-14	I-4	J-8	66.00	10 inch	5.97	1.66	4,523.73	4,520.83	0.043939	1.43	4,524.11	4,522.59	4,524.01	4,522.58	0.41
P-17	I-7	J-9	60.00	12 inch	11.42	2.67	4,523.84	4,520.19	0.060833	2.24	4,524.54	4,522.15	4,524.34	4,522.10	1.40
P-12	J-8	J-9	91.40	15 inch	5.41	3.62	4,520.83	4,520.19	0.007002	0.43	4,522.73	4,522.30	4,522.53	4,522.10	4.44
P-16	I-6	J-6	12.00	12 inch	24.21	2.67	4,523.33	4,520.05	0.273333	1.98	4,524.03	4,521.90	4,523.83	4,521.85	1.40
P-8	J-9	J-6	20.00	15 inch	5.40	4.76	4,520.19	4,520.05	0.007000	0.16	4,522.36	4,522.20	4,522.01	4,521.85	5.84
P-9	J-6	O-1	68.60	15 inch	5.40	5.90	4,520.05	4,519.57	0.006997	0.86	4,522.25	4,521.39	4,521.71	4,520.85	7.24

BASIN		Tc LENGTH	Elev Hi
B	0.71 ACRES	352'	4533
C	0.21 ACRES	96'	4532.4
D	0.73 ACRES	297'	4531
E	0.38 ACRES	223'	4528
F	0.73 ACRES	216'	4530

Designed by:

Checked by:

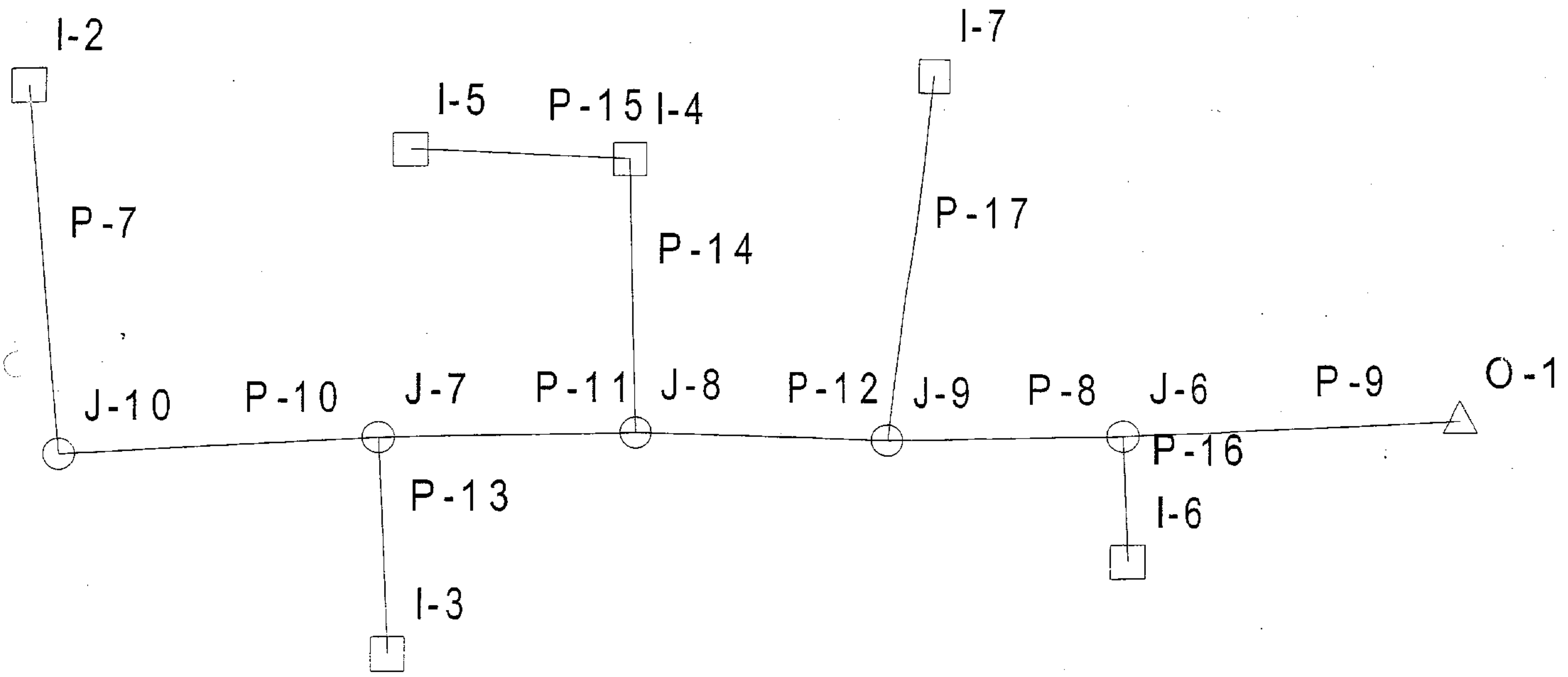
RAINFALL INTENSITY CHART



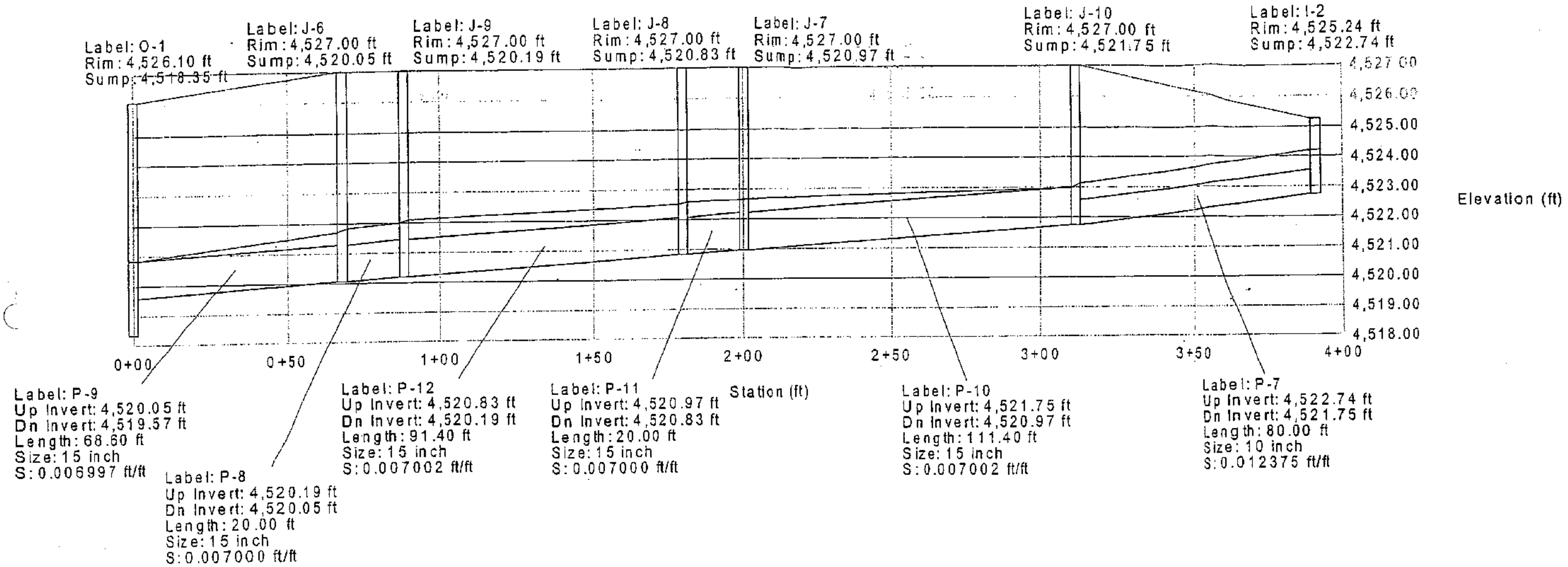
City of Reno

Rainfall Intensity - Duration - Frequency Curves for General Reno Area

Based on Rainfall Data from Cannon Airport Gauging


I-2
P-7
J-10
P-10
J-7
I-5
P-15
I-4
P-14
P-11
J-8
P-13
I-3
I-7
P-17
P-12
J-9
P-8
J-6
P-16
I-6
P-9
O-1

Scenario: Base



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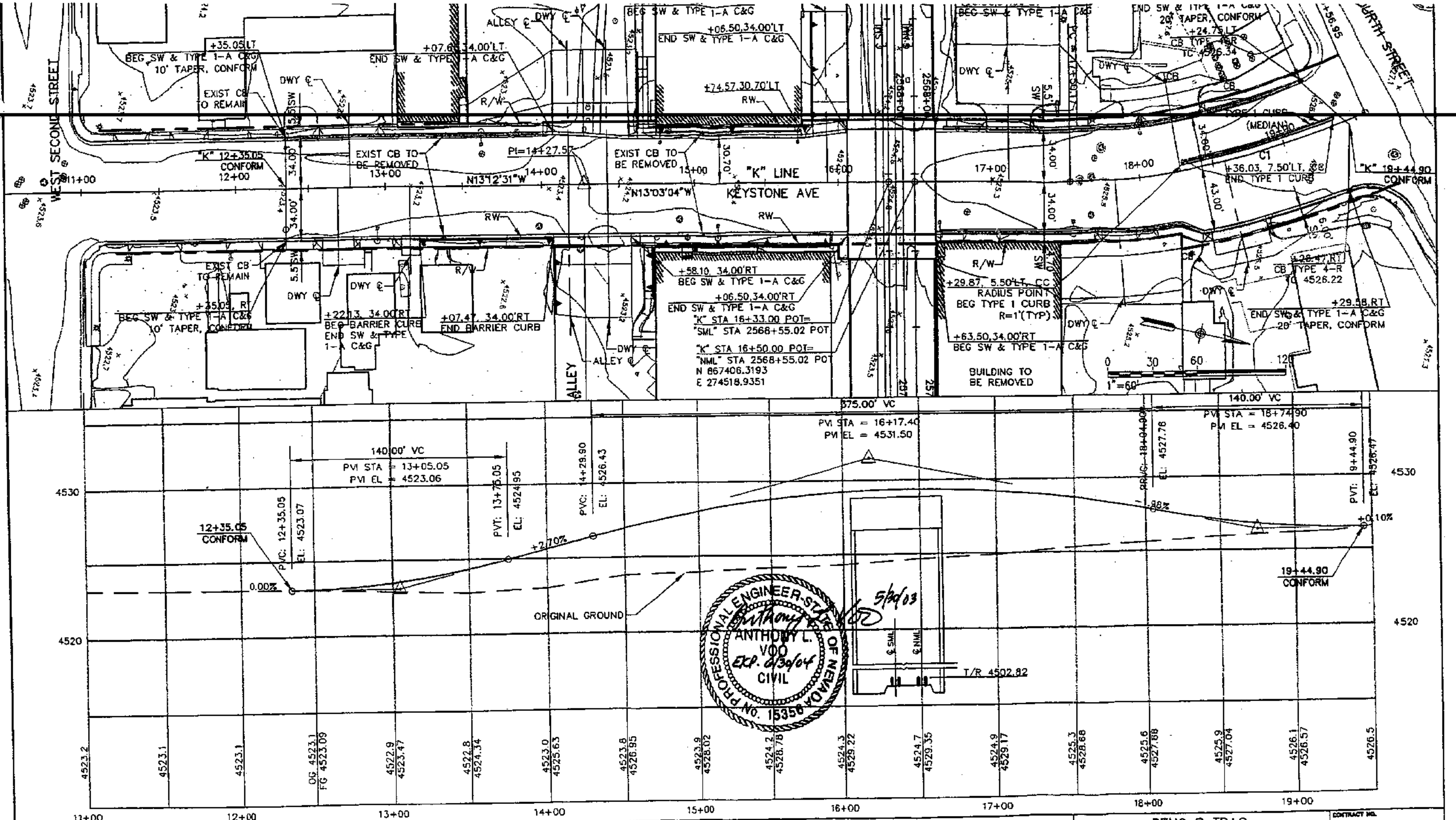
Stantec Consulting Inc
© Haestad Methods, Inc. 37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Project Engineer: Stantec
StormCAD v3.0 [319]



ANTHONY L. VOO
No. 15356
EXP. 6/30/04
Anthony L. Voo 5/30/03

REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION
0	5/30/03	AV	TR	BRD	ISSUE FOR CONSTRUCTION						

DESIGNED BY A.VOO/C.TRIPLET
DRAWN BY C. TRIPLET
CHECKED BY J. SHAFER
IN CHARGE A. VOO
DATE 5/30/03

ISSUED FOR CONSTRUCTION

RENO ReTRAC
RENO WASHOE COUNTY NEVADA

ReTRAC THE GRANITE TEAM

SUBMITTED
APPROVED

RENO ReTRAC
KEYSTONE AVENUE IMPROVEMENTS
KEYSTONE AVENUE
PLAN & PROFILE

CONTRACT NO.
DRAWING NO. C-003
REV
SCALE 1"=60'H, 1"=6'V

COMP. INDEX NO. REV. NO.

SUBJECT RETRAC SHEET NO. OF
KEYSTONE DRAINAGE

MADE BY ZRB DATE 4/7/03 CHECKED BY QAZ DATE 04/17/03

Q=CIA

C_A = 0.90

C_B = 0.70

i_{100} = 3.8 in/hr

A_A = 0.33 AC

A_B = 0.93 AC

Q_{100} = 1.2 CFS BASIN A

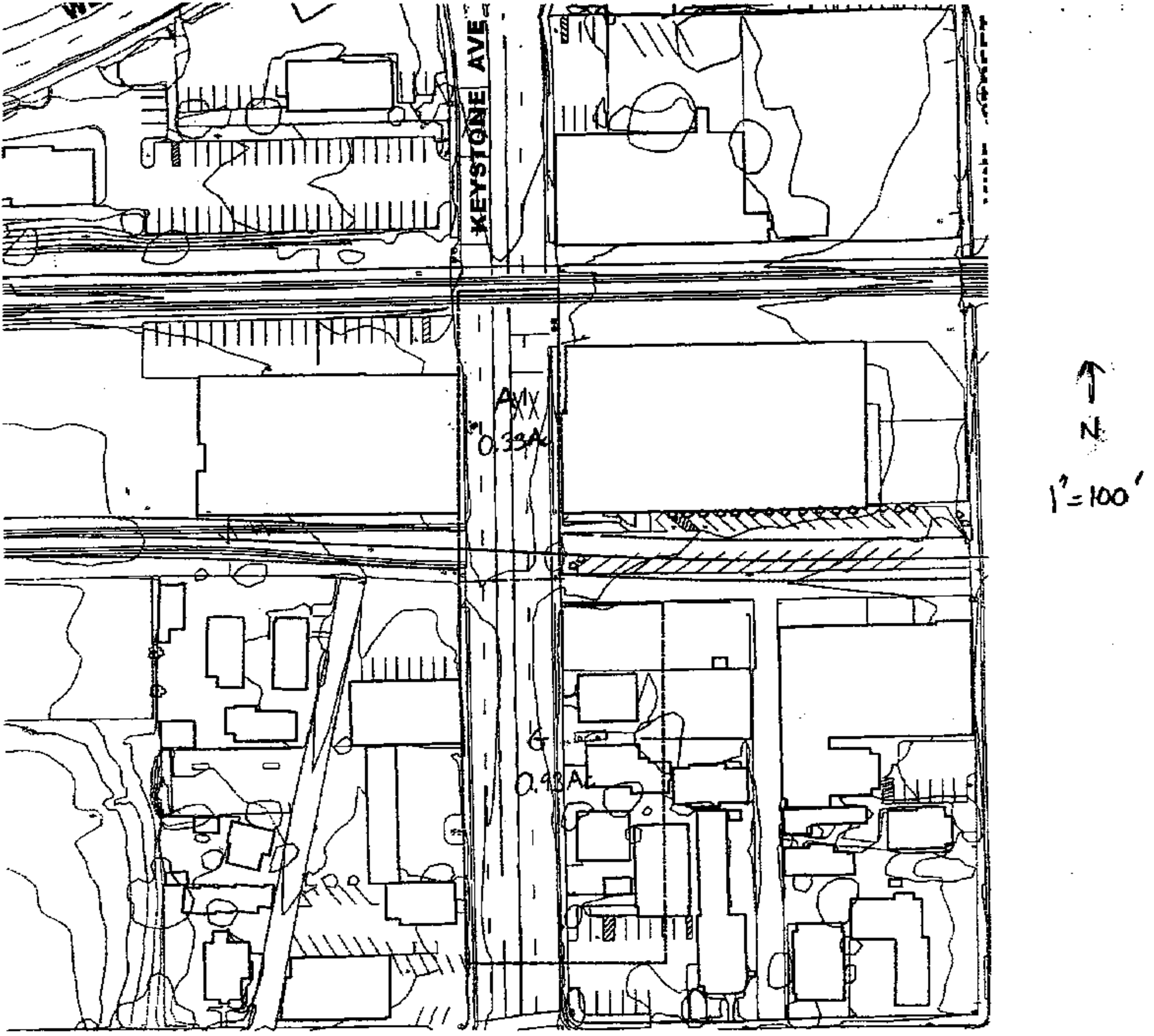
Q_{100} = 2.4 CFS BASIN B

3.6 CFS TOTAL

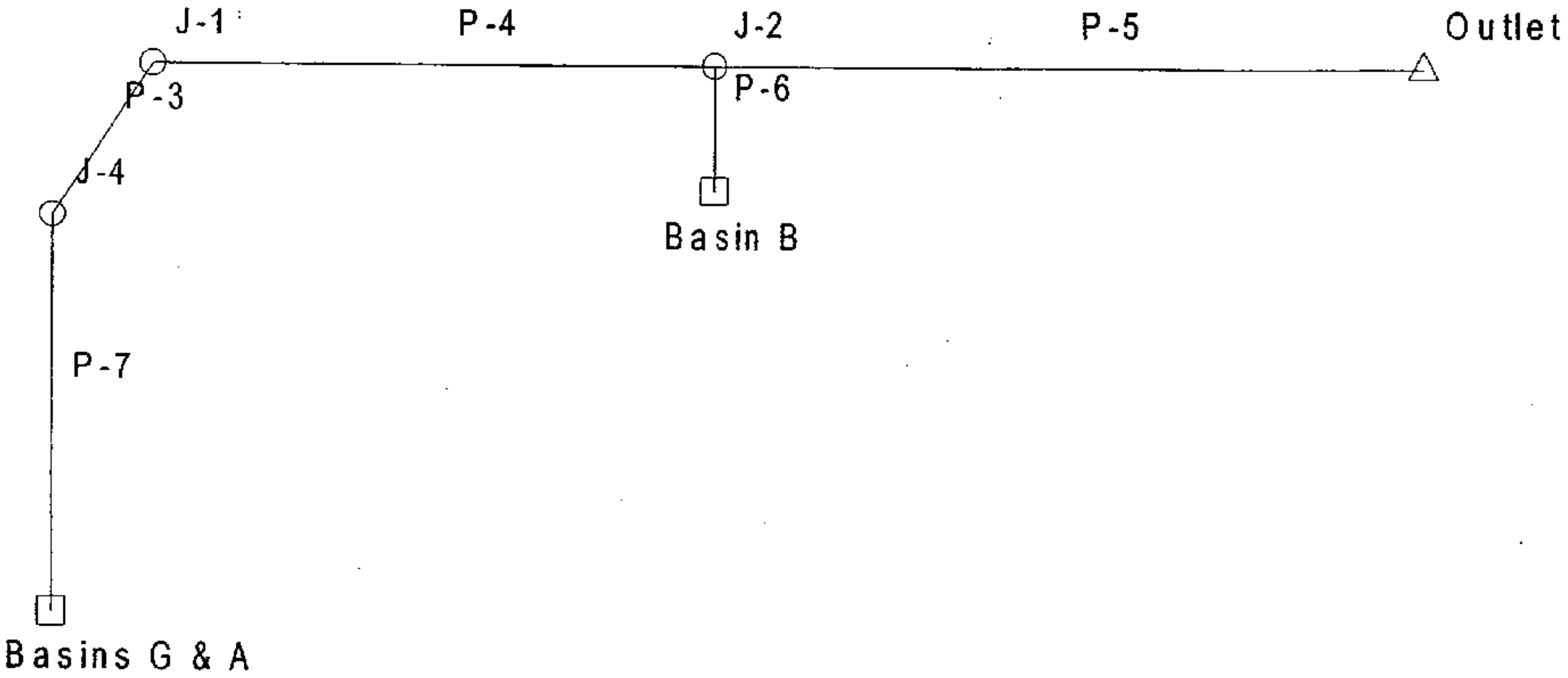
FIGURE 907

TYPE 4-R CB w/ 0.5' HEAD CONVEYS 4.4 cfs > 3.6 cfs

USE TYPE 4-R CB


KEYSTONE AVE
AMX
0.33Ac
G
0.98Ac
N
1" = 100'

): Base



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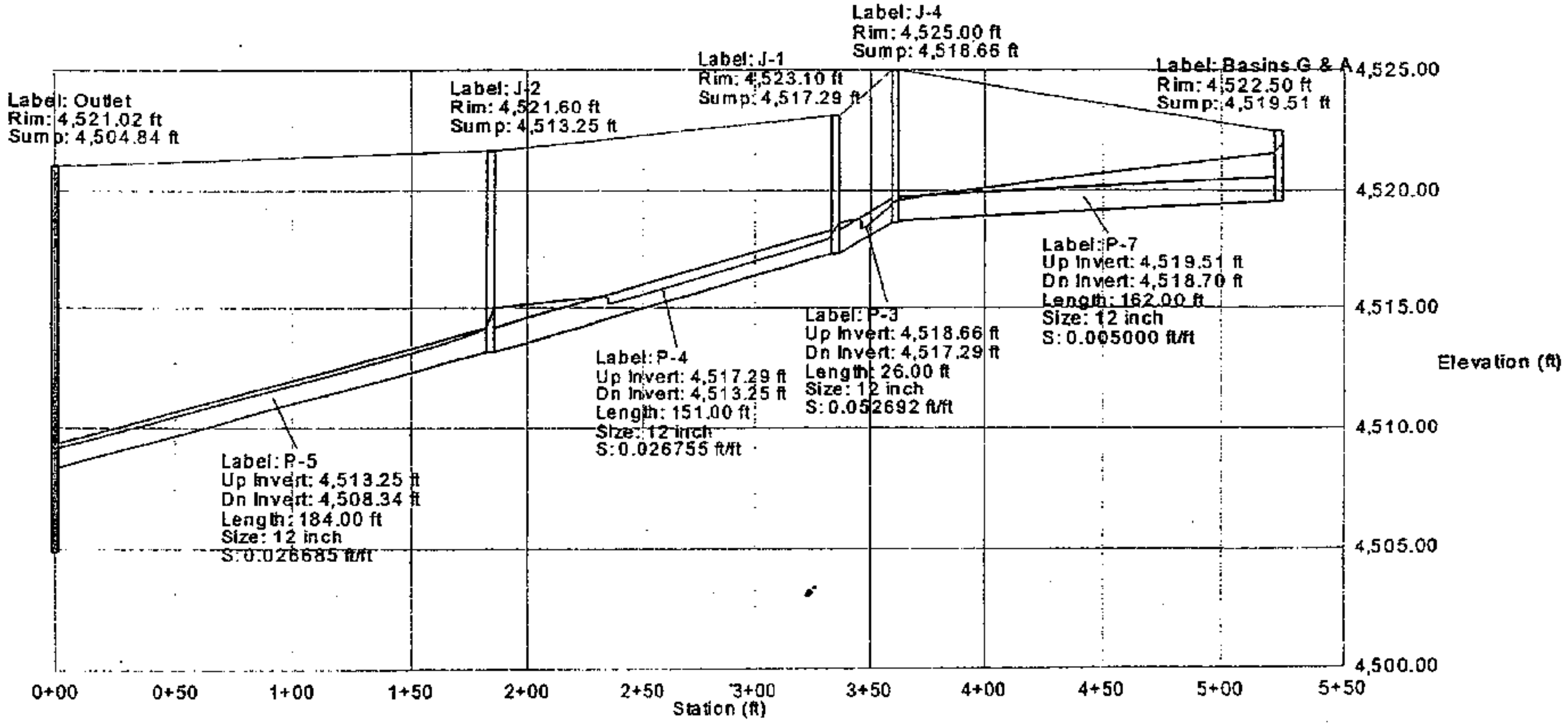

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Stantec Consulting Inc
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Project Engineer: Stanley Technology Grou
StormCAD v3.0 [31

Combi pe/Node Report

Label	Upstream Node	Downstream Node	Length (ft)	Section Size	Capacity (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Calculated Headloss (ft)	Energy Grade In (ft)	Energy Grade Out (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)	Total System Flow (cfs)
P-7	Basins G &	J-4	162.00	12 inch	2.34	4.75	4,519.51	4,518.70	0.005000	1.95	,521.86	4,519.96	4,521.53	4,519.58	3.60
P-3	J-4	J-1	26.00	12 inch	7.59	4.93	4,518.66	4,517.29	0.052692	0.81	,519.90	4,518.99	4,519.47	4,518.66	3.60
P-4	J-1	J-2	151.00	12 inch	5.83	4.93	4,517.29	4,513.25	0.026755	3.09	,518.53	4,515.33	4,518.10	4,515.01	3.60
P-6	Basin B	J-2	15.00	12 inch	19.76	3.39	4,518.60	4,513.25	0.356667	4.21	,519.48	4,515.12	4,519.22	4,515.01	2.10
P-5	J-2	Outlet	184.00	12 inch	5.82	7.93	4,513.25	4,508.34	0.026685	5.05	,515.05	4,510.25	4,514.20	4,509.14	5.70

DROP INLET

ORIFICE FLOW CHECK

MAX ALLOWABLE HEADWATER = 4525'

48" MANHOLE BARREL AREA = 12.6 SQ FT

$Q = 0.6 A \sqrt{2gh}$

$53.5 = 0.6 (12.6) \sqrt{64.4 h}$

$h = 0.8'$ REQ. HEAD

INLET INVERT = 4523.5'

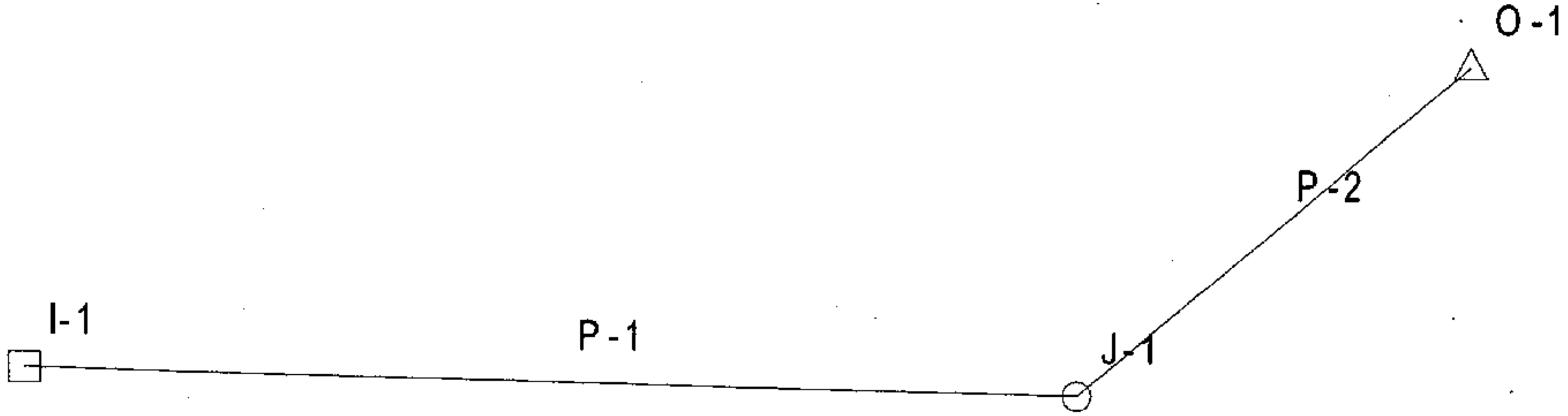
4523.5' + 0.8' = 4524.3' < 4525' OK

o: Base

Combined Pipe/Node Report

Label	Upstream Node	Downstream Node	Length (ft)	Section Size	Capacity (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Calculated Headloss (ft)	Energy Grade In (ft)	Energy Grade Out (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)	Total System Flow (cfs)
P-1	I-1	J-1	356.00	36 inch	49.99	7.70	4,520.00	4,518.00	0.005618	1.98	4,523.78	4,521.79	4,522.85	4,520.87	53.50
P-2	J-1	O-1	50.00	36 inch	66.69	8.70	4,518.00	4,517.50	0.010000	0.38	4,521.61	4,521.12	4,520.38	4,520.00	53.50

rio: Base



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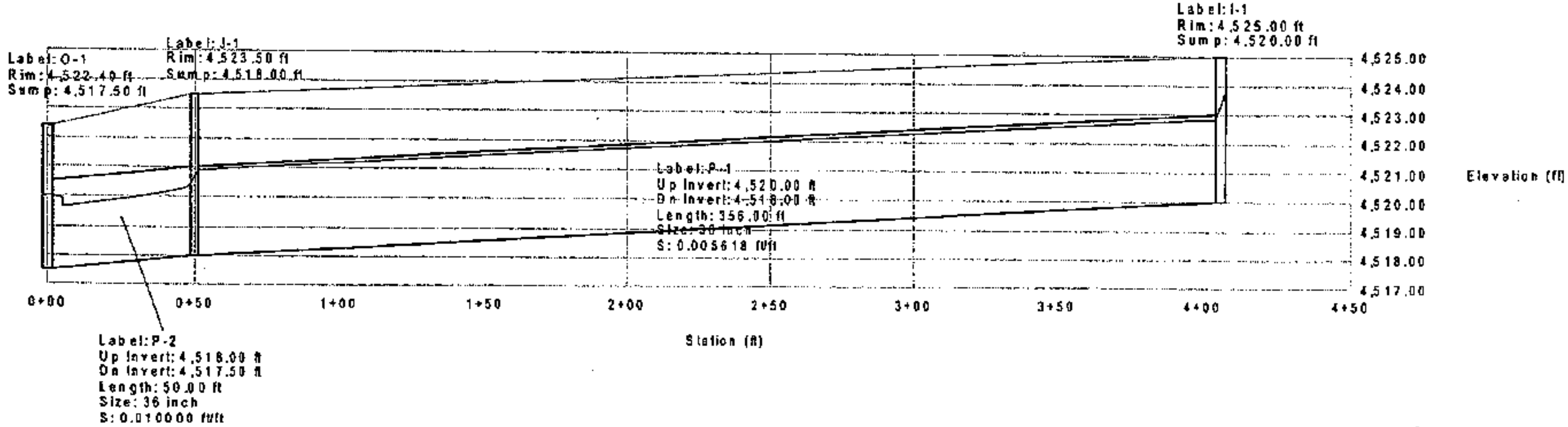

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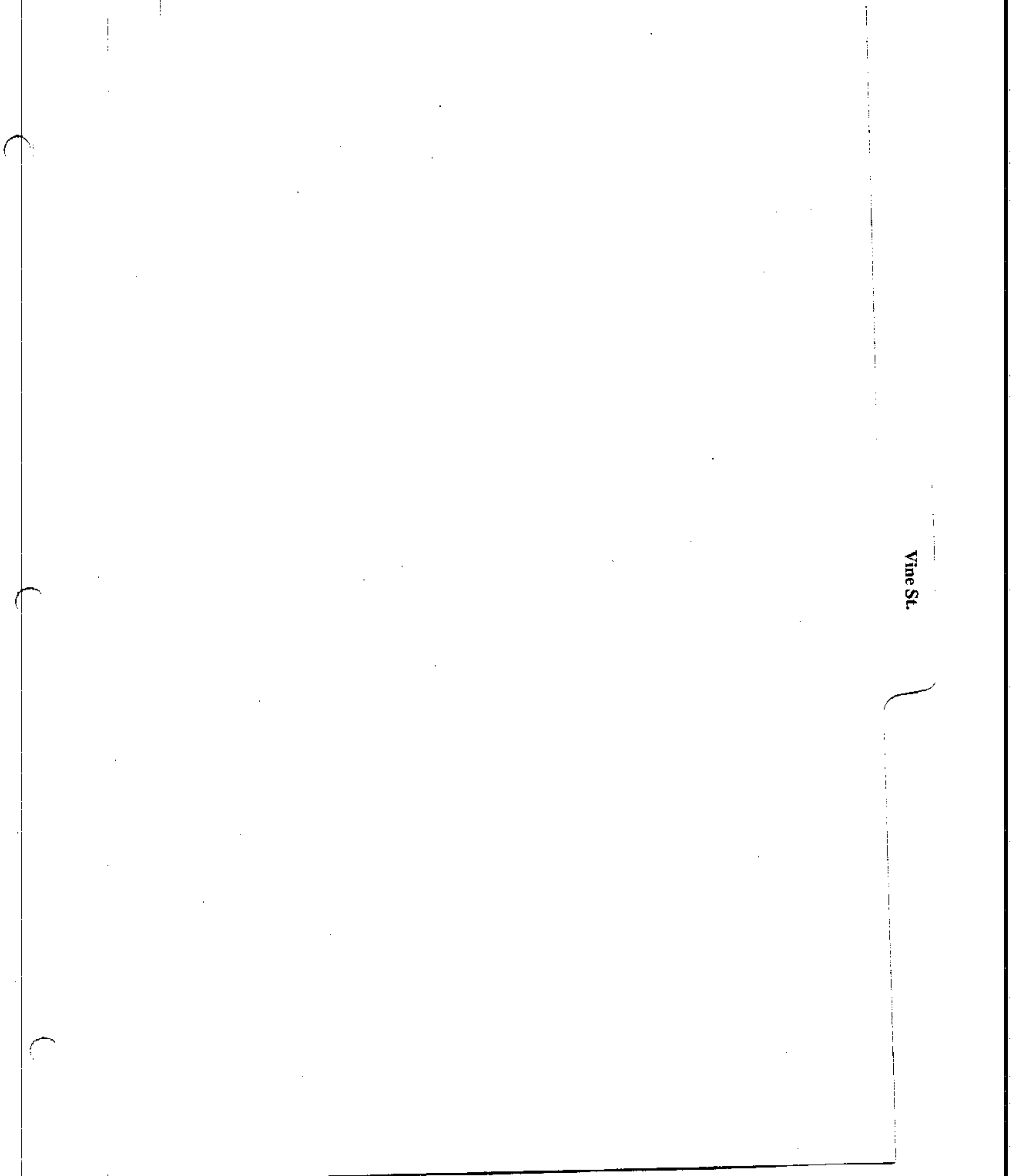
Stantec Consulting Inc

Project Engineer: Stante
StormCAD v3.0 [319


Vine St.

IFC Submittal

July 18, 2003
Project No. 80100603

Mr. Avrum Loewenstein, P.E.
ReTRAC
Parsons Transportation Group
264 Keystone Avenue
Reno, Nevada 89503

Reference: **ReTRAC Hydrologic and Hydraulic Design Memorandum for the Vine Street Overland Drainage**

Dear Mr. Loewenstein:

This letter report is to document the design parameters and assumptions for the proposed improvements of the Vine Street UPRR trench crossing and associated perpetuation of the 100-year overland flow. The proposed improvements begin at Third Street and end just south of the proposed UPRR trench. The 100-year storm event overland flow patterns were analyzed for existing and proposed conditions.

The 100-year watershed basin has been delineated and is shown in the *IFC ReTRAC Drainage Report, Volume 1.* Flow from the 100-year event affecting the intersection of Vine Street and Third Street is negligible. A portion of the 100-year overland flow travels south on Vine Street, through a series of splits between Sixth Street and Fourth Street, resulting in negligible flow on Vine Street south of Fourth Street. Therefore the water surface elevation at the existing Vine Street & Third Street intersection during the 100-year event is limited to nuisance flow and proposed roadway improvement analyses for the 100-year event are not needed.

A series of proposed catch basins will capture the localized 5-year storm drainage from areas impacted by the proposed Vine Street profile. The catch basins will drain to the proposed Vine Siphon. See the submitted plan sheet SD-250 *(Vine Street, Surface Drainage)* for catch basin layout.

The existing subsurface storm drain system has been analyzed and proposed improvements have been preliminarily designed.

The existing storm drain system runs north-south within Vine Street from the south side of the Interstate 80 (I-80) overpass to Second Street then turns east on Second Street to Arlington Avenue and turns south on Arlington Avenue to its outlet at the Truckee River. The existing system within the limits of the ReTRAC project is a 96-inch Reinforced Concrete Pipe (RCP).

Existing pipe sizes, inverts, slopes, elevations and capacities were taken from the Nevada Department of Transportation (NDOT) "as built" plans entitled *City of Reno Storm Drainage System Vine Street Storm Drain*, prepared by Porter, O'Brien & Armstrong, dated September 1965 (NDOT plans). The hydraulic calculations prepared for the project were used as the basis for the existing Vine Street storm drain system. Refer to the following section for the as-built drawings and calculations.

The system was designed for a 50-year event capacity of 816cfs and a 5-year event capacity of 380cfs. Flow within the system collects in a series of watersheds originating on Peavine Mountain and combines at a sump located on the north side of I-80 at Vine Street. Water is then forced into the Vine Street storm drain system and, in the 100-year event, into a pair of 10' x 4'

Reinforced Concrete Boxes (RCBs) which conveys the water through the freeway and returns the flow to its existing overland flow pattern (see sheet number 64, State of Nevada Department of Highways, *Special Details Overflow Relief Culvert Structure No. WA-12.68 Drop Inlet at Canal Street* plans in this report). Additional flow, south of the freeway, is captured by a series of storm drain systems servicing the downtown area and catch basins located along Vine Street.

Proposed storm drain improvements will consist of a modified junction at the Third Street manhole, placement of 96-inch RCP pipe to connect to the new parallel alignment, an inverted siphon on the parallel north-south alignment composed of 3-66-inch RCP pipes, a new junction south of the UPRR trench and removal of the section of 96-inch RCP pipe under the UPRR trench. Refer to the IFC Vine Street Siphon plans for details.

From the east, the Third Street Storm Drain System at Washington will connect to the proposed 96-inch RCP pipe via a 30-inch RCP pipe with a 30-inch NEENAH, R5050 Series Type SF30 flap gate for backwater prevention. This system will convey flows that previously continued south in the Washington Street storm drain. Please refer to the previously submitted report entitled *ReTRAC Hydrologic and Hydraulic Design Memorandum for the Third Street Storm Drain System at Washington Street Addendum No. 1*, dated March 14, 2003.

From the west, a 36" RCP conveying excess 100-year flows from the West Keystone basin will connect to the siphon alignment. Flow in the pipe is approximately 53.5 cfs and will enter the proposed storm drain system before the capacity of the Vine Street system is reached. The IFC Keystone Report was submitted on September 5, 2003, and can be referred to in the previous section.

Additional capacity for the connecting east and west contributing flows is not needed in the Vine Street Storm drain system due to the difference in the time of concentration for the peak flow rates of the system.

A StormCad model was prepared to determine the hydraulic grade line of the proposed inverted siphon storm drain system in Vine Street. The peak discharge of the system was determined from the NDOT plans and accompanying hydraulic calculations. The capacity of the existing storm drain system as shown in the NDOT plans and backup calculations is 816cfs. The capacity of the proposed siphon is 797cfs. The excess 19cfs will back up into the Keystone 100-year Drainage improvements and then be conveyed east within Third Street. The additional 19cfs has a negligible impact on the overland water surface elevations and will not impact upstream properties. The IFC Vine Street Siphon plans and backup calculations are shown in the IFC ReTRAC Drainage Report.

Sincerely,

STANTEC CONSULTING INC.

Trina M. Magoon, PE
Water Resources Project Manager

TMM:zrb
Enclosure(s)
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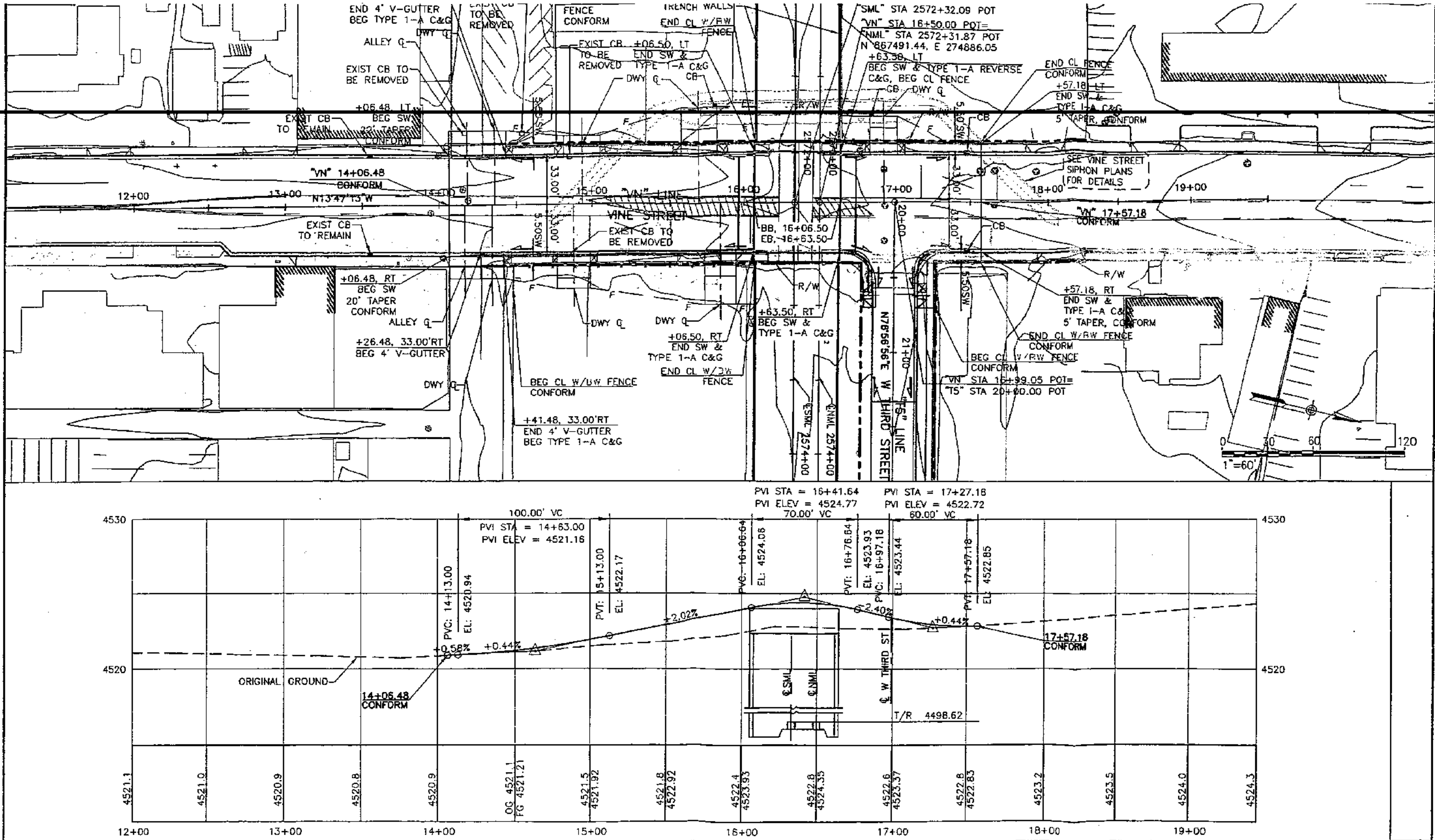


REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION
0	07/18/03	JS	AL	BRD	ISSUED FOR CONSTRUCTION						

DESIGNED BY TRIPLET/SHAFER
DRAWN BY GALLEGOS/RHODES
CHECKED BY A. VOO
IN CHARGE J. SHAFER
DATE 07/18/03

ISSUED FOR CONSTRUCTION

RENO ReTRAC
RENO WASHOE COUNTY NEVADA

ReTRAC THE GRANITE TEAM

SUBMITTED

APPROVED

RENO ReTRAC
VINE STREET IMPROVEMENTS
VINE STREET
PLAN AND PROFILE

CONTRACT NO.
DRAWING NO. C-003
REV 0
SCALE H:1"=60' V:1"=6'

ReTRAC
Vine Street Storm Drain Siphon
IFC Submittal

Calculation Package

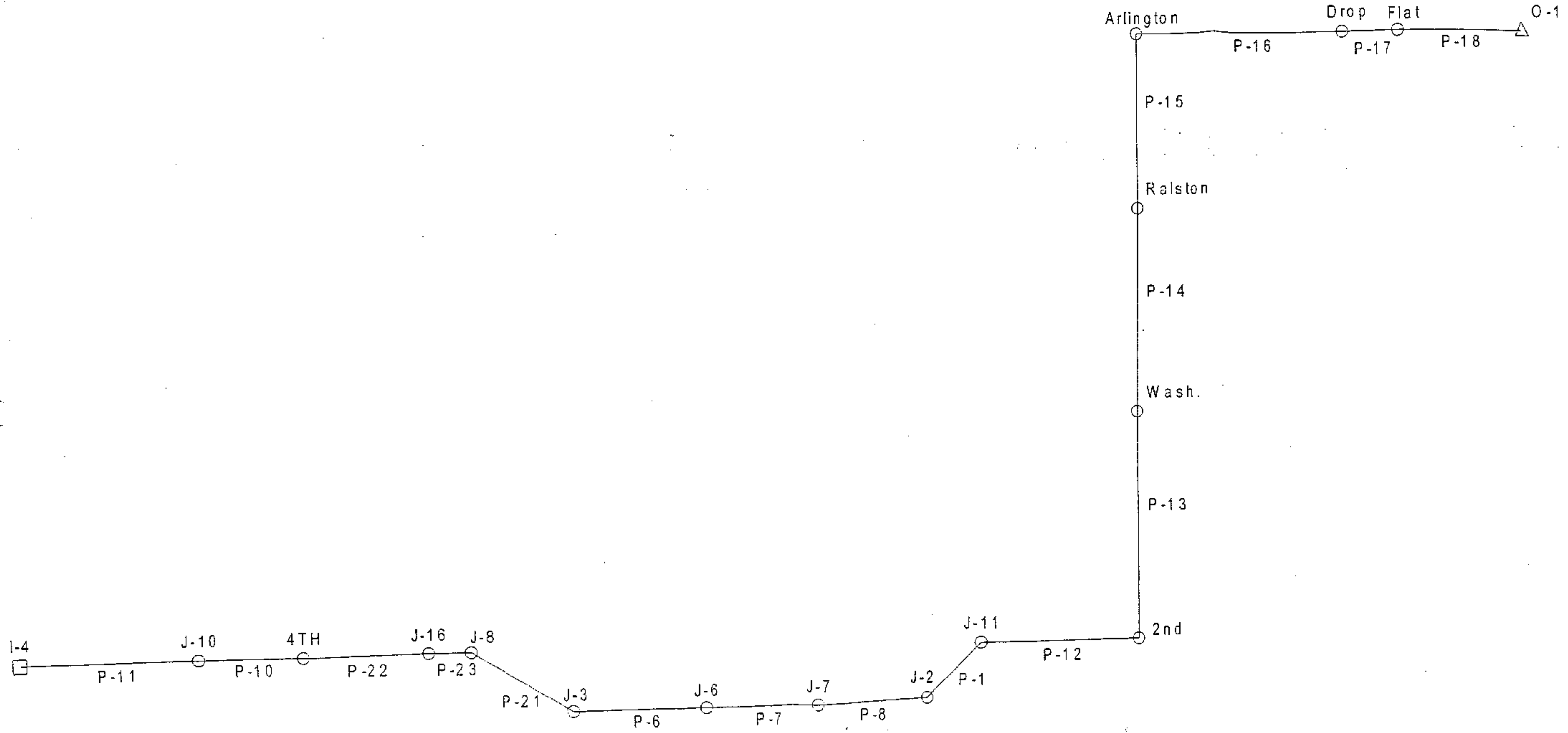
For Hydraulic Calculations
pages 1-14 of 40
only.

PROFESSIONAL ENGINEER-STATE OF NEVADA
TRINA M.
MAGOON
Magoon
CIVIL
03/04/04
No 13963
exp 12/31/05

March 4, 2004

Hydraulic Calculations

40



Title: VINE ST. SIPHON
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Stantec Consulting Inc
© Haestad Methods, Inc. 37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Project Engineer: Stantec
StormCAD v3.0 [319]
Page 1 of 1

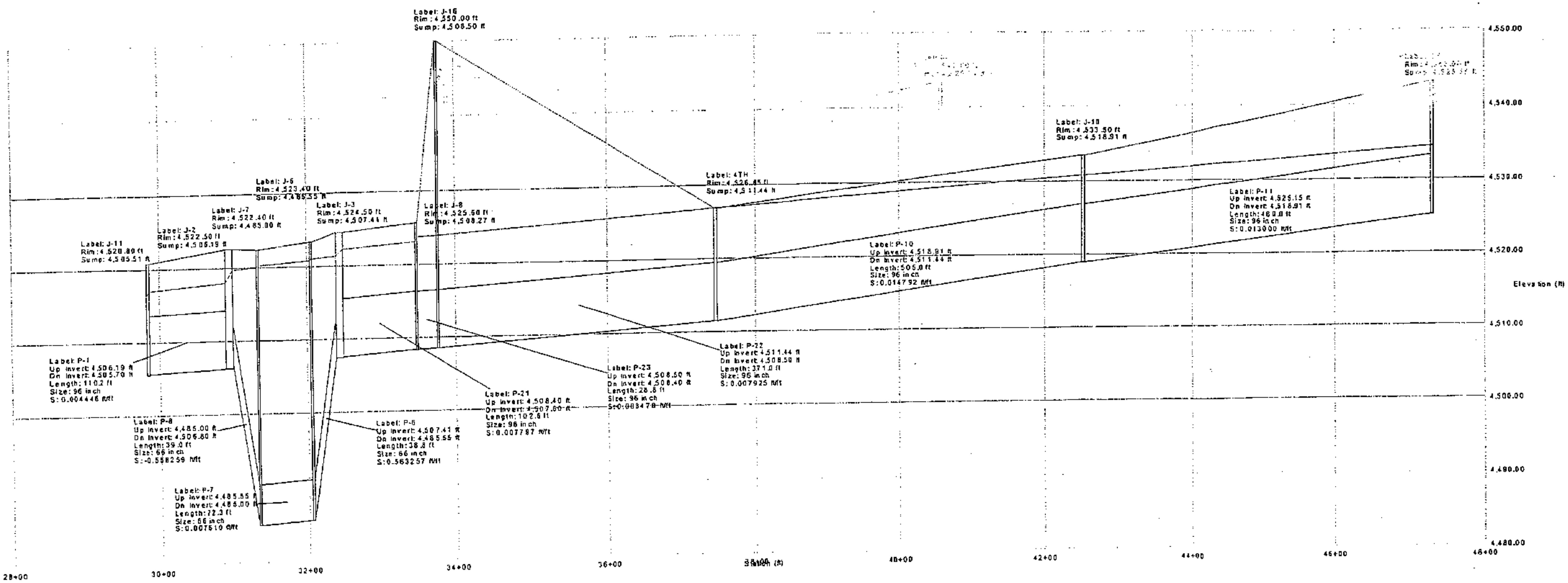
Scen o: Base

Combined Pipe/Node Report

Label	Upstream Node	Downstream Node	Length (ft)	Section Size	Capacity (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Calculated Headloss (ft)	Energy Grade In (ft)	Energy Grade Out (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)	Total System Flow (cfs)
P-11	I-4	J-10	480.0	96 inch	1,039.87	15.86	4,525.15	4,518.91	0.013000	3.67	4,538.36	4,534.69	4,534.45	4,530.78	797.00
P-10	J-10	4TH	505.0	96 inch	1,109.23	15.86	4,518.91	4,511.44	0.014792	3.86	4,534.61	4,530.76	4,530.71	4,526.85	797.00
P-22	4TH	J-16	371.0	96 inch	811.89	15.86	4,511.44	4,508.50	0.007925	2.83	4,530.70	4,527.86	4,526.79	4,523.96	797.00
P-23	J-16	J-8	28.8	96 inch	537.88	15.86	4,508.50	4,508.40	0.003478	0.22	4,527.86	4,527.64	4,523.96	4,523.74	797.00
P-21	J-8	J-3	102.6	96 inch	805.34	15.86	4,508.40	4,507.60	0.007797	0.78	4,526.94	4,526.16	4,523.03	4,522.25	797.00
P-6	J-3	J-6	38.8	66 inch	7,560.38	11.18	4,507.41	4,485.55	0.563257	0.24	4,523.30	4,523.06	4,521.36	4,521.11	797.00
P-7	J-6	J-7	72.3	66 inch	878.80	11.18	4,485.55	4,485.00	0.007610	0.45	4,522.71	4,522.25	4,520.76	4,520.31	797.00
P-8	J-7	J-2	39.0	66 inch	-7,526.76	11.18	4,485.00	4,506.80	-0.558259	0.24	4,521.90	4,521.66	4,519.96	4,519.72	797.00
P-1	J-2	J-11	110.2	96 inch	608.16	15.86	4,506.19	4,505.70	0.004446	0.84	4,521.83	4,520.99	4,517.92	4,517.08	797.00
P-12	J-11	2nd	389.0	96 inch	828.49	15.86	4,505.70	4,502.49	0.008252	2.97	4,520.28	4,517.31	4,516.38	4,513.40	797.00
P-13	2nd	Wash.	523.0	96 inch	912.03	15.86	4,502.49	4,497.26	0.010000	3.99	4,516.33	4,512.34	4,512.43	4,508.43	797.00
P-14	Wash.	Ralston	760.0	96 inch	831.03	15.86	4,497.26	4,490.95	0.008303	5.80	4,512.26	4,506.46	4,508.36	4,502.55	797.00
P-15	Ralston	Arlington	763.0	96 inch	508.30	15.86	4,490.95	4,488.58	0.003106	5.83	4,506.38	4,500.55	4,502.47	4,496.65	797.00
P-16	Arlington	Drop	446.0	12 x 5 ft	361.16	13.28	4,488.58	4,488.00	0.001300	2.82	4,498.62	4,495.80	4,495.88	4,493.05	797.00
P-17	Drop	Flat	17.0	12 x 5 ft	5,095.10	13.28	4,488.00	4,483.60	0.258824	4.35	4,495.74	4,491.40	4,493.00	4,488.65	797.00
P-18	Flat	O-1	86.0	12 x 5 ft	836.52	14.18	4,483.60	4,483.00	0.006977	1.19	4,491.34	4,490.94	4,488.60	4,487.41	797.00

3 of 40

Scenario: Base



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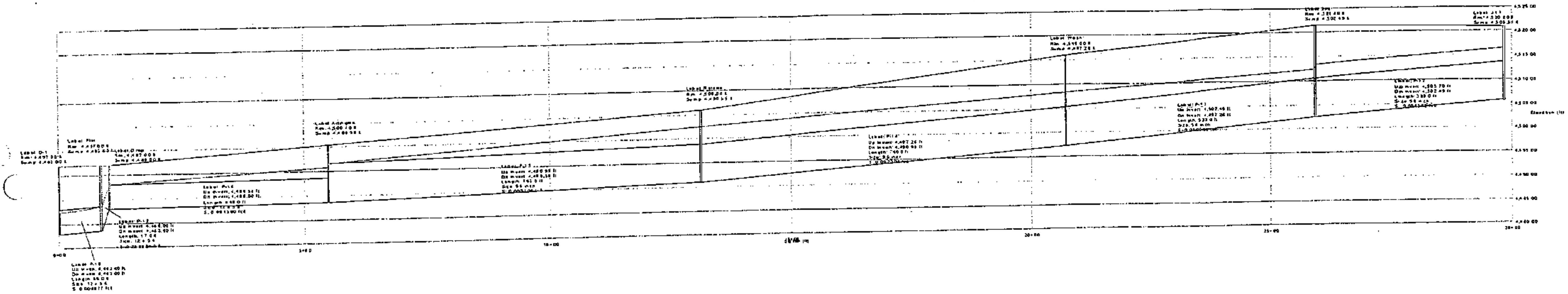
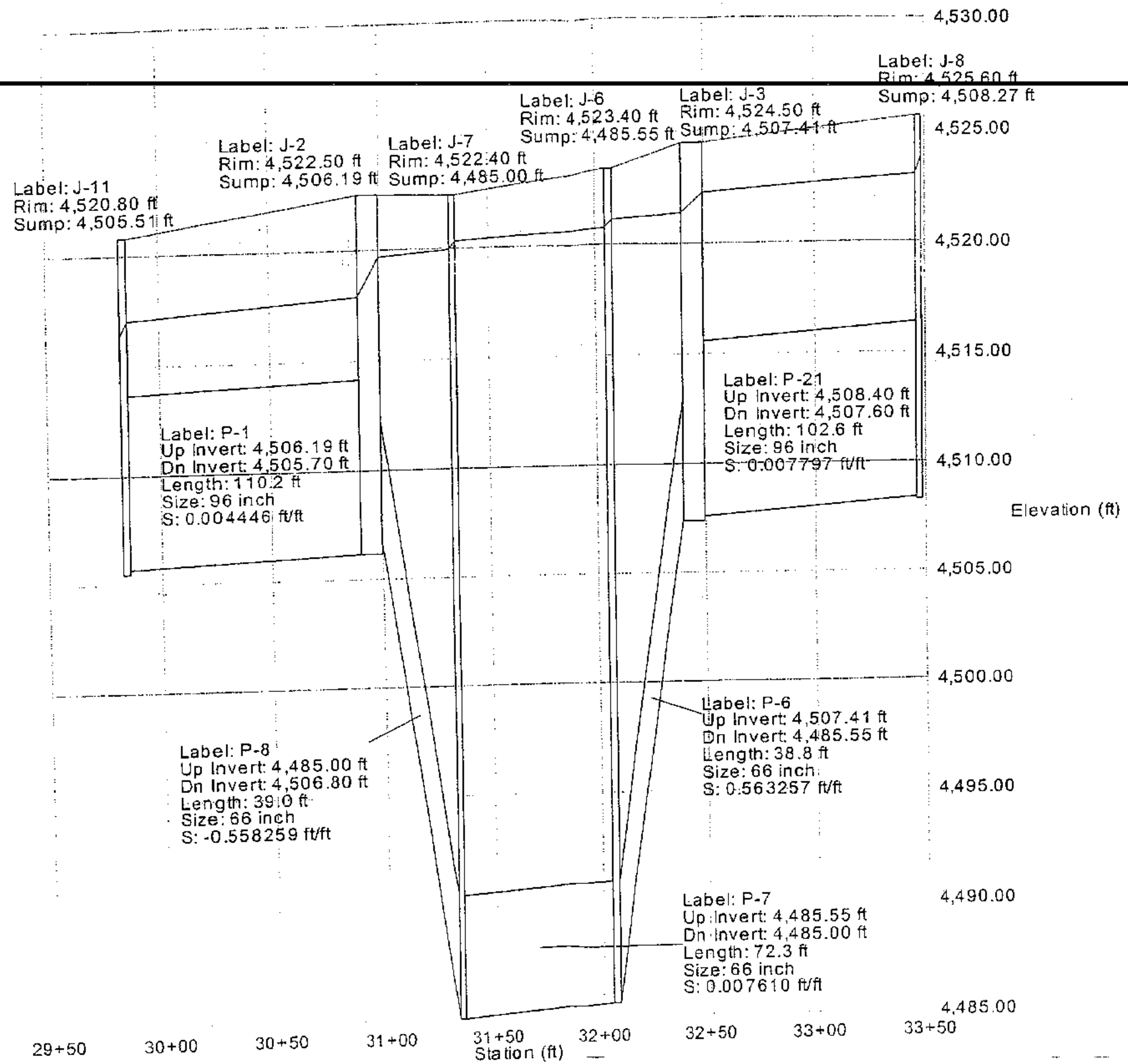
Project Engineer: Stantec
StormCAD v3.0 [319]
Page 1 of 1


0+00
5+00
10+00
15+00
20+00
25+00
30+00
4,525.00
4,520.00
4,515.00
4,510.00
4,505.00
4,500.00
4,495.00
4,490.00
4,485.00
4,480.00
Elevation (ft)

Scenario: Base



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Project Engineer: Stantec
StormCAD v3.0 [319]

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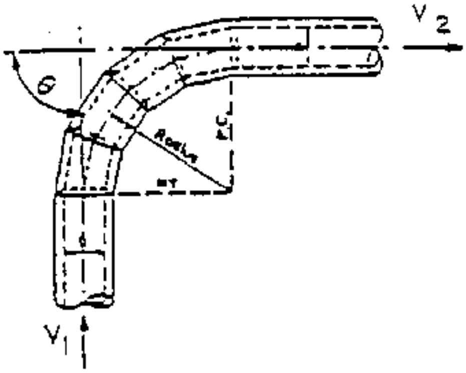
STORM SEWER ENERGY LOSS COEFFICIENTS

(C) BENDS

I. Large Radius Bends
(Pipe Diameter > Bend Radius)

$K_b = 0.25\ (\theta/90)^{0.5}$

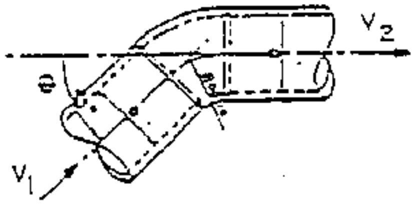
θ	K_b
90°	0.25
60°	0.20
45°	0.18
30°	0.14



Note: Head loss applied at P.C.

II. Sharp Radius Bends
(Pipe Diameter = Bend Radius)

θ	K_b
90°	0.50
60°	0.43
45°	0.35
30°	0.25



Note: Head loss applied at entrance to bend.

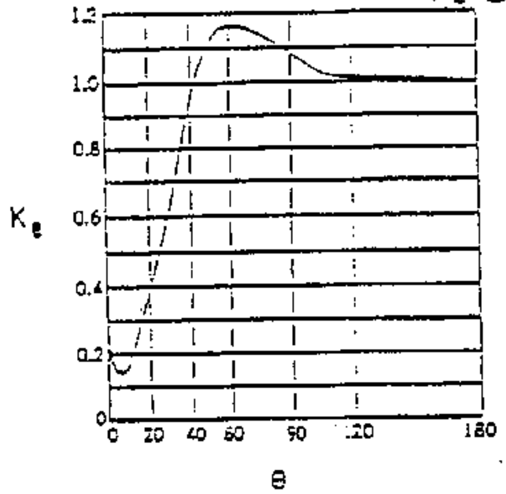
"Urban Stormwater Management,"

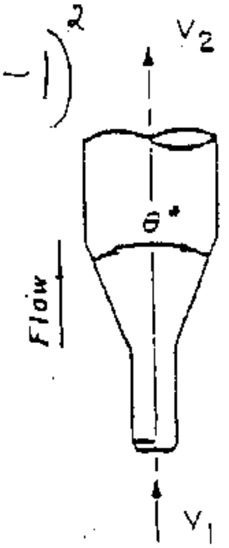
8 of 40

STORM SEWER ENERGY LOSS COEFFICIENTS

(A) EXPANTIONS

$$H_L = K_e\left(\frac{V^2}{2g}\right)\left(\frac{A_2}{A_1}-1\right)^2$$

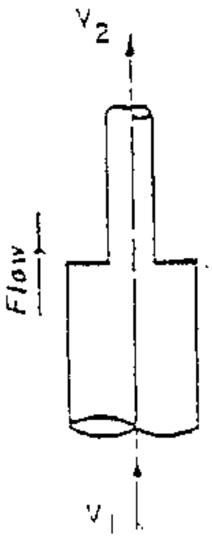




* The angle θ is the angle in degrees between the sides of the tapering section.

(B) CONTRACTIONS

A_2/A_1	K_c
0.1	0.35
0.2	0.34
0.3	0.31
0.4	0.27
0.5	0.22
0.6	0.18
0.7	0.11
0.8	0.05
0.9	0.0
1.0	0.00



NOTE: Losses due to angular expansions and abrupt contractions will normally only occur in retro-fit storm sewer design.

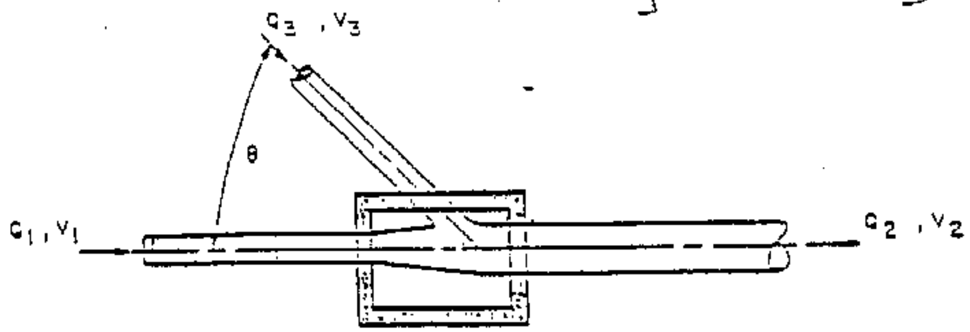
REFERENCE:
Fluid Mechanics, Daugherty and Franzini, 1977
Fluid Mechanics, Streeter and Wylie, 1979

9 of 40

STORM SEWER ENERGY LOSS COEFFICIENTS

(D) JUNCTIONS

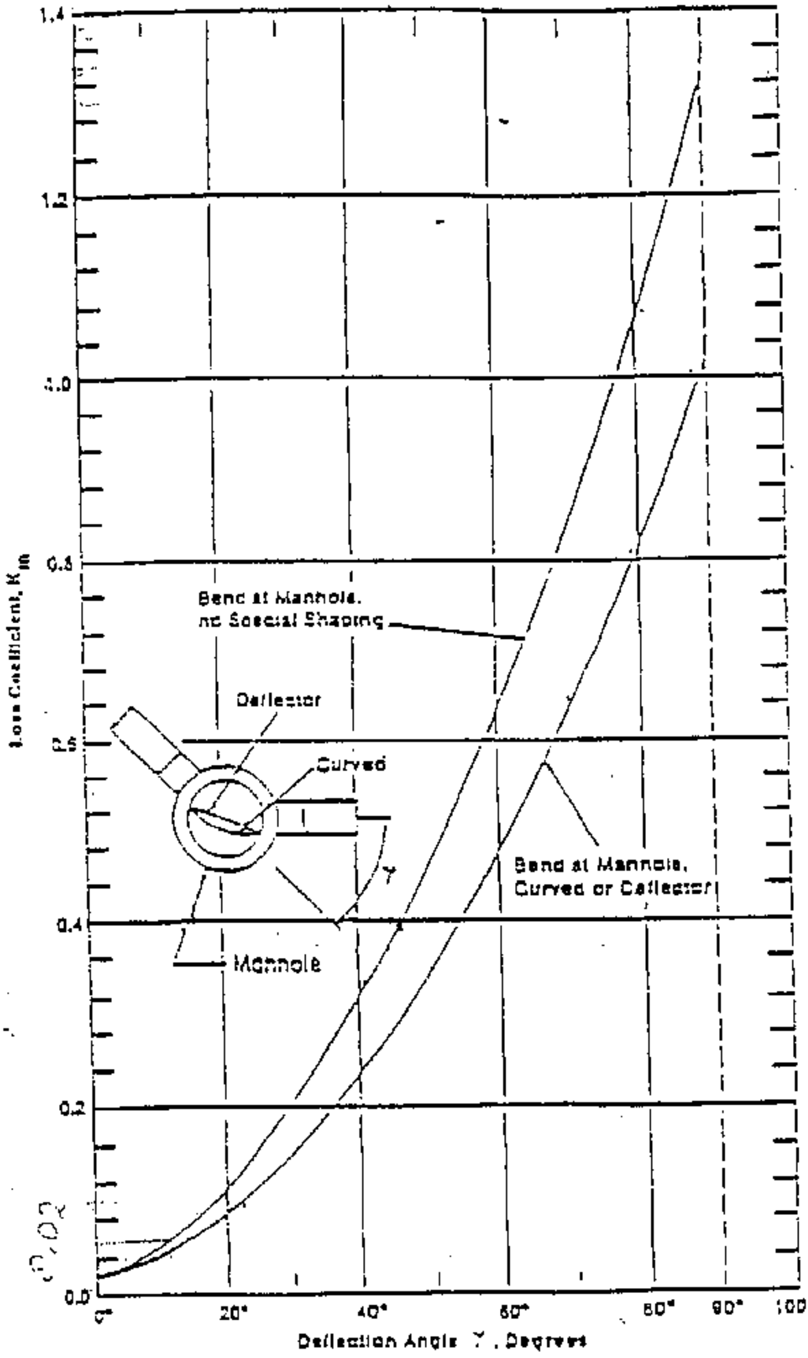
$$\frac{V_2^2}{2g} - K_I \frac{V_1^2}{2g} = H_L$$



θ	K_j
90°	0.25
60°	0.35
45°	0.50
30°	0.65
15°	0.85

NOTE: Head loss applied at exit of junction

ENERGY LOSS COEFFICIENT IN STRAIGHT THROUGH MANHOLE



NOTE: Head loss applied at outlet of manhole.

Stantec

RETRAC
VINE STREET SIPHON
HEADLOSS COEFFICIENTS
(STORMCAD)

REF. WASHOE COUNTY DRAINAGE DESIGN MANUAL
(PORTION ATTACHED)

NODE J-8

— 96" RCP ⇒ 45° LARGE RADIUS BEND

$$\boxed{K = 0.18}$$ ✓

NODE J-3

— 96" RCP ⇒ 45° LARGE RADIUS BEND

K = 0.18 ✓

— EXPANSION 96" RCP to 3-66" RCPs

K_e for 30° = 0.6 ✓

$$K = \left(\frac{A_2}{A_1} - 1\right)^2 K_e$$

96" = 50.27 SQ FT
3 – 66" = 71.27 SQFT

$$\left(\frac{71.27}{50.27} - 1\right)^2 0.6 = 0.1$$

K = 0.1 ✓

— 3-66" RCPs ⇒ 45° LARGE RADIUS BEND

K = 0.18 ✓

$$\boxed{\text{TOTAL} = 0.46}$$ ✓

Designed by:

Checked by:

Stantec

KETRAC
VINE STREET SIPHON
HEADLOSS COEFFICIENTS
(STORMCAD)

NODE J-6

- 3-66" RCPs ⇒ 45° LARGE RADIUS BEND

$\boxed{K = 0.18}$ ✓

NODE J-7

- 3-66' RCPs ⇒ 45° LARGE RADIUS BEND

$\boxed{K = 0.18}$ ✓

NODE J-2

- 3-66" RCPs ⇒ 45° LARGE RADIUS BEND

$K = 0.18$ ✓

- CONTRACTION 3-66" RCPs to 96" RCP

$$\frac{A^2}{A_1} = \frac{50.27}{71.27} \Rightarrow 0.71$$ INTERPOLATE

$K = 0.10$ ✓

- 96" RCP ⇒ 45° LARGE RADIUS BEND

$K = 0.18$ ✓

$\boxed{\text{TOTAL} = 0.46}$ ✓

Designed by:

Checked by:

[illegible]

VINE STREET SIPHON
HEADLOSS COEFFICIENTS
(STORMCAD)

NODE J-11

- 96" RCP ⇒ 45° LARGE RADIUS BEND

$\boxed{K = 0.18}$ ✓

Designed by:

Checked by:

Joint Venture Design Team for the Tutor – Saliba Team

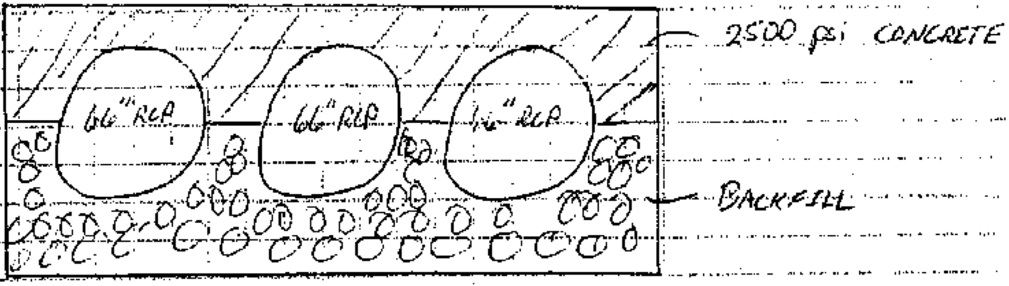
INDEX NO. NO.

SUBJECT Vine Street Siphon

Buoyancy Check

SHEET NO. 14 OF 40

MADE BY ZRB DATE 2/27/04 CHECKED BY DATE



– BUOYANCY OF PIPE

OUTSIDE DIA = 6.83 FT. (82" @ BELL)

AREA = $\frac{6.83^2 \pi}{4}$ = 36.64 SQ.FT.

PER LIN. FT. = 36.64 CU.FT.

36.64 FT³ (62.4 lbs/CU.FT.) = 2286.3 lbs ↑

– WEIGHT + LOAD OR PIPE (NO TRENCH) (CONSERVATIVE)

1755 lbs/FT = PIPE WEIGHT

1' MIN. COVER OF CONCRETE (150 lbs/CU.FT.) (CONSERVATIVE)

1755 lbs/FT. + 1' (6.83') 1' (150 lbs/CU.FT.) = 2779.5 lbs ↓

$\frac{2779.5}{2286.3}$ = 1.22 > 1.0 OK

NO UPLIFT

PROJECT NO. 8105 COMPUTATIONS FOR SHEET 1 OF 10

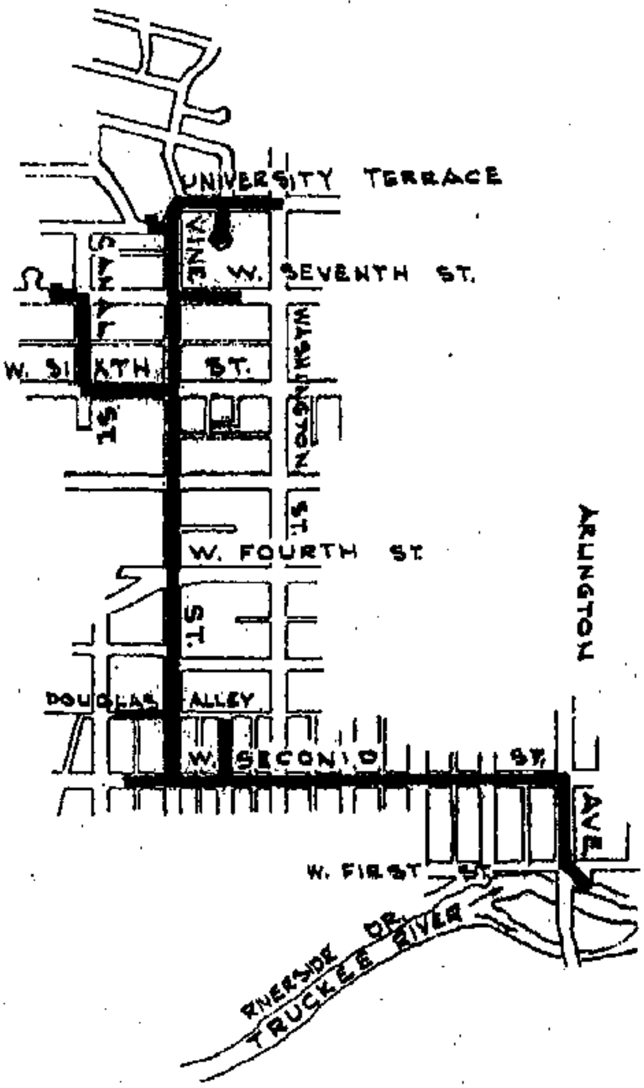
BY R.H. DATE 9-23-65

HYDRAULIC COMPUTATIONS

VINE STREET
STORM DRAIN

RENO, NEVADA

PROJECT NO. 8105
COMPUTATIONS FOR
VINE STREET STORM DRAIN
RENO, NEVADA
SHEET 2 OF 10
BY R.H.
DATE 9-24-65



LOCATION PLAN

PORTER, ARMSTRONG, RIPA & ASSOCIATES
Engineering, Foundations and Testing

PROJECT NO. 8105
COMPUTATIONS FOR VINE ST. STORM DRAIN RENO, NEVADA
SHEET 3 OF 10
BY R.H.
DATE 9-21-65

DESIGN CRITERIA

RUNOFF COMPUTATIONS BASED ON THE RATIONAL FORMULA

$$Q = ciA \text{ cfs}$$

VALUES FOR COEFFICIENT OF RUNOFF "C"

RESIDENTIAL DISTRICT	0.40
MULTIPLE DWELLING	0.50
COMMERCIAL RESIDENTIAL	0.50
LIGHT MANUFACTURING	0.60
TOURIST COURTS	0.70
COMMERCIAL DISTRICT	0.90

DESIGN STORM FREQUENCY WILL BE: 5 YEAR STORM RAINFALL (INCHES PER HOUR) i TAKEN FROM RAINFALL INTENSITY CURVES PREPARED BY THE U.S. DEPARTMENT OF COMMERCE

TIME OF CONCENTRATION T_c WILL BE COMPUTED BASED ON THE FOLLOWING OVERLAND FLOW VELOCITIES:

EAST WASH	3 fps
PIPE FLOW VELOCITY	10 "

STORM SEWER HYDRAULIC COMPUTATIONS WILL BE BASED ON DARCY-WEISBACH AND MANNING'S FORMULAE:

$n = 0.013$ FOR RCP
$n = 0.021$ " CMP (UNLINED)

MINOR LOSSES. THE FOLLOWING "K" VALUES WILL BE USED FOR THE COMPUTATION OF LOSS OF HEAD:

ENTRANCE	$K_1 = 0.10$ (FLUSH ENTRANCE ONLY)
DISCHARGE	$K_2 = 1.00$
ENLARGEMENT	$K_3 = 0.10$ TO 0.50
CHANGE IN DIRECTION	$K_4 = 0.10$ TO 1.00

REFERENCE DATA OBTAINED FROM STUDIES MADE BY KENNEDY ENGINEER'S IN 1957 AND THE ADDENDUM PREPARED IN AUGUST 1963

PROJECT NO. 8105
COMPUTATIONS FOR VINE ST. STORM DRAIN RENO NEVADA
SHEET 4 OF 10
BY R.H.
DATE 9-22-65

DESIGN CRITERIA CONT'D.

THE STORM DRAIN WILL BE DESIGNED BASED UPON THE FLOWS AS FOLLOWS:

FROM 7th ST. NORTH – 5 YEAR STORM
FROM 7th ST. SOUTH – 50 YEAR STORM
FLOW Q = 616 cfs
SUPPLIED BY NEVADA ENGINEERING CONSULTANTS

THE 50 YEAR STORM FLOW WAS USED AS A DESIGN CRITERIA FOR THE INTER-STATE 80 FREEWAY

THE 5-YEAR FLOWS WILL BE COMPUTED AND SHOWN TO ARRIVE AT A COST PARTICIPATION BETWEEN THE CITY OF RENO, STATE OF NEVADA AND THE BUREAU OF PUBLIC ROADS.

THE STORM DRAIN FLOWS AT 7th & CANAL ST'S. TO 6th & VINE STREETS WILL BE COMPUTED BASED UPON A 5-YEAR STORM AND MAY BE COMPARED WITH THE 50-YEAR DESIGN STORM FOR THE FREEWAY

NEVADA ENGINEERING CONSULTANTS Q_{50} = 200 cfs
FROM 6th & CANAL to 6th & VINE

SHEET 5 OF 10 DATE 9-21-65

PORTER, ARMSTRONG, RIPA & ASSOC.
Consulting Engineers
RENO, NEVADA

DF

INLET NO. OR ROAD STATIONS	DRAINAGE AREA IN ACRES					WEIGHTED "C"	WEIGHTED "i" IN./HR.
	LENGTH OF	AREA ACRES	"C"	ΔCA ACRES	ΣcA TOTAL ACRES		
OVERLAND FLOW FROM TOP OF WATERSHE							
EAST WASH DAM		—	—	—	—		
	7400'						
UNIV. TERR. & PEAVINE DITCH		602.6	0.4	241	241		
	350'						
7TH & VINE STS.		—	—	—	—		
	500'						
6TH & VINE STS.		307.6	0.4	123	364		
	1000'						
4ND & VINE STS.		24.8	0.7	17.4	381.4		
	1128'						
2ND & VINE STS.		9.0	0.4	3.6	385		
	2630'						
1ST & ARLINGTON AVE. & RIVER		26.0	0.7	18.2	403.2		
* THESE ARE SIZED FOR A 5 YEAR STO							
SIZES REQ'D FOR Q_{50} (FREEWAY TRAF							
7th to 6th - 84"							
6th to RIVER - 96"							

5 of 10

INAGE COMPUTATIONS

VINE STREET STORM DRAIN
RENO, NEVADA

PROJECT NO. 8105
LOCATION RENO
COMPUTED R.H.
CHECKED A.C.B.

TIME OF CONCENTRATION IN MINUTES INLET TIME OR DRAIN 10 + $\frac{L}{V \times 60}$ = tc V= 3 fps	RAINFALL INTENSITY I - IN/HR.	I - f IN./HR.	DISCHARGE "Q" C.F.S.	DESIGN SLOPE "S" FT./FT.	DIAMETER OF PIPE "D" INCHES	CAPACITY C.F.S.	VELOCITY "V" FT./SEC.	NOTES
								1. DESIGN BASED
D TO EAST WASH DAM								UPON Tc = 0 AT
								TOP OF WATER-
10+ $\frac{4 \times 5280}{3 \times 60}$ = 128 MIN.								SHED - INCLUDE
2.14 HRS.								DAM OUTFLOWS
Tc = 2.14 HRS = 128 MIN.	.29		36	—	—	—	—	2. OVERLAND FLOW
128 + 7400×.00167 = 2.18 HRS								VELOCITIES ARE
	.28		36+74+68 178					SAME AS USED
140.4+350×.00167 = 2.36 HRS				.018	54"	260	11.2	BY SOIL CONSERVA-
	.27		178					TION SERVICE IN
500×.00167 = 2.36 HRS				.010	*54"	195	11.2	DESIGNING DAMS
	.27		198+98.4 296.4					PEAVINE CK = 5fps
141.8 + 1000×.00167 = 2.40 HRS				.014	*66"	400	12.5	WEST WASH = 4fps
	.27		198+103 301					EAST WASH = 3fps
143.5+1128×.00167 = 2.42 HRS				.008	*72"	380	10.6	
	.26		301					3. DAM OUTFLOWS
145.4+2630×.00167 = 2.49 HRS				.008	*72"	380	10.6	ARE MAXIMUM
	.25		301					FLOWS FROM
								PEAVINE MOUNTAIN
								WATERSHED WORK
								PLAN BY U.S.
ORM FLOW								SOIL CONSERVATION
ECTION) ARE								SERVICE - 1958
								PEAVINE CR. - 88 cfs
417 cfs (FROM NEVADA ENGINEERING CONSULTANTS)								EAST WASH - 36 cfs
								WEST WASH - 74 cfs
816 cfs " "		"		"				Σ = 198 cfs
								4. LONGEST Tc FROM
								TOP OF WATERSHED
								DOWN EAST WASH

STORM SEWER COM

ORTER, ARMSTRONG, RIPA & ASSOCIATES
nsulting Engineers
NO, NEVADA

VINE STREET S
RENO, NEV

LOCATION	STRUCT. NO.	TYPE OF STRUCT.	LENGTH L FT. ⑤	PIPE SIZE D INCHES	SLOPE S FT./FT.	PIPE CAPACITY Q C.F.S.	VELOCITY V FT./SEC.	$\frac{V^2}{2G}$ FT. ③	LOSS COEFF. Σ K	① HEAD LO IN STRUCT FT.
1ST & ARLINGTON AVE. @ RIVER	—							2.88	1.00	2.9
			86	12'x5' RCB	.0070	*816	13.6			
INTERSECTION OF 1ST & ARLINGTON	—							"	0.1	0.3
			17	"	.260	"	"			
—	—							"	0.1	0.3
			13	"	.0013	"	"			
P.C. RCB	—							"	0.1	0.3
			31.76	"	.0013	"	"			
T. RCB	—							2.88	0.5	1.44
			397.7	"	.0013	"	"			
2ND & P.T. Arlington Ave.	—							2.88	0.54 ~~1.3~~	1.59 ~~3.74~~
		TRANSITION	34.4	—	.0013	"	2 "			
Beginning of 96" RCP	—							4.08	0.1	0.4
			763	96	.003	*816	16.2			
2ND & RALSTON	13	M.H.						"	0.1	0.4
			760	96	.0083	"	"			
2ND & WASHINGTON	12	M.H.						"	0.1	0.4
			507	96	.010	"	"			
2ND & P.C. VINE St.	—	90° Bend						2.54	0.4 ~~0.8~~	1.01 ~~2.03~~
			26.2	8'x8' RCB	.009	*816	12.8			
2ND & P.T. Vine St.	—	90° Bend						4.06	—	—
			618	96	.008	*816	16.2			
VINE St. & RD St.	11	M.H.						4.08	0.1	0.4
			485	96	.008	*816	16.2			
VINE St. & 4TH St.	10	M.H.						4.08	0.1	0.4

COMPUTATIONS

STORM DRAIN

NEVADA

SHEET 6 OF 10

PROJECT NO. 8105

CALC. BY R.H. DATE 9-12-65

CHKD. BY A.C.B. DATE 9-27-65

① HEAD LOSS IN STRUCT. FT.	MANNINGS COEFF. N	DIFF. IN ELEVATION FT.	INVERT ELEVATION AT STRUCT.		FRICTION COEFF. -f	HEAD LOSS FT./FT. ④	② HEAD LOSS IN PIPE FT. ③×④×⑤	①+② ELEVATION OF HYDR. GRADE FT.	GROUND ELEVATION FT.	HEIGHT OF STRUCT FT.
			INLET	OUTLET						
2.9	—		4483.00		—			4488.00	4497.00	
		.60			—	—	0.57			
0.3	—		483.60					491.5		
		4.42			—	—	0.11			
0.3	—		488.02					491.9		
		.017			—	—	0.07			
0.8	—		488.04					492.8		
		.04			—	—	0.21			
	—		488.08					492.8		
		.52			—	—	2.62			
1.59 ~~2.74~~	—		488.60					496.8		
		.04			—	—	0.23			
0.4	.013		488.64					498.5 ~~504.8~~		
		2.29			.015	.0019	5.9			
0.4	"		490.93					504.1 ~~507.9~~		
		6.30			"	"	5.9			
0.4	"		497.23					511.1 ~~513.4~~		
		5.07			"	"	4.1			
1.08 ~~1.03~~	—		502.30					515.6 ~~517.9~~		
		0.23			—	—	0.13			
—	.013		502.53					516.8 ~~520.1~~		
		4.94			.015	.0019	4.80			
	"		507.47					521.6 ~~524.9~~		
		3.88			.015	.0019	3.77			
.4	"		511.35					525.7 ~~529.0~~		

7 of 10

STORM SEWER

PORTER, ARMSTRONG, RIPA & ASSOCIATES
Consulting Engineers
RENO, NEVADA

VINE STREE
RENO

LOCATION	STRUCT. NO.	TYPE OF STRUCT.	LENGTH L FT. ⑤	PIPE SIZE D INCHES	SLOPE S FT./FT.	PIPE CAPACITY Q C.F.S.	VELOCITY V FT./SEC.	$\frac{V^2}{2G}$ FT. ③	LOSS COEFF. ΣK
VINE ST. & 4TH ST.	10	M.H.						4.08	0.1
			505	96	.0148	*816	16.2		
VINE ST. & 5TH ST.	9	M.H.						4.08	0.1
			480	96	.013	*816	16.2		
VINE ST. & 6TH ST.	8	M.H.						1.87	0.3
			451	84	.010	*417	10.8		
VINE ST. & 7TH ST.	–	Junction Box						1.95	0.3
			450	54	.018	178	11.2		
VINE ST. & UNIV. TERR. S.	7	M.H.						0.78	0.6
			135	36	.0061	50	7.1		
VINE ST. & UNIV. TERR. N.	5	M.H.						0.78	0.6
			280	36	.0095	50	7.1		
UNIV. TERR. & WHITTAKER DR.	2	M.H.						2.47	0.3
			260	27	.087	50	12.6		
UNIV. TERR. & WASHINGTON ST.	1	M.H.							

* FLOWS (Q_{50} = 816 cfs & Q_{10} = 417 cfs) ARE FROM NEVADA ENGINEER
FOR FREEWAY PROTECTION

ER COMPUTATIONS

SHEET 7 OF 10
PROJECT NO. 8105
CALC. BY R.H. DATE 9-27-65
CHKD. BY A.C.B. DATE 9-27-65

STORM DRAIN
O, NEVADA

OSS OEFF. Σ K	① HEAD LOSS IN STRUCT. FT.	MANNINGS COEFF. N	DIFF. IN ELEVATION FT.	INVERT ELEVATION AT STRUCT. INLET	OUTLET	FRICTION COEFF. f	HEAD LOSS FT./FT. ④	② HEAD LOSS IN PIPE FT. ③x④x⑤	①+② ELEVATION OF HYDR. GRADE FT.	GROUND ELEVATION FT.	HEIGHT OF STRUCT. FT.
.1	0.4	.013		511.35					525.7 ~~529.0~~		
			7.47			.015	.0019	3.92			
1	0.4	"		518.9					530.1 533.3		
			6.25			.015	.0019	3.73			
3	0.54	"		OUT 525.15 IN 526.13					534.2 537.5		
			4.51			.016	.0023	0.99			
.3	0.59	"		OUT 530.64 IN 532.14					535.7 ~~539.0~~		
			8.10			.019	.0042	3.68			
	0.47	"		OUT 540.24 IN 542.74					540.0 543.3		
			0.82			.022	.0073	0.77			
.6	0.47	"		543.56					541.2 ~~544.5~~		
			2.66			.022	.0073	1.60			
3	0.74	"		OUT 546.22 IN 546.96					543.3 ~~546.8~~		
			22.62			.024	.011	7.1			
				569.58					551.1 554.5		

ERING CONSULTANTS

PORTER, ARMSTRONG, RIPA & ASSOCIATES

Engineering, Foundations and Testing

PROJECT NO. 8105

COMPUTATIONS FOR
VINE St. STORM DRAIN
RENO, NEVADA

SHEET 8 OF 10

BY R.H.

DATE 9-22-65

✓ A.C.B. 9-27-65

12' × 5' RCB HEAD LOSS - H

$$H = \frac{L\,n^2 V^2}{2.2082\; r^{4/3}} \qquad r = A/p = \frac{60}{34} = 1.77$$

RIVER to 0+86

$$H = \frac{86 \times .013^2 \times 13.6^2}{2.208 \times 1.77^{4/3}} = 86 \times .0066 = 0.57'$$

0+86 to 1+03 L = 17'

$$H = 17 \times .0066 = 0.11'$$

1+03 to 2ND & ARLINGTON AVE.

$$L = 455'$$

$$H = 455 \times .0066 = 3.00'$$

TRANSITION STRUCTURE

$$H \approx 34.4' \times .0066 = 0.23'$$

90° Bend

$$r = \frac{64}{32} = 2.00$$

$$H = \frac{25.2 \times .013^2 \times 15.8^2}{2.208 \times 2.00^{4/3}} = 0.134'$$

SHEET 9 OF 10 DATE 9-22-65

PORTER, ARMSTRONG, RIPA & ASSOC.
Consulting Engineers
RENO, NEVADA

DRAINAGE
VINE STREET
RENO

INLET NO. OR ROAD STATIONS	DRAINAGE AREA IN ACRES					WEIGHTED "C"	WEIGHTED I IN./HR.	TIME OF CONCENTR IN MINUTES
	LENGTH OF	AREA ACRES	"C"	ΔCA ACRES	Σ CA TOTAL ACRES			INLET TIME OR DRAIN 10 + $\frac{L}{V \times 60}$ V= 5fps
OVERLAND FLOW FROM TOP OF WATERSHED							TO	WYOMING & ELMCR
								$10+\frac{4.8\times5280}{5\times60}=94.5$
								1.58
WYOMING & ELMCREST		—	—	—	—			$T_c = 94.5$ min. = 1.58
	4791							94.5+ 4791x.00167 = 1.7
7TH & PEAVINE DITCH		339.9	0.4	136	136			
	133							107.5+ 133x.00167 = 1.7
7TH & CANAL		—	—	136	136			
	529							107.7+ 529x.00167 = 1.73
6TH & CANAL		17.5	0.4	7.0	143			
	486							103.6+486x.00167=1.74
6TH & VINE ST.		12.0	0.4	4.8	147.8			

* USE 54" RCP FOR FREEWAY PROTECTION FOR 6

9 & 10

INAGE COMPUTATIONS

INE STREET STORM DRAIN

RENO, NEVADA PEAVINE CREEK DRAINAGE

PROJECT NO. 8105

LOCATION RENO

COMPUTED R.H.

CHECKED A.C.B. 9-27-65

TIME OF CONCENTRATION IN MINUTES INLET TIME OR DRAIN 10 + $\frac{L}{V \times 60}$ = tc V= 5 fps	RAINFALL INTENSITY I = IN/HR.	I - f IN./HR.	DISCHARGE "Q" C.F.S.	DESIGN SLOPE "S" FT./FT.	DIAMETER OF PIPE "D" INCHES	CAPACITY C.F.S.	VELOCITY "V" FT./SEC.	NOTES
WYOMING & ELMCREST								
10 + $\frac{4.8 \times 5280}{5 \times 60}$ = 94.5 min. 1.58 HRS.								
Tc = 94.5 min. = 1.58 HRS	0.40		88					
94.5 + 4791 x .00167 = 1.71 HRS				—	—	—	—	
	0.36		88 + 49 137					
107.5 + 133 x .00167 = 1.71 HRS				.020	42	145	14.2	
	0.36		137					
+ 529 x .00167 = 1.73 HRS				.020	42	145	14.2	
	0.36		88 + 51.5 139.5					
103.6 + 486 x .00167 = 1.74 HRS				.010	48*	145	11.1	
	0.36		88 + 53 141					
ECTION FOR 50-YEAR STORM								

100610

STORM SEWE

PORTER, ARMSTRONG, RIPA & ASSOCIATES
Consulting Engineers
RENO, NEVADA

VINE STREET
RENO ,

LOCATION	STRUCT. NO.	TYPE OF STRUCT.	LENGTH L FT.	PIPE SIZE D INCHES	SLOPE S FT./FT.	PIPE CAPACITY Q C.F.S.	VELOCITY V FT./SEC.	$\frac{V^2}{2G}$ FT.	LOSS COEF ΣK
VINE ST. & 6th ST.	8	M.H.						2.47	1.2
			486	54	.010	*200	12.6		
6th ST. & CANAL ST.	17	M.H.						2.76	0.9
			529	42	.020	125	13.3		
CANAL & 7th ST.	16	M.H.						2.76	0.7
			133	42	.015	125	13.3		
CANAL ST. & PEAVINE DITCH	15	M.H.							

* Q_{50} FROM NEVADA ENGINEERING CONSULTANTS FOR

FED. ROAD REG. NO.	STATE	PROJECT NO.	COUNTY	CONTROL SECTION	STATE ROUTE	SHEET NO.	
7	NEVADA	I-080-1(34)12	WASHOE	31-082		S-1	[illegible]

STATE OF NEVADA

DEPARTMENT OF HIGHWAYS

TESTING LAB. FILE

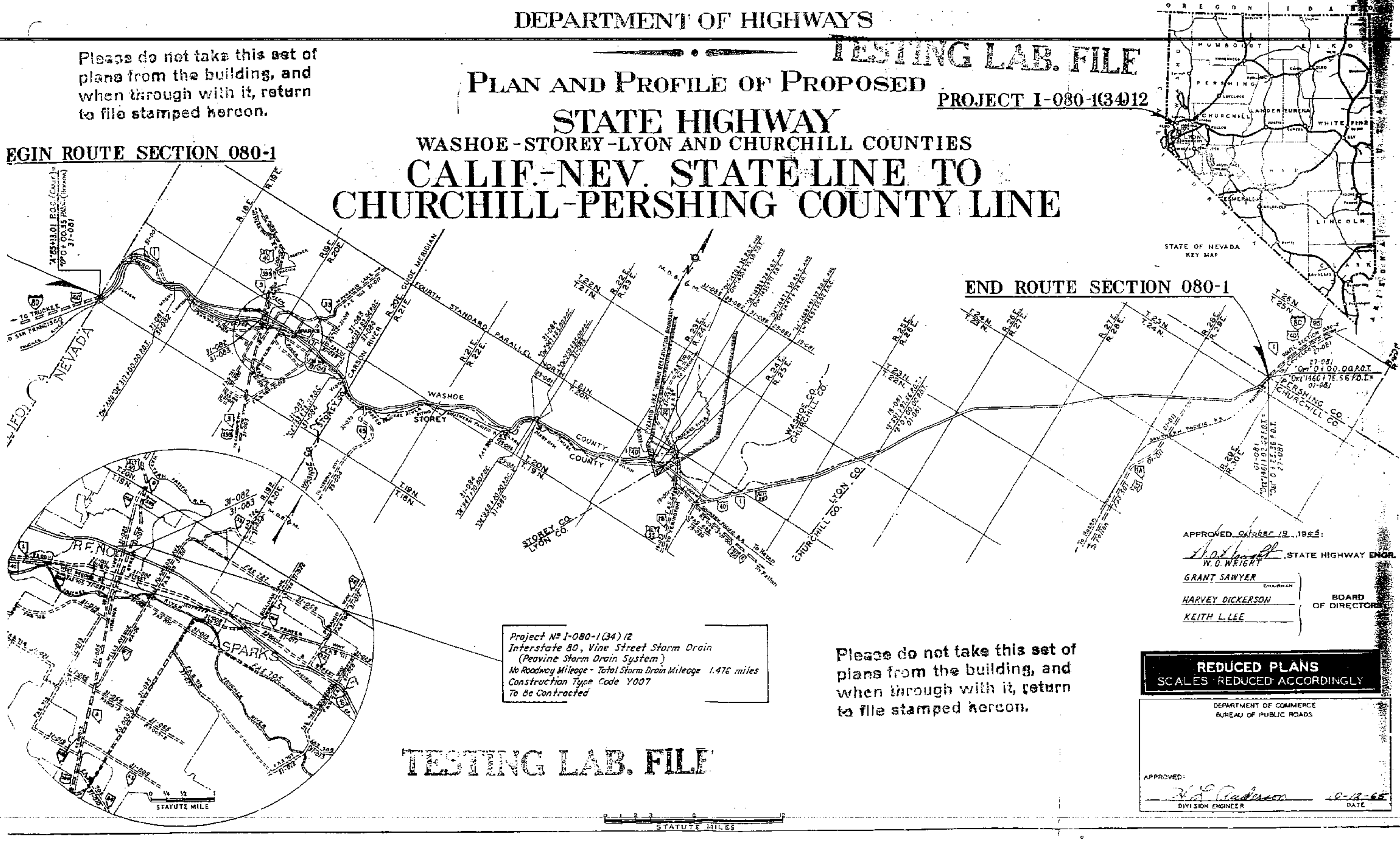
Please do not take this set of
plans from the building, and
when through with it, return
to file stamped hereon.

PLAN AND PROFILE OF PROPOSED
STATE HIGHWAY

WASHOE-STOREY-LYON AND CHURCHILL COUNTIES

CALIF.-NEV. STATE LINE TO CHURCHILL-PERSHING COUNTY LINE

PROJECT I-080-1(34)12



Project № I-080-1(34)12
Interstate 80, Vine Street Storm Drain
(Peavine Storm Drain System)
No Roadway Mileage - Total Storm Drain Mileage 1.476 miles
Construction Type Code Y007
To Be Contracted

TESTING LAB. FILE

Please do not take this set of
plans from the building, and
when through with it, return
to file stamped hereon.

APPROVED October 19, 1965:

W.O. Wright, STATE HIGHWAY ENGR.
W.O. WRIGHT

GRANT SAWYER
CHAIRMAN

HARVEY DICKERSON

KEITH L. LEE

BOARD OF DIRECTORS

REDUCED PLANS
SCALES REDUCED ACCORDINGLY

DEPARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS

APPROVED:

DIVISION ENGINEER

10-12-65
DATE

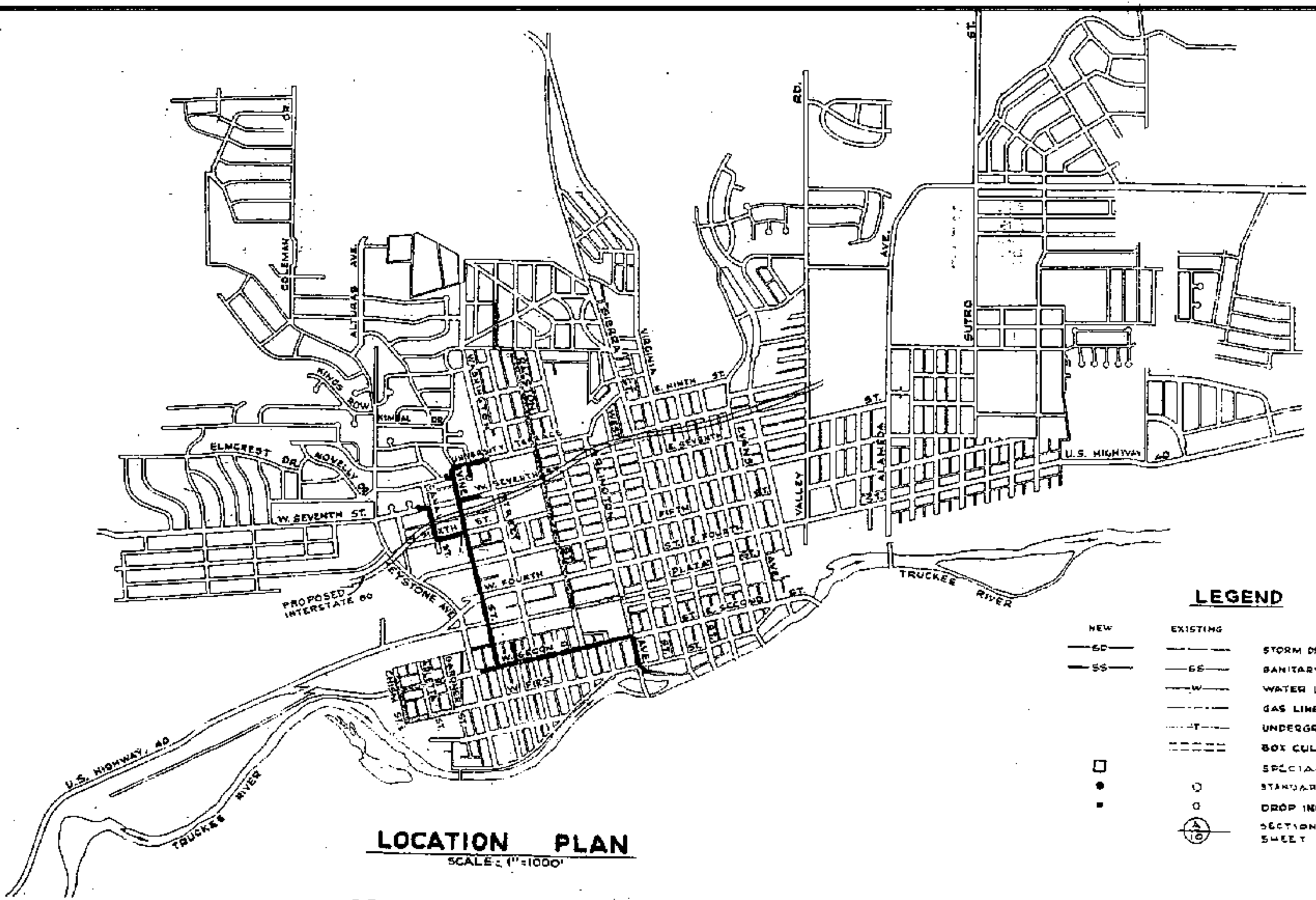
Reduced Plans
Do Not Scale

CITY OF RENO
STORM DRAINAGE SYSTEM

1.	18" R.C.P., in place (Class III)	2,202	L.F.
2.	21" R.C.P., in place (Class III)	28	L.F.
3.	24" R.C.P., in place (Class III)	12	L.F.
4.	27" R.C.P., in place (Class III)	260	L.F.
5.	36" R.C.P., in place (Class III)	415	L.F.
6.	42" R.C.P., in place (Class III)	717	L.F.
	54" R.C.P., in place (Class III)	1,036	L.F.
	[illegible] R.C.P., in place (Class III)	463	L.F.
9.	96" R.C.P., in place (Class III)	3,941	L.F.
10.	96" R.C.P., in place (Class IV)	100	L.F.
11.	102" Tunnel Liner Plate	50	L.F.
12.	12' x 8' R.C.B., in place	545	L.F.
13.	22" x 13" C.M.P. Arch, in place	28	L.F.
14.	Standard Manhole, 42", in place	10	Ea.
15.	Standard Manhole, 60", in place	2	Ea.
16.	Manhole, 42" to 54" R.C.P., in place	1	Ea.
17.	Manhole, 21" & 54" to 54" R.C.P., in place	1	Ea.
18.	Manhole, 36" & 54" to 54" R.C.P., in place	1	Ea.
19.	Junction Box, in place	1	Ea.
20.	Manhole, 84" & 54" to 96", in place	1	Ea.
21.	Manhole, 96" to 96", in place	5	Ea.
22.	Transition Structure, in place	1	Ea.
23.	12" C.P., for Sanitary Sewer, in place	165	L.F.
24.	Drop M.H., for Sanitary Sewer, in place	1	Ea.
25.	Misc. Concrete	13	C.Y.
26.	Remove Drop Inlet, cut and plug conn. pipe	30	Ea.
27.	Cutting & Plugging Exist. Pipes	6	Ea.
28.	Drop Inlet, in place	29	Ea.
29.	Backfill exist. conc. boxes	52	C.Y.
30.	Grouted riprap	8	C.Y.
31.	Removal of Structural Concrete	35	C.Y.
	Curb & Gutter, in place	684	L.F.
33.	Valley Gutter, in place	1	Ea.
34.	Sidewalk, in place	18	S.Y.
35.	Pavement replacement, 4"	230	S.Y.
36.	Pavement replacement, 1 1/2"	5,400	S.Y.
37.	Pavement replacement, 2 1/2"	11,495	S.Y.
38.	90-Degree Bend	1	Ea.

GENERAL NOTES

1. All pipes shall be Class III unless otherwise noted.
2. Curb and gutters shall be reconstructed to new inlet grate elevations or as established by the Engineer.
3. Curb and gutter shall be reconstructed when existing drop inlets are removed and not replaced.
4. Pipe lengths as shown on plans are approximate. Payment shall be based on measured lengths in place.
5. Use mortar joints or approved rubber couplings.
6. All concrete shall have a compressive strength of 3000 psi at 28 days unless otherwise noted.
7. The accuracy or completeness of the utility lines shown on the plans is approximate. All service connections to adjacent properties may or may not be shown. Gas and water lines will be located in the field by Sierra Pacific Power Company.
8. All drop inlet connecting pipes abandoned in place shall be plugged.
9. All existing R.C.B. culverts to remain in operation until downstream portion of storm drain is completed to the river.
10. Drop inlets and connecting pipes to be constructed at the same time complete in place. Do not stub out from manholes for later construction.
11. Construction type code Y-007.



LOCATION PLAN

SCALE: 1"=1000'

LEGEND

NEW	EXISTING	
—SD—	— — —	STORM DRAIN
—SS—	—SS—	SANITARY SEWER
	—W—	WATER LINE
	—·—·—	GAS LINE
	···T···	UNDERGROUND TELEPHONE DUCT
	═ ═ ═	BOX CULVERT
□		SPECIAL MANHOLE
●	○	STANDARD PRECAST CONC. MANHOLE
■	□	DROP INLET
	$\frac{A}{10}$	SECTION NUMBER SHEET NUMBER

ABBREVIATIONS

CMPA	CORRUGATED METAL PIPE ARCH
RCP	REINFORCED CONCRETE PIPE
RCB	REINFORCED CONCRETE BOX
DIA	DIAMETER
MH	MANHOLE
INV	INVERT
EL	ELEVATION
EXIST	EXISTING
DI	DROP INLET
TBM	TEMPORARY BENCH MARK

SCHEDULE OF DRAWINGS

SHEET NO.	TITLE	SHEET NO.	TITLE
1	LOCATION PLAN & SCHEDULE OF DRAWINGS	8	STORM DRAIN (Laterals)
2	STORM DRAIN (University Terrace & Washington St. to Vine & 7th Streets)	9	STORM DRAIN (RCB Outfall 1st St. & Arlington Ave.)
3	STORM DRAIN (7th St. to 5th St. on Vine St.)	10	STRUCTURAL DETAILS & PAVEMENT SECTIONS
4	STORM DRAIN (5th St. to 2nd St. on Vine St.)	11	STRUCTURAL DETAILS & MANHOLE DETAILS
5	STORM DRAIN (Vine St. to Stevenson St. on 2nd St.)	12	STRUCTURAL & MISCELLANEOUS DETAILS
6	STORM DRAIN (Stevenson & 2nd Sts. to 1st St. & Arlington Ave.)	13	BORING LOGS & LOCATIONS
7	STORM DRAIN (7th & Canal Sts. to 6th & Vine Sts.)	14	STRUCTURE LIST

AERIAL PHOTOGRAPHY DATA
BY C.O. GREENWOOD & ASSOCIATES
DATE FLOWN 6-12-64 ELEV. FLOWN 3000'
PHOTO SCALE 1"=250'
CAMERA DATA: K-17B FAIRCHILD FOCAL LENGTH 12"

APPROVALS

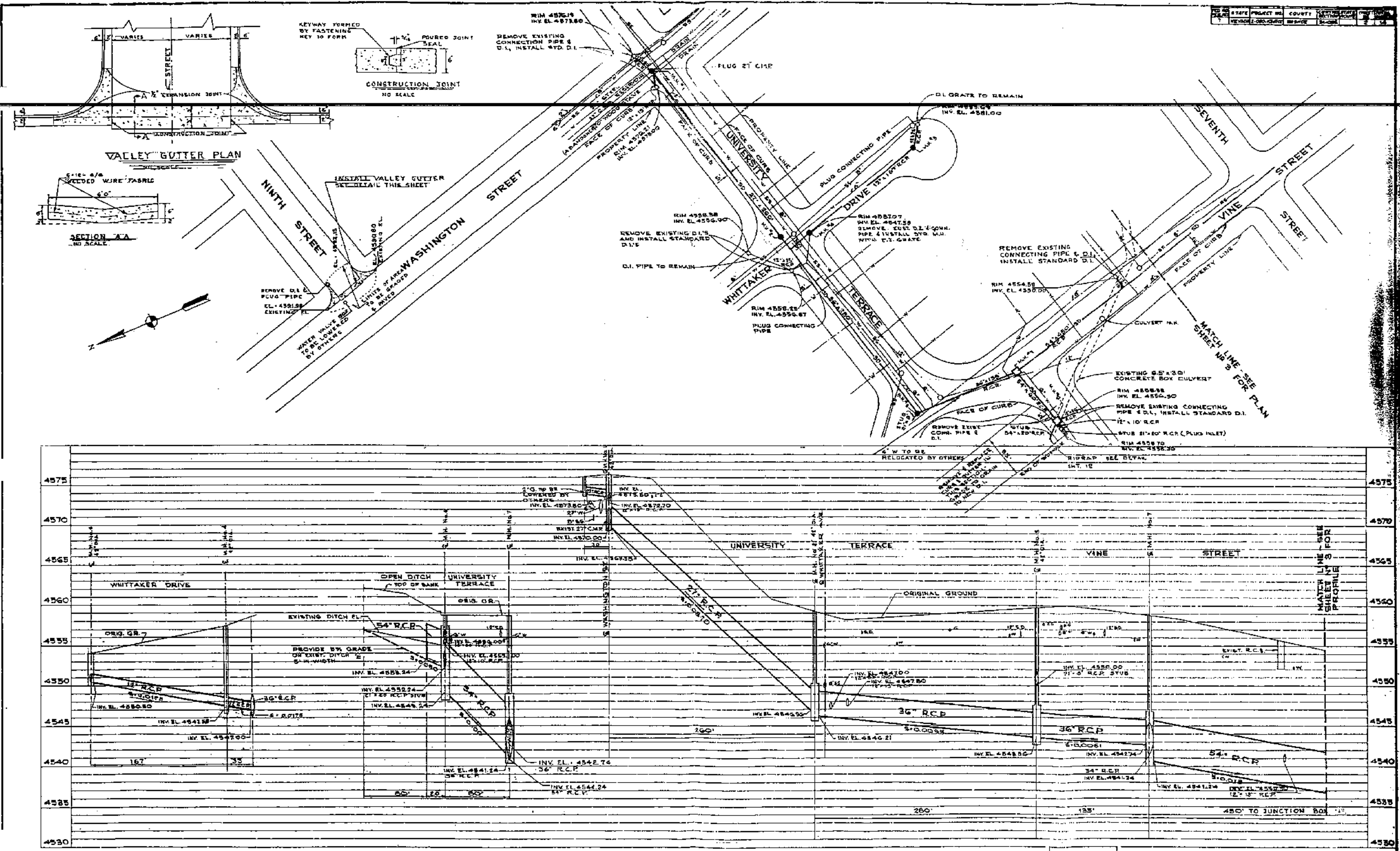
REVISION	DATE	DESCRIPTION	BY	APPR'VD

PORTER, O'BRIEN & ARMSTRONG
CONSULTING ENGINEERS
2161 E. Second St.
RENO, NEVADA
DESIGNED BY: E.T. & R.M.
DRAWN BY: K.L.L.
CHECKED BY: B.A.K.
SUBMITTED BY: Bruce A. Kester
C.E. 1208 DATE 9-17-65
SCALE: AS SHOWN

CITY OF RENO
STORM DRAINAGE SYSTEM
VINE STREET STORM DRAIN

DEPARTMENT OF PUBLIC WORKS
CITY OF RENO NEVADA
APPROVED
DATE 11-5-65 DIRECTOR OF PUBLIC WORKS

SHEET 1 OF 14



Reduced Plans
Do Not Scale

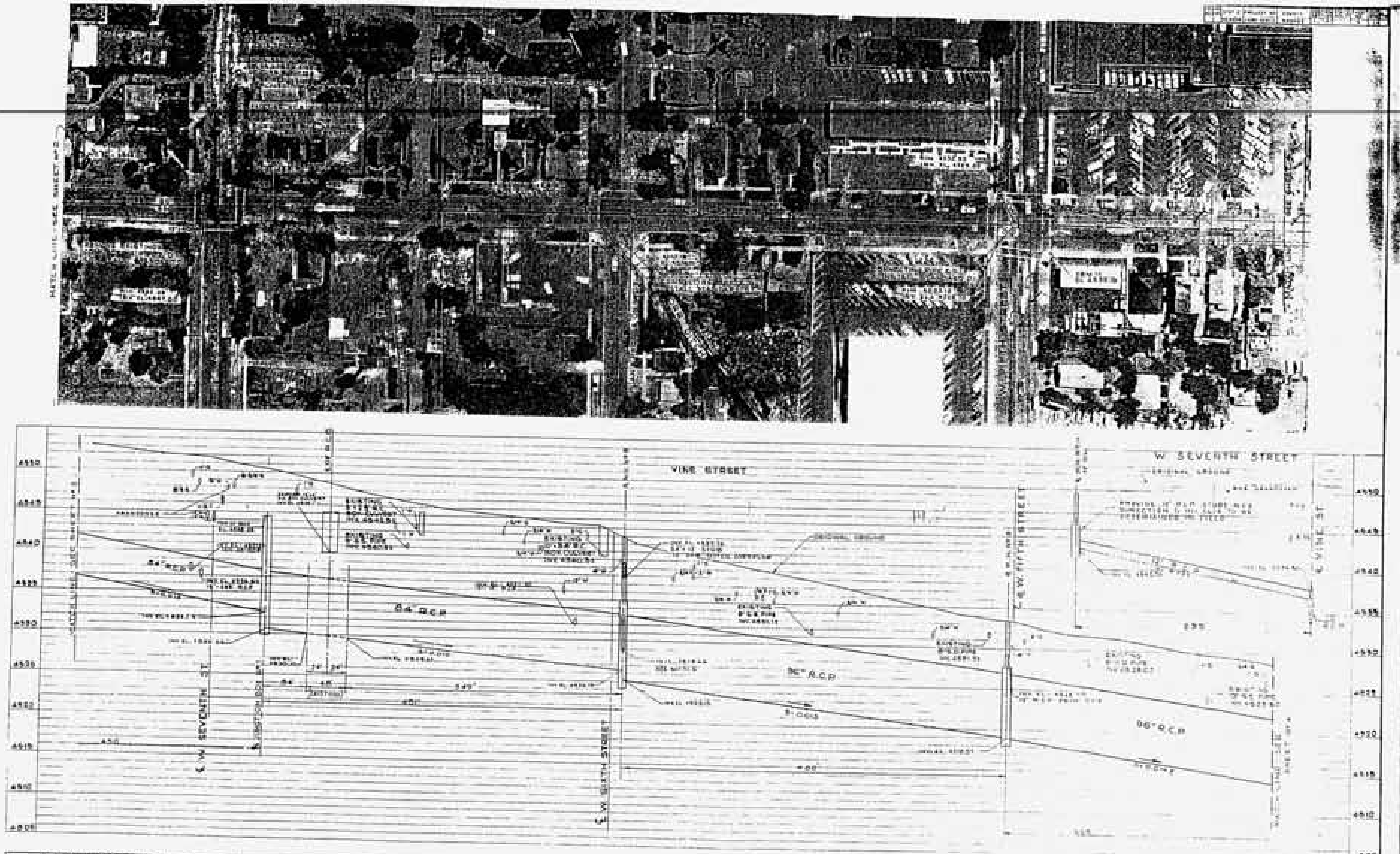
AERIAL PHOTOGRAPHY DATA	APPROVALS	REVISION	DATE	DESCRIPTION	BY	APPR'VD
BY: C.O. GREENWOOD & ASSOCIATES DATE FLOWN: ___ ELEV. FLOWN: ___ PHOTO SCALE: ___ CAMERA DATA: MAKE ___ FOCAL LENGTH ___						

PORTER, O'BRIEN & ARMSTRONG
CONSULTING ENGINEERS
2161 E Second St RENO, NEVADA
DESIGNED BY: E.H.H. SUBMITTED BY: B. A. Kuhn
DRAWN BY: X.A.L. C.E. 1203 DATE: 9-17-65
CHECKED BY: B.A.K. SCALE: HORIZ. 1"=50' VERT. 1"=5'

CITY OF RENO
STORM DRAINAGE SYSTEM
VINE STREET STORM DRAIN

DEPARTMENT OF PUBLIC WORKS
CITY OF RENO, NEVADA
APPROVED:
DATE: 11-5-65 DIRECTOR OF PUBLIC WORKS

SHEET 2 OF 14



AERIAL PHOTOGRAPHY DATA
BY: C.O. GREENWOOD & ASSOCIATES
DATE FLOWN: 4-13-64 ELEV FLOWN: 3000'
PHOTO SCALE: 1"=250'
CAMERA DATA: [illegible] FOCAL LENGTH 12"

APPROVALS

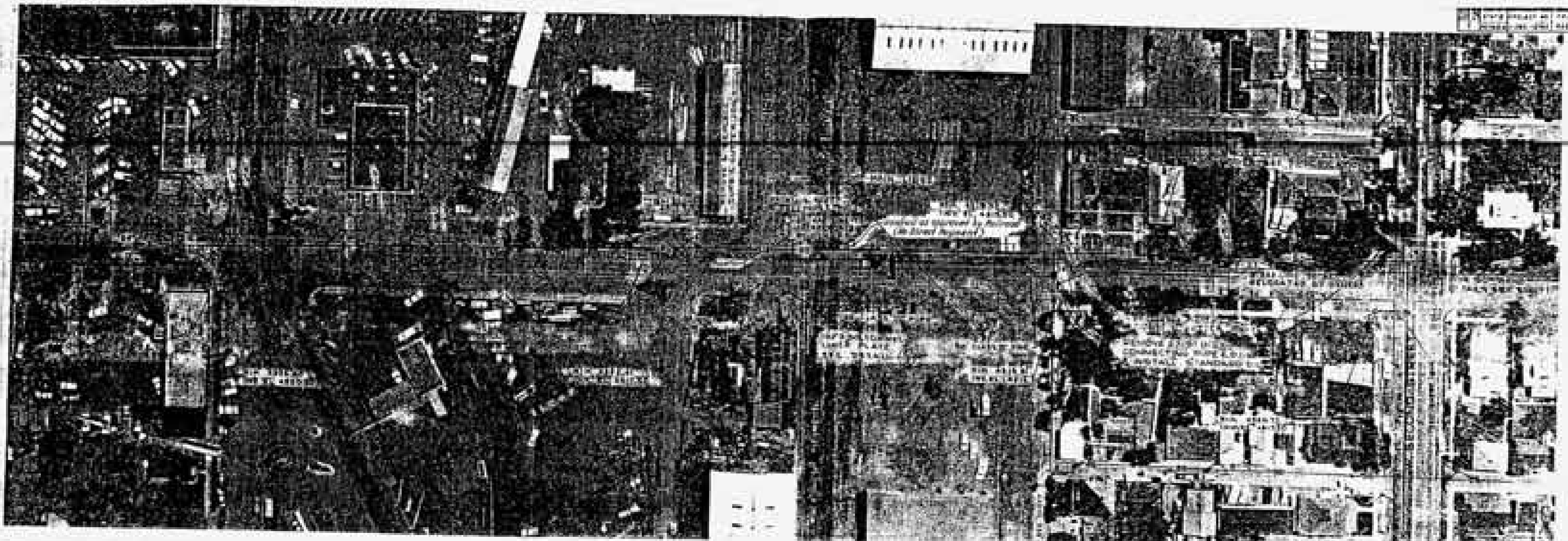
REVISION	DATE	DESCRIPTION	BY	APPR'D

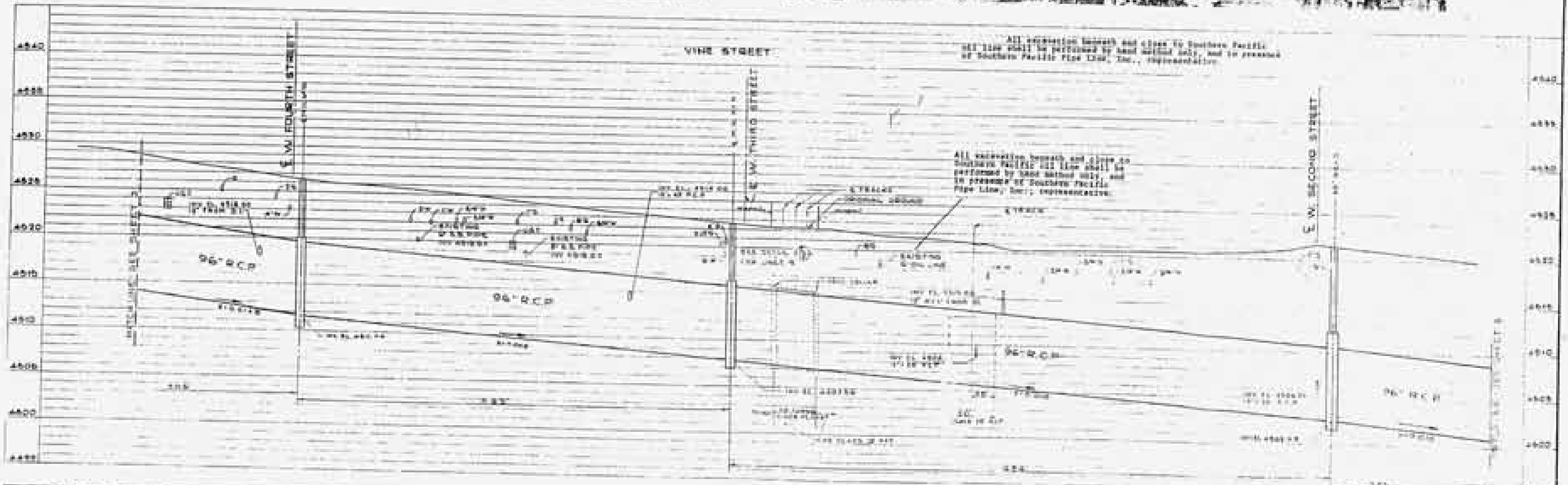
PORTER, O'BRIEN & ARMSTRONG
CONSULTING ENGINEERS
2167 E. Second St. RENO, NEVADA
DESIGNED BY: [illegible] SUBMITTED BY: [illegible]
DRAWN BY: [illegible] C.E. 1909 DATE 2-17-65
CHECKED BY: [illegible] SCALE HORIZ. 1"=50' VERT. 1"=5'

CITY OF RENO
STORM DRAINAGE SYSTEM
VINE STREET STORM DRAIN

DEPARTMENT OF PUBLIC WORKS
CITY OF RENO, NEVADA
APPROVED:
DATE: DIRECTOR OF PUBLIC WORKS

SHEET 3 OF 14

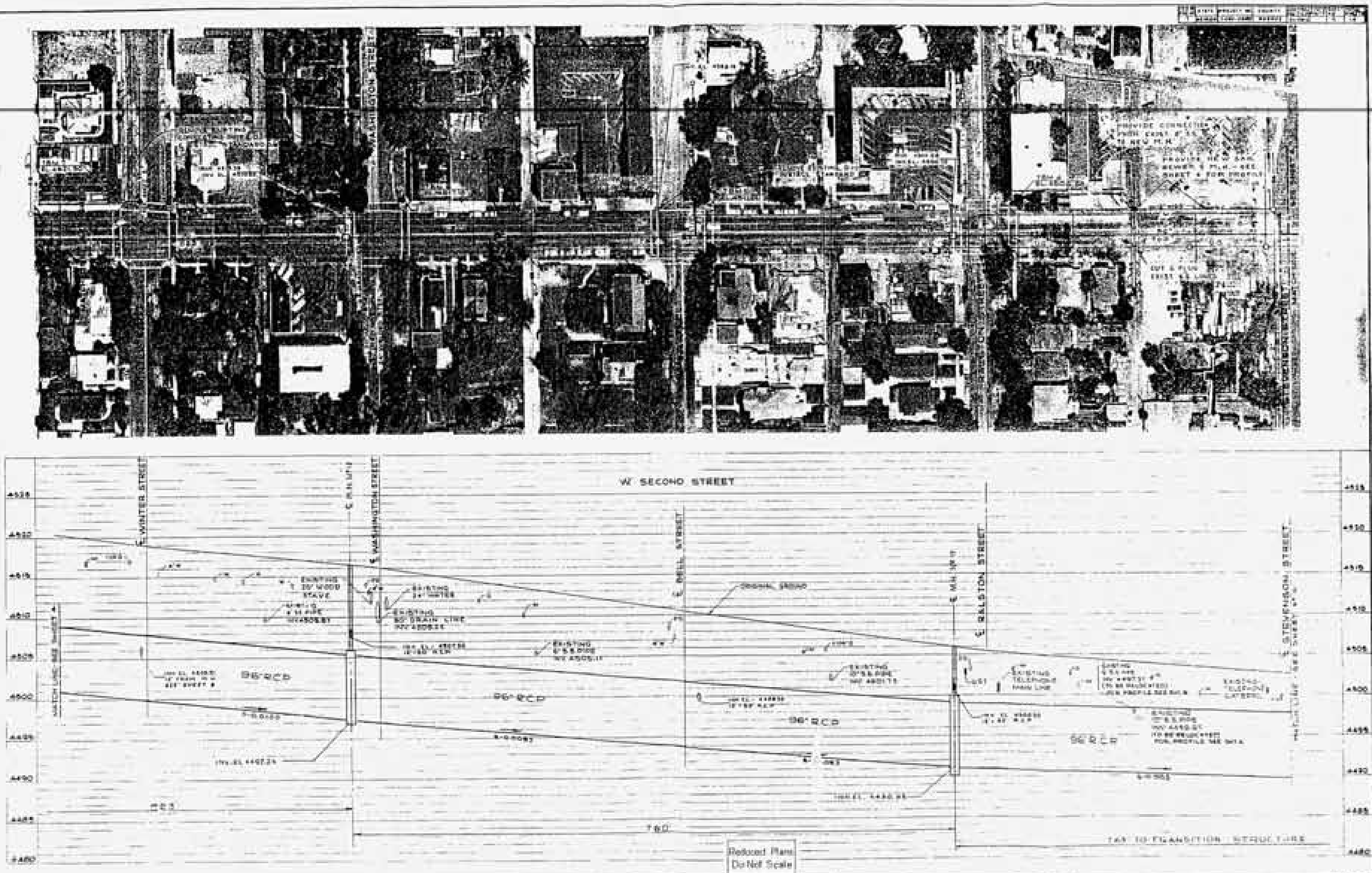




All excavation beneath and close to Southern Pacific oil line shall be performed by hand method only, and in presence of Southern Pacific Pipe Line, Inc., representative.

All excavation beneath and close to Southern Pacific oil line shall be performed by hand method only, and in presence of Southern Pacific Pipe Line, Inc., representative.

AERIAL PHOTOGRAPHY DATA	APPROVALS	REVISION	DATE	DESCRIPTION	BY	APPD.	PORTER, O'BRIEN & ARMSTRONG	CITY OF RENO	DEPARTMENT OF PUBLIC WORKS	SHEET
BY C.O. GREENWOOD & ASSOCIATES DATE FLOWN 6-17-64 ELEV FLOWN 5000' PHOTO SCALE 1"=150' CAMERA DATA K-17B FAIRCHILD FOCAL LENGTH 12"							CONSULTING ENGINEERS RENO, NEVADA DESIGNED BY DRAWN BY CHECKED BY SUBMITTED BY SCALE: HORIZ. 1"=50' VERT. 1"=5'	STORM DRAINAGE SYSTEM VINE STREET STORM DRAIN	CITY OF RENO, NEVADA APPROVED DATE DIRECTOR OF PUBLIC WORKS	4 OF 14



Reduced Plans
Do Not Scale

AERIAL PHOTOGRAPHY DATA
BY: C.O. GREENWOOD & ASSOCIATES
DATE FLOWN: 10-12-64 ELEV. FLOWN: 5000'
PHOTO SCALE: 1"=250'
CAMERA DATA: FOCAL LENGTH 12"

APPROVALS

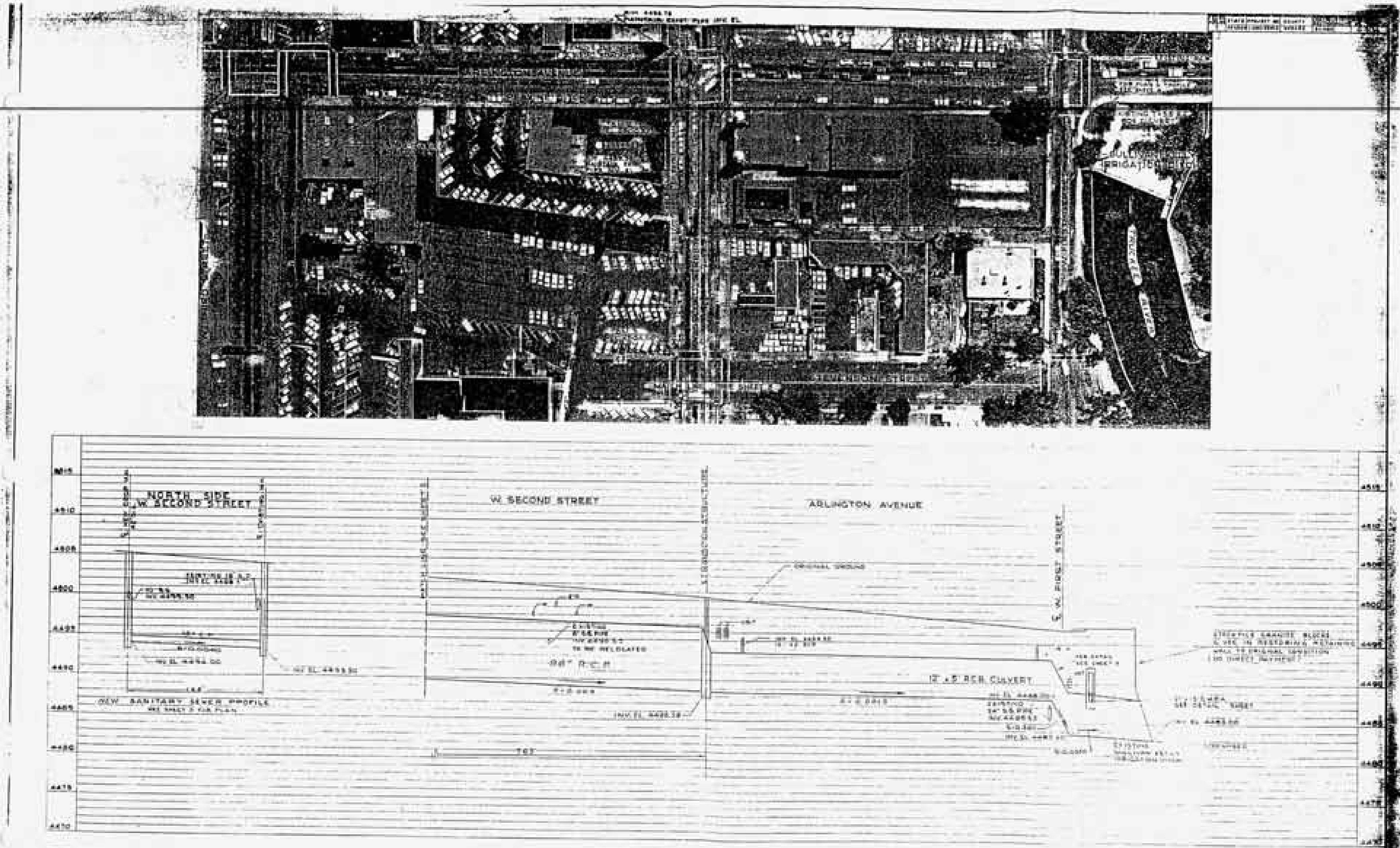
REVISION	DATE	DESCRIPTION	BY	APPR'D

PORTER, O'BRIEN & ARMSTRONG
CONSULTING ENGINEERS
2161 E. SALOME ST. RENO, NEVADA
DESIGNED BY: R.E.P.
DRAWN BY:
CHECKED BY:
SUBMITTED BY:
C.E. 1205 DATE: 5-13-65
SCALE: HORIZ. 1"=50' VERT. 1"=5'

CITY OF RENO
STORM DRAINAGE SYSTEM
VINE STREET STORM DRAIN

DEPARTMENT OF PUBLIC WORKS
CITY OF RENO, NEVADA
APPROVED:
DATE: DIRECTOR OF PUBLIC WORKS

SHEET
5
OF
14



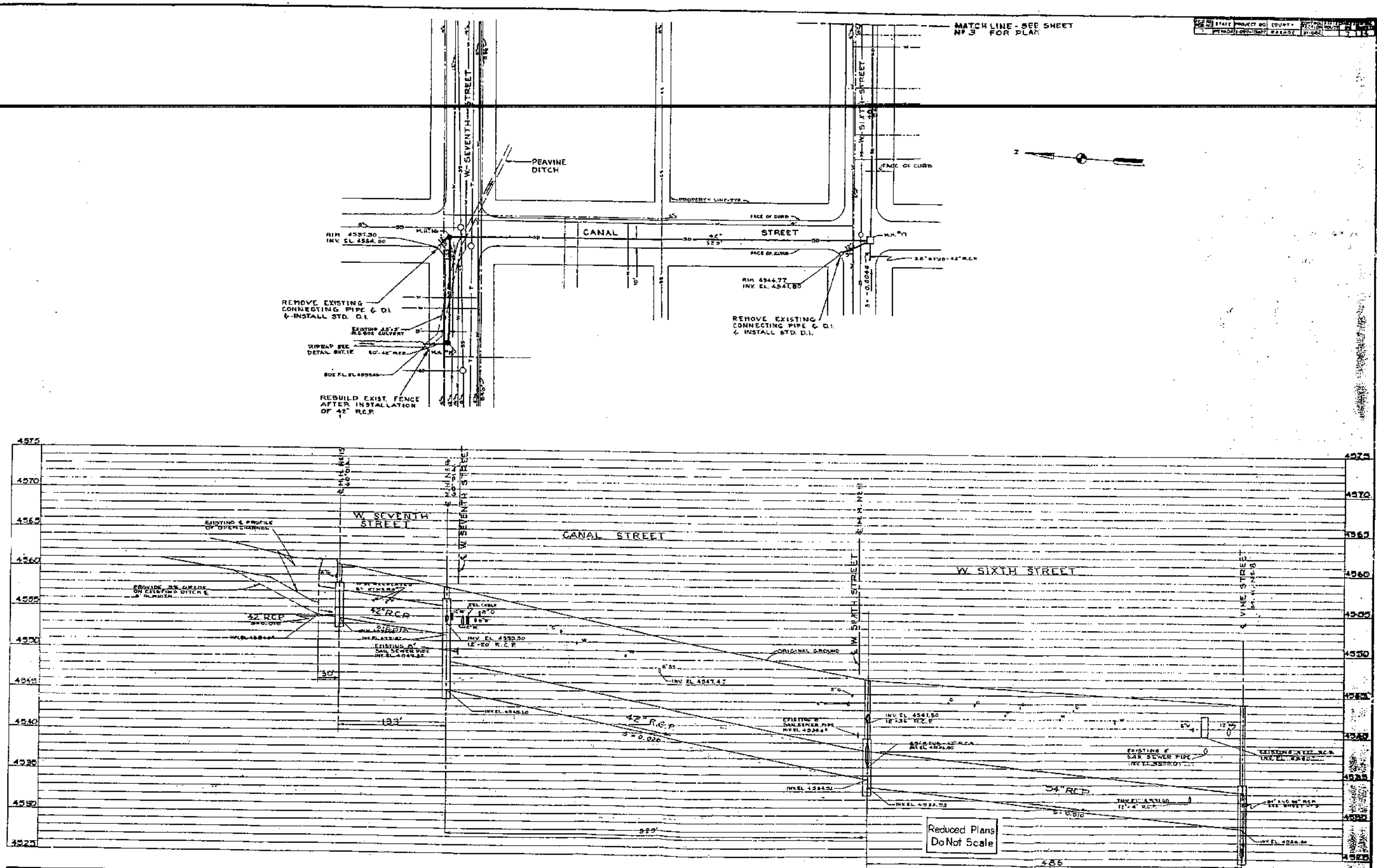
AERIAL PHOTOGRAPHY DATA BY: C.O. GREENWOOD & ASSOCIATES DATE FLOWN: 2-17-68 ELEV. FLOWN: 5000' PHOTO SCALE: 1"=250' CAMERA DATA: K17B FAIRCHILD FOCAL LENGTH 12"	APPROVALS	REVISION | DATE | DESCRIPTION | BY | APPR'D

PORTER, O'BRIEN & ARMSTRONG
CONSULTING ENGINEERS
RENO, NEVADA

CITY OF RENO
STORM DRAINAGE SYSTEM
VINE STREET STORM DRAIN

DEPARTMENT OF PUBLIC WORKS
CITY OF RENO, NEVADA
APPROVED:
DATE: DIRECTOR OF PUBLIC WORKS

SHEET 6 OF 14



AERIAL PHOTOGRAPHY DATA
BY: C.O. GREENWOOD & ASSOCIATES
DATE FLOWN: ______ ELEV. FLOWN: ______
PHOTO SCALE: ______
CAMERA DATA: MAKE ______ FOCAL LENGTH ______

APPROVALS

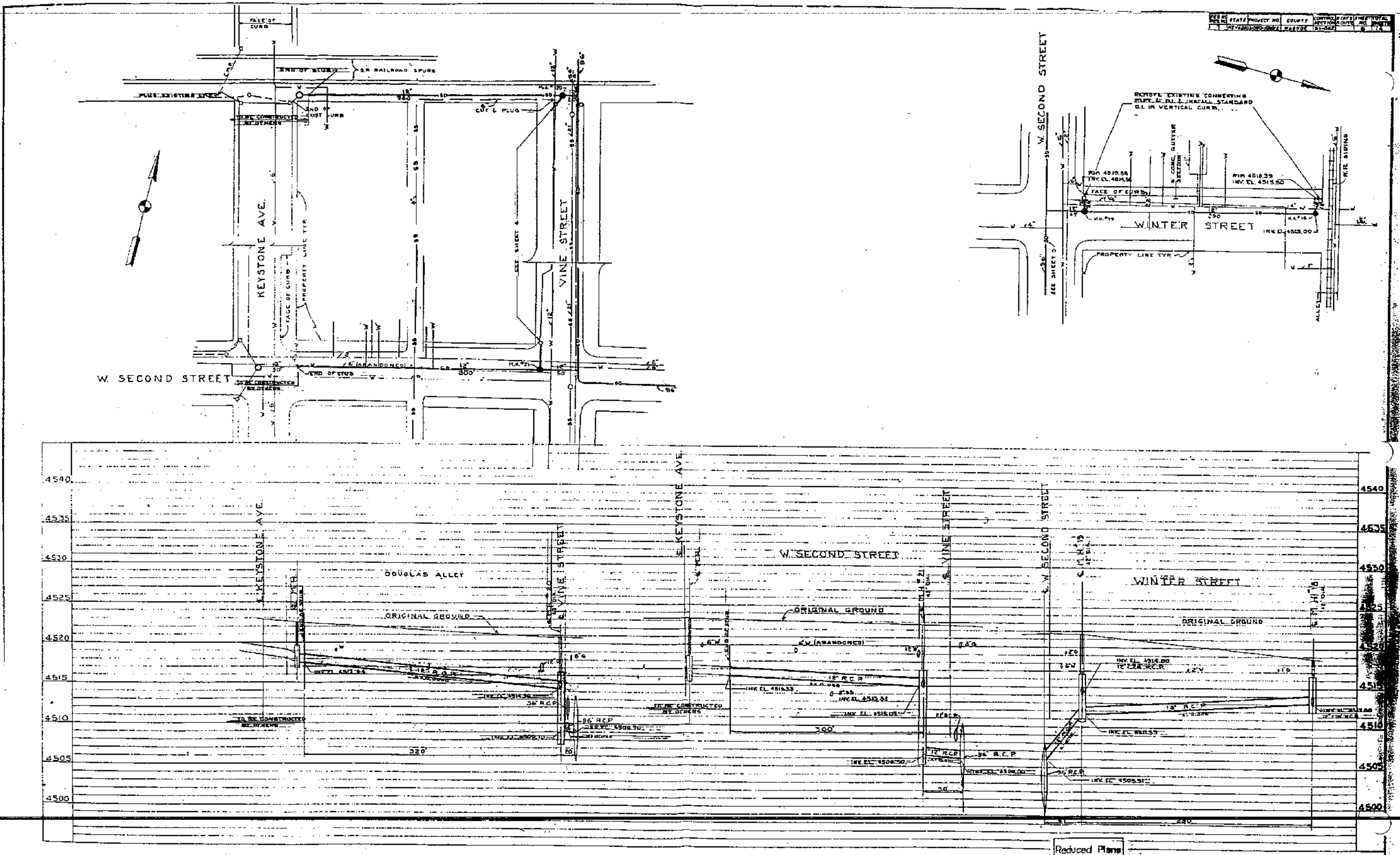
REVISION	DATE	DESCRIPTION	BY	APPR'V'D

PORTER, O'BRIEN & ARMSTRONG
CONSULTING ENGINEERS
2167 E Second St
RENO, NEVADA
DESIGNED BY: A.C.B.
DRAWN BY: B.S.B.
SUBMITTED BY: B. A9C
C.E.: 1209 DATE: 9-17-65

CITY OF RENO
STORM DRAINAGE SYSTEM
VINE STREET STORM DRAIN

DEPARTMENT OF PUBLIC WORKS
CITY OF RENO, NEVADA
APPROVED:

SHEET



Reduced Plans
Do Not Scale

AERIAL PHOTOGRAPHY DATA
BY: C.O. GREENWOOD & ASSOCIATES
DATE FLOWN: ______ ELEV. FLOWN: ______
PHOTO SCALE: ______
CAMER. ______ FOCAL LENGTH ______

APPROVALS

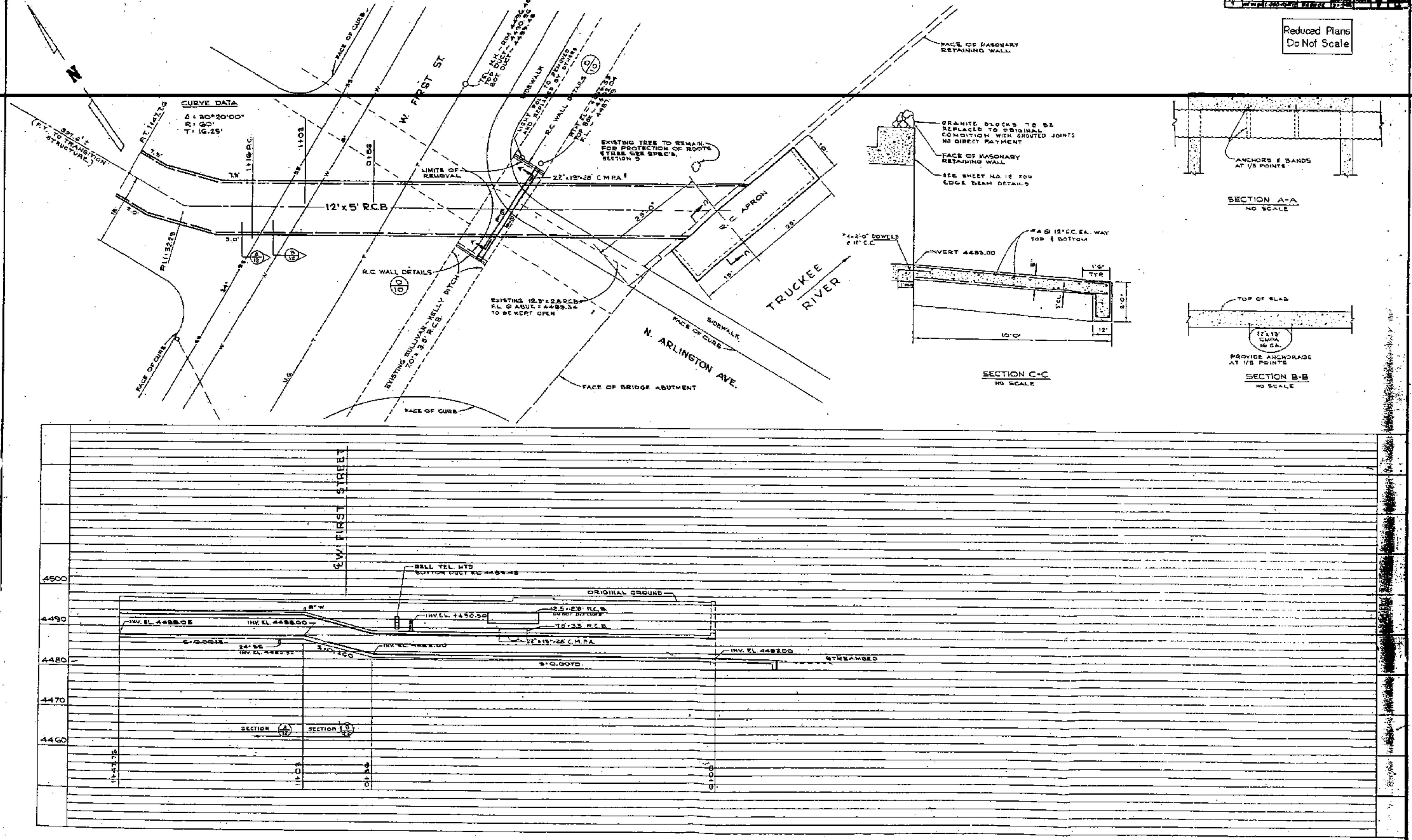
REVISION	DATE	DESCRIPTION	BY	APPR'VD

PORTER, O'BRIEN & ARMSTRONG
CONSULTING ENGINEERS
2167 E Second St RENO, NEVADA
DESIGNED BY: R.R.H.
DRAWN BY: B.G.K.
CHECKED BY: R.M.
SUBMITTED BY: B. A. Armstrong
C.E.: 1308 DATE: 10-14-65
SCALE: HORIZ. 1"=40' VERT. 1"=5'

CITY OF RENO
STORM DRAINAGE SYSTEM
VINE STREET STORM DRAIN
LATERALS

DEPARTMENT OF PUBLIC WORKS
CITY OF RENO, NEVADA
APPROVED: A. 2. 16
DATE: 11-5-65 DIRECTOR OF PUBLIC WORKS

SHEET
8
OF
14



Reduced Plans
Do Not Scale

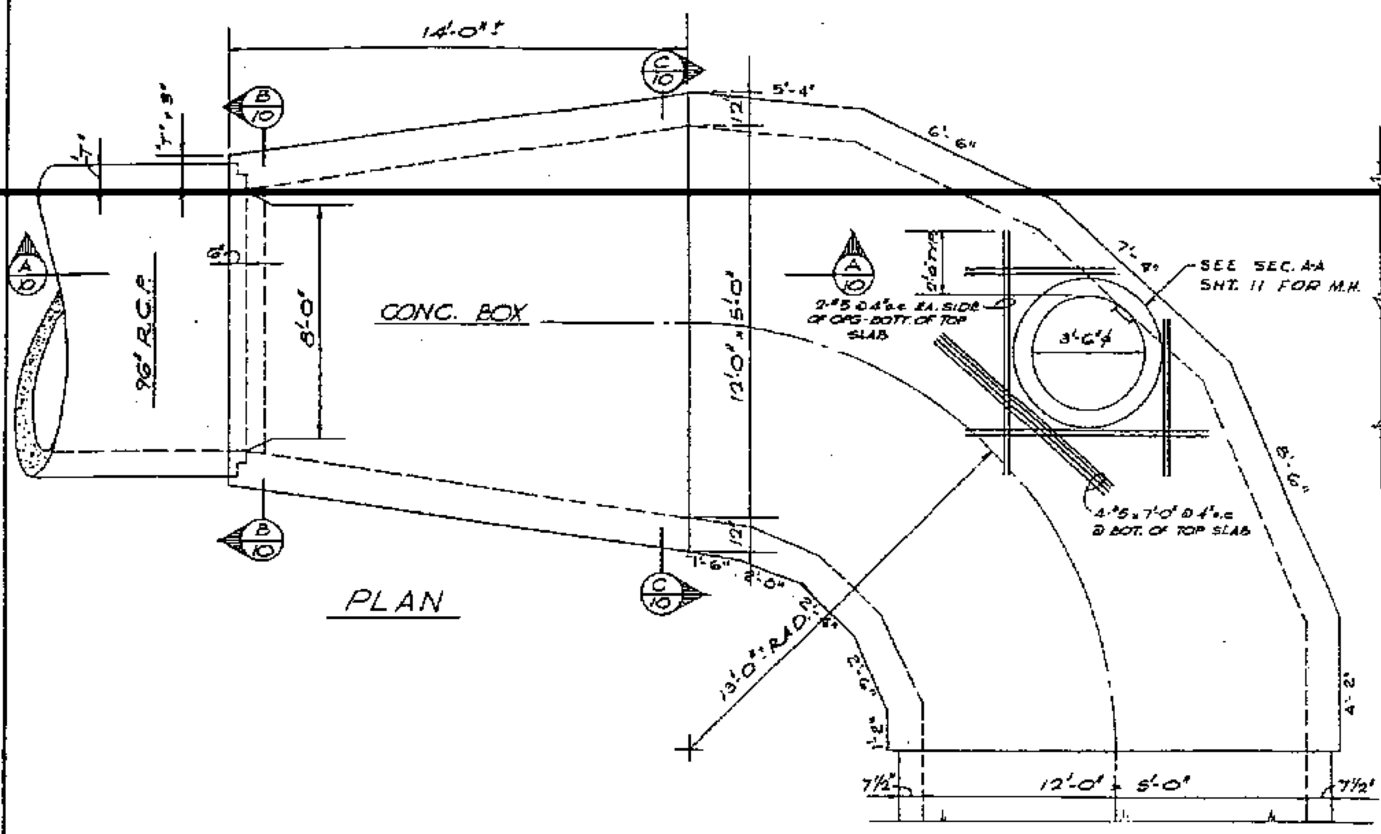
AERIAL PHOTOGRAPHY DATA	APPROVALS	REVISION	DATE	DESCRIPTION	BY	APPR'VD
BY: C.O. GREENWOOD & ASSOCIATES DATE FLOWN: ______ ELEV. FLOWN: ______ PHOTO SCALE: CAMERA DATA: MAKE ______ FOCAL LENGTH ______						

PORTER, O'BRIEN & ARMSTRONG
CONSULTING ENGINEERS
2161 E Second St
RENO, NEVADA
DESIGNED BY: C.S.
DRAWN BY: K.A.L.
CHECKED BY: R.W.
SUBMITTED BY: B. A. Porter
C.E.: 1203 DATE: 3-17-65
SCALE: HORIZ. 1"=10' VERT. 1"=10'

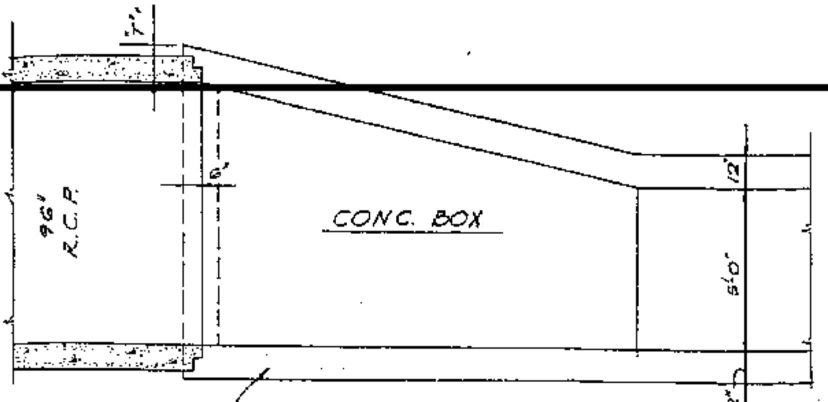
CITY OF RENO
STORM DRAINAGE SYSTEM
VINE STREET OUTFALL

DEPARTMENT OF PUBLIC WORKS
CITY OF RENO, NEVADA
APPROVED:
DATE: 11-5-65 DIRECTOR OF PUBLIC WORKS

SHEET
9
OF
14



PLAN

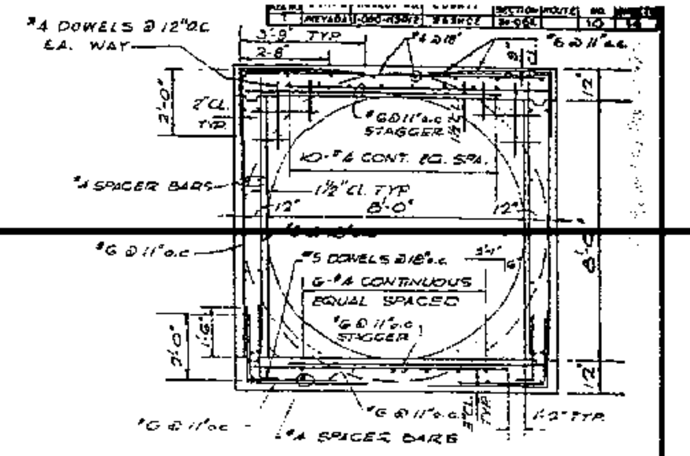


REINFORCING STEEL BAR LENGTHS SHALL VARY UNIFORMLY THROUGHOUT THE TRANSITION

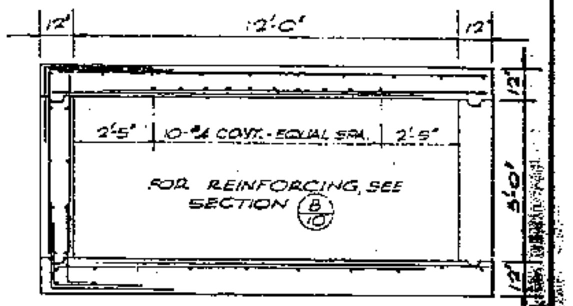
SECTION (A/10)
3/8" = 1'-0"

TRANSITION STRUCTURE

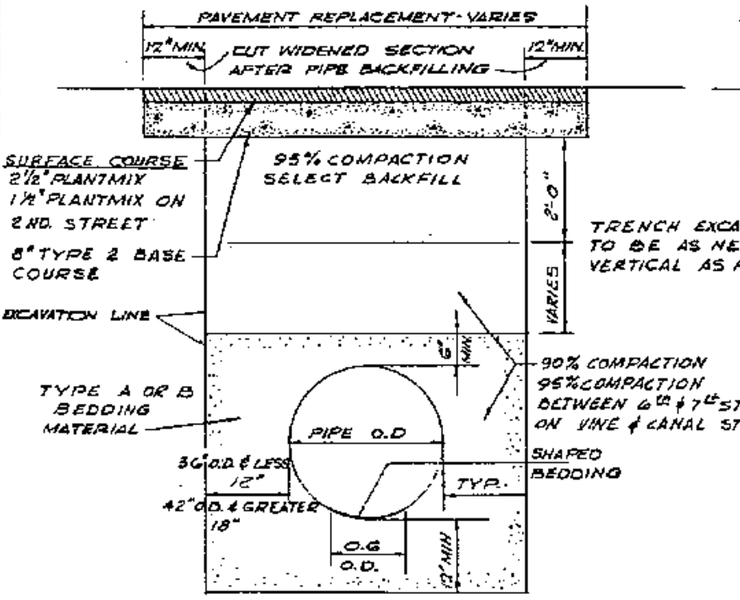
SCALE 3/8" = 1'-0"
AT SECOND STREET & ARLINGTON AVE.



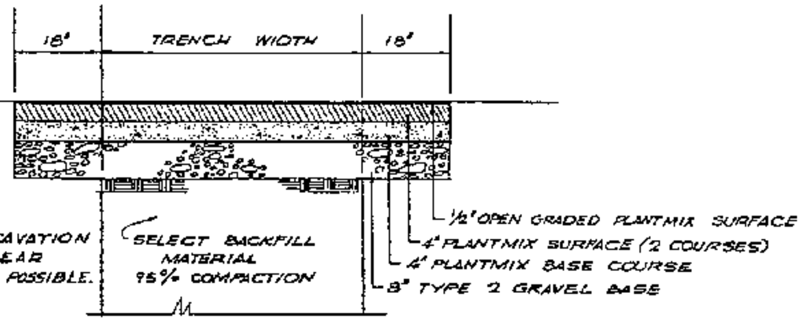
SECTION (B/10)
3/8" = 1'-0"



SECTION (C/10)
3/8" = 1'-0"



TYPICAL FOR ALL STREETS
(EXCEPT AS NOTED)



TRENCH EXCAVATION TO BE AS NEAR VERTICAL AS POSSIBLE.

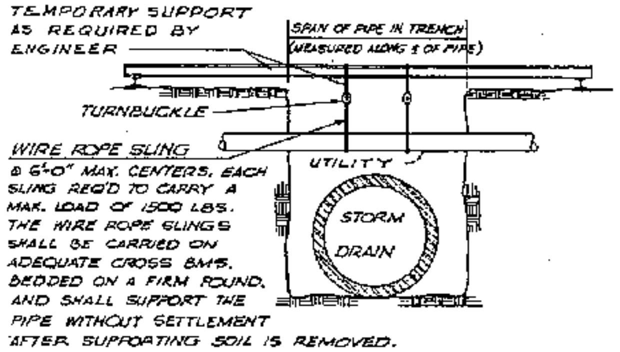
FOR CONTINUATION, SEE SECTION AT LEFT

AT 4TH & VINE ST. INTERSECTION

NOTES
1. EDGES OF PAVEMENT REPLACEMENT TO BE SAW CUT STRAIGHT AND UNIFORM
2. ALL EXCAVATED MATERIAL TO BE DISPOSED OF.

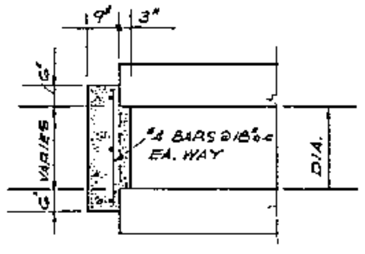
TYPICAL PAVEMENT REPLACEMENTS

NO SCALE



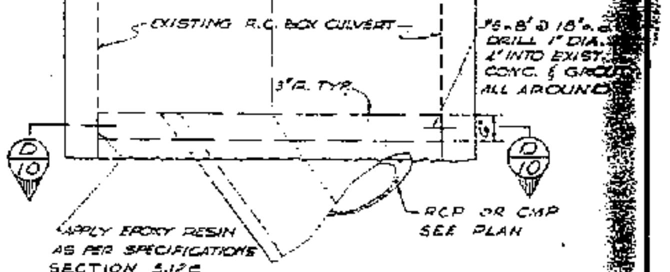
WIRE ROPE SLING @ 6'-0" MAX. CENTERS, EACH SLING REQ'D TO CARRY A MAX. LOAD OF 1500 LBS. THE WIRE ROPE SLINGS SHALL BE CARRIED ON ADEQUATE CROSS BMS. BEDDED ON A FIRM FOUND. AND SHALL SUPPORT THE PIPE WITHOUT SETTLEMENT AFTER SUPPORTING SOIL IS REMOVED.

SUPPORT REQUIREMENTS FOR UNDERGROUND UTILITIES

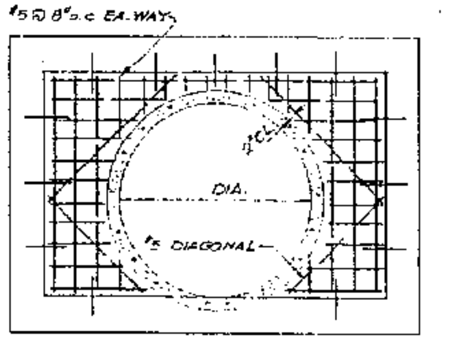


PLUG DETAIL
NO SCALE

Reduced Plans
Do Not Scale



PLAN



SECTION (D/10)

TYPICAL WALL DETAIL TO EXISTING RC CULVERTS
NO SCALE

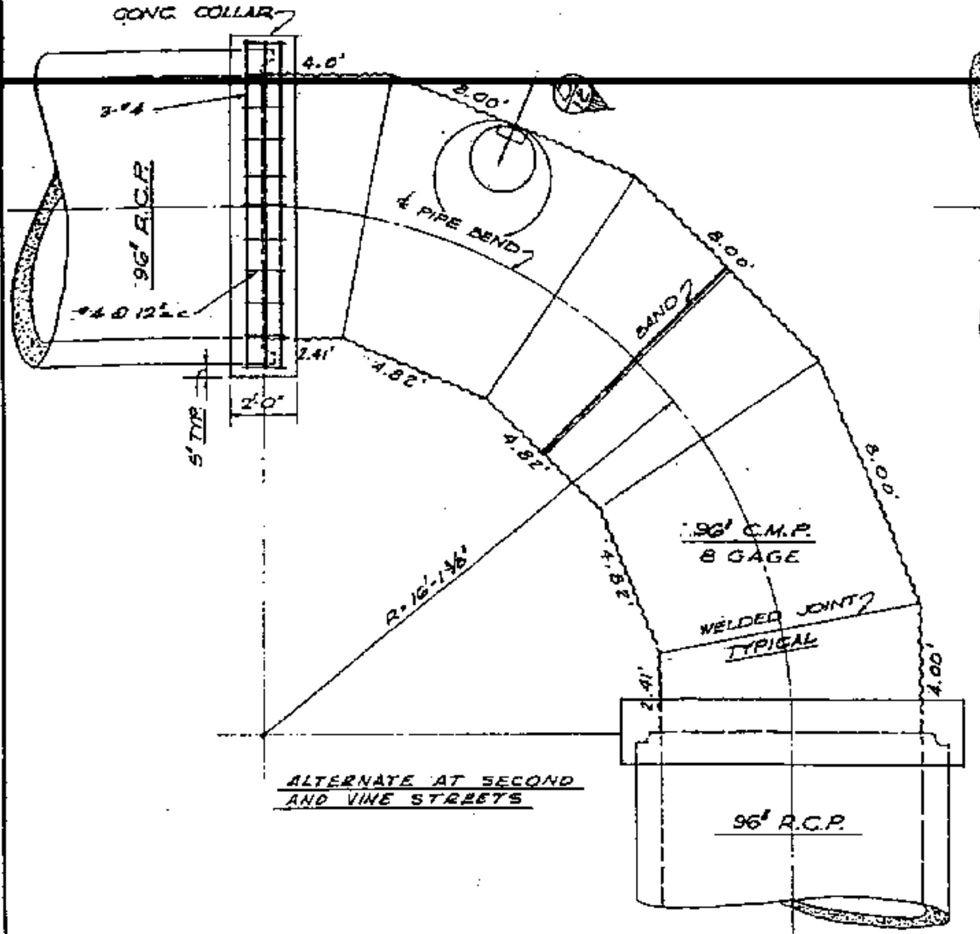
REMARKS	APPROVALS	REVISION	DATE	DESCRIPTION	BY	APPROVE

PORTER, O'BRIEN & ARMSTRONG
CONSULTING ENGINEERS
2167 EAST SECOND STREET RENO, NEVADA
DESIGNED BY: E.T.
DRAWN BY: J.A.T.
CHECKED BY: R.M. & B.A.A.
SUBMITTED BY: B. A. Armstrong
C.E.: 1203 DATE: 9-17-65
SCALE: AS SHOWN

CITY OF RENO
STORM DRAINAGE SYSTEM
VINE STREET STORM DRAINS

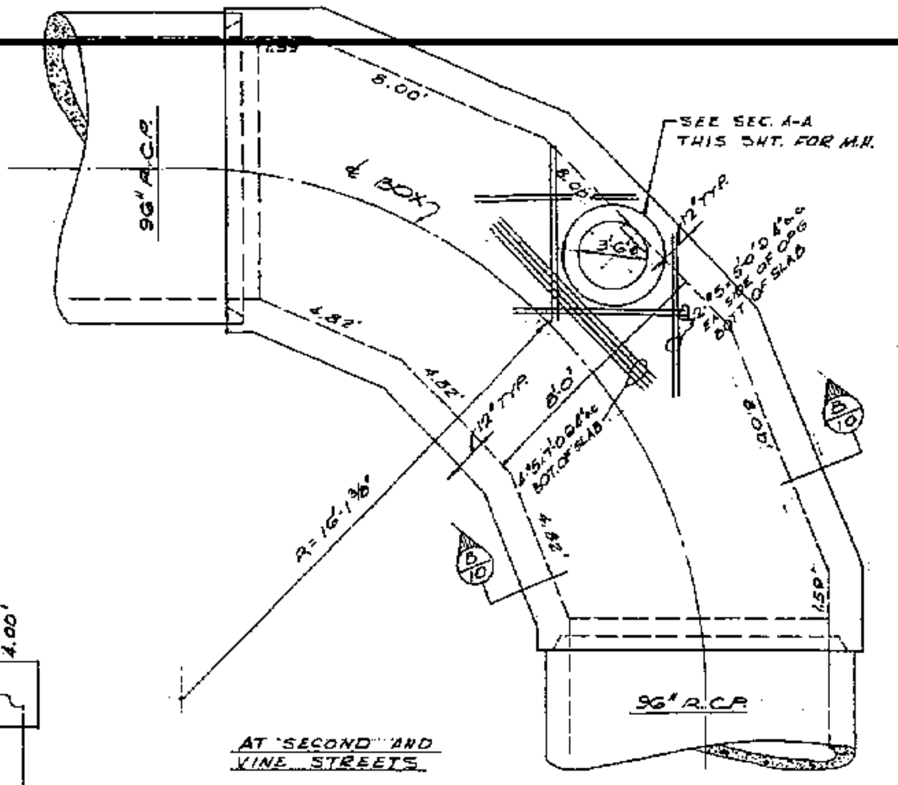
DEPARTMENT OF PUBLIC WORKS
CITY OF RENO, NEVADA
APPROVED: H. Arthur
DATE: 11-5-65 DIRECTOR OF PUBLIC WORKS

SHEET 10 OF 14



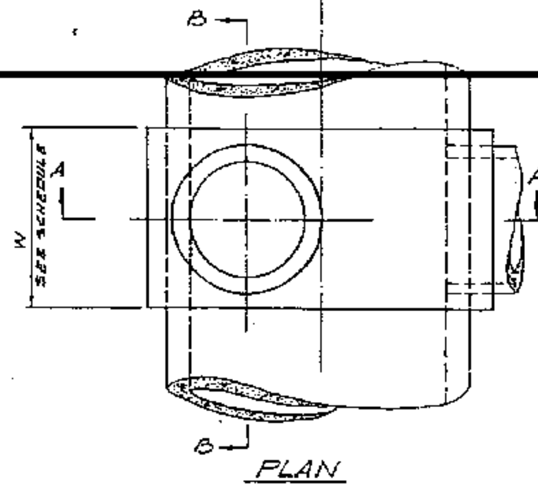
CORRUGATED METAL PIPE - 90° BEND

3/8" = 1'-0"

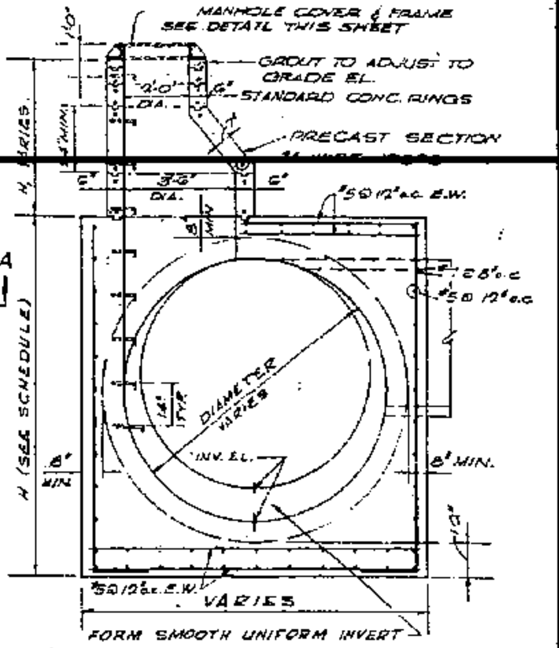


REINFORCED CONCRETE BOX - 90° BEND

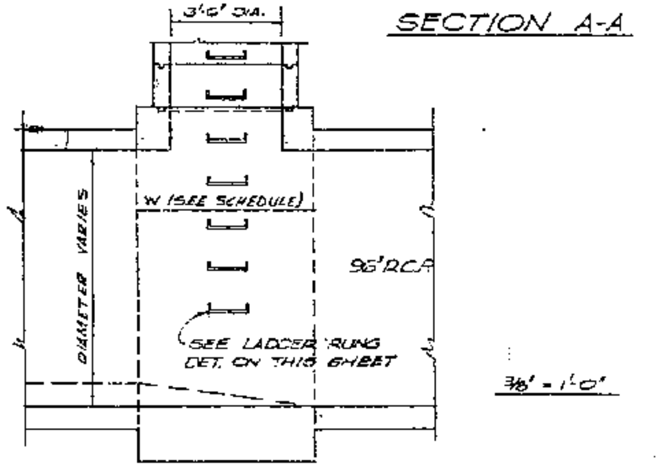
3/8" = 1'-0"



PLAN



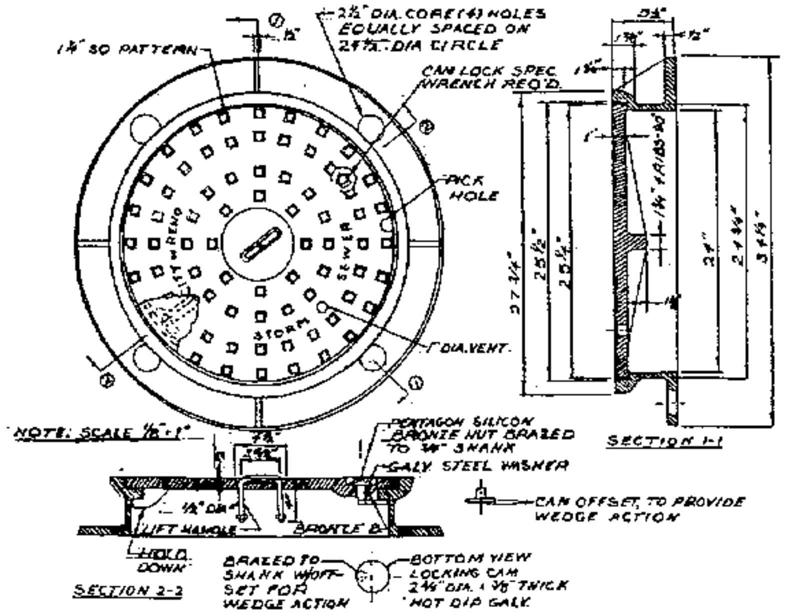
SECTION A-A



SECTION B-B

SPECIAL MANHOLE

SCHEDULE OF MANHOLES				
M.H. NO.	PIPE DIAM.	W	H	REMARKS
1-5, 14 18-21	VARIES	—	—	STANDARD 42" DIA. R.C. M.H.
15, 16	42" to 42"	—	—	STANDARD 60" DIA. R.C. M.H.
6	21" & 54" to 54"	7'-0"	9'-0"	AT UNIVERSITY TEEE & PEAVINE DITCH
7	36" & 54" to 60"	6'-8"	7'-8"	AT UNIVERSITY TEEE & VINE ST.
8	54" & 84" to 96"	6'-8"	11'-0"	AT SIXTH & VINE STS.
9, 10, 11 12, 13	96" to 96"	6'-0"	11'-0"	
17	42" to 54"	5'-6"	7'-0"	AT SIXTH & CANAL STS.



24" MANHOLE FRAME AND COVER

CITY OF RENO STANDARD, A-384, OR EQUAL

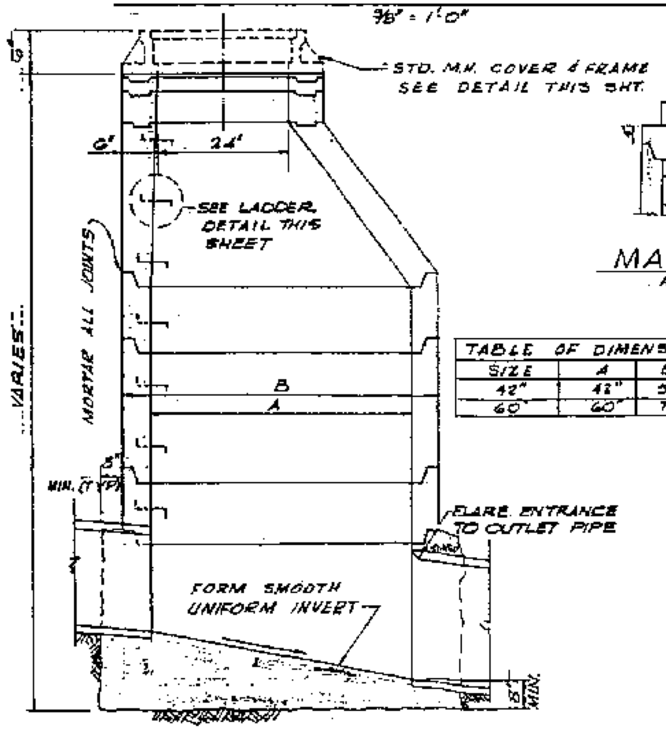
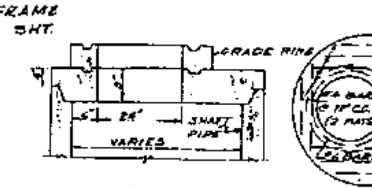


TABLE OF DIMENSIONS		
SIZE	A	B
42"	42"	50"
60"	60"	72"

STANDARD PRECAST CONC. MANHOLE DETAIL

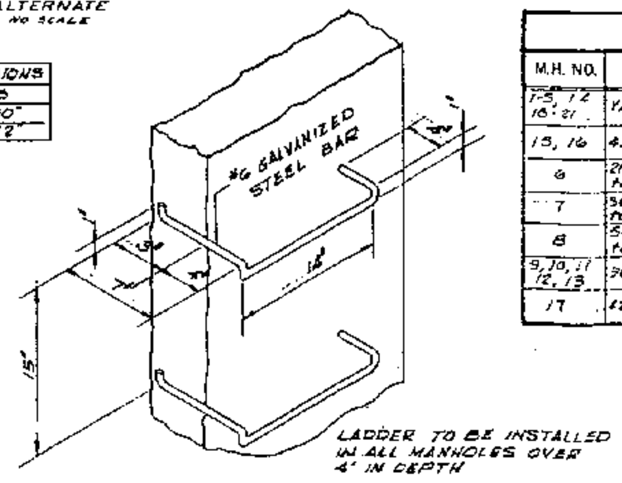
NO SCALE.



MANHOLE LID

ALTERNATE

NO SCALE



LADDER DETAIL

NO SCALE

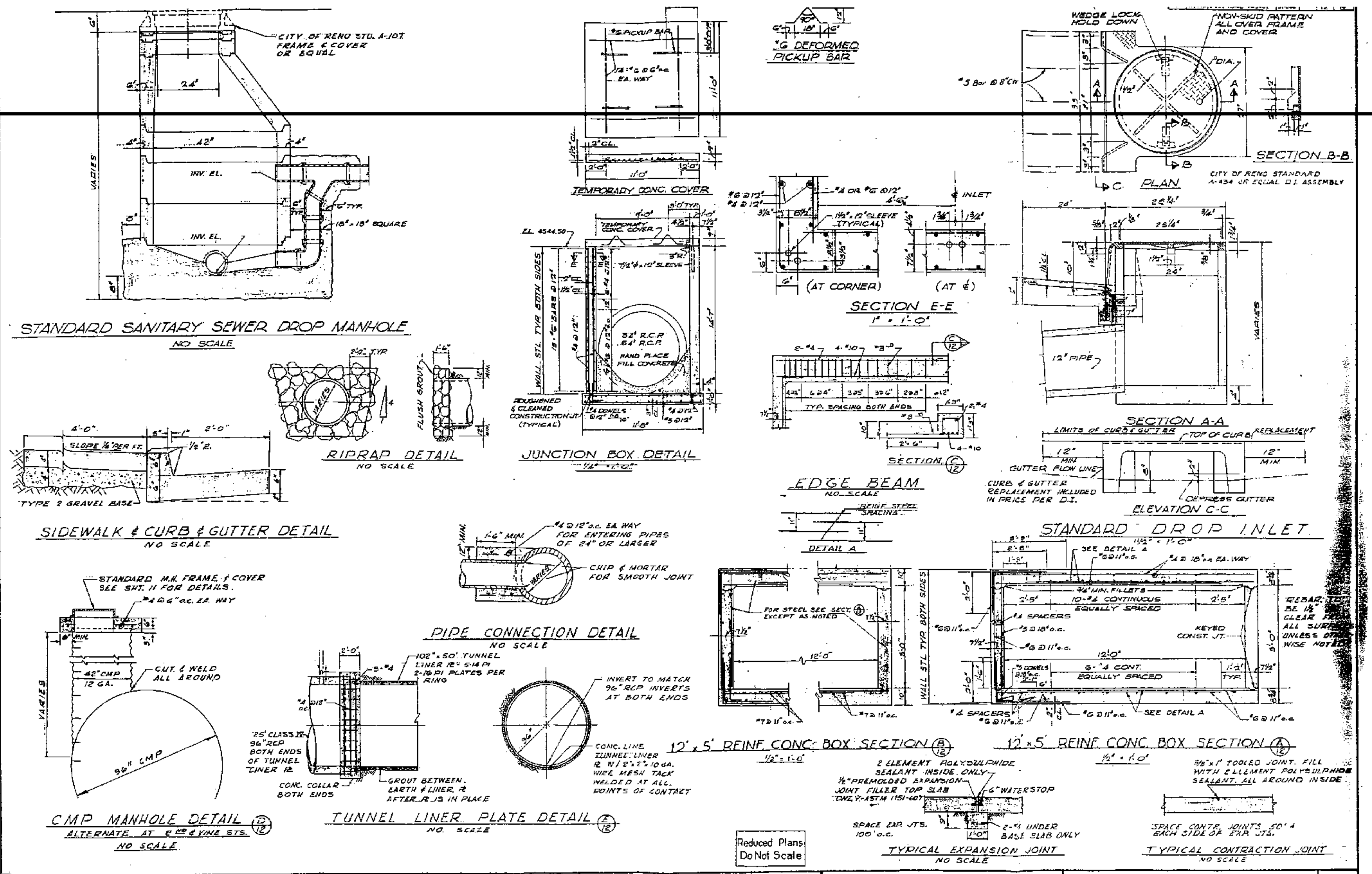
REMARKS	APPROVALS	REVISION	DATE	DESCRIPTION	BY	APPROVE

PORTER, O'BRIEN & ARMSTRONG
CONSULTING ENGINEERS
2157 EAST SECOND STREET RENO, NEVADA
DESIGNED BY E.L.
DRAWN BY J.A.T.
CHECKED BY R.M.
SUBMITTED BY
C.E. 1205 DATE 9-17-65
SCALE: AS SHOWN

CITY OF RENO
STORM DRAINAGE SYSTEM
VINE STREET STORM DRAINS

DEPARTMENT OF PUBLIC WORKS
CITY OF RENO, NEVADA
APPROVED
DATE: 11-5-65 DIRECTOR OF PUBLIC WORKS

SHEET 11 OF 14



Reduced Plans
Do Not Scale

REMARKS	APPROVALS	REVISION	DATE	DESCRIPTION	BY	APPROVE

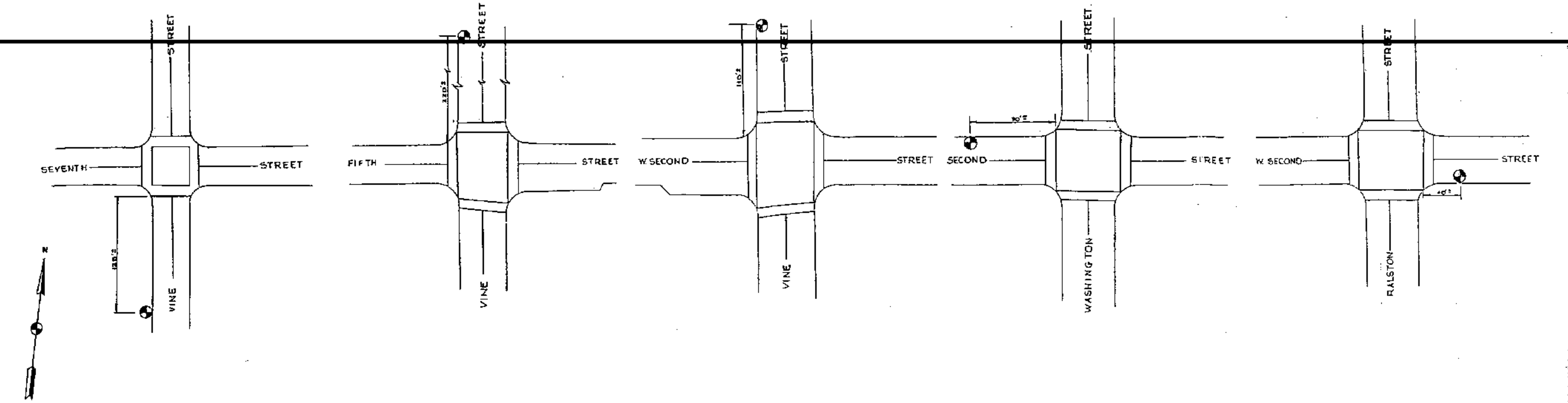
PORTER, O'BRIEN & ARMSTRONG
CONSULTING ENGINEERS
2167 EAST SECOND STREET RENO, NEVADA

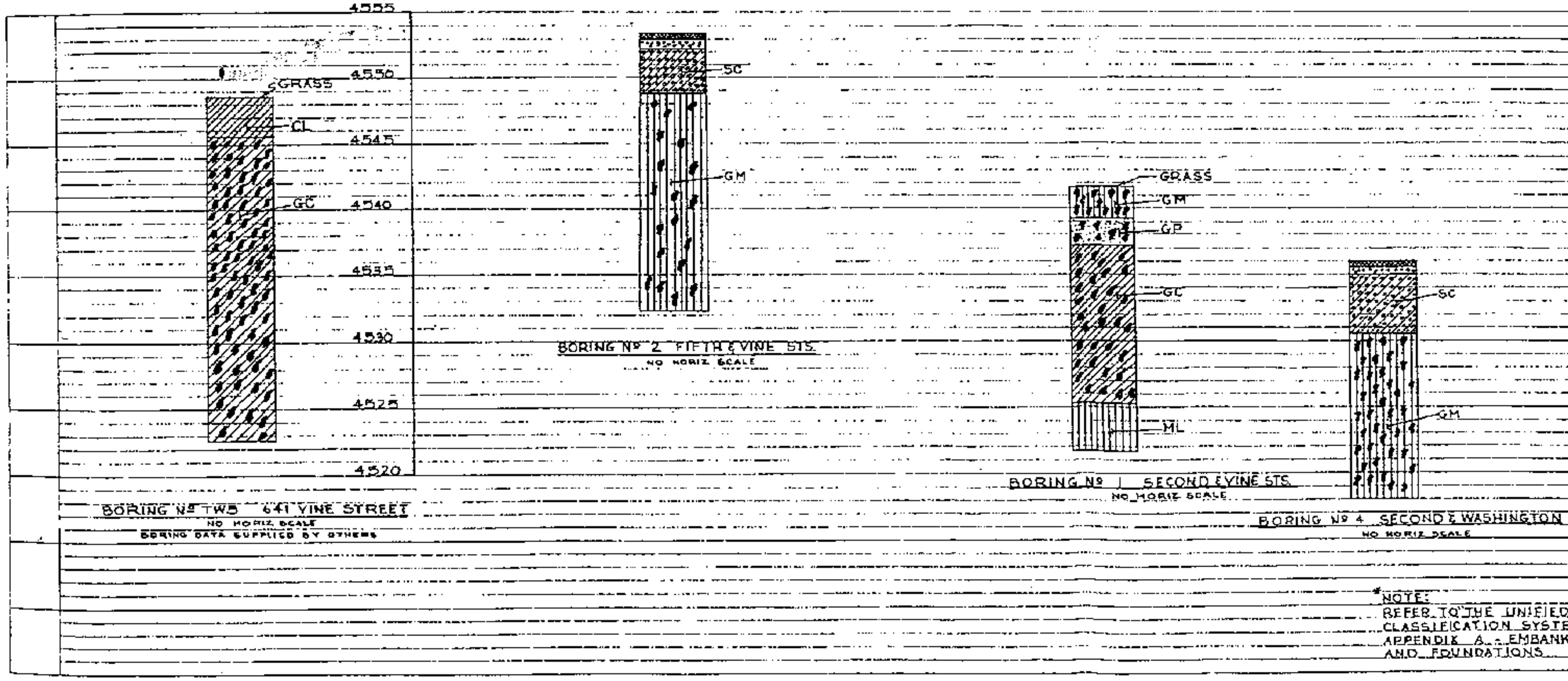
DESIGNED BY: E.T.
DRAWN BY: J.A.T.
CHECKED BY: R.H.(B.L.L.)
SUBMITTED BY: B... O. Y...
C.E. 1203 DATE: 9-17-65
SCALE: AS SHOWN

CITY OF RENO
STORM DRAINAGE SYSTEM
VINE STREET STORM DRAINS

DEPARTMENT OF PUBLIC WORKS
CITY OF RENO, NEVADA
APPROVED: [illegible]
DATE: [illegible] DIRECTOR OF PUBLIC WORKS

SHEET
12
OF
14

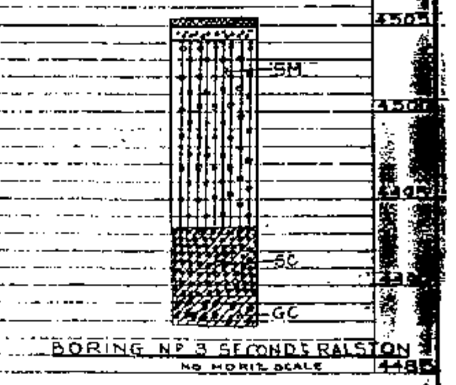




LEGEND

SYMBOL	LETTER	CLASSIFICATION
▨	GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES LITTLE OR NO FINES.
▥	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES.
▨	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES.
▥	SM	SILTY SANDS, SAND-SILT MIXTURES.
▨	SC	CLAYEY SANDS, SAND-SILT MIXTURES.
▥	ML	INORGANIC SILTS EVERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
▩		ASPHALT
▨		BASE COURSE
◕		BORING LOCATION
▨	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS

*NOTE:
REFER TO "THE UNIFIED SOIL CLASSIFICATION SYSTEM" APPENDIX A - EMBANKMENTS AND FOUNDATIONS



Reduced Plans
Do Not Scale

AERIAL PHOTOGRAPHY DATA	APPROVALS	REVISION	DATE	DESCRIPTION	BY	APPR'VD
BY: C.O. GREENWOOD & ASSOCIATES DATE FLOWN: ___ ELEV. FLOWN: ___ PHOTO SCALE: ___ CAMERA DATA: MAKE ___ FOCAL LENGTH ___						

PORTER, O'BRIEN & ARMSTRONG
CONSULTING ENGINEERS
2167 E Second St RENO, NEVADA
DESIGNED BY: ___ SUBMITTED BY:
DRAWN BY: R.S.R. C.E.: 1203 DATE: 9-13-65
CHECKED BY: SCALE: HORIZ. 1"=50' VERT. 1"=5'

CITY OF RENO
STORM DRAINAGE SYSTEM
VINE STREET STORM DRAIN

DEPARTMENT OF PUBLIC WORKS
CITY OF RENO, NEVADA
APPROVED:
DATE: 11-5-65 DIRECTOR OF PUBLIC WORKS

SHEET 13 OF 14

	BY	DATE	CHECKED BY	DATE
DESIGN				
DRAWING				
TRACING				

STRUCTURE LIST

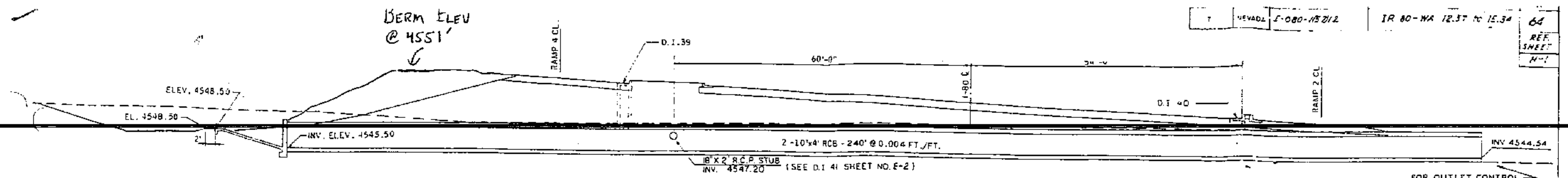
FED. ROAD REG. NO.	STATE	PROJECT NO.	COUNTY	CONTROL SECTION	STATE ROUTE	SHEET NO.	TOTAL SHEETS
7	NEVADA	I-080-1(54)12	WAS-02	31-082		14	14

Reduced Plans Do Not Scale

STATION	DESCRIPTION NOTE: ENCIRCLED QUANTITIES ARE NON-PARTICIPATING WITH THE STATE OF NEVADA, DEPT. OF HIGHWAYS AND THE BUREAU OF PUBLIC ROADS	REMOVE DROP INLET	INSTALL DROP INLET	PLUG EXIST. PIPE	REINFORCED CONCRETE PIPE CLASS III											R.C.P. CLASS IV		12' × 5' REINF. CONC. BOX	22" × 13" C.M.P.A.	42" STANDARD M.H.	60" STANDARD M.H.	SPECIAL MANHOLE	SPECIAL STRUCTURE	12" C.P. SEWER PIPE	DROP MANHOLE	MISC. CONCRETE	BACKFILL CONC. BOXES	GROUTED RIP RAP	REMOVE STRUC. CONC.	CONC. CURB & GUTTER	VALLEY GUTTER	CONC. SIDEWALK	PAVEMENT 1½"	PAVEMENT 2½"	PAVEMENT 4"	102" TUNNEL LINER PLATE—8 GAUGE
					12"	21"	24"	27"	36"	42"	54"	84"	96"			96"																				
		EA.	EA.	EA.	L.F.	L.F.	L.F.	L.F.	L.F.	L.F.	L.F.	L.F.	L.F.	L.F.	L.F.	L.F.	L.F.	L.F.	L.F.	EA.	EA.	EA.	EA.	L.F.	EA.	C.Y.	C.Y.	C.Y.	C.Y.	L.F.	EA.	S.Y.	S.Y.	S.Y.	S.Y.	L.F.
9TH & WASHINGTON ST.	SEE SHEET 2	①																													①			(233)		
WASHINGTON ST. & UNIV. TERRACE	" " "	②	②	①	㊺															1														⑮		
	" " "							240																										210		
UNIV. TERRACE & WHITAKER ST.	" " " (INCLUDES CUL-DE-SAC)	②	②	①	(240)															⑦ 1														(180)		
	" " "								280																									400		
UNIV. TERRACE & VINE ST.	" " "					⑧														1														10		
	" " "								135													1 (*1)												210		
UNIV. TERRACE WESTERLY	" " "	③	②	①	㊵	⑳					⑩ 80											1 (*4)						⑥	⑬	(55)				(233)		
	SEE SHEET 2 & 3	①	①		⑱						450																							⑮ 834		
W. SEVENTH & VINE ST'S.	SEE SHEET 3 (INCLUDES 7TH ST. LATERAL)	①	①		㊵ 295															1							52		25	80				510		
	" " "		①		⑱							403											1						21					⑮ 884		
W. SIXTH & VINE STS.	" " "	①	①		④		12															1 (*8)												③ 12		
	" " "												480																					1065		
W. FIFTH & VINE ST'S.	" " "	②	②		(70)																	1 (*9)												㊺		
	SEE SHEET 3 & 4												505																					1050	105	
W. FOURTH & VINE STS.	SEE SHEET 4	①	①		⑰																	1 (*10)												⑮		
	" " "	①	①		㊺								485																	210				970	㉝ 50	
W. THIRD & VINE STS.	" " "																					1 (*11)														
	" " "	②	②		⑯								468			100														300				⑤ 1016		50
W. SECOND & VINE STS.	" " "	①	①		㊿																		1 (90°)										㉝ 55			
	SEE SHEET 5												507																				1180			
W. SECOND & WASHINGTON STS.	" " "	①	①		㉚																	1 (*12)											㉕			
	" " "	②	②		(52)								760																				㊹ 1116			
W. SECOND & RALSTON STS.	" " "	①	①		㊵																												㉟			
	SEE SHEET 5 & 6			3									736									1 (*15)		165	1								1165			
W. SECOND ST. & ARLINGTON AVE.	SEE SHEET 6	③	③		㊽																		1										㉝ 13			
	" " "																	545															55	1310		
TRUCKEE RIVER	" " "	①	①		㉗														28							13			25	25		18		⑳		
W. FIRST ST. & ALLEY	" " "																																			
W. SECOND & WINTER STS.	SEE SHEET 8	①	①		⑬															①													(55)			
	" " "				(250)																													(259)		
WINTER ST. & DOUGLAS ALLEY	" " "	①	①		⑱															①														⑮		
W. SIXTH & VINE ST'S.	SEE SHEET 9																																			
	SEE SHEET 7										486																							845		
W. SIXTH & CANAL STS.	" " "	①	①		㊱					25												1 (*17)												㊾ 30		
	" " "									529																								810		
W. SEVENTH & CANAL ST'S.	" " "	①	①		㉓																1													15		
	" " "									135																								180		
PEAVINE DITCH	" " "									30											1							4		14				40		
VINE ST. & DOUGLAS ALLEY	SEE SHEET 8																																			
	" " "				(340)															①																
KEYSTONE AVE. & DOUGLAS ALLEY	" " "																																			
	" " "																																			
W. SECOND & VINE ST'S.	" " "																																			
	" " "				(350)															①													(330)			
W. SECOND & KEYSTONE AVE.	" " "																																			
	GRAND TOTALS	30	29	6	2202	28	12	260	415	717	1,036	405	3,941			100		545	28	10	2	9	3	165	1	13	52	6	85	484	1	18	3400	11,095	230	50

7	NEVADA	I-080-1(5)212	IR 80-WA 12.37 to 15.34	64

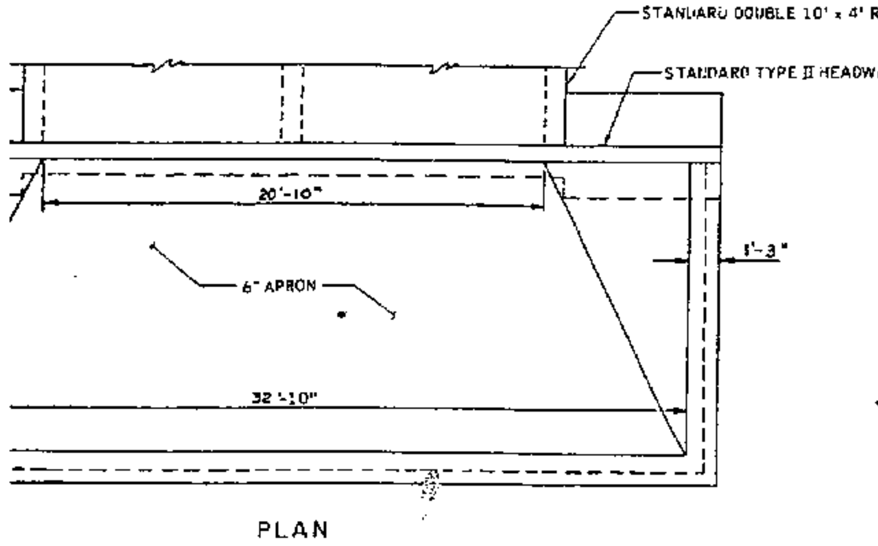
REF. SHEET H-1

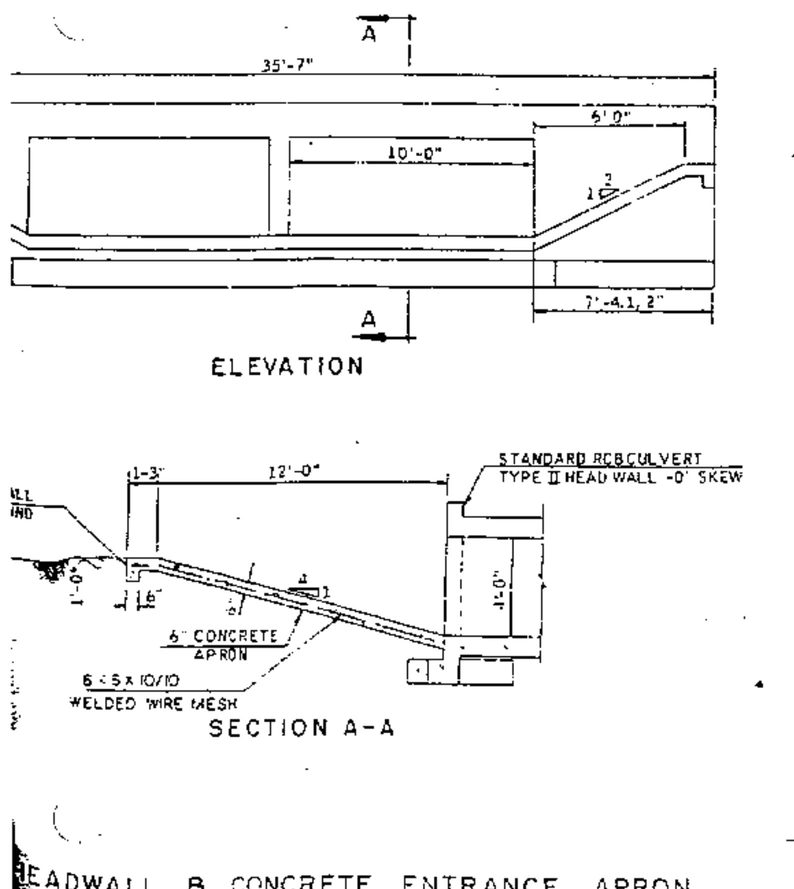


OVERFLOW RELIEF CULVERT

DOUBLE 10' x 4' x 240' R.C.B. STA. 670 + 69

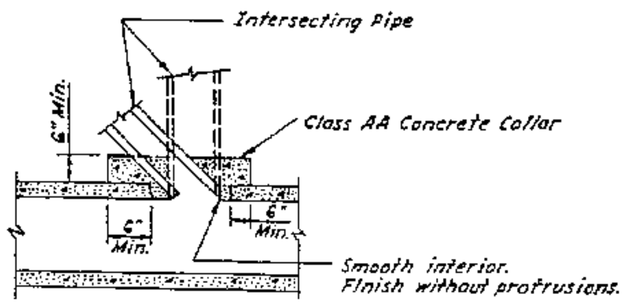
STRUCTURE NO. WA-12.68



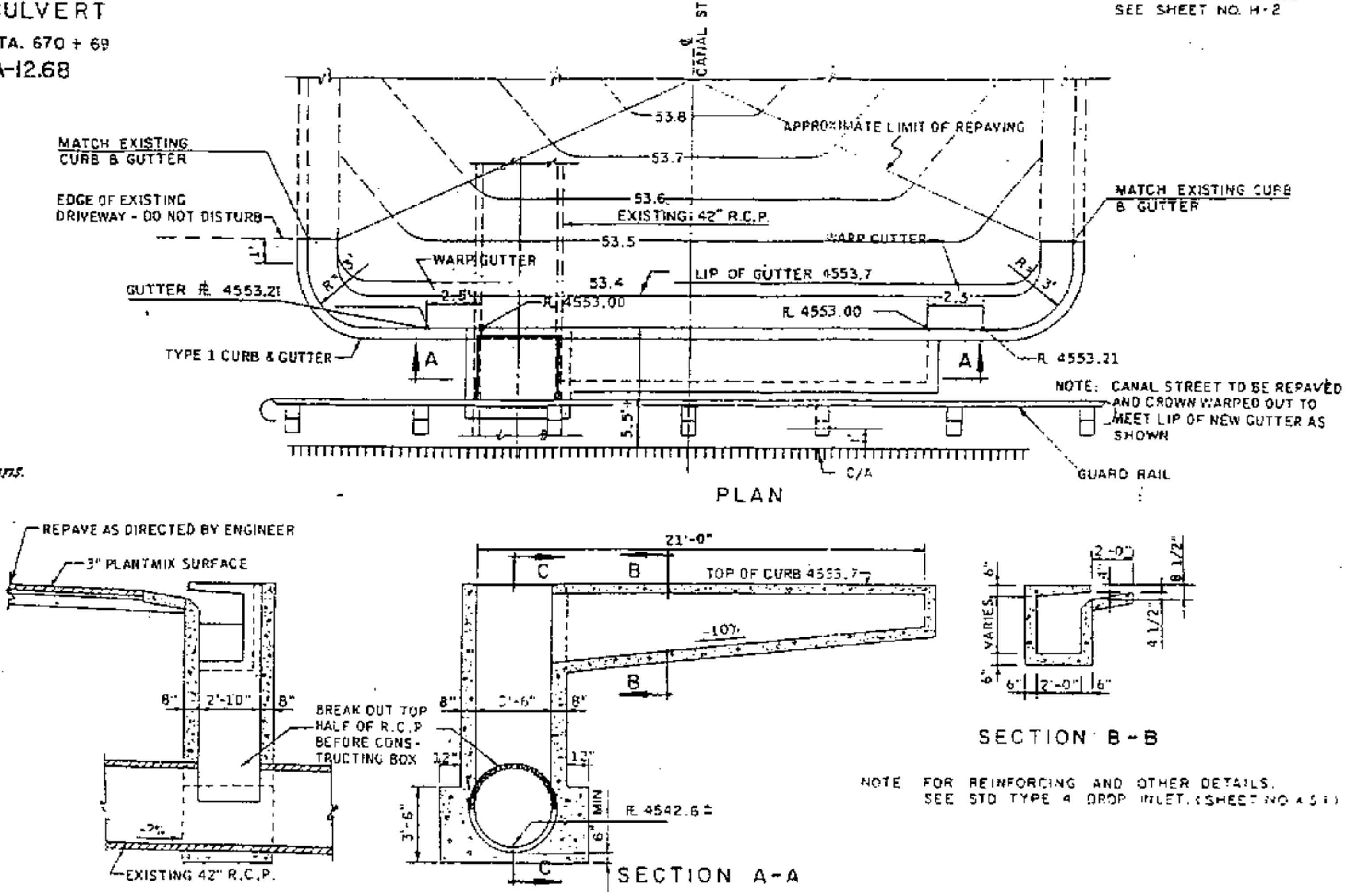


HEADWALL & CONCRETE ENTRANCE APRON

STA. 670+69



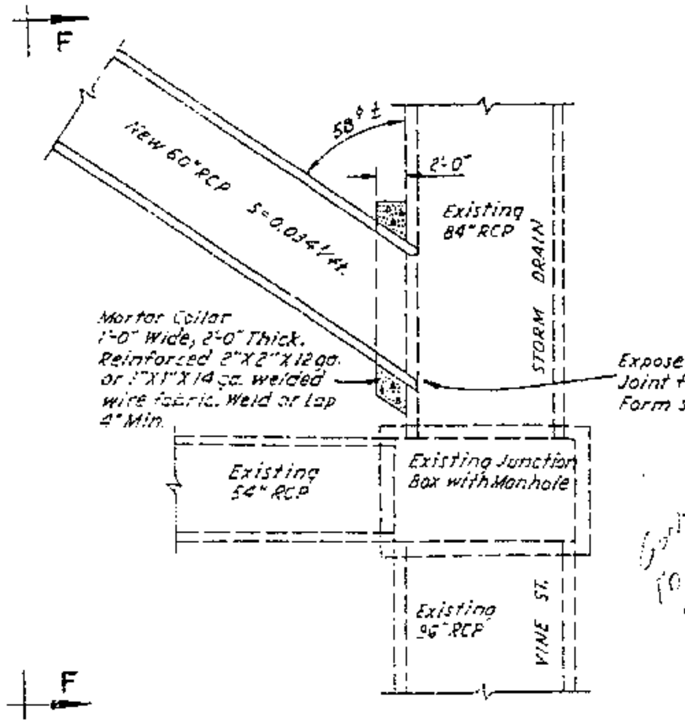
PIPE JUNCTION

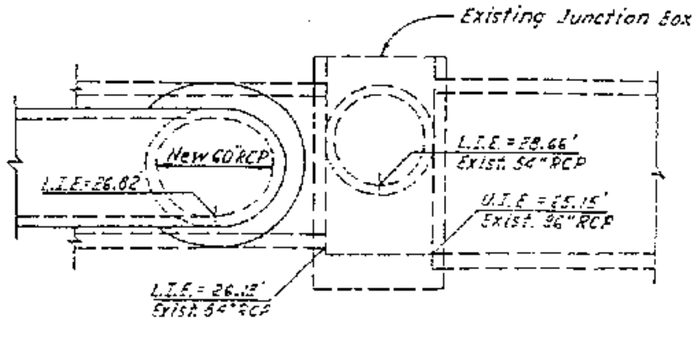


NOTE FOR REINFORCING AND OTHER DETAILS. SEE STD TYPE 4 DROP INLET. (SHEET NO. 4.5.1)

MODIFIED TYPE 4 DROP INLET AT CANAL ST.

STA. 668+60 - 160'± LT.

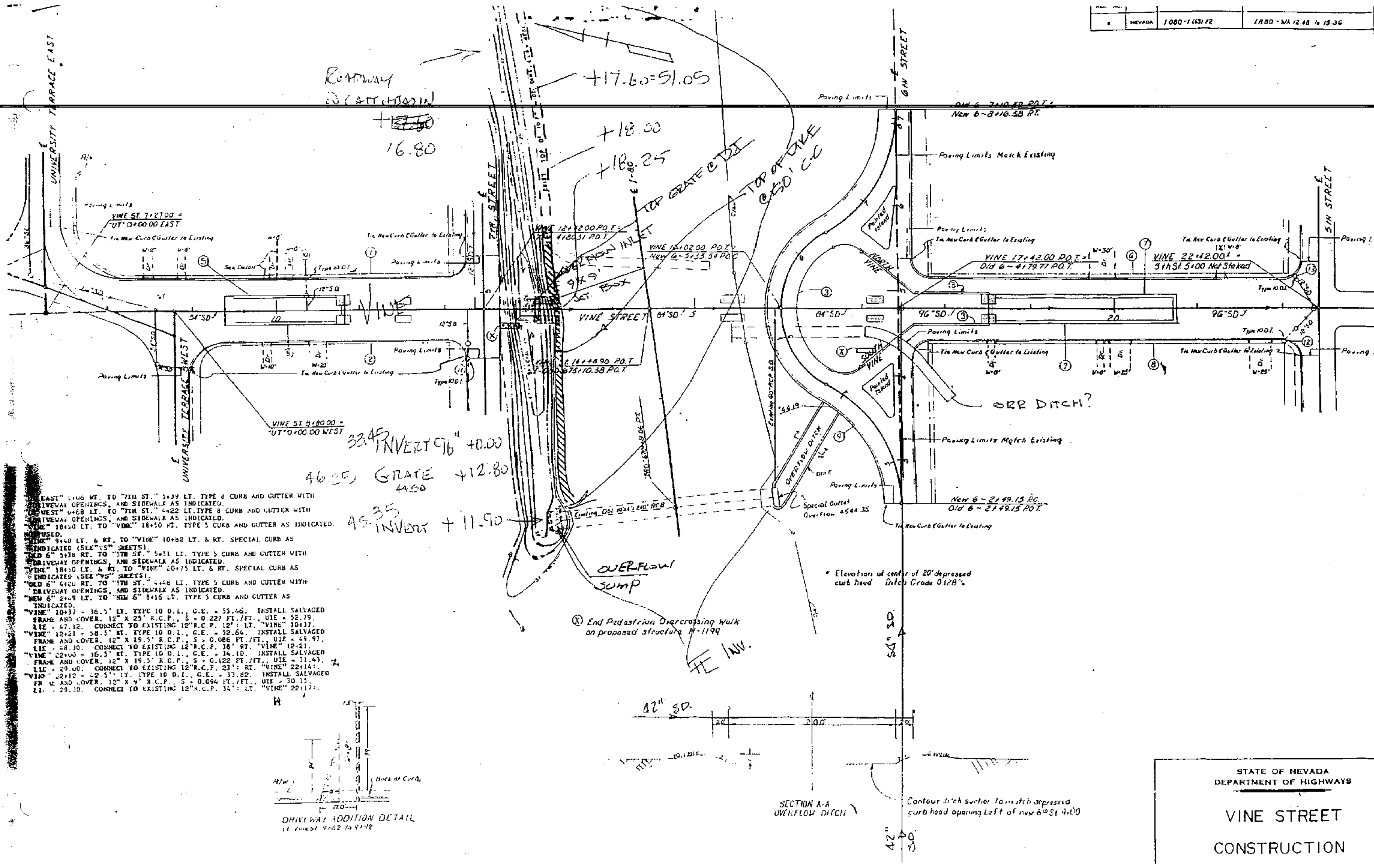




FIELD TAP DETAILS

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

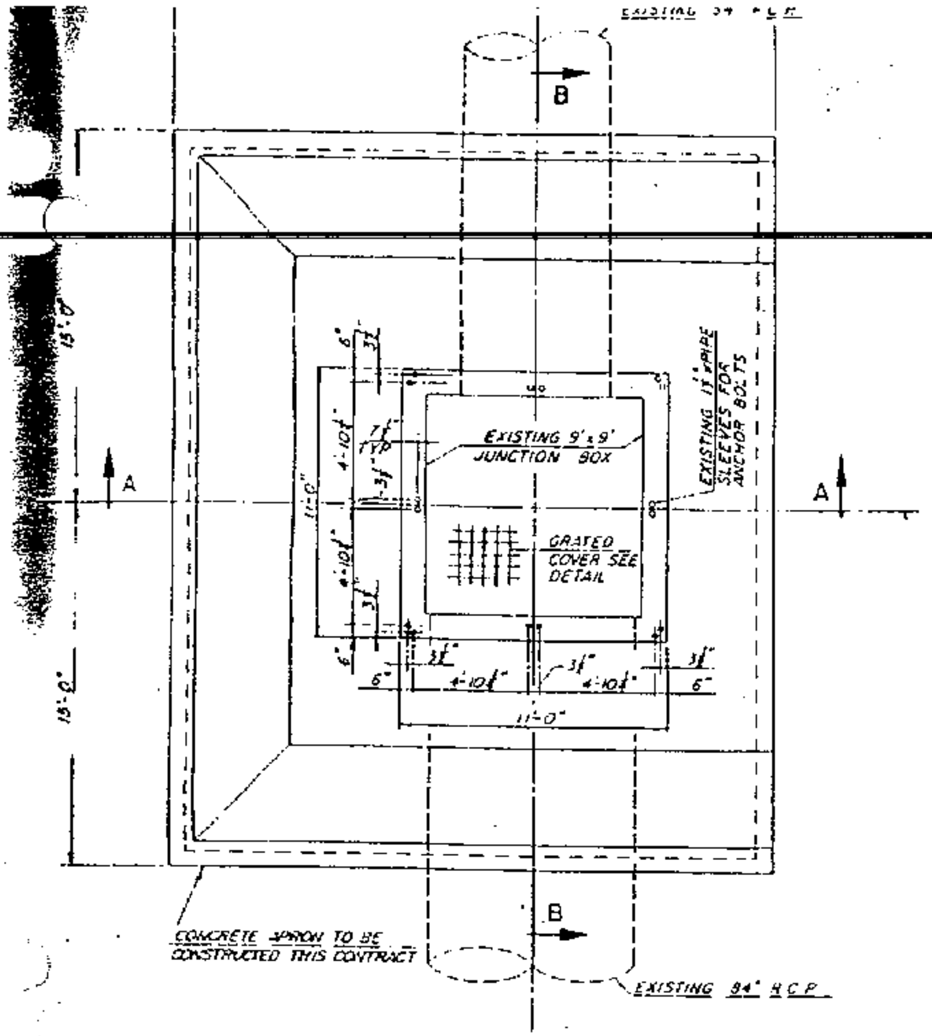
SPECIAL DETAILS
OVERFLOW RELIEF CULVERT
STRUCTURE NO. WA-12.68
DROP INLET AT CANAL ST



EAST" 1+06 RT. TO "7TH ST." 5+39 LT. TYPE 8 CURB AND GUTTER WITH DRIVEWAY OPENINGS, AND SIDEWALK AS INDICATED.
WEST" 0+68 LT. TO "7TH ST." 4+22 LT. TYPE 8 CURB AND GUTTER WITH DRIVEWAY OPENINGS, AND SIDEWALK AS INDICATED.
"VINE" 18+50 LT. TO "VINE" 18+50 RT. TYPE 5 CURB AND GUTTER AS INDICATED.
USED.
"VINE" 9+40 LT. & RT. TO "VINE" 10+82 LT. & RT. SPECIAL CURB AS INDICATED (SEE "VS" SHEETS).
"OLD 6" 3+78 RT. TO "5TH ST." 5+51 LT. TYPE 5 CURB AND GUTTER WITH DRIVEWAY OPENINGS, AND SIDEWALK AS INDICATED.
"VINE" 18+50 LT. & RT. TO "VINE" 20+75 LT. & RT. SPECIAL CURB AS INDICATED (SEE "VS" SHEETS).
"OLD 6" 4+20 RT. TO "5TH ST." 4+48 LT. TYPE 5 CURB AND GUTTER WITH DRIVEWAY OPENINGS, AND SIDEWALK AS INDICATED.
"NEW 6" 2+49 LT. TO "NEW 6" 8+16 LT. TYPE 5 CURB AND GUTTER AS INDICATED.
"VINE" 10+37 - 36.5' LT. TYPE 10 D.I., G.E. = 55.46. INSTALL SALVAGED FRAME AND COVER. 12" X 25' R.C.P., S = 0.227 FT./FT., UIE = 52.79, LIE = 47.12. CONNECT TO EXISTING 12"R.C.P. 12'± LT. "VINE" 10+37.
"VINE" 12+21 - 58.5' RT. TYPE 10 D.I., G.E. = 52.64. INSTALL SALVAGED FRAME AND COVER. 12" X 19.5' R.C.P., S = 0.086 FT./FT., UIE = 49.97, LIE = 48.30. CONNECT TO EXISTING 12"R.C.P. 38' RT. "VINE" 12+21.
"VINE" 22+00 - 36.5' RT. TYPE 10 D.I., G.E. = 34.10. INSTALL SALVAGED FRAME AND COVER. 12" X 19.5' R.C.P., S = 0.122 FT./FT., UIE = 31.43, LIE = 29.00. CONNECT TO EXISTING 12"R.C.P. 23'± RT. "VINE" 22+14±.
"VINE" 22+12 - 42.5' LT. TYPE 10 D.I., G.E. = 33.82. INSTALL SALVAGED FRAME AND COVER. 12" X 9' R.C.P., S = 0.094 FT./FT., UIE = 30.15, LIE = 29.30. CONNECT TO EXISTING 12"R.C.P. 34'± LT. "VINE" 22+17±.

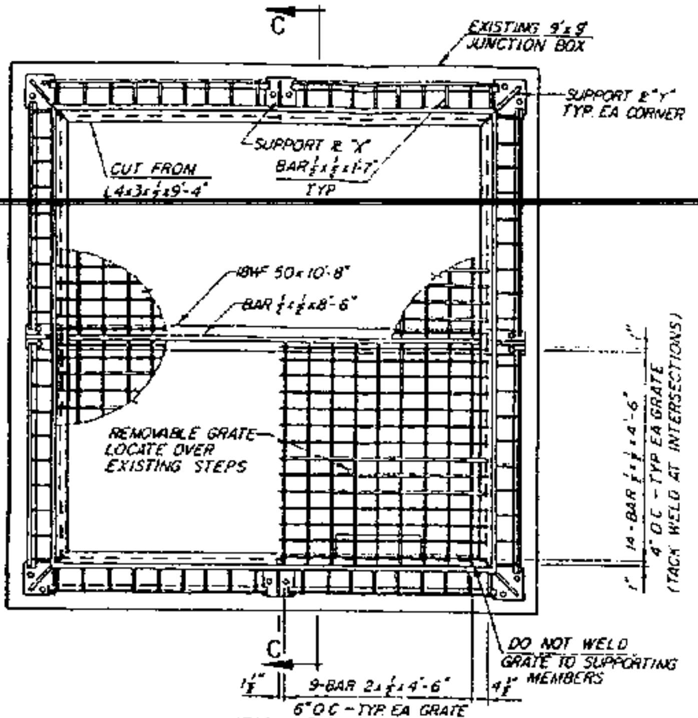
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

VINE STREET
CONSTRUCTION

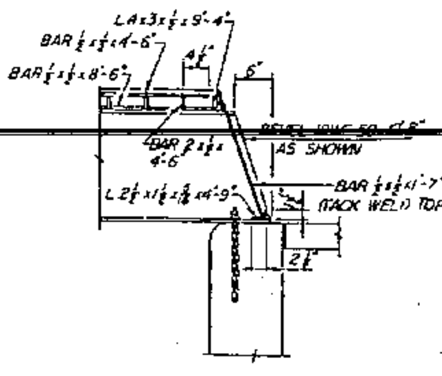


PLAN
(143.5' LEFT OF STA 673+27)

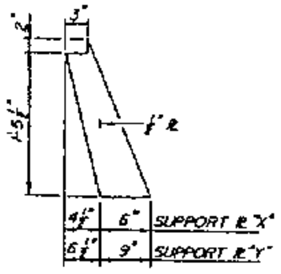
TACK WELD 2" BARS TO SUPPORTING ANGLES & BEAM IN FIELD. TYPICAL EXCEPT FOR REMOVABLE GRATE.



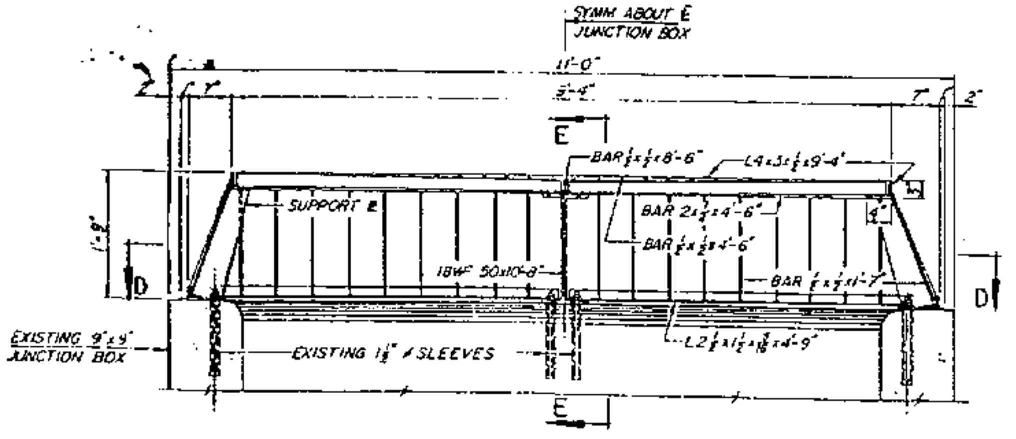
GRATED COVER



SECTION E-E

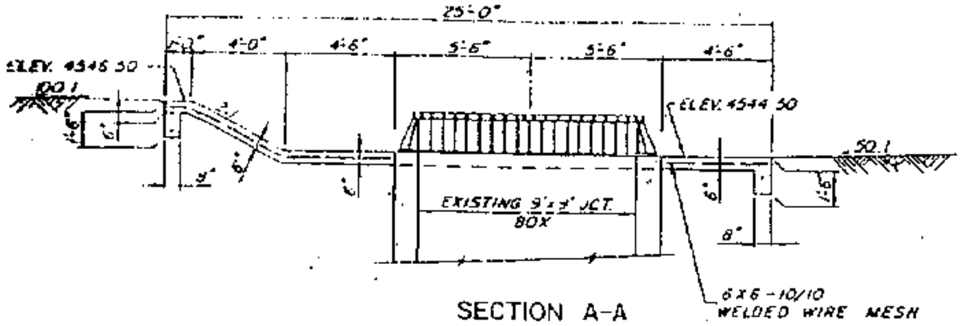


SUPPORT ℞ DETAIL

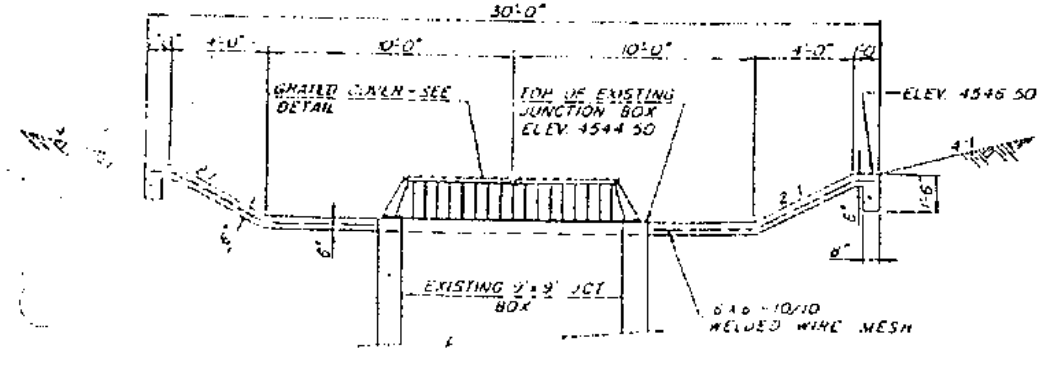


SECTION C-C

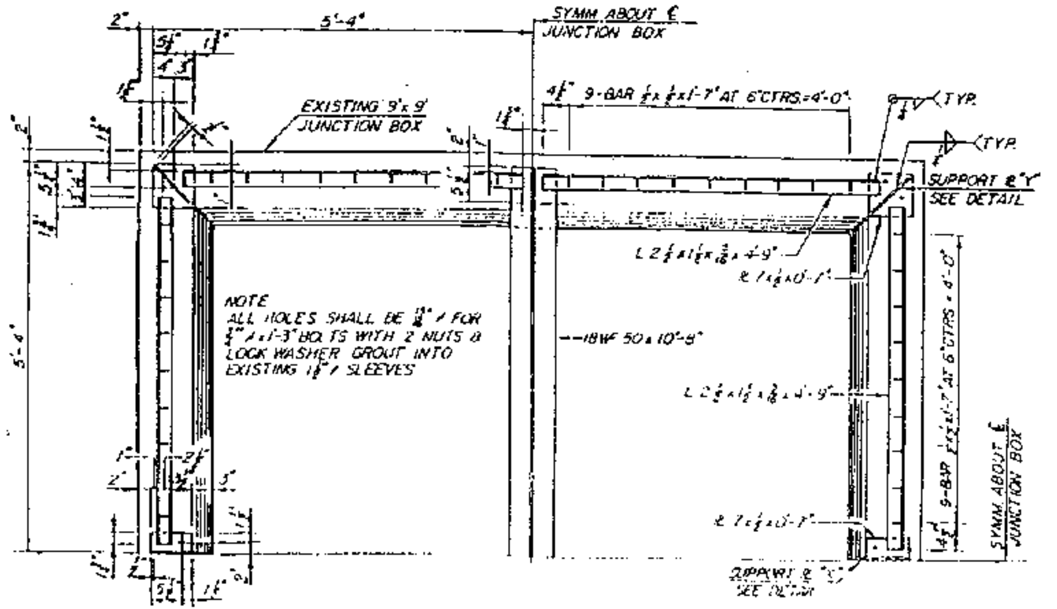
NOTE:
DIMENSIONS & STRUCTURAL STEEL ARE TYPICAL FOR ALL QUADRANTS.



SECTION A-A



SECTION B-B



NOTE
ALL HOLES SHALL BE ⅞" ϕ FOR ¾" ϕ x1'-3" BOLTS WITH 2 NUTS & LOCK WASHER GROUT INTO EXISTING 1½" ϕ SLEEVES

SECTION D-D

QUANTITY

STRUCTURAL STEEL	2048 LBS.
CLASS AA CONCRETE	15.21 CU YDS
6x6-10/10 WELDED MESH REINFORCING	70 SQ. YDS.

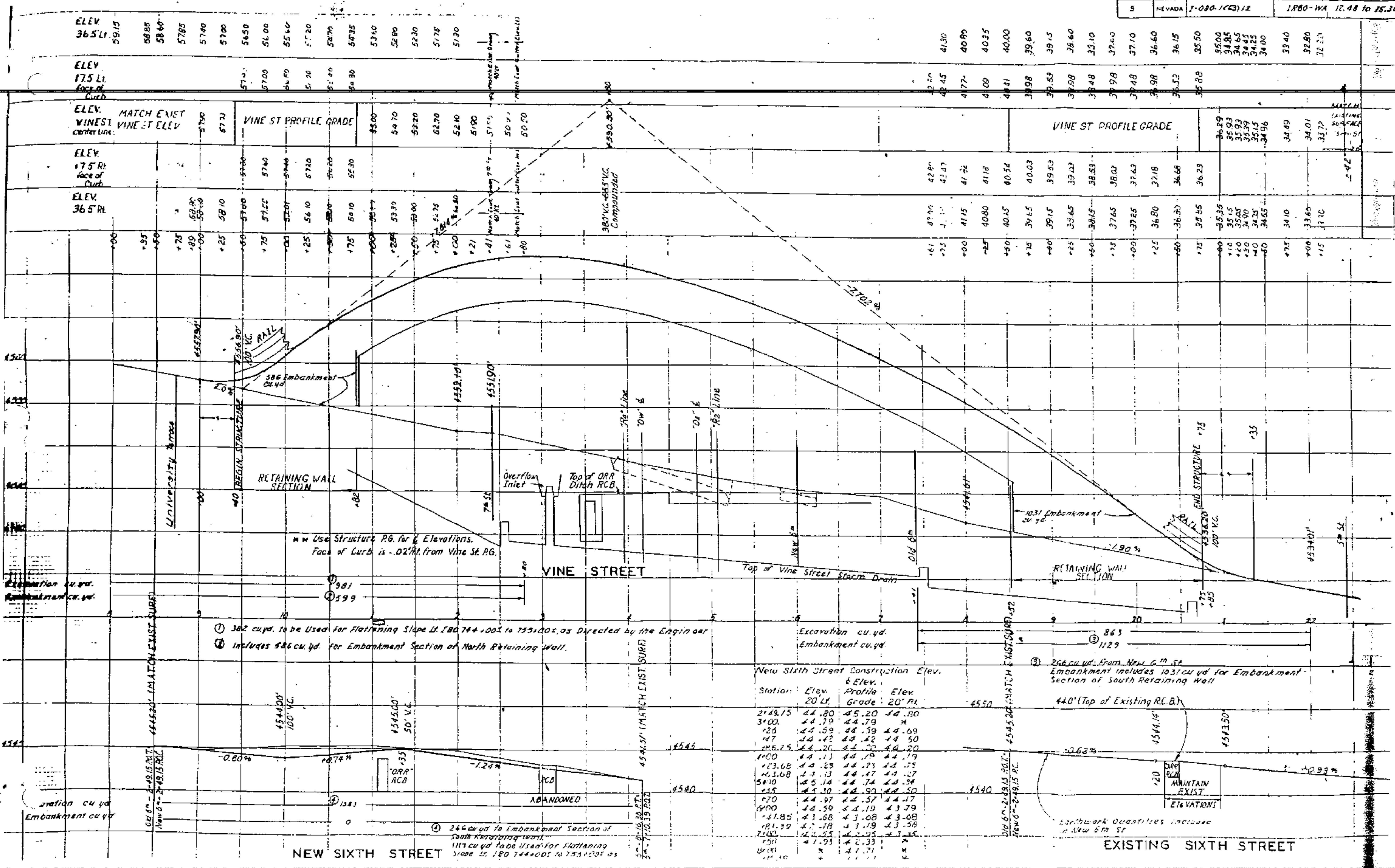
NOTE:
1. GRATED COVER SHALL BE OF WELDED CONSTRUCTION USIN
A36 STEEL AND PAINTED AFTER FABRICATION.
2. TEMPORARY CONCRETE COVER TO BE REMOVED FROM
OF 9'x9' EXISTING JUNCTION BOX AND DISPOSED OF
DIRECTED BY ENGINEER. (NO DIRECT PAYMENT)

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

SPECIAL DETAILS
INLET TO
VINE STREET STORM DRA

STA. 673+27 LT

REG NO			
5	NEVADA	I-080-1(53)12	IR80-WA 12.48 to 15.3



① 382 cu.yd. to be Used for Flattening Slope Lt. I80 744+00± to 755+00±, as Directed by the Engineer

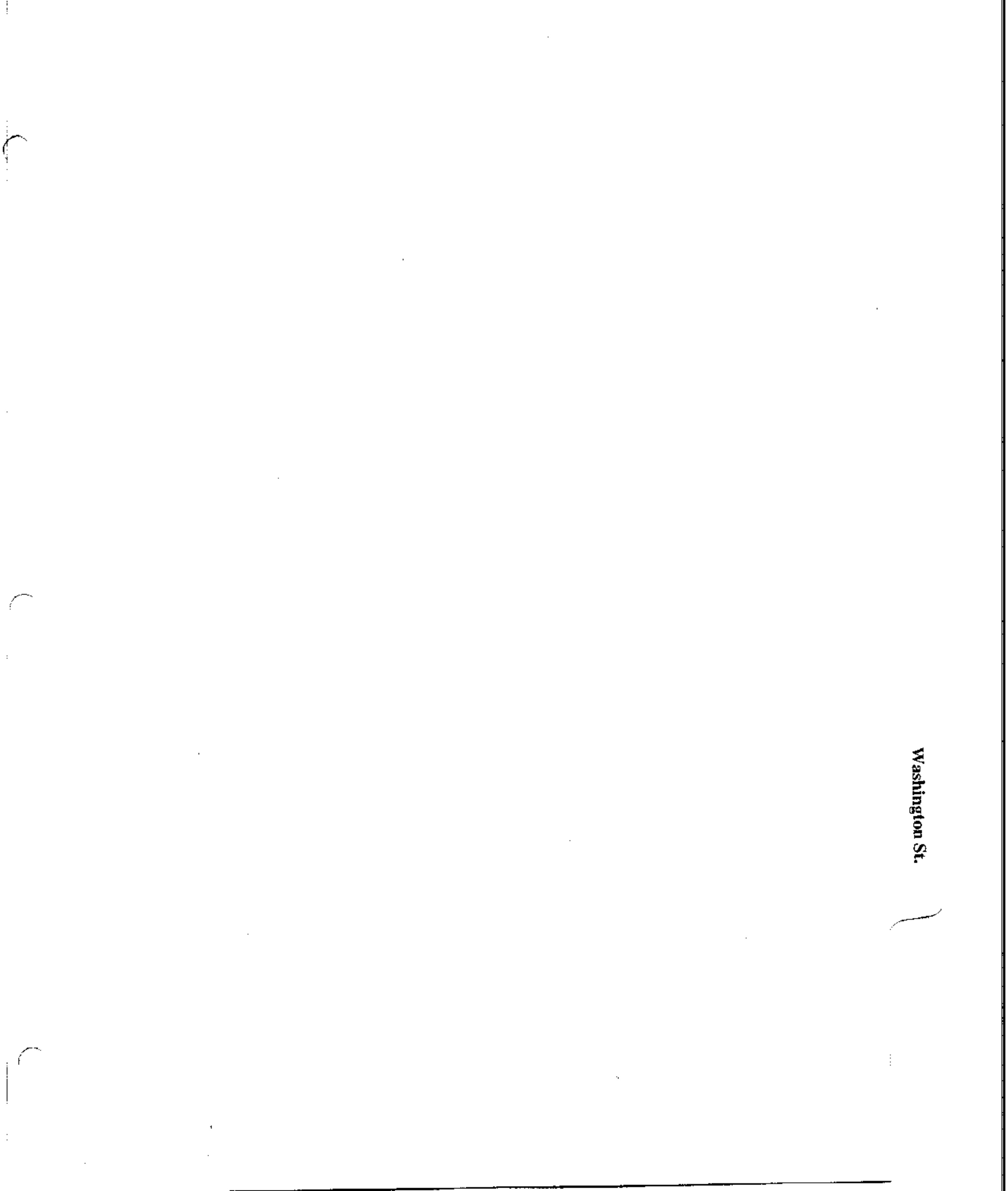
② Includes 586 cu. yd. for Embankment Section of North Retaining Wall.

③ 266 cu yd. From New 6th St. Embankment includes 1031 cu yd for Embankment Section of South Retaining Wall

④ 266 cu yd to Embankment Section of South Retaining Wall. 1117 cu yd to be Used for Flattening Slope Lt. I80 744+00± to 755+00± as

New Sixth Street Construction Elev.

Station	Elev. 20' Lt.	℄ Elev. Profile Grade	Elev. 20' Rt.
2+49.15	44.80	45.20	44.80
3+00.	44.79	44.79	*
+26	44.59	44.59	44.69
+47	44.42	44.42	44.50
+86.25	44.20	44.20	44.20
4+00	44.13	44.19	44.19
+23.68	44.23	44.23	44.23
+43.68	44.33	44.47	44.27
5+10	45.14	44.74	44.34
+15	45.30	44.90	44.50
+70	44.97	44.57	44.17
6+00	44.59	44.19	43.79
+41.85	43.68	43.68	43.68
+81.39	42.78	43.19	43.58
7+00	42.55	42.95	43.35
+50	41.93	42.33	*
8+00	*	41.71	*


Washington St.

IFC SUBMITTAL

May 15, 2003
Project No. 80100603

Mr. Ted Roworth
ReTRAC
Parsons Transportation Group
264 Keystone Avenue
Reno, Nevada 89503

Reference: ReTRAC Hydrologic and Hydraulic Design Memorandum for the Third Street Storm Drain System

Dear Mr. Roworth:

This letter report is to document the design parameters and assumptions for the relocation and diversion of the existing Washington Street reinforced concrete pipe (RCP) storm drain system that crosses the UPRR tracks just south of Third Street. The 100-year storm event overland flow patterns were also analyzed for existing and proposed conditions. The existing storm drain system runs north-south within Washington Street from the south side of the I-80 overpass to its outlet at the Truckee River. The existing RCP at the UPRR crossing is a 30" diameter pipe.

The contributing watershed for the Third Street storm drain system has been delineated and is shown on Figure 1, Third Street Storm Drain System Watershed Basin Map in the Appendix. Flows from the basin combine at catch basins along Washington Street and are conveyed south. Flows exceeding the capacity of the storm drain catch basin inlets will be conveyed overland to the east.

The Rational Method was used to develop the peak flow rates for the localized watershed along with the City of Reno's Rainfall Intensity-Duration-Frequency Curves, basin areas and weighted runoff coefficients (C values). The 5-year peak runoff flow rate for the localized contributing watershed was found to be 16.1 cfs. Quantification of the 100-year flow was not performed for the Third Street storm drain because all flow exceeding the capacity of the catch basin inlets will be conveyed east and will not impact the existing storm drain system.

There are four catch basins that contribute flow to the Washington Street storm drain system; one at the northwest corner of the intersection at Third Street, one at the northwest corner of the intersection at Fourth Street, one at the northwest corner of the intersection at Fifth Street and one in a parking lot just northeast of the intersection at Sixth Street. The combined interception capacity of these catch basins is 11.2 cfs.

Existing pipe sizes, inverts, slopes and elevations were taken from the ReTRAC 1-foot contour interval topographic mapping prepared for the EIS phase of the project. Additional information was taken from site visits and the City of Reno 2-foot contour interval topography.

Proposed improvements will consist of a new junction at the intersection of Washington Street and Third Street, removal of the section of 30" RCP pipe under the UPRR trench, and placement of a new section of 30" RCP from the new junction in Washington Street, west to the Vine Street Siphon system.

A StormCad model was prepared to determine the hydraulic grade line of the proposed 30" storm drain system in Third Street. The peak discharge for the proposed storm drain system was determined with an upstream maximum head elevation of 4518.1 and assuming that a City of Reno Type 4-R catch basin would replace the Type 1 catch basin at the intersection of Third and Washington Streets. The combined capacity of the upstream catch basins and the new Type 4-R catch basin is 15.3 cfs, which exceeds the inlet capacity of the existing system (11.2 cfs). Flows exceeding the capacity of the storm drain system will maintain their historic flow patterns. The Third Street system was modeled with a tail water elevation of 4516' (pipe flowing full) at the Vine Street Siphon connection. See the Appendix for the proposed storm drain design and hydrologic and hydraulic backup calculations.

The 100-year watershed basin was delineated and will be shown in the *ReTRAC Drainage Report* 100% submittal. Preparation of this report is in progress and will be submitted shortly. Flow from the 100-year event affecting the intersection of Washington Street and Third Street is approximately 105cfs. A portion of the 100-year overland flow travels south on Washington Street, from the freeway, and turns east on Third Street. The flow travels east over the Washington Street crown and continues east on Third Street. The water surface elevation at the existing Washington Street crown during the 100-year event is 4518.47-feet, as shown by the calculation sheet labeled "*3rd Street 2400*".

The proposed flow of 270 cfs was analyzed and the water surface elevation at the Washington Street crown was found to be 4518.59-feet, as shown by the calculation sheet labeled "*Proposed 3rd Street 2400*". The additional 19 cfs is overflow from the proposed siphon at Vine Street. Refer to the Vine Street Improvements report. The proposed improvements on Washington Street do not significantly increase the existing water surface elevation and do not alter the historic drainage pattern in the 100-year event. See the attached *Washington Street Plan & Profile* drawing for proposed improvements.

Sincerely,

STANTEC CONSULTING INC.

Trina M. Magoon, PE
Project Engineer

TMM:zrb
Enclosure(s)
P:\CIVIL\80100803\H&H\Design Memorandums\MEMO H&H 3rd St Design(IFC).doc

Washington Street Location and Improvement Map

Figure 1

3rd Street 2400
Worksheet for Irregular Channel

Project Description	
Worksheet	3rd_Street 2400 - 3rd & Was
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	022000	ft/ft
Discharg	251.00	cfs

Options	
Current Roughness Methc	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	4,518.67	ft
Elevation Range	18.00 to 4,520.00	
Flow Area	35.2	ft²
Wetted Perimeter	94.21	ft
Top Width	94.20	ft
Actual Depth	0.67	ft
Critical Elevation	4,518.92	ft
Critical Slope	0.004662	ft/ft
Velocity	7.14	ft/s
Velocity Head	0.79	ft
Specific Energy	4,519.46	ft
Froude Number	2.06	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	12+29	0.016

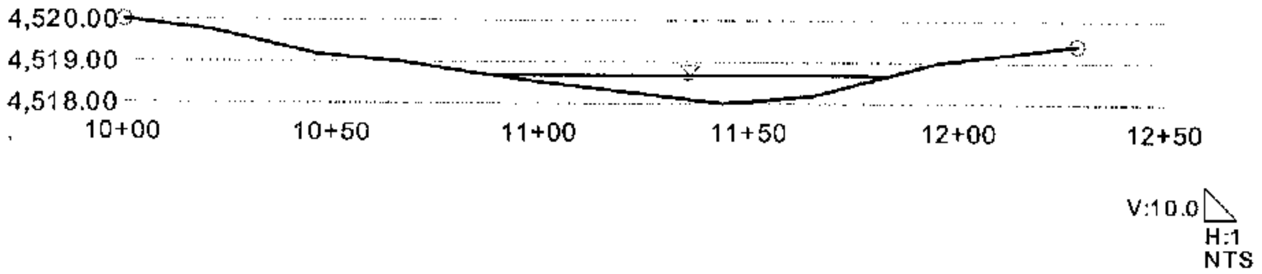
Natural Channel Points

Station (ft)	Elevation (ft)
10+00	4,520.00
10+20	4,519.80
10+46	4,519.20
10+66	4,519.00
10+93	4,518.60
11+44	4,518.00
11+65	4,518.20
11+95	4,519.00
12+29	4,519.40

3rd Street 2400
Cross Section for Irregular Channel

Project Description	
Worksheet	3rd_Street 2400 - 3rd & Was
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficiei	0.016	
Slope	0.022000	ft/ft
Water Surface Elev	4,518.67	ft
Elevation Range	18.00 to 4,520.00	
Discharge	251.00	cfs



Proposed 3rd Street 2400
Worksheet for Irregular Channel

Project Description	
Worksheet	Proposed 3rd_Street 2400 - 3rd & V
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	022000	ft/ft
Discharg	270.00	cfs

Options	
Current Roughness Methc	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	4,518.59	ft
Elevation Range	18.07 to 4,519.97	
Flow Area	37.0	ft²
Wetted Perimeter	95.77	ft
Top Width	95.76	ft
Actual Depth	0.52	ft
Critical Elevation	4,518.85	ft
Critical Slope	0.004575	ft/ft
Velocity	7.30	ft/s
Velocity Head	0.83	ft
Specific Energy	4,519.42	ft
Froude Number	2.07	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
9+50	11+65	0.016

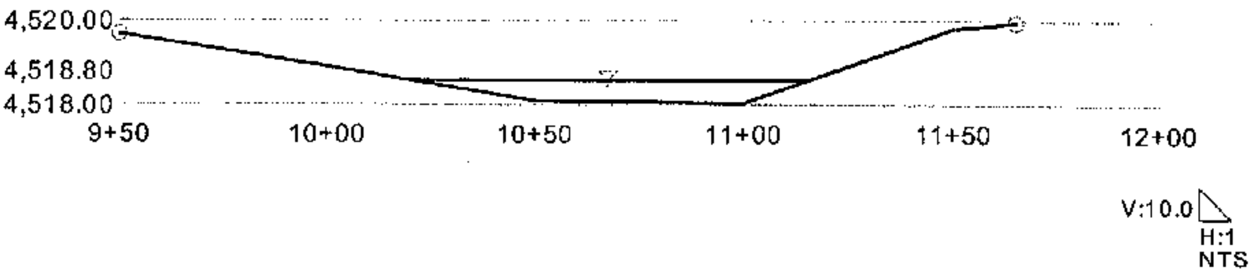
Natural Channel Points

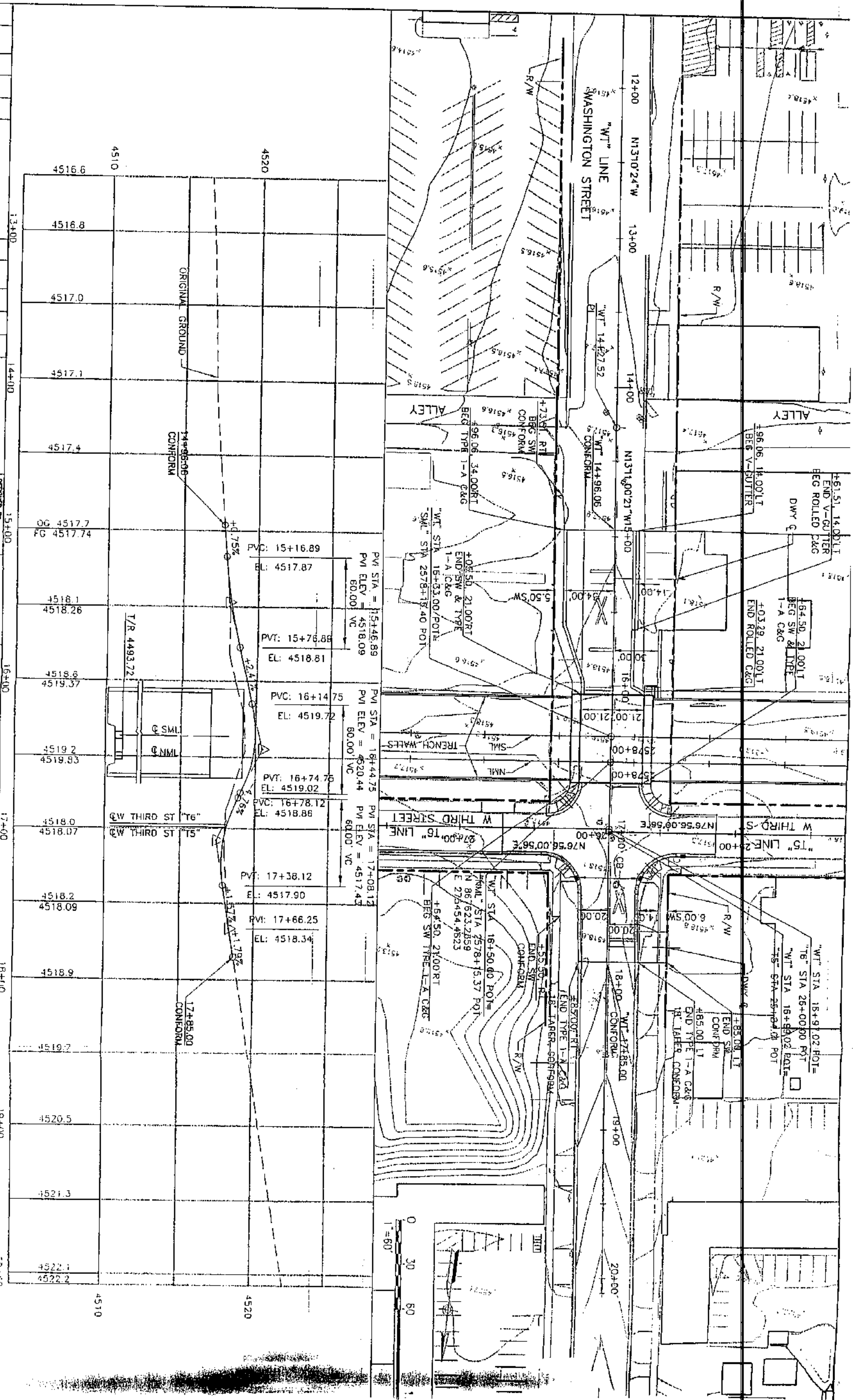
Station (ft)	Elevation (ft)
9+50	4,519.70
10+00	4,518.90
10+50	4,518.10
11+00	4,518.07
11+50	4,519.83
11+65	4,519.97

Proposed 3rd Street 2400
Cross Section for Irregular Channel

Project Description	
Worksheet	Proposed 3rd_Street 2400 - 3rd & V
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficiei	0.016	
Slope	0.022000	ft/ft
Water Surface Elev	4,518.59	ft
Elevation Range	18.07 to 4,519.97	
Discharge	270.00	cfs





100% SUBMITTAL
NOT FOR CONSTRUCTION

DESIGNED BY TRIPLET/SHAFER
DRAWN BY TRIPLET/SHAFER
CHECKED BY A. VOO
IN CHARGE J. SHAFER

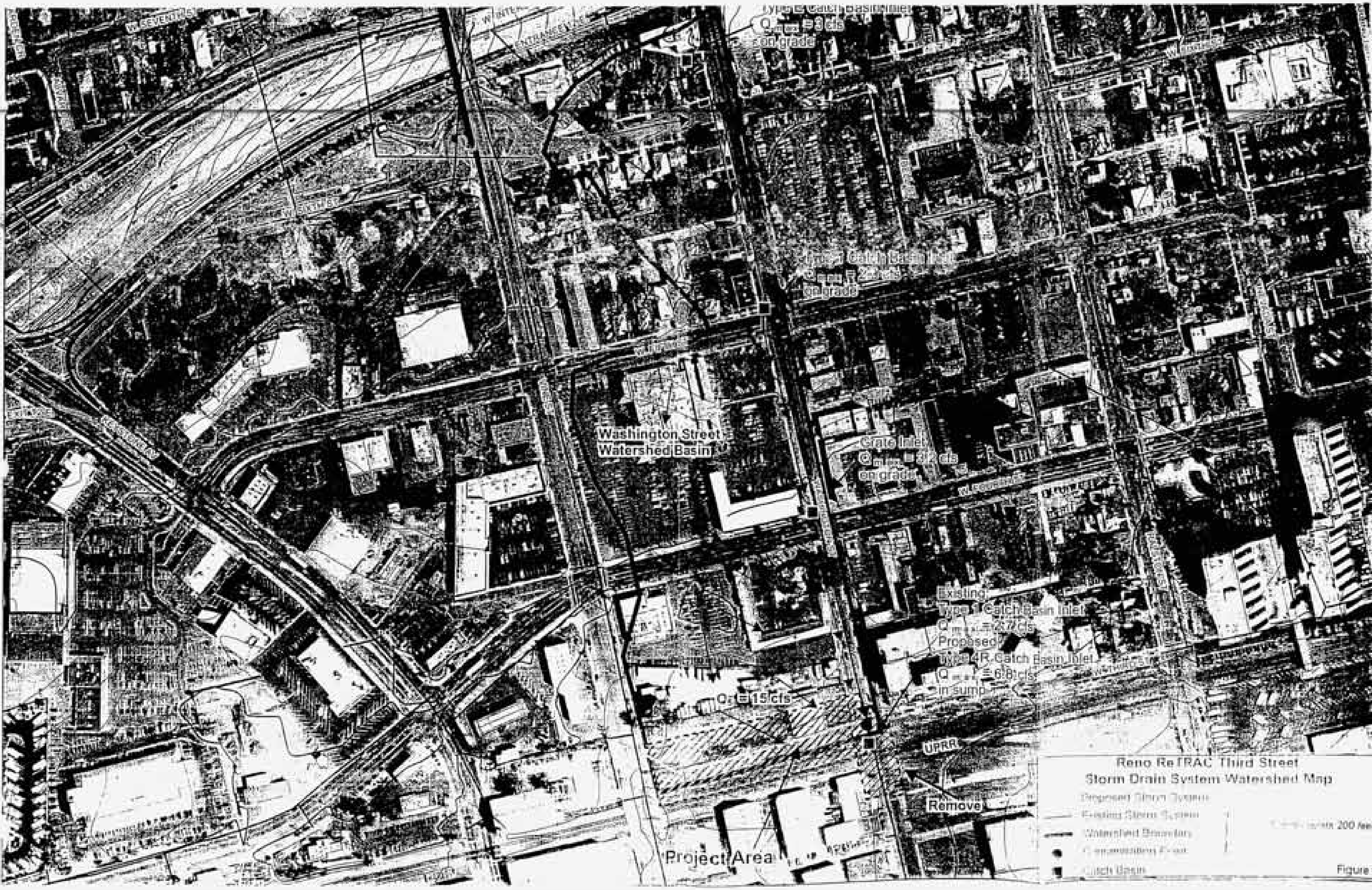
RENO
ReTRAC
THE GRANITE TEAM

RENO ReTRAC
WASHOE COUNTY

NEVADA

RENO ReTRAC
WASHINGTON STREET IMPROVEMENTS
WASHINGTON STREET

C-003
SCALE H:1"=60' V:1"=6



Reno ReTRAC Third Street
Storm Drain System Watershed Map

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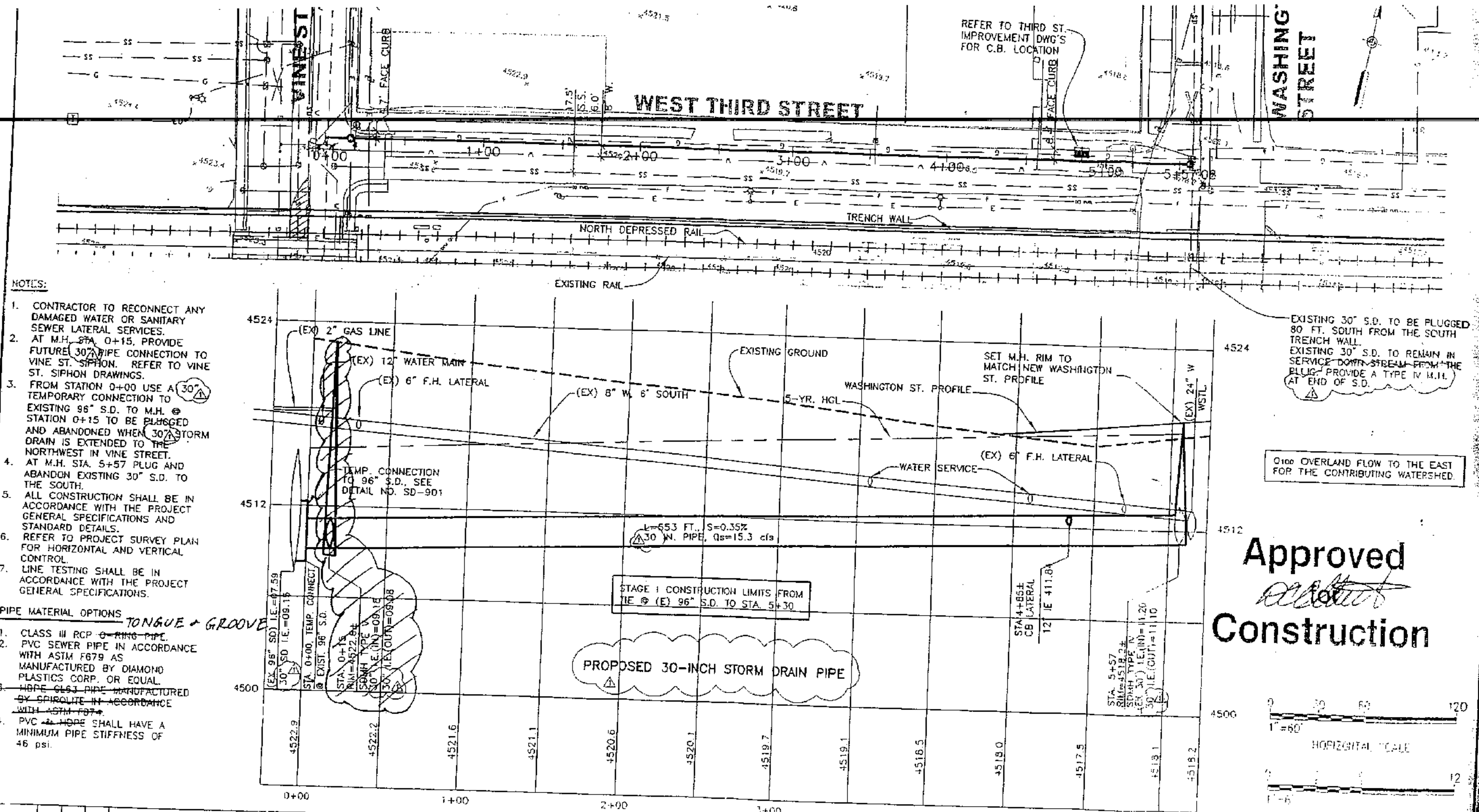


NOTES:

1. CONTRACTOR TO RECONNECT ANY DAMAGED WATER OR SANITARY SEWER LATERAL SERVICES.
2. AT M.H. STA. 0+15, PROVIDE FUTURE 30" PIPE CONNECTION TO VINE ST. SIPHON. REFER TO VINE ST. SIPHON DRAWINGS.
3. FROM STATION 0+00 USE A 30" TEMPORARY CONNECTION TO EXISTING 96" S.D. TO M.H. @ STATION 0+15 TO BE PLUGGED AND ABANDONED WHEN 30" STORM DRAIN IS EXTENDED TO THE NORTHWEST IN VINE STREET.
4. AT M.H. STA. 5+57 PLUG AND ABANDON EXISTING 30" S.D. TO THE SOUTH.
5. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE PROJECT GENERAL SPECIFICATIONS AND STANDARD DETAILS.
6. REFER TO PROJECT SURVEY PLAN FOR HORIZONTAL AND VERTICAL CONTROL.
7. LINE TESTING SHALL BE IN ACCORDANCE WITH THE PROJECT GENERAL SPECIFICATIONS.

PIPE MATERIAL OPTIONS

1. CLASS III RCP ~~O-RING PIPE~~. TONGUE + GROOVE
2. PVC SEWER PIPE IN ACCORDANCE WITH ASTM F679 AS MANUFACTURED BY DIAMOND PLASTICS CORP. OR EQUAL.
3. ~~HDPE CL63 PIPE MANUFACTURED BY SPIROLITE IN ACCORDANCE WITH ASTM F894.~~
4. PVC ~~& HDPE~~ SHALL HAVE A MINIMUM PIPE STIFFNESS OF 46 psi.

Approved for Construction

REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION
1	2/19/03	LWL	CER	BRD	NDC-001						
0	1/31/03	LWL	CER	BRD	ISSUED FOR CONSTRUCTION						

DESIGNED BY LWL
DRAWN BY LWL/CF
CHECKED BY JW
IN CHARGE JE
DATE JAN. 31, 2003

LARRY W. LINDSTROM
No. 7944

RENO

RENO ReTRAC
WASHOE COUNTY NEVADA

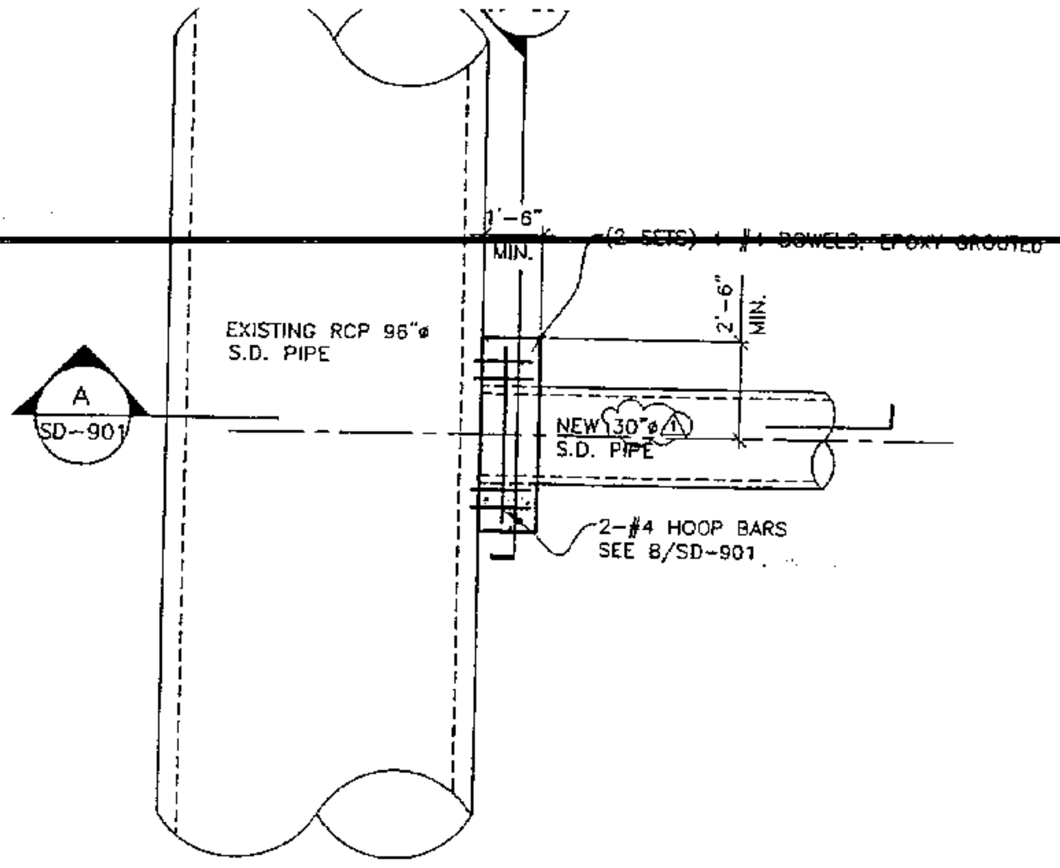
ACCEPTED

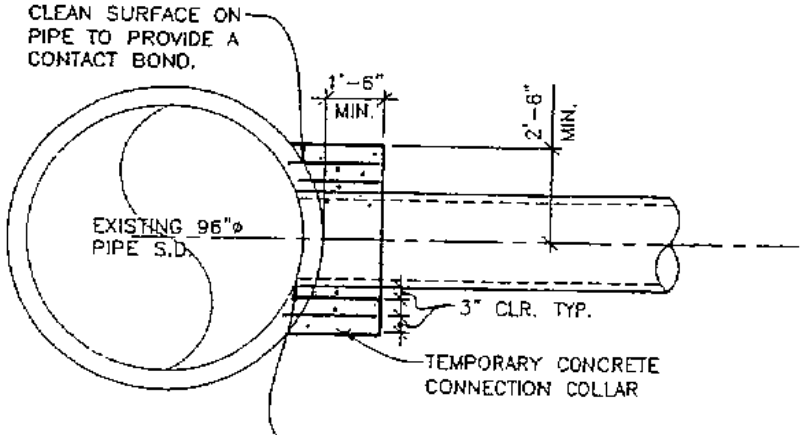
ReTRAC THE GRANITE TEAM

SUBMITTED
APPROVED

RENO ReTRAC
THIRD STREET STORM DRAIN
30-INCH VINE-WASHINGTON ST

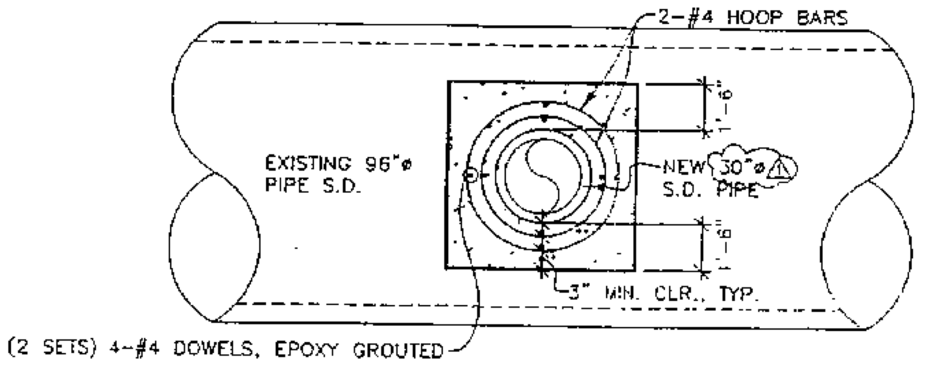
CONTRACT NO.
DRAWING NO. SD-200
REV 1
SCALE AS SHOWN
SHEET NO.





SEE INVERT AS SHOWN ON PLAN/PROFILE SH. SD-200

A
SD-901
SECTION VIEW



B
SD-901
SECTION VIEW

TEMPORARY CONNECTION TO 96"ø STORM DRAIN

N.T.S.

Approved for Construction

REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION
1	2/19/03	LWL	CER	BRD	NDC-001						
0	1/31/03	LWL	CER	BRD	ISSUED FOR CONSTRUCTION						

DESIGNED BY LWL
DRAWN BY CMF
CHECKED BY JW
IN CHARGE JE
DATE JAN. 31, 2003

LARRY W. LINDSTROM
CIVIL

RENO
ReTRAC THE GRANITE TEAM

RENO ReTRAC
WASHOE COUNTY NEVADA

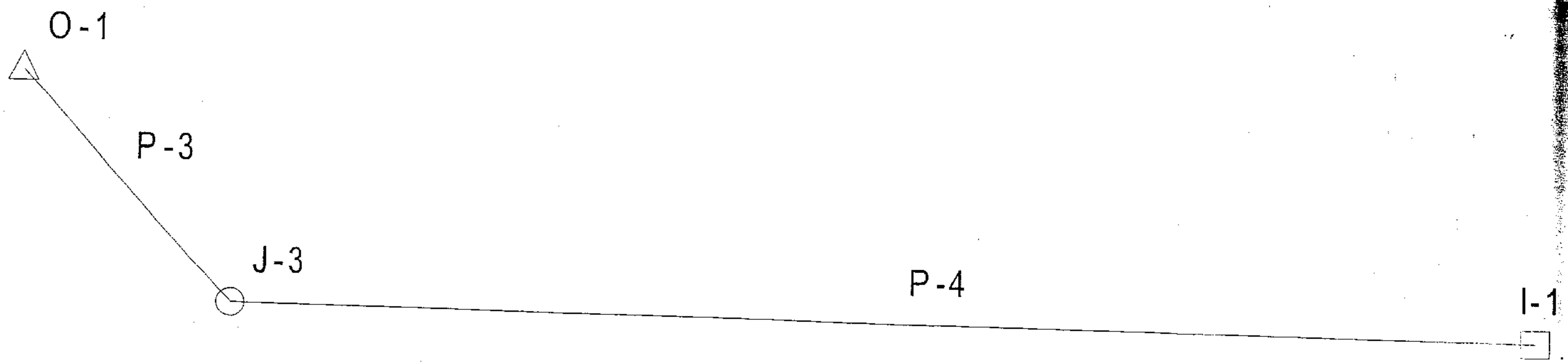
ACCEPTED

SUBMITTED
APPROVED

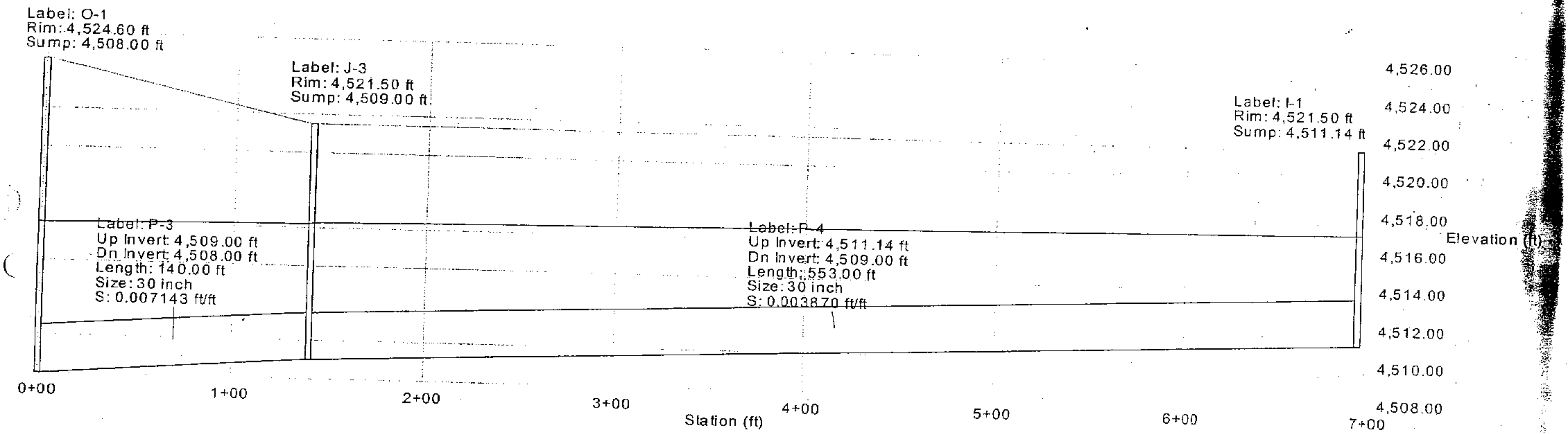
RENO ReTRAC
THIRD STREET STORM DRAIN
30 INCH VINE-WASHINGTON ST.

CONTRACT NO.
DRAWING NO. SD-901
SCALE AS SHOWN
SHEET NO.

Scenario: Base



Scenario: Base



IFC Submittal

July 18, 2003
Project No. 80100603

Mr. Avrum Loewenstein, P.E.
ReTRAC
Parsons Transportation Group
264 Keystone Avenue
Reno, Nevada 89503

Reference: ReTRAC Hydrologic and Hydraulic Design Memorandum for Ralston Street Overland Drainage

Dear Mr. Loewenstein:

This letter is to document the design parameters and assumptions for the proposed improvements of the Ralston Street UPRR trench crossing. The proposed improvements begin at Third Street and end just south of the proposed UPRR trench. The 100-year storm event overland flow patterns were analyzed for existing and proposed conditions. There is no existing storm drainage affected by the proposed improvements.

The localized 5-year storm drainage for the intersection of Third Street and Ralston Street was previously designed by CFA, Inc. for the construction of Studio 3 Apartments, located on the northeast corner of the intersection of Ralston Street and Third Street. The City of Reno approved the Hydrology Report dated October 21, 1998. A copy entitled "*Hydrology Report for Studio 3 Apartments*" is enclosed in the Appendix. The 5-year storm drainage will not be affected by the proposed improvements. No additional design is needed.

The 100-year watershed basin was delineated and is shown in the IFC ReTRAC Drainage Report, Volume 1. The 100-year event existing conditions flow affecting the intersection of Ralston Street and Third Street is approximately 328 cfs. A portion of the 100-year overland travels east on Third Street over the Ralston Street crown and continues east on Third Street. The water surface elevation at the existing Ralston Street crown during the 100-year event is 4514.58-feet, as shown by the calculation sheet labeled "*3rd Street 2200*".

The 100-year event proposed conditions flow affecting the intersection of Ralston Street and Third Street is approximately 347 cfs. The proposed crown was analyzed and the water surface elevation was found to be 4514.68-feet, as shown by the calculation sheet labeled "*Proposed 3rd Street 2200*". The proposed improvements on Ralston Street do not significantly increase the existing water surface elevation and do not alter the historic drainage pattern in the 100-year event. See the attached *Ralston Street Plan and Profile* drawing for proposed improvements.

Sincerely,

STANTEC CONSULTING INC.

Trina M. Magoon, PE
Water Resources Project Manager

TMM:
Enclosure(s)
V:\52801\active\80100603\H&H\Design Memorandums\MEMO H&H 3rd & Ralston St Design(IFC%).doc

3rd Street 2200
Worksheet for Irregular Channel

Project Description	
Worksheet	3rd_Street 2200 - 3rd & R
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	004000	ft/ft
Discharg	328.00	cfs

Options	
Current Roughness Metho	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	4,514.58	ft
Elevation Range	l3.60 to 4,515.60	
Flow Area	86.5	ft²
Wetted Perimeter	166.81	ft
Top Width	166.80	ft
Actual Depth	0.98	ft
Critical Elevation	4,514.55	ft
Critical Slope	0.004692	ft/ft
Velocity	3.79	ft/s
Velocity Head	0.22	ft
Specific Energy	4,514.81	ft
Froude Number	0.93	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	12+62	0.016

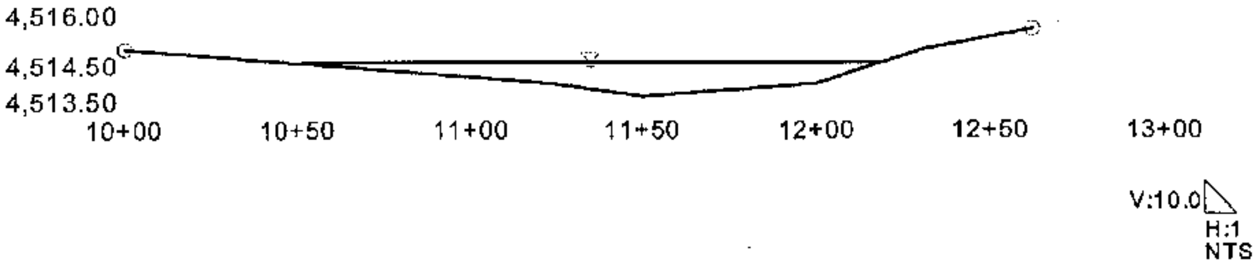
Natural Channel Points

Station (ft)	Elevation (ft)
10+00	4,515.00
11+23	4,514.00
11+50	4,513.60
12+00	4,514.00
12+31	4,515.00
12+62	4,515.60

3rd Street 2200
Cross Section for Irregular Channel

Project Description	
Worksheet	3rd_Street 2200 - 3rd & R
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.016	
Slope	0.004000	ft/ft
Water Surface Elev	4,514.58	ft
Elevation Range	13.60 to 4,515.60	
Discharge	328.00	cfs



Proposed 3rd Street 2200
Worksheet for Irregular Channel

Project Description	
Worksheet	Proposed 3rd_Street 2200 - 3rd
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	004000	ft/ft
Discharg	347.00	cfs

Options	
Current Roughness Metho	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	4,514.68	ft
Elevation Range	13.77 to 4,515.34	
Flow Area	92.5	ft²
Wetted Perimeter	181.15	ft
Top Width	181.14	ft
Actual Depth	0.91	ft
Critical Elevation	4,514.65	ft
Critical Slope	0.004724	ft/ft
Velocity	3.75	ft/s
Velocity Head	0.22	ft
Specific Energy	4,514.90	ft
Froude Number	0.93	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
8+50	11+50	0.016

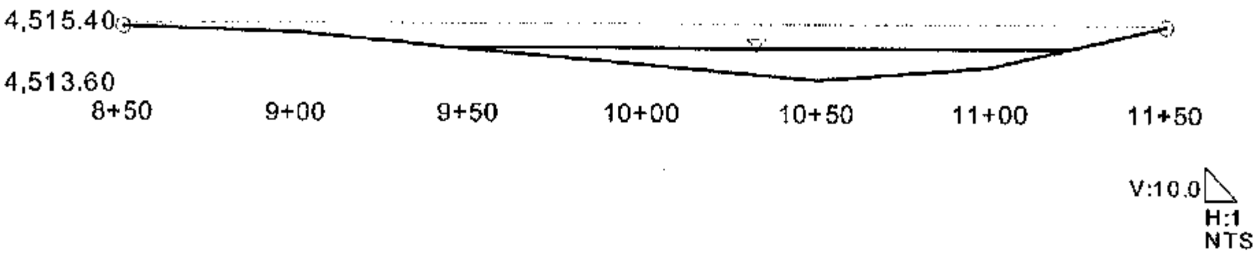
Natural Channel Points

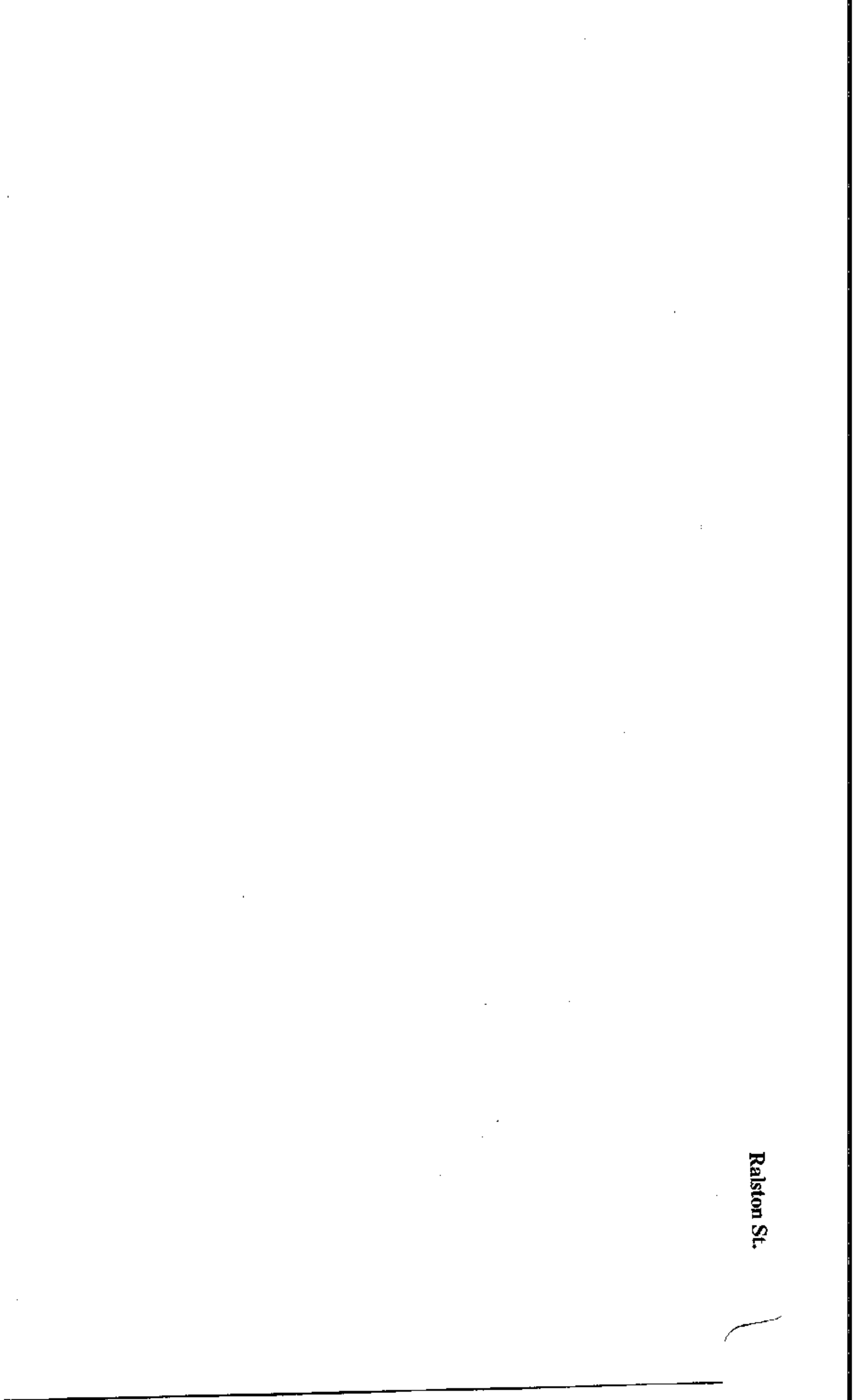
Station (ft)	Elevation (ft)
8+50	4,515.30
9+00	4,515.10
9+50	4,514.60
10+00	4,514.20
10+50	4,513.77
11+00	4,514.12
11+50	4,515.34

Proposed 3rd Street 2200
Cross Section for Irregular Channel

Project Description	
Worksheet	Proposed 3rd_Street 2200 - 3rd £
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficiei	0.016	
Slope	0.004000	ft/ft
Water Surface Elev.	4,514.68	ft
Elevation Range	13.77 to 4,515.34	
Discharge	347.00	cfs





Ralston St.

: Base

Combined Pipe/Node Report

Label	Upstream Node	Downstream Node	Length (ft)	Section Size	Capacity (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Calculated Headloss (ft)	Energy Grade In (ft)	Energy Grade Ou (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Ou (ft)	Total System Flow (cfs)
P-4	I-1	J-3	553.00	30 inch	25.51	3.12	4,511.14	4,509.00	0.003870	0.77	4,517.21	4,516.44	4,517.05	4,516.29	15.30
P-3	J-3	O-1	140.00	30 inch	34.66	3.12	4,509.00	4,508.00	0.007143	0.19	4,516.35	4,516.15	4,516.19	4,516.00	15.30

Stantec

RETCAL
SD DESIGN
80100403

Nov/22/92 WASHINGTON ST ERF
(S. OF FREEWAY)

BASIN AREA = 17.7 ACRES

			C_s
RESIDENTIAL ¼ ACRE	= 4.75 ACRES	26.8%	0.5
BUSINESS COMMERCIAL	= 12.95 ACRES	73.2%	0.85

$C_s = 0.5(.268) + 0.85(.732)$

$C_s = 0.76$

$L = 1913'$

$SLOPE = \frac{4550-4522}{1913} = 1.4$[illegible]

$VEL = 2.5$ fps

$t = 12.6$ MIN

$i_s = 1.2$ in/hr

$Q_s = CiA$

$Q_s = 0.76(1.2)17.7$

$Q_s = 16.1$ cfs

Designed by:

Checked by:

Stantec

ReTRAC
Washington/3rd St Storm Drain

DATUM: NAVD 88
RETRAC STRIP TOPO
AND COR 2' TOPO

Third St
Type 1 DI @ NW corner
Overflow = 4518.1
Rim = 4517.43
Depth = 0.67'
Qmax = 2.7 cfs

Fourth St.
Grate only @ NW Corner
Depth = 0.5' (approx)
Qmax = 3.2 cfs

Fifth St.
Type 1 DI @ NW Corner
Depth = 0.5' (approx)
S = .003
Q max = 2.3 cfs

Sixth St.
Type E grate in Parking lot
Depth = 1' (approx)
Qmax = 3 cfs

Total 11.2

Third St.
Replace Type 1 with Type 4R

D = 0.67
Qmax = 6.3 cfs

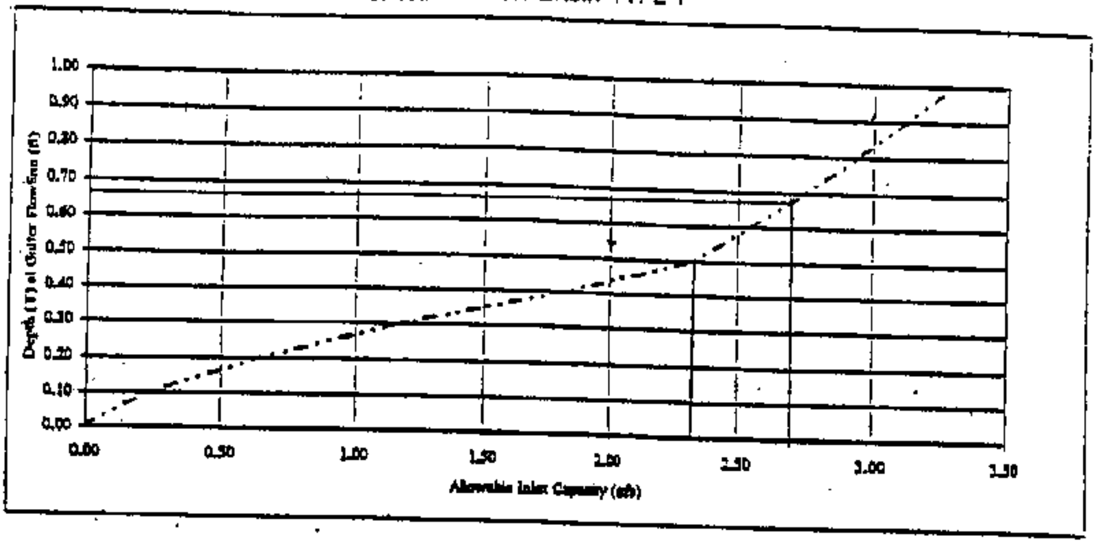
Total 15 cfs

Designed by:

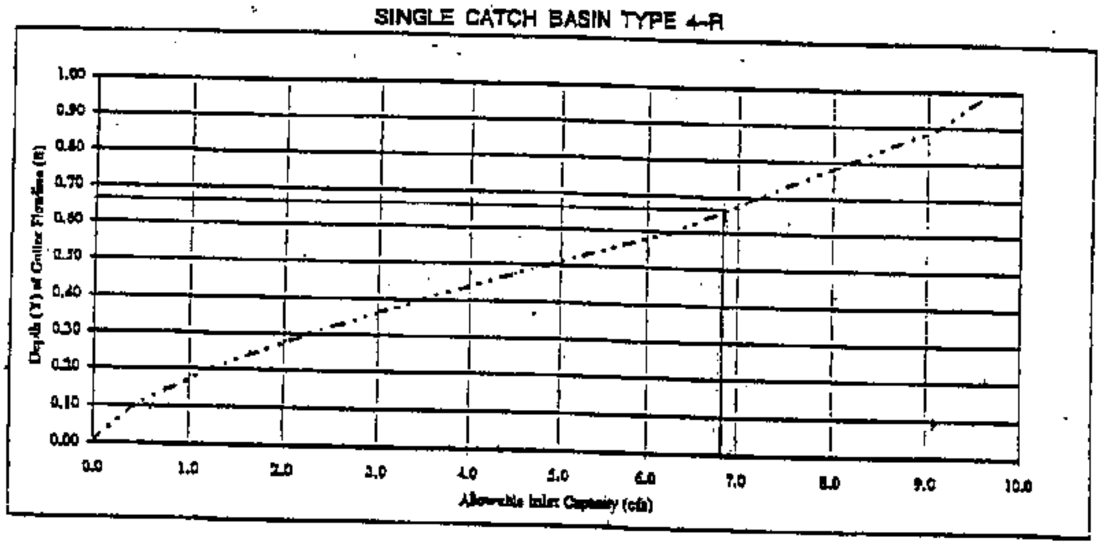
Checked by:

ALLOWABLE INLET CAPACITY
SUMP CONDITION

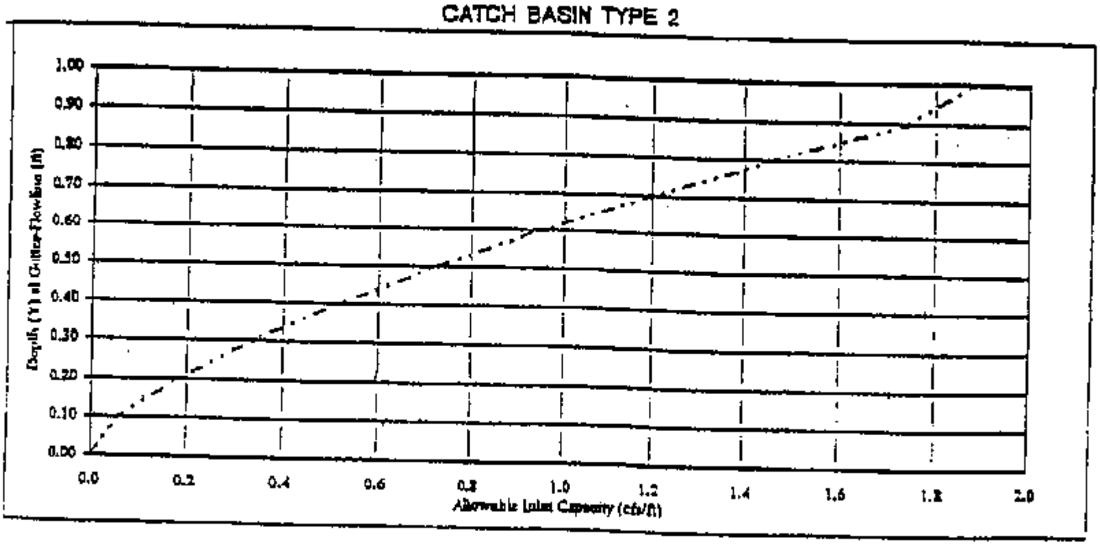
SINGLE CATCH BASIN TYPE 1



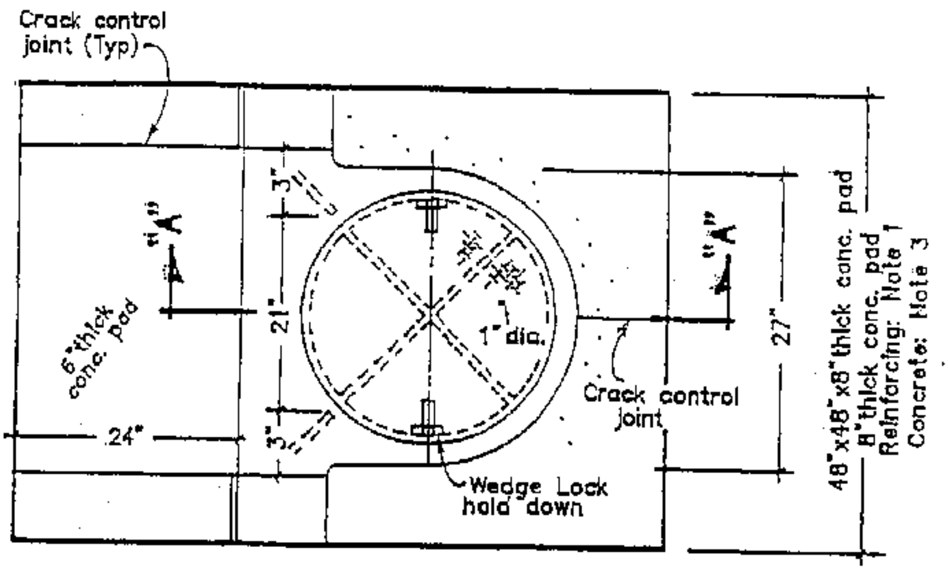
SINGLE CATCH BASIN TYPE 4-R



CATCH BASIN TYPE 2

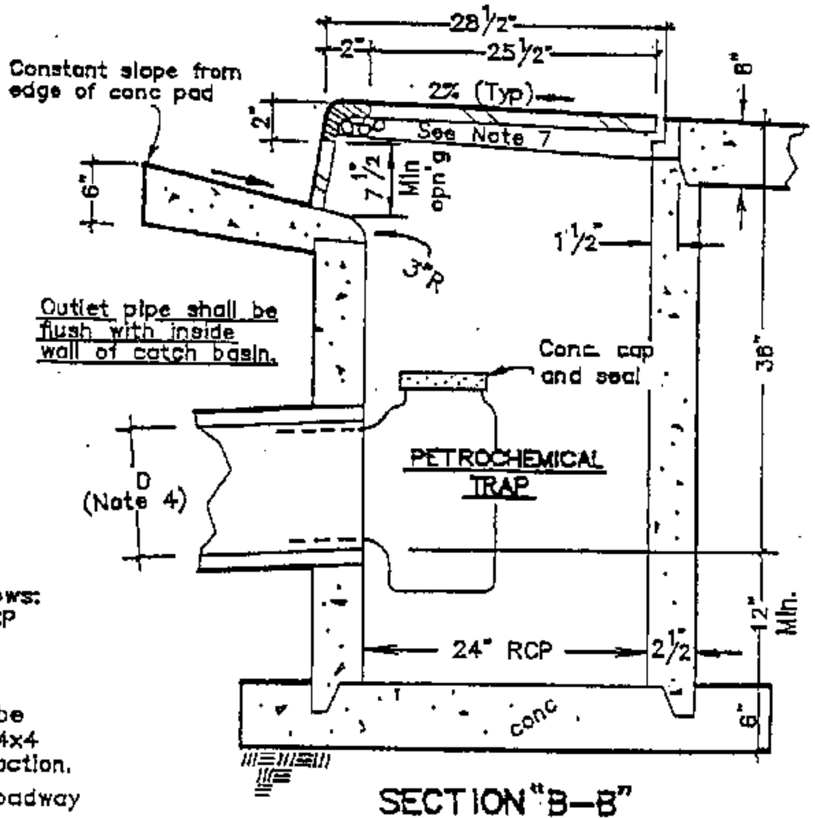


NOTE: 1) INCLUDES CAPACITY REDUCTION FACTOR OF 0.5 FOR GRATE AND 0.7 FOR CURB OPERNING



PINKERTON A-434 FRAME & COVER, OR EQUAL

N. T. S.



SECTION "B–B"

N. T. S.

NOTES

1. Reinforcing shall be fiber mesh.
2. Conc. shall be 6.25sack (min.) 4000psi w/ 4.5%-7.5% air.
3. An 8" thick conc. pad shall be constructed as shown.
4. "D" shall have a min. dia as follows: WASHOE COUNTY: D=12" dia RCP
5. Conc. shall receive a medium broom finish.
6. 6" TYPE2 aggregate base shall be placed and compacted beneath 4x4 conc. pad to 90% relative compaction.
7. In Washoe Co. for use outside roadway section only.

NO.	REVISION	DATE
1	Redraw	2/92vp
2	Note 2	2/93vp
3	Corr's.Notes	12/93vp

STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION

CATCH BASIN TYPE I

SECTION WASHOE

DRAWING NO. W–10.1

DATE 2–92

PAGE W–22

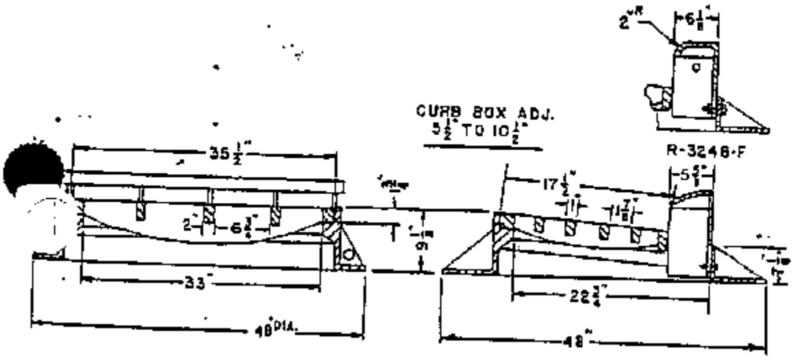
NOTE: When specifying/ordering grates, refer to "CHOOSING THE PROPER INLET GRATE" on pages 106-109. For FREE OPEN AREAS of Neenah Grates, refer to pages 326-330.

3246-CC

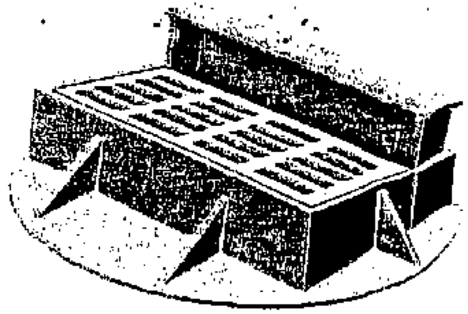
as R-3246-CL except furnished with Type C grate as shown on R-3246-E.

R-3246-E
Curb Inlet Frame, Grate, Curb Box For Mountable Curb

Heavy Duty



R-3246-E

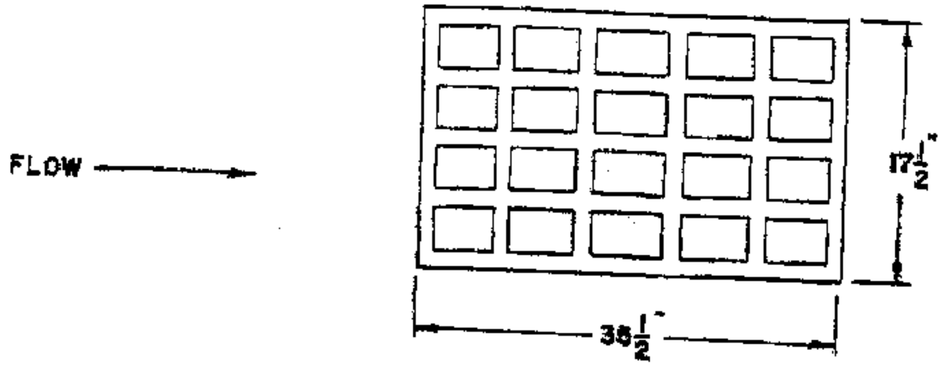


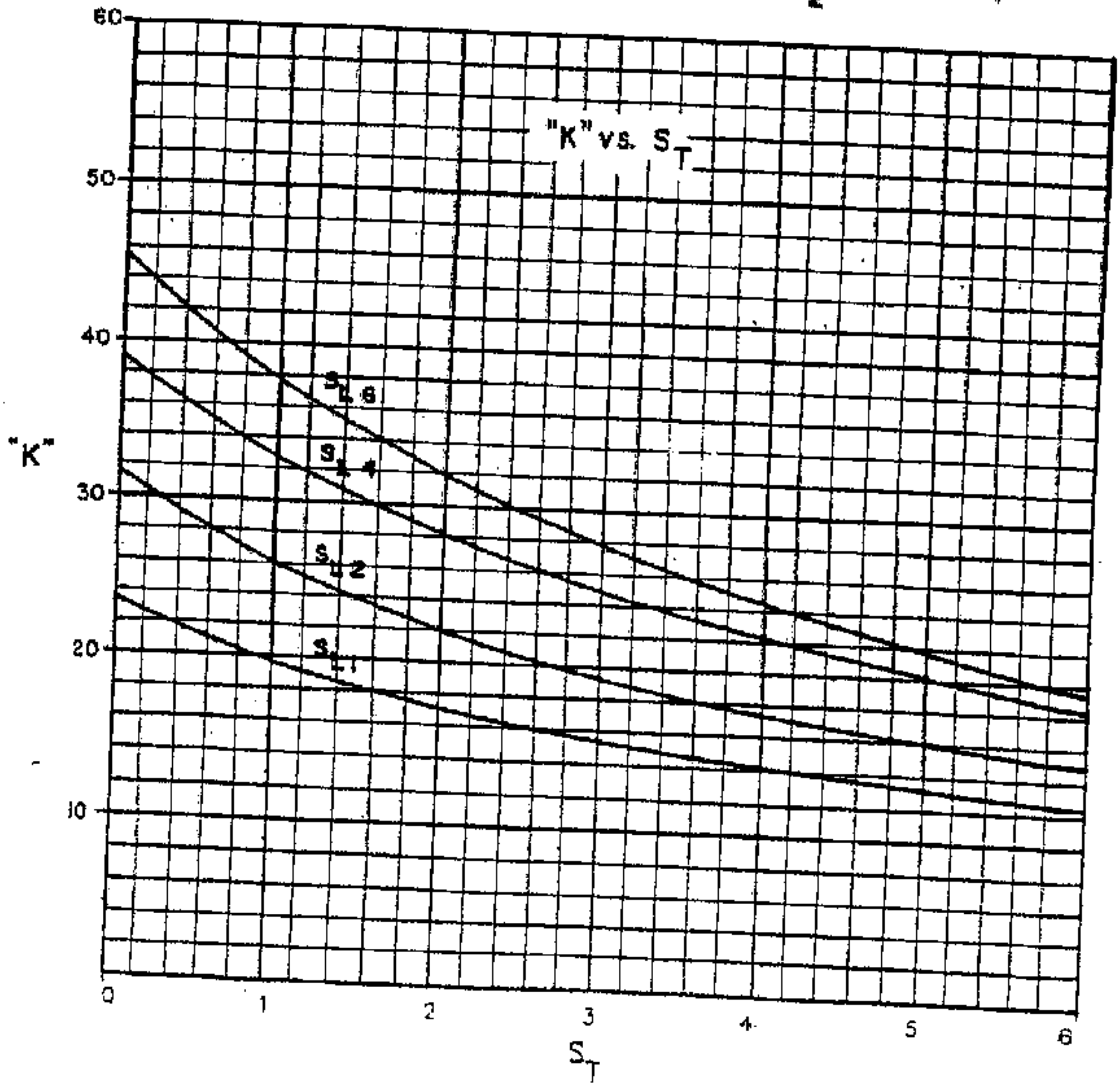
3246-F

ne as R-3246-E except with 2" radius curb box.
detail.

To print K-chart, click ctrl-P.

CAT. NO.-R-3246-E,F
DESCRIPTION-TYPE C



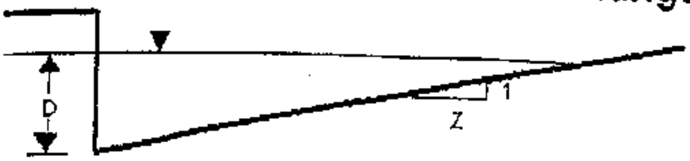


S_T = Transverse Gutter Slope %

S_L = Longitudinal Gutter Slope %

K = Grate Inlet Coefficient

On Grade Flow in Triangular Gutter Sections



Where...

Q = Channel flow in CFS (calculated)
Z = Reciprocal of transverse slope ($1/S_T$)
D = Depth in feet
S = Longitudinal slope
N = Roughness coefficient at constant 0.016 (value for concrete and asphalt)

$$Q = \frac{0.56}{N} Z D^{8/3} S^{1/2}$$

(Modified Manning Equation)

Instructions: Enter the available known values for **D** *(0.01-0.5)*, 1/Z ($1/S_T$) *(0.005-0.06)*, **S** (S_L) *(0.005-0.1)*, **Q** and/or the spread of flow. Press Calculate and the formulae will solve for any missing single variable in the equation. If using a Neenah grate, select the catalog number and from the pop-up K-chart, enter in your required K value. Pressing Calculate again will then determine the Grate Capacity for that specific Neenah grate. *NOTE: Changing a variable will force an error (pop-up) and will require you to clear the "Grate Capacity in CFS" results box.*

	Alternate One	Alternate Two	Alternate Three
Depth of flow in feet (D):	0.5		
Transverse Slope in ft./ft. (S_T):	.02		
Longitudinal Slope in ft./ft. (S_L):	.003		
Roughness coefficient (N):	0.016 (value for concrete or asphalt)	0.016 (value for concrete or asphalt)	0.016 (value for concrete or asphalt)
Total flow in cfs (Q):	15		
Spread of flow in feet:	25		

Catalog numbers and grate types that have K-charts: 3246-E,F

Grate Coefficient from K-chart (K):	10		
Grate capacity in cfs:	3.15		
	(Flow captured)	(Flow captured)	(Flow captured)
	Calculate Reset	Calculate Reset	Calculate Reset

For additional information regarding Neenah Inlet Grate Capacities, please contact our Product Engineer, Steve Akkala, at 920-725-7000 or at sakkala@nfco.com.

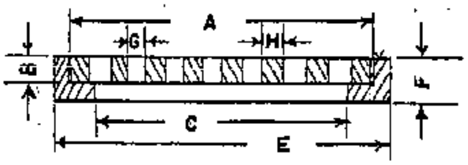
NOTE: When specifying/ordering grates, refer to "CHOOSING THE PROPER INLET GRATE" on pages 108-109. For FREE OPEN AREAS of Neenah Grates, refer to pages 326-330.

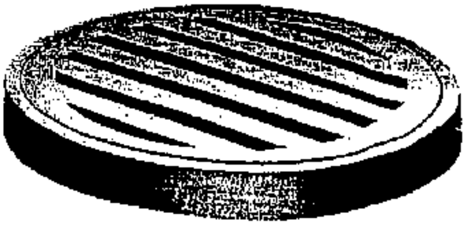
-2586 Series
ast Iron Angle Frames and Grates

Anchors, integrally cast on frame, can be supplied if specified.

	Dimensions in Inches							
Catalog No.	A	B	C	E	F	G	H	Duty
R-2586-A	14 1/4	3/4	13	16	1 1/2	3/4	1	Light
R-2586-B	16	1	13 1/2	18 1/4	1 5/8	1 1/8	1	Heavy§*
R-2586-C	18	3/4	16	19 1/2	1 1/4	7/8	3/4	Light
R-2586-D	19 3/4	1	17 1/2	21 3/4	1 5/8	1	3/4	Light§*
R-2586-E	19 1/2	1 1/2	18	20 1/2	2	3/4	3/4	Light*
R-2586-F	20 1/2	3/4	18 3/4	23	1 1/4	1	1	Light§*
R-2586-G	22 1/4	1 1/2	20	24 1/4	2 1/4	1 1/4	1	Heavy*
R-2586-H	22 3/4	1 5/8	20 1/2	25 1/2	3	1 1/2	1	Heavy§†
R-2586-K	24	3/4	21 1/2	26 1/2	1 1/4	1	1	Light*
R-2586-M	26 5/8	3/4	24	30	1 3/8	1 1/4	1	Light*
R-2586-N	30	1	27 1/2	33	1 3/4	1 1/4	1	Light*
R-2586-O	32	1	30	36 1/2	2	1 1/4	1	Light*

*Type G grate style as shown on page 89.
†Furnished standard with machined horizontal bearing surfaces. All others have as-cast surfaces.
§Not recommended for bicycle traffic.





Illustrating R-2586-A

Weir & Orifice Flow Comparison

$$Q = 0.6A\sqrt{2gh}$$

(Orifice Flow Equation)

Q = Capacity in CFS
A = Free open area of grate in sq. ft.
g = 32.2 (feet per sec/sec)
h = Head in feet

Instructions:

- Either Select catalog number (will automatically fill in Open Area and Perimeter) or enter your own values
- Enter head value
- Press CALCULATE

The results will determine automatically if your situation falls into a Weir, Transitional or Orifice flow. Additionally, a pop-up window will offer Neenah grates which fall within the parameters chosen.

$$Q = 3.3P(h)^{1.5}$$

(Weir Equation)

Q = Capacity in CFS
P = Feet perimeter
h = Head in feet

Orifice Information

Weir Information

Catalog number and grate type: R-2586-C E

Head in feet (h): 1

Feet perimeter (P): 4.7

Calculate

Free open area in sq. ft. (A): 0.6

Weir capacity in cfs:

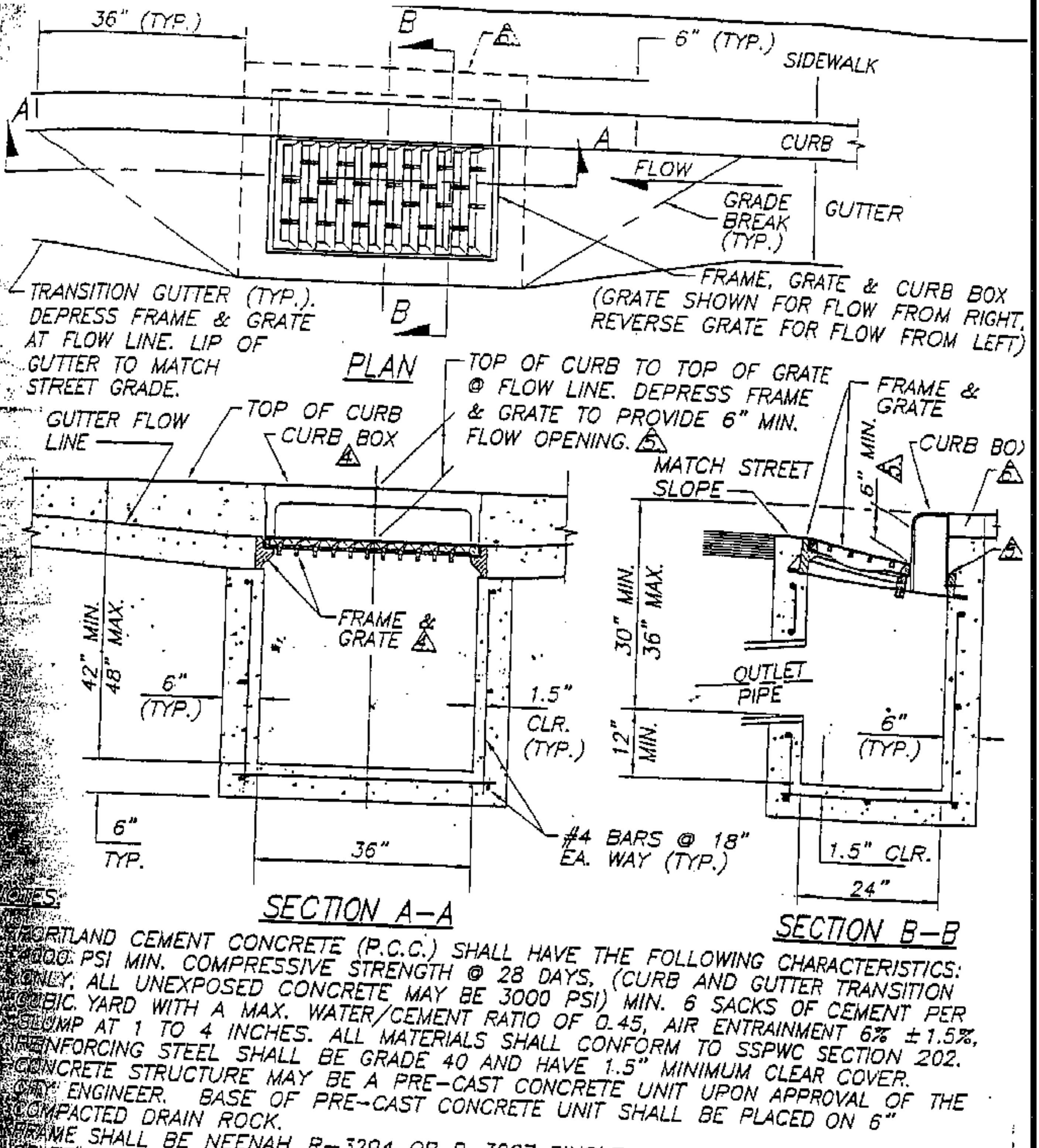
Transitional flow in cfs:

Orifice capacity in cfs: 2.9

(Results assume no debris restriction.)

NOTE: The above results do not account for the dome height of Beehive-type grates. Please take note of this when determining the Head (h) value.

For additional information regarding Neenah Inlet Grate Capacities, please contact our Product Engineer, Steve Akkala, at 920-725-7000 or at sakkala@nfco.com.



NOTES:

PORTLAND CEMENT CONCRETE (P.C.C.) SHALL HAVE THE FOLLOWING CHARACTERISTICS: 4000 PSI MIN. COMPRESSIVE STRENGTH @ 28 DAYS, (CURB AND GUTTER TRANSITION ONLY. ALL UNEXPOSED CONCRETE MAY BE 3000 PSI) MIN. 6 SACKS OF CEMENT PER CUBIC YARD WITH A MAX. WATER/CEMENT RATIO OF 0.45, AIR ENTRAINMENT 6% ± 1.5%, SLUMP AT 1 TO 4 INCHES. ALL MATERIALS SHALL CONFORM TO SSPWC SECTION 202.

REINFORCING STEEL SHALL BE GRADE 40 AND HAVE 1.5" MINIMUM CLEAR COVER.

CONCRETE STRUCTURE MAY BE A PRE-CAST CONCRETE UNIT UPON APPROVAL OF THE CITY ENGINEER. BASE OF PRE-CAST CONCRETE UNIT SHALL BE PLACED ON 6" COMPACTED DRAIN ROCK.

FRAME SHALL BE NEENAH R-3294 OR R-3067 SINGLE CURB UNIT WITH A TYPE L "VANE GRATE" AND CURB BOX, SOUTH BAY FOUNDRY VANE GRATE SBF 1947 OR APPROVED EQUAL, INSTALLED WITH PROPER FLOW DIRECTION.

TILT FRAME & GRATE AS REQUIRED TO ATTAIN 6" MIN. FLOW OPENING & INSTALL DURABLE SHIMS BETWEEN THE CURB BOX & FRAME AS REQUIRED TO MATCH CURB BOX TO TOP OF CURB AND FACE OF CURB (SEE SECTION B-B).

CONCRETE SHALL BE PLACED AS SHOWN WHEN NOT LOCATED IN A SIDEWALK.

INSTALL GREASE TRAP PER STANDARD DETAIL DRAWING NO. R-213 (311).

NO.	REVISION	DATE
APPROVED BY:	S.V.	08/00

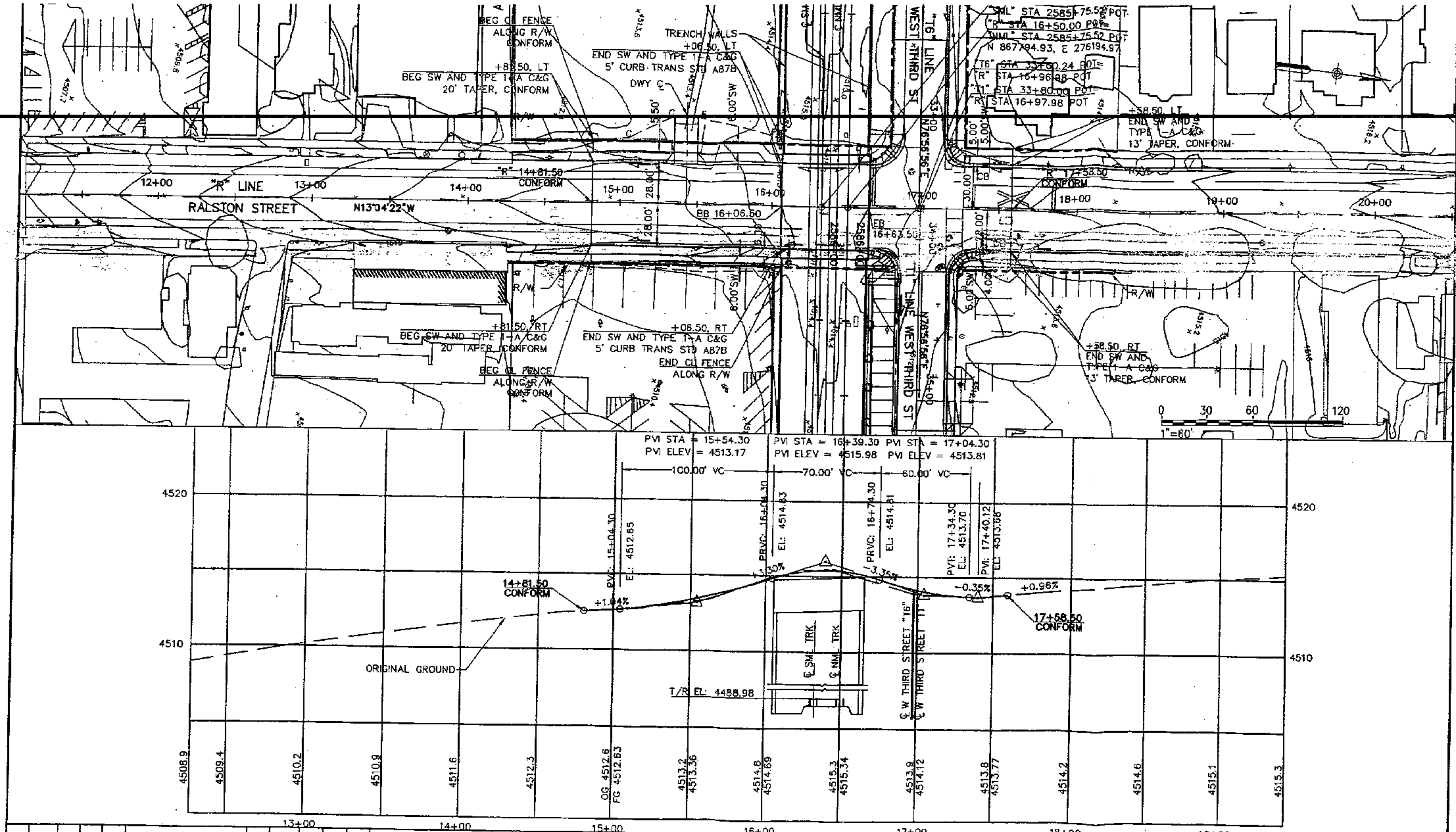
STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION

CATCH BASIN
TYPE 4-R

SECTION RENO

DRAWING NO. R-206 (311)

DATE PAGE



REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION
0	07/22/03	AV	AL	BRD	ISSUED FOR CONSTRUCTION						

DESIGNED BY C. TRIPLET/A.VOO
DRAWN BY GALLEGOS/TRIPLET
CHECKED BY J. SHAFER
IN CHARGE A. VOO
DATE 07/22/03

ISSUED FOR CONSTRUCTION

RENO ReTRAC
RENO WASHOE COUNTY NEVADA

ReTRAC THE GRANITE TEAM

SUBMITTED
APPROVED

RENO ReTRAC
RALSTON STREET IMPROVEMENTS
RALSTON STREET
PLAN AND PROFILE

CONTRACT NO.
DRAWING NO. C-003
REV 0
SCALE H:1"=60', V:1"=6'

IFC Submittal

June 27, 2003
Project No. 80100603

Mr. Avrum Loewenstein
ReTRAC
Parsons Transportation Group
264 Keystone Avenue
Reno, Nevada 89503

Reference: **ReTRAC Hydrologic and Hydraulic Design Memorandum for Arlington Avenue Overland Drainage**

Dear Mr. Loewenstein:

This letter is to document the design parameters and assumptions for the proposed improvements of the Arlington Avenue UPRR trench crossing. The proposed improvements begin just south of Commercial Row and end at Third Street. The 100-year storm event overland flow patterns were analyzed for existing and proposed conditions.

The localized 5-year storm drainage patterns surrounding the proposed Arlington Avenue UPRR crossing will remain as existing. The proposed Arlington Avenue profile conforms to existing grade north of the crossing, leaving the localized drainage patterns unaffected. The existing storm drain that crosses under the UPRR will be re-routed east to the Plaza Street storm drain. The Plaza Street storm drain will be upsized to convey the additional flow. Please see the IFC submittal *ReTRAC Hydrologic and Hydraulic Design Memorandum for East Third Street Storm Drain System* prepared on May 15, 2003 for further details.

The 100-year watershed basin has been delineated and is shown in the 100% submittal of the ReTRAC Drainage Report. Existing conditions flow from the 100-year event affecting the intersection of Arlington Avenue and Third Street is approximately 389 cfs. A portion of the 100-year overland flow travels east on Third Street over the Arlington Avenue crown and continues east on Third Street. The water surface elevation at the existing Arlington Avenue crown during the 100-year event is 4508.88-feet, as shown by the calculation sheet labeled "*Existing 3rd Street 1600*".

The proposed conditions peak flow rate from the 100 year storm is 408 cfs yielding a water surface elevation of 4508.93-feet, as shown by the calculation sheet labeled "*Proposed 3rd Street 1600*". The proposed improvements on Arlington Avenue do not significantly increase the existing water surface elevation and do not alter the historic drainage pattern in the 100-year event. See the attached *North Arlington Avenue Plan and Profile* drawing for proposed improvements.

Sincerely,

STANTEC CONSULTING INC.

Trina M. Magoon, PE
Water Resources Project Manager

TMM:zrb
Enclosure(s)
P:\CIVIL\80100603\H&H\Design Memorandums\MEMO H&H 3rd & Arlington St Design(IFC).doc

Existing 3rd Street 1600
Worksheet for Irregular Channel

Project Description	
Worksheet	3rd_Street 1600 - Arlington
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	009000	ft/ft
Discharg	389.00	cfs

Options	
Current Roughness Methc	)ved Lotter's Method
Open Channel Weighting	)ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficiei	0.016	
Water Surface Elev	4,508.88	ft
Elevation Range	)8.23 to 4,510.00	
Flow Area	79.7	ft^2
Wetted Perimeter	193.08	ft
Top Width	193.08	ft
Actual Depth	0.65	ft
Critical Elevation	4,508.98	ft
Critical Slope	0.004790	ft/ft
Velocity	4.88	ft/s
Velocity Head	0.37	ft
Specific Energy	4,509.25	ft
Froude Number	1.34	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	13+53	0.016

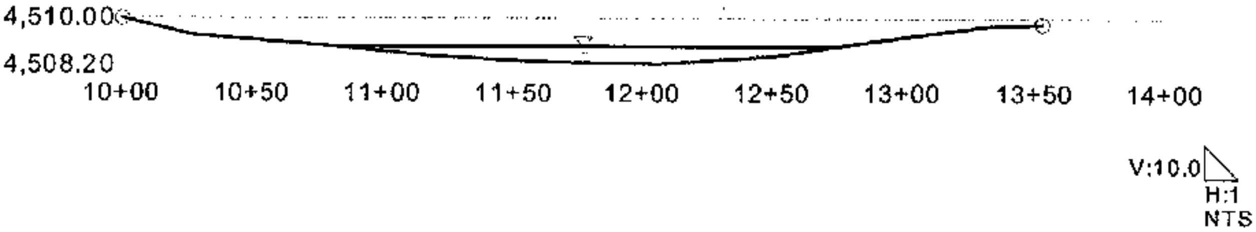
Natural Channel Points

Station (ft)	Elevation (ft)
10+00	4,510.00
10+26	4,509.35
10+72	4,508.96
11+19	4,508.51
11+60	4,508.31
12+06	4,508.23
12+50	4,508.57
12+90	4,509.11
13+33	4,509.68
13+53	4,509.80

Existing 3rd Street 1600
Cross Section for Irregular Channel

Project Description	
Worksheet	3rd_Street 1600 - Arlington
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficiei	0.016	
Slope	0.009000	ft/ft
Water Surface Elev	4,508.88	ft
Elevation Range	)8.23 to 4,510.00	
Discharge	389.00	cfs



Proposed 3rd Street 1600
Worksheet for Irregular Channel

Project Description	
Worksheet	Proposed 3rd_Street 1600 - Arlingt
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	009000	ft/ft
Discharg	408.00	cfs

Options	
Current Roughness Methc	ved Lotter's Method
Open Channel Weighting	›ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	4,508.93	ft
Elevation Range	)8.26 to 4,509.72	
Flow Area	82.5	ft²
Wetted Perimeter	196.17	ft
Top Width	196.17	ft
Actual Depth	0.67	ft
Critical Elevation	4,509.03	ft
Critical Slope	0.004765	ft/ft
Velocity	4.95	ft/s
Velocity Head	0.38	ft
Specific Energy	4,509.31	ft
Froude Number	1.34	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
8+00	11+00	0.016

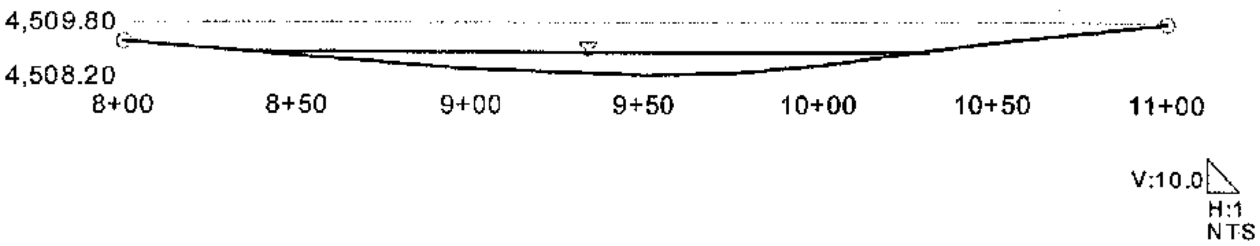
Natural Channel Points

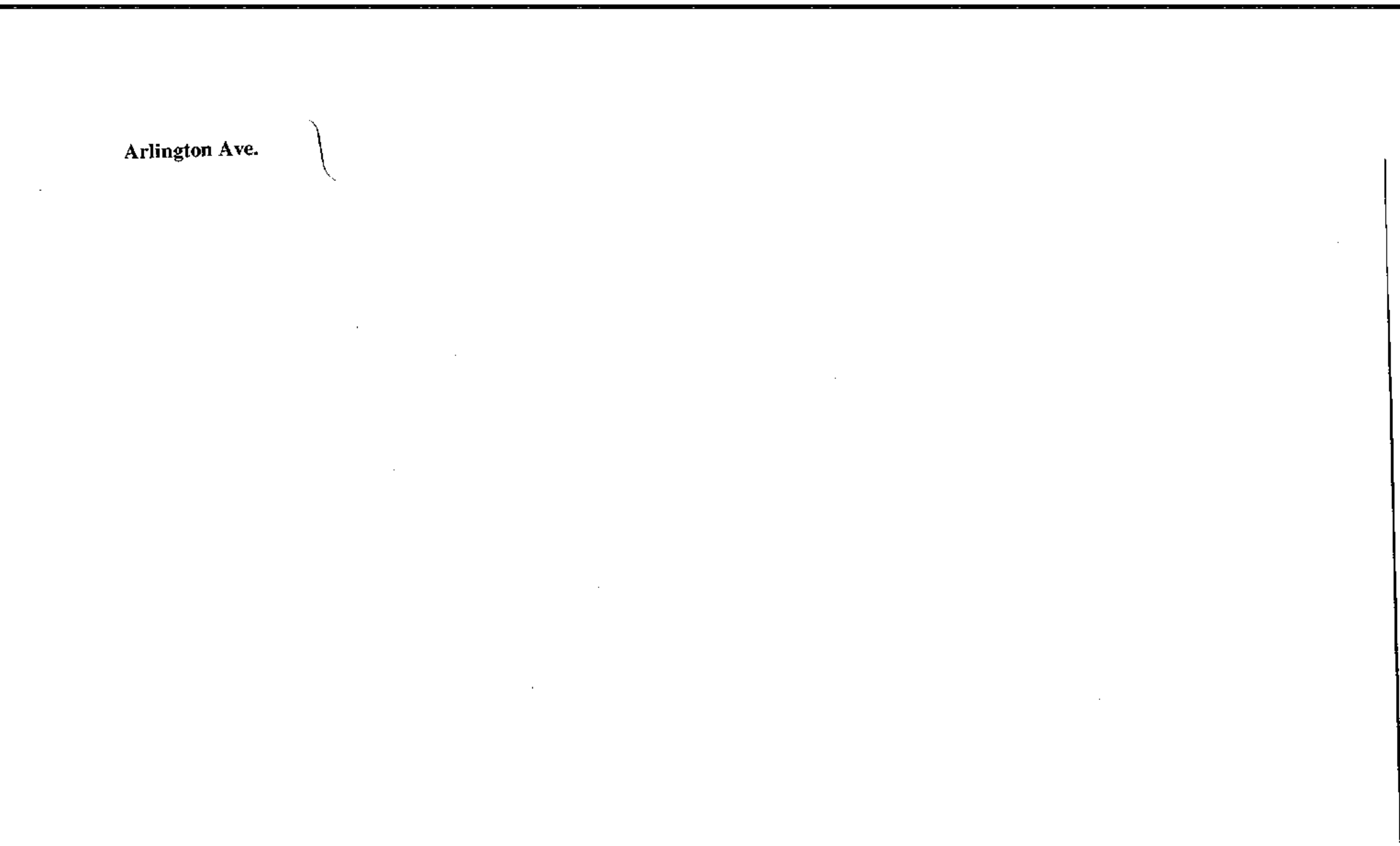
Station (ft)	Elevation (ft)
8+00	4,509.24
8+50	4,508.80
9+00	4,508.40
9+50	4,508.26
9+75	4,508.30
10+00	4,508.55
10+50	4,509.16
11+00	4,509.72

Proposed 3rd Street 1600
Cross Section for Irregular Channel

Project Description	
Worksheet	Proposed 3rd_Street 1600 - Arlingt
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficiei	0.016	
Slope	0.009000	ft/ft
Water Surface Elev	4,508.93	ft
Elevation Range	08.26 to 4,509.72	
Discharge	408.00	cfs




Arlington Ave.

J-11
1549

Hydrology Report

for

Studio 3 Apartments

Reno, Nevada

102823

RECEIVED
CITY OF RENO
PERMIT PLAZA
98 OCT 23 PM 4:27

Prepared for:

SDA, Incorporated
5555 DTC Parkway, Suite B-2500
Englewood, Colorado 80111
(303) 220-0500

TIMOTHY F. HOLST
CIVIL
No. 9427
10-21-98

21 October 1998

cfa
PLANNERS ENGINEERS SURVEYORS LANDSCAPE ARCHITECTS
1150 CORPORATE BLVD RENO NV. 89502 (702) 856-1150 FAX (702) 856-1160

INTRODUCTION:

This report presents hydrologic and hydraulic calculations for the proposed Studio 3 Apartments. This proposed project is located in the City of Reno, within the northwest ¼ of Section 11, T. 19 N., R. 19 E., and specifically on the north side of Third Street between Washington Street and Ralston Street. This site encompasses Assessor Parcel Nos. 007-274-19, 007-274-29, and 007-274-30. The site is bordered on the north by existing professional offices and an existing hotel, to the south by Third Street, to the east by the City of Reno Housing Authority, and to the west by Washington Street.

HISTORIC DRAINAGE:

The existing site consists of several multi-residential buildings with compacted gravel parking areas, and very little vegetation. This site lies within FEMA Flood Zone X, which indicates minimal flood potential. The existing topography drains to the southeast corner of the site, at approximately 2% grade, at which point it sheet flows onto Third Street where it is picked up in the existing storm drainage system to the east, at the northwest corner of Ralston Street and Third Street.

The existing onsite flows are estimated at 1.1 cfs for the 5-year event and 2.8 cfs for the 100-year event. The approximated existing offsite flows are shown on Figure 1.

DEVELOPED CONDITION:

In the developed condition, the proposed site will sheet flow onto existing watersheds A, B, and C, as shown in Figures 2 and 3. This flow entering the existing watersheds B and C will be routed to the proposed and existing storm drainage systems located at the northwest corner of Third and Ralston Streets. The flow entering existing watershed A will sheet flow down the alley to the proposed storm drain system at the southeast corner of watershed A. At this point the flow will be carried via the proposed storm drain system to the north, to connect to the existing 24" diameter RCP located within Fourth Street. The remainder of the onsite flows will be routed via a proposed private storm drain lift station with a force main discharging to the existing 30" diameter storm drain located southwest of the site, within Washington Street. Reference the Appendix for hydrology and hydraulic calculations.

The total developed onsite flows are estimated at 1.4 cfs for the 5-year event and 3.8 cfs for the 100-year event. The increased runoff is 0.3 cfs in the 5-year event and 1.0 cfs in the 100-year event.

HYDROLOGY:

The Rational Method was used to estimate the peak runoff resulting from a rain storm of given intensity and frequency falling on a specific watershed. The peak flow is expressed as:

$$Q = C\,i\,A$$

where Q = Peak rate of runoff, cubic feet per second
C = Runoff coefficient
i = Average rainfall intensity, inches per hour
A = Watershed area, acres

The City of Reno allows the use of the Rational Method for urban and small watersheds 500 acres or less. Runoff computations are made using criteria provided by the City of Reno Public Works Design Manual. Runoff coefficients used are 0.70 for multi-residential areas, 0.40 for open space with no vegetation, and 0.90 for paved areas. Rainfall intensities are determined from the rainfall intensity-duration-frequency (IDF) curves for the City of Reno. The initial time of concentration, Tc(1), is calculated by the formula:

$$T_{c(1)} = 10 \text{ or } \frac{L}{60 \times V} \text{ (whichever is greater)}$$

where $T_{c(1)}$ = Initial time of concentration, minutes

L = Length from uppermost point of watershed to design point, feet

V = Channel or overland velocity, feet per second

For this project, because of the small watershed size and high percentage of impervious area, the time of concentration was assumed to be 10 minutes for all drainage areas.

DISCUSSION:

The estimated flows calculated in this study show a negligible increase across the entire proposed site. It was shown that the onsite developed condition had an increased flow of 0.3 cfs in the 5-year event, which is ultimately distributed between two separate existing storm drain systems. The upgrade of the gravel alley to pavement shows an increase of only 0.02 cfs, which is to be picked up via a proposed storm drain system as discussed above.

CONCLUSION:

Due to the negligible increase in the 5-year event flows, the proposed Studio 3 Apartments can be constructed as planned without adverse impact to downstream properties.

APPENDIX

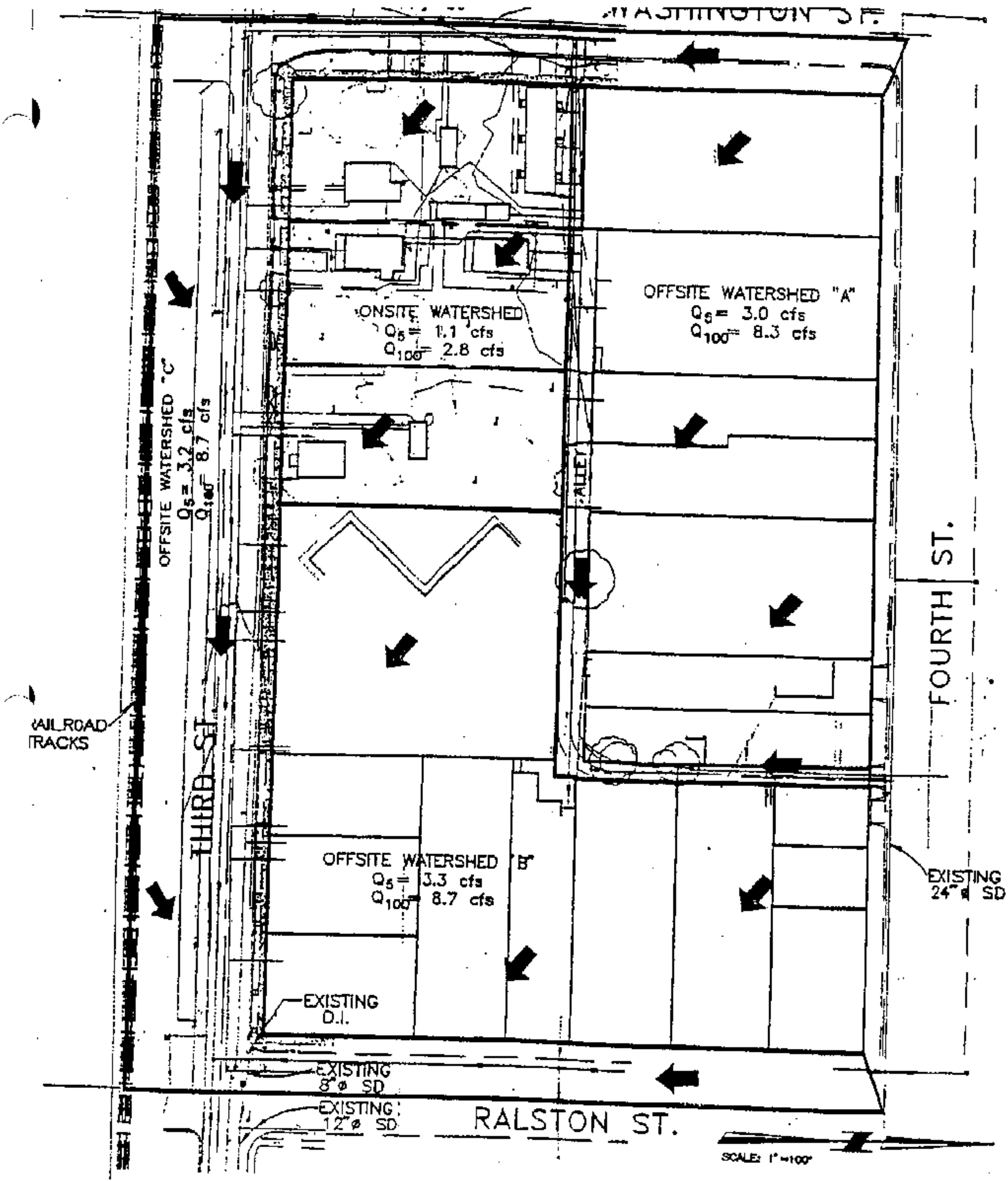


FIGURE 1

STUDIO 3 APARTMENTS

EXISTING CONDITION WATERSHED MAP

DATE:
9/1/98

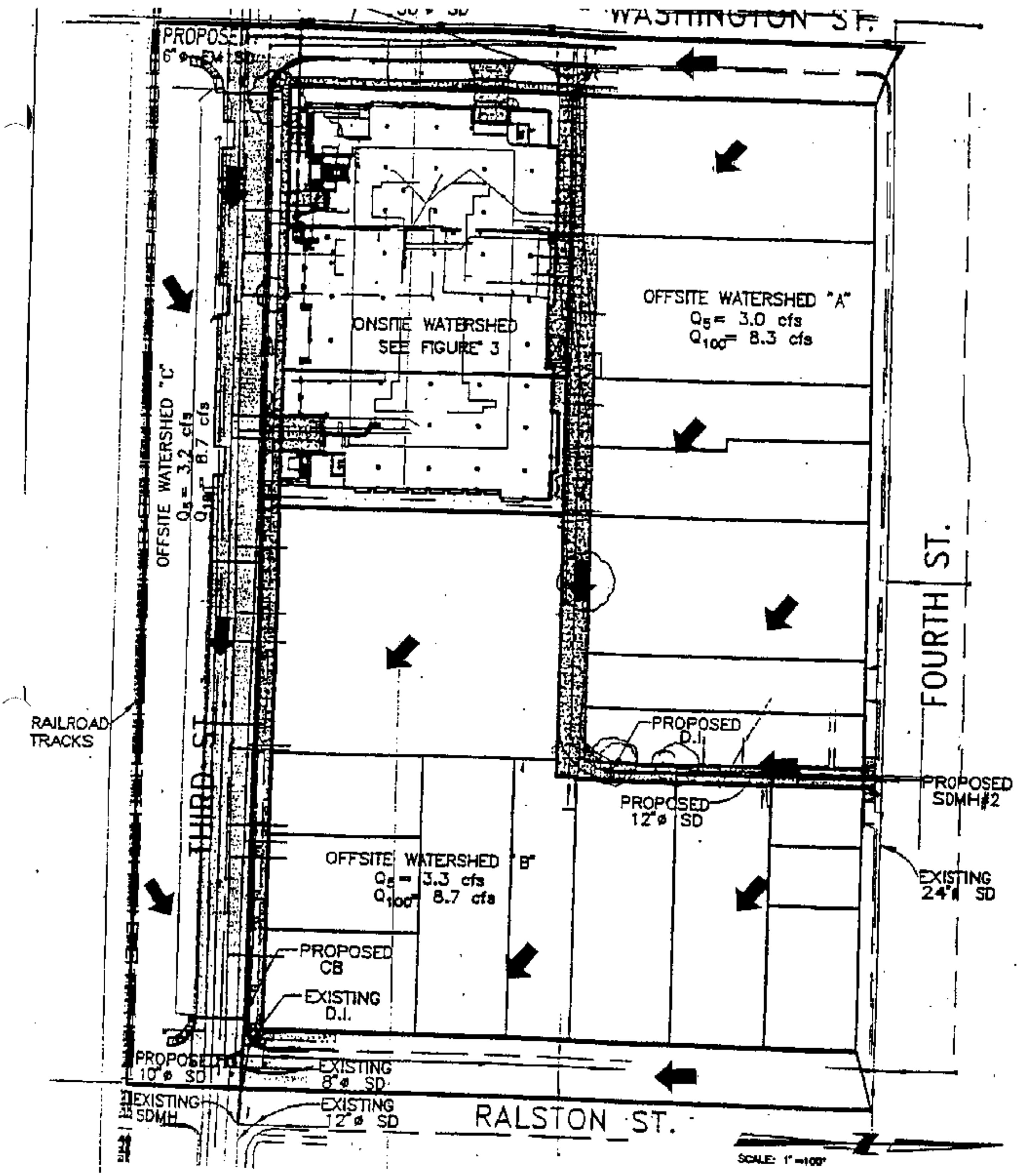


FIGURE 2

STUDIO 3 APARTMENTS

DEVELOPED CONDITION WATERSHED MAP

DATE:
9/1/98

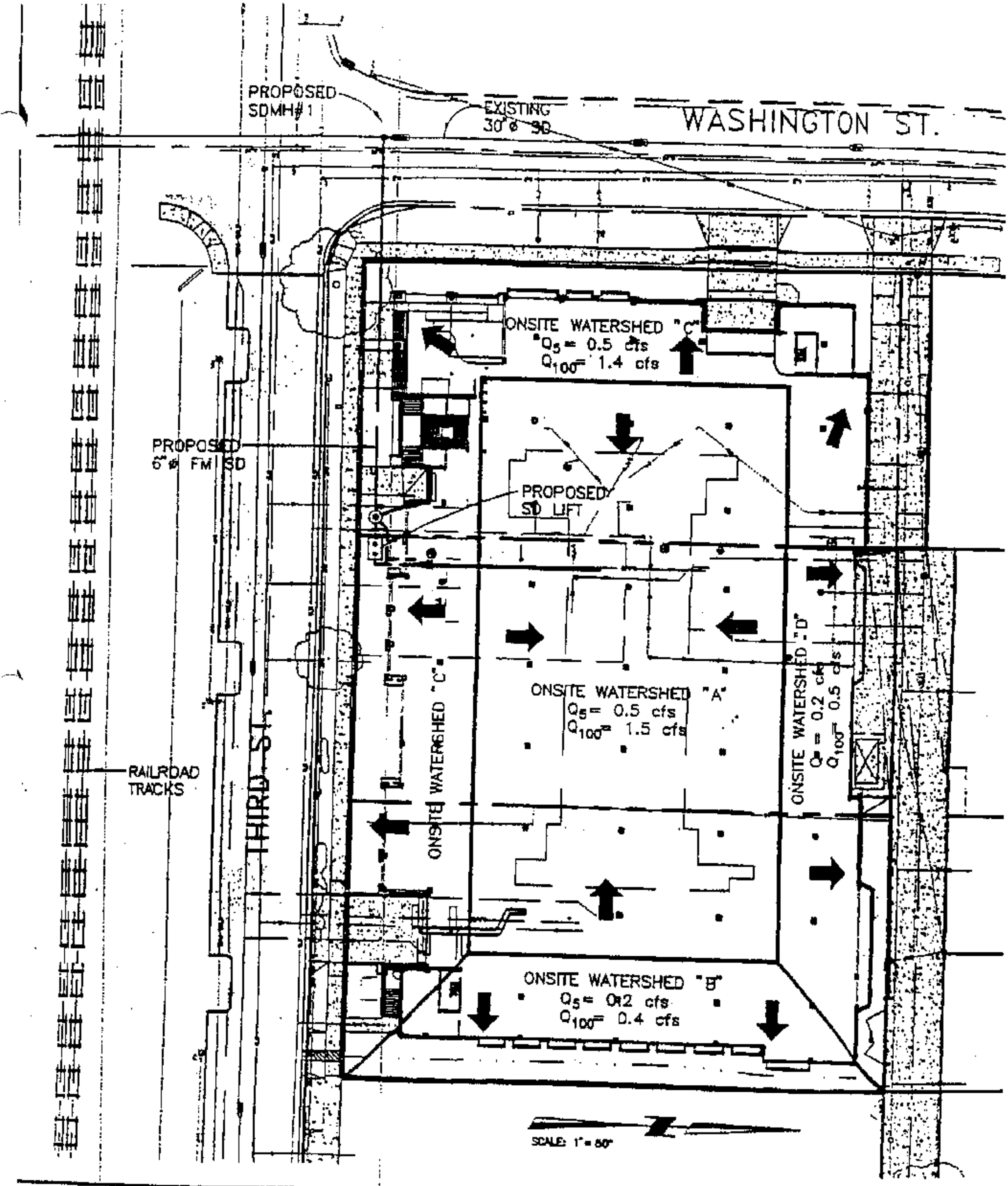


FIGURE 3

STUDIO 3 APARTMENTS

DATE:
9/1/98

DEVELOPED CONDITION WATERS

APPENDIX

Existing Conditions - Onsite

Total Drainage Area = 72,930 sf

Runoff Coefficients: C=0.7 multiresidential
C=0.4 Open Space - 1.0 - flg. (0-5%)

Building / Sidewalk = 9700 sf

Open Space = 65,230 sf

t_c = 10 min. i_5 = 1.4 in/hr i_{100} = 3.3 in/hr

Q_5 = 1.1 cfs

Q_{100} = 2.8 cfs

Existing Conditions - Offsite

Watershed (A) Area = 110,900 [illegible]

Watershed (B) Area = 117,100 sf

c=0.85 t_c = [illegible] i_5 = 1.4 in/hr i_{100} = 3.3 in/hr

(A) Q_5 = 3.0 cfs

Q_{100} = 8.3 cfs

(B) Q_5 = 3.3 cfs

Q_{100} = 8.7 [illegible]

Watershed (C) Area = 110,140 sf

c=0.9

Q_5 = 3.2 cfs

Q_{100} = 8.7 cfs

Developed Condition - OnSite

Watershed A

Area = 23,700 sf

i_5 = 1.4 cfs c = 0.7
i_{100} = 3.8 cfs

Q_5 = 0.5 cfs

Q_{100} = 1.5 cfs

Watershed B

Area = 7125 sf

Q_5 = 0.2 cfs

Q_{100} = 0.4 cfs

Watershed C

Area = 22,570 sf

Q_5 = 0.5 cfs

Q_{100} = 1.4 cfs

Watershed D

Area = [illegible]

Q_5 = 0.2 [illegible]

Q_{100} = 0.5 cfs

Total Q_5 = 1.4 cfs

Δ = 0.5 cfs

Offsite - Developed Condition

Watershed A

A_{paved} = [illegible] ft²
c=0.9

Q_5 = 0.3 cfs

Q_{100} = 0.9 cfs

Filled - Existing
c=0.85

Q_5 = 0.28 cfs

Δ = 0.02 cfs [illegible]

Capacity Type 3R Grate

$$Q_{cap} = CA\sqrt{2gh}$$

$$= 0.6\,(1.9\,sf)\sqrt{2(32.2)(0.25)}$$

$$= 4.6\ cfs \quad OK \quad (Q_5 = 3.2\ cfs)$$

Capacity 12"Φ orifice

$$Q_{12"}\ \text{entrance} = 0.6\,(\pi \times 0.5^2)\sqrt{64.4(2.5)}$$

$$= 6.0\ cfs \quad OK$$

Capacity 12"Φ Pipe

12"Φ PVC w/ $S = 0.0061$

$Q_{cap} = 2.6$ cfs

$V = 3.3$ fps

SYSTEM HEAD CALCS

ITEM	EQUIV. L.
6" - 90° ELL	15.0'
6" D.I.	8.0'
6" 90° ELL	15.0'
6" D.I.	2.0'
6" CHK VALVE	39.0'
6" FLAP GATE	60.0'

STATION + FITTINGS: 139.0' C = 130

PVC FORCE MAIN: 131.0' C = 130

$$S_f = \left(\frac{Q}{1.318 C A r^{0.63}} \right)^{1.85}$$

TOTAL EQUIV. L = 270.0'

SYSTEM HEAD DATA:

H = FRICTION LOSS + STATIC LIFT
($\Sigma S_f L$)

	200 GPM S_f=.0038	400 GPM S_f=.0137	600 GPM S_f=.0290	800 GPM S_f=.0494
STATION	0.5	1.9	4.0	6.9
FORCE MAIN	0.5	1.8	3.8	6.5
STATIC LIFT	7.0	7.0	7.0	7.0
TOTAL	8.0	10.7	14.8	20.4
V (FPS)	2.3	4.6	6.8	9.1

MAX. STATIC LIFT = HIGH PT. IE - PUMP OFF LEVEL

= 4914.00 - 4907.00

= 7.00

OVERALL DIMEN
and
APPROXIMATE W

H/Q = Head/Capacity
EFF = Hydraulic Efficiency
KW = Kilowatts Input
BHP = Brake Horsepower

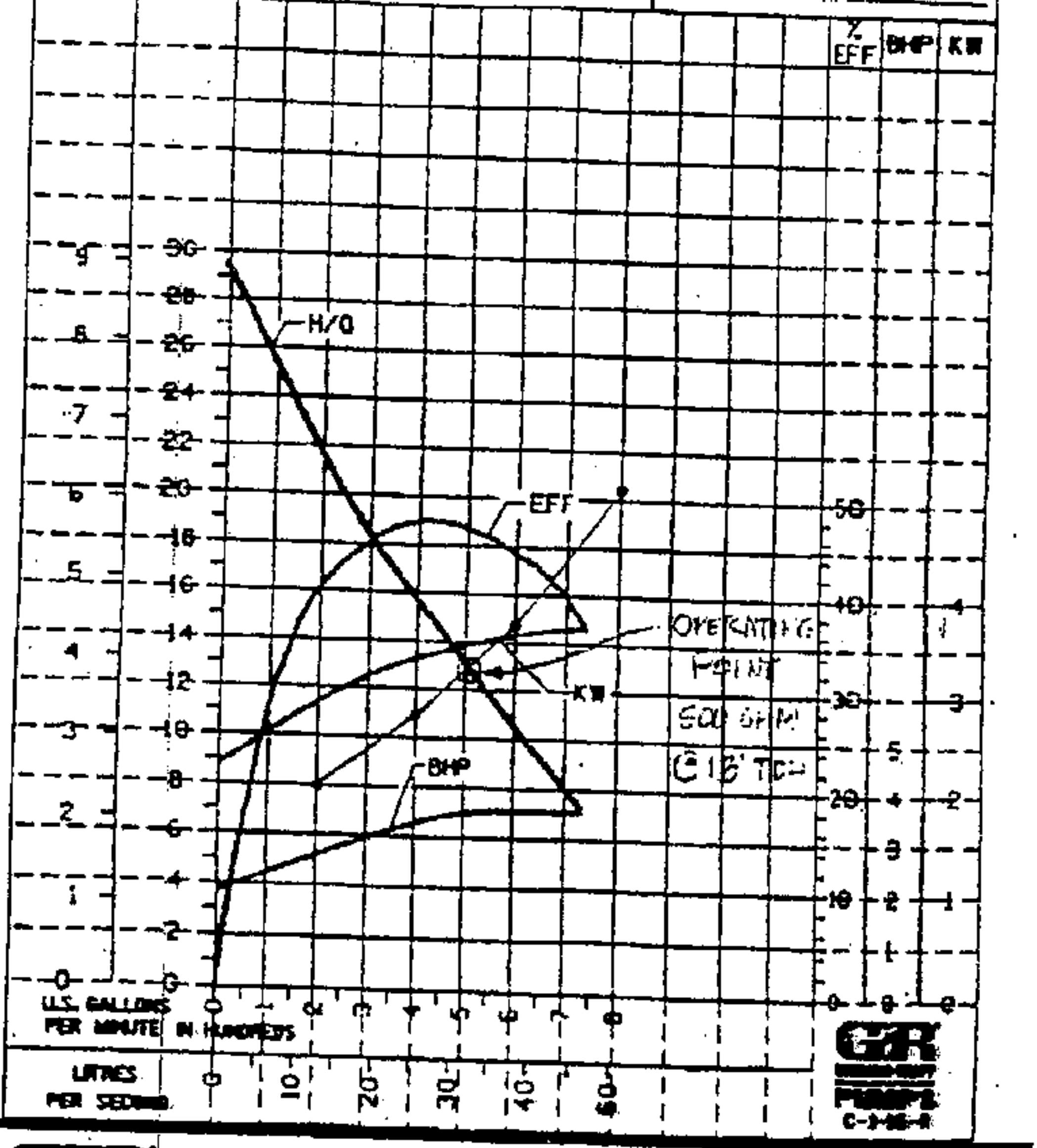
3.94" DIA. Spherical Solids

CURVE JS4C-E6.2-1

MODEL JS4C-E6.2/X6.2
JT4C-E6.2/X6.2

SIZE 4" IMP.DIA. 6.22/5.55"

SP.GR. 1.0 RPM 1750

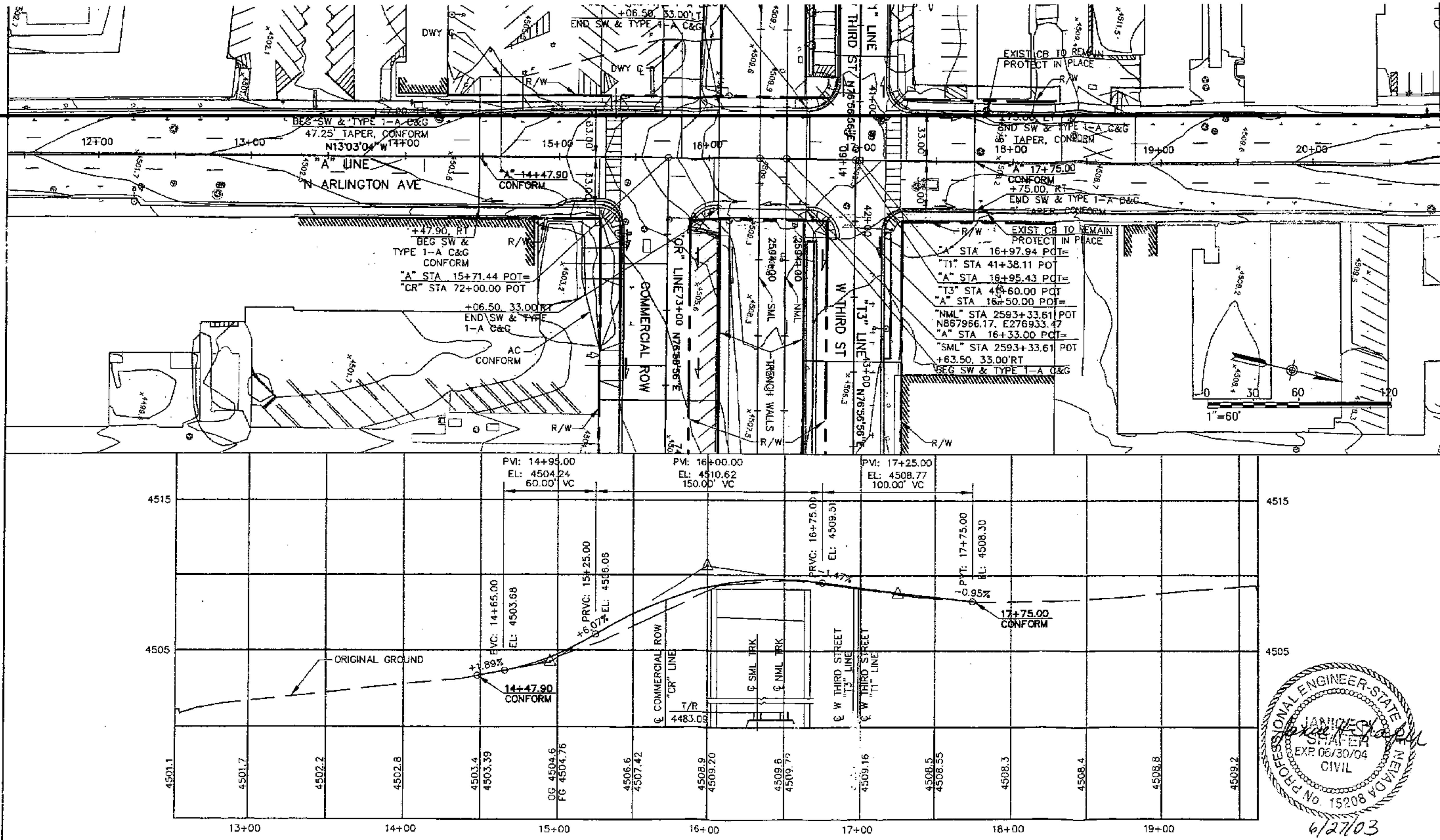


OPERATING POINT
500 GPM
@ 18' TDH

THE GORMAN-RUPP COM

GORMAN- RUPP OF CANADA LIMIT

Specifications Subje



JANICE SHAFER
EXP 06/30/04
CIVIL
No. 15208

6/27/03

REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION
0	6/27/03	JS	AL	BRD	ISSUED FOR CONSTRUCTION						

DESIGNED BY J. SHAFER
DRAWN BY C. TRIPLET
CHECKED BY A. VOO
IN CHARGE J. SHAFER
DATE 06/27/03

ISSUED FOR CONSTRUCTION

RENO ReTRAC
RENO WASHOE COUNTY NEVADA

ReTRAC THE GRANITE TEAM

SUBMITTED ____
APPROVED ____

RENO ReTRAC
N ARLINGTON AVE IMPROVEMENTS
NORTH ARLINGTON AVENUE
PLAN AND PROFILE

CONTRACT NO.
DRAWING NO. C-003
REV 0
SCALE H: 1"=60' V: 1"=6'

IFC Submittal

April 16, 2004
Project No. 80100603

Mr. Avrum Loewenstein
ReTRAC
Parsons Transportation Group
264 Keystone Avenue
Reno, Nevada 89503

Reference: **ReTRAC Hydrologic and Hydraulic Design Memorandum for East Third Street Storm Drain System (Arlington to Lake)**

Dear Mr. Loewenstein:

This letter is to document the design parameters and assumptions for the proposed East Third Street Storm Drain System. The proposed system will combine two existing storm drain systems; one located within Arlington Avenue and one located within Third and Plaza Streets and will convey the flows east to the Evans Avenue Storm Drain System, which conveys flows to the Wells Avenue outfall structure.

The proposed improvements begin on Third Street just west of Arlington Avenue and end at the intersection of Plaza Street and Lake Street. The proposed storm drain intercepts flows from the Reinforced Concrete Box (RCB) storm drain at Third Street and Arlington Avenue and conveys them west in Third Street to West Street. At the intersection of West and Third Streets the proposed storm drain begins to follow the alignment of the existing Plaza Street Storm Drain and combines flows from the Arlington system with the Plaza Street system in an upsized storm drain to the existing Lake Street Storm Drain.

Existing pipe sizes, slopes, inverts and elevations were taken from a collection of "record" drawings and field survey data. The original RCB system serviced an area from Vine Street and Sixth Street to The Sands Hotel property where it crossed the existing UPRR tracks and continued south on Arlington Avenue to the Truckee River. Many sections of the system upstream of the UPRR crossing have been abandoned and/or modified and therefore original design capacity no longer applies to the system. The existing capacity of the RCB system was determined by inlet analysis. Flow capacity of each inlet was calculated by analyzing the inlet type with the applied head allowed by surrounding geometry. The existing capacity is 37cfs. Inlet calculations can be found in the appendix.

The Plaza Street Storm Drain system has not been altered since its original design. The capacity of the Plaza Street system at Lake Street is 35cfs. An existing conditions StormCAD model of the Plaza Street system is located in the appendix.

Proposed improvements consist of a 30-inch Reinforced Concrete Pipe (RCP) in Third Street from the existing RCB system to the existing Plaza Street storm drain system, a 30-inch RCP following the existing Plaza Street storm drain system alignment to Center Street and a 36-inch RCP from Center Street to Lake Street along the Plaza Street storm drain alignment. The proposed system will convey 37cfs from the RCB system and 35cfs from the Plaza Street system to Lake Street where the proposed Evans storm drain system will intercept the existing Plaza Street system and convey the flow to the proposed Wells outfall structure.

Construction phasing cannot impact peak flow rates throughout the existing system. Please note that the RCB at Arlington Avenue should not be severed to the south and connected into the East Third Street Storm Drain System until the entire proposed downstream system from Arlington to the Wells Avenue outfall structure has been constructed and is in service.

A StormCAD model was prepared to determine the hydraulic grade line of the proposed East Third Street Storm Drain. The peak discharge of the system at Lake Street is 72cfs. All flow entering the existing Plaza Street system is conveyed in the proposed East Third Street Storm Drain system. The East Third Street Storm Drain ties into the Evans Avenue Storm Drain at Lake Street. A full flow capacity at Lake Street was assumed for the starting hydraulic grade line of the East Third Street system. The East Third Street Storm Drain combined flow of 72cfs will have no adverse impact on the Evans Street Storm Drain system due to the difference in the time of concentration for the peak flow rates of the system. There are therefore no adverse impacts to adjacent properties and no additional catch basins are needed.

Sincerely,

STANTEC CONSULTING INC.

Trina M. Magoon, PE
Water Resources Project Manager

TMM:
Enclosure(s)
P:\CIVIL\80100603\H&H\Design Memorandums\MEMO H&H 3rd St Design(IFC).doc

Stantec

1/16/05

KeTRAC
2x5 RCB
INLET ANALYSIS

80100605

ZRB

ATION

1) TYPE 3 ≈ 2' WIDE (NF)
4 ROWS 1" WIDE SLOTS
2" HEAD
1.5 cfs

2) TYPE 1 1' HEAD (WASHOE CHART) 3.25 cfs

3) TYPE 1 1/2' HEAD (WASHOE CHART) 2.3 cfs

4) TYPE 1 1/2' HEAD (WASHOE CHART) 2.3 cfs

5) TYPE 1 1/2' HEAD (WASHOE CHART) 2.3 cfs

6 MINI TYPE 4 3/4' HEAD (WASHOE CHART) 3.8 cfs

7) TYPE 3 1/4' HEAD (NF)
≈ 18" WIDE
1.4 cfs

→ 16.85 cfs

8) TYPE 3 1/4' HEAD (NF)
≈ 30" WIDE
3.5 cfs

8a) TYPE 3 1' HEAD (NF)
≈ 18" WIDE
2.9 cfs

9) TYPE 3 0.85' HEAD (NF)
≈ 18" WIDE
2.7 cfs

0) TYPE 3 0.65' HEAD (NF)
≈ 30" WIDE
7.8 cfs

Designed by: Checked by:

Stantec

11)	TYPE 1	0.3' HEAD	(WASHOE CHART)	1.2 cfs
12)	TYPE 1	0.5' HEAD	(WASHOE CHART)	2.3 cfs

——→ 30.4 cfs

TOTAL 37.25 cfs

Q_5 = 35.3 cfs

Designed by: Checked by:

(1)

Weir & Orifice Flow Comparison

$Q = 0.6A\sqrt{2gh}$

(Orifice Flow Equation)

Q = Capacity in CFS
A = Free open area of grate in sq. ft.
g = 32.2 (feet per sec/sec)
h = Head in feet

Orifice Information

Instructions:

- Either Select catalog number (will automatically fill in Open Area and Perimeter) or enter your own values
- Enter head value
- Press CALCULATE

The results will determine automatically if your situation falls into a Weir, Transitional or Orifice flow. Additionally, a pop-up window will offer Neenah grates which fall within the parameters chosen.

$Q = 3.3P(h)^{1.5}$

(Weir Equation)

Q = Capacity in CFS
P = Feet perimeter
h = Head in feet

Weir Information

Catalog number and grate type: R-2553 G

Head in feet (h): .17

Feet perimeter (P): 6.3

Calculate

Free open area in sq. ft. (A): 1.1

Weir capacity in cfs: 1.5

Transitional flow in cfs:

Orifice capacity in cfs:

(Results assume no debris restriction.)

NOTE: The above results do not account for the dome height of Beehive-type grates. Please take note of this when determining the Head (h) value.

For additional information regarding Neenah Inlet Grate Capacities, please contact our Product Engineer, Steve Akkala, at 920-725-7000 or at sakkala@nfco.com.

1

Weir & Orifice Flow Comparison

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- Enter head value
- Press CALCULATE

The results will determine automatically if your situation falls into a Weir, Transitional or Orifice flow. Additionally, a pop-up window will offer Neenah grates which fall within the parameters chosen.

$Q = 3.3P(h)^{1.5}$

(Weir Equation)

Q = Capacity in CFS
P = Feet perimeter
h = Head in feet

Weir Information

Catalog number and grate type: R-2525-E E

Head in feet (h): .25

Feet perimeter (P): 4.7

Calculate

Free open area in sq. ft. (A): 0.6

Weir capacity in cfs:

Transitional flow in cfs:

Orifice capacity in cfs: 1.4

(Results assume no debris restriction.)

NOTE: The above results do not account for the dome height of Beehive-type grates. Please take note of this when determining the Head (h) value.

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Weir & Orifice Flow Comparison

$Q = 0.6A\sqrt{2gh}$

(Orifice Flow Equation)

Q = Capacity in CFS
A = Free open area of grate in sq. ft.
g = 32.2 (feet per sec/sec)
h = Head in feet

Orifice Information

Instructions:

- Either Select catalog number (will automatically fill in Open Area and Perimeter) or enter your own values
- Enter head value
- Press CALCULATE

The results will determine automatically if your situation falls into a Weir, Transitional or Orifice flow. Additionally, a pop-up window will offer Neenah grates which fall within the parameters chosen.

$Q = 3.3P(h)^{1.5}$

(Weir Equation)

Q = Capacity in CFS
P = Feet perimeter
h = Head in feet

Weir Information

Catalog number and grate type: R-2557 G

Head in feet (h): .25

Feet perimeter (P): 8.4

Calculate

Free open area in sq. ft. (A): 2

Weir capacity in cfs: 3.5

Transitional flow in cfs:

Orifice capacity in cfs:

(Results assume no debris restriction.)

NOTE: The above results do not account for the dome height of Beehive-type grates. Please take note of this when determining the Head (h) value.

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Weir & Orifice Flow Comparison

$Q = 0.6A\sqrt{2gh}$

(Orifice Flow Equation)

Q = Capacity in CFS
A = Free open area of grate in sq. ft.
g = 32.2 (feet per sec/sec)
h = Head in feet

Orifice Information

Instructions:

- Either Select catalog number (will automatically fill in Open Area and Perimeter) or enter your own values
- Enter head value
- Press CALCULATE

The results will determine automatically if your situation falls into a Weir, Transitional or Orifice flow. Additionally, a pop-up window will offer Neenah grates which fall within the parameters chosen.

$Q = 3.3P(h)^{1.5}$

(Weir Equation)

Q = Capacity in CFS
P = Feet perimeter
h = Head in feet

Weir Information

Catalog number and grate type: R-2525-E E

Head in feet (h): 1

Feet perimeter (P): 4.7

Calculate

Free open area in sq. ft. (A): 0.6

Weir capacity in cfs:

Transitional flow in cfs:

Orifice capacity in cfs: 2.9

(Results assume no debris restriction.)

NOTE: The above results do not account for the dome height of Beehive-type grates. Please take note of this when determining the Head (h) value.

For additional information regarding Neenah Inlet Grate Capacities, please contact our Product Engineer, Steve Akkala, at 920-725-7000 or at sakkala@nfco.com.

(9)

Weir & Orifice Flow Comparison

$$Q = 0.6A\sqrt{2gh}$$

(Orifice Flow Equation)

Q = Capacity in CFS
A = Free open area of grate in sq. ft.
g = 32.2 (feet per sec/sec)
h = Head in feet

Orifice Information

Instructions:

- Either Select catalog number (will automatically fill in Open Area and Perimeter) or enter your own values
- Enter head value
- Press CALCULATE

The results will determine automatically if your situation falls into a Weir, Transitional or Orifice flow. Additionally, a pop-up window will offer Neenah grates which fall within the parameters chosen.

$$Q = 3.3P(h)^{1.5}$$

(Weir Equation)

Q = Capacity in CFS
P = Feet perimeter
h = Head in feet

Weir Information

Catalog number and grate type: R-2525-E E

Head in feet (h): .85

Feet perimeter (P): 4.7

Calculate

Free open area in sq. ft. (A): 0.6

Weir capacity in cfs:

Transitional flow in cfs:

Orifice capacity in cfs: 2.7

(Results assume no debris restriction.)

NOTE: The above results do not account for the dome height of Beehive-type grates. Please take note of this when determining the Head (h) value.

For additional information regarding Neenah Inlet Grate Capacities, please contact our Product Engineer, Steve Akkala, at 920-725-7000 or at sakkala@nfco.com.

Weir & Orifice Flow Comparison

$$Q = 0.6A\sqrt{2gh}$$

(Orifice Flow Equation)

Q = Capacity in CFS
A = Free open area of grate in sq. ft.
g = 32.2 (feet per sec/sec)
h = Head in feet

Orifice Information

Instructions:

- Either Select catalog number (will automatically fill in Open Area and Perimeter) or enter your own values
- Enter head value
- Press CALCULATE

The results will determine automatically if your situation falls into a Weir, Transitional or Orifice flow. Additionally, a pop-up window will offer Neenah grates which fall within the parameters chosen.

$$Q = 3.3P(h)^{1.5}$$

(Weir Equation)

Q = Capacity in CFS
P = Feet perimeter
h = Head in feet

Weir Information

Catalog number and grate type: R-2557 G

Head in feet (h): .65

Feet perimeter (P): 8.4

Calculate

Free open area in sq. ft. (A): 2

Weir capacity in cfs:

Transitional flow in cfs:

Orifice capacity in cfs: 7.8

(Results assume no debris restriction.)

NOTE: The above results do not account for the dome height of Beehive-type grates. Please take note of this when determining the Head (h) value.

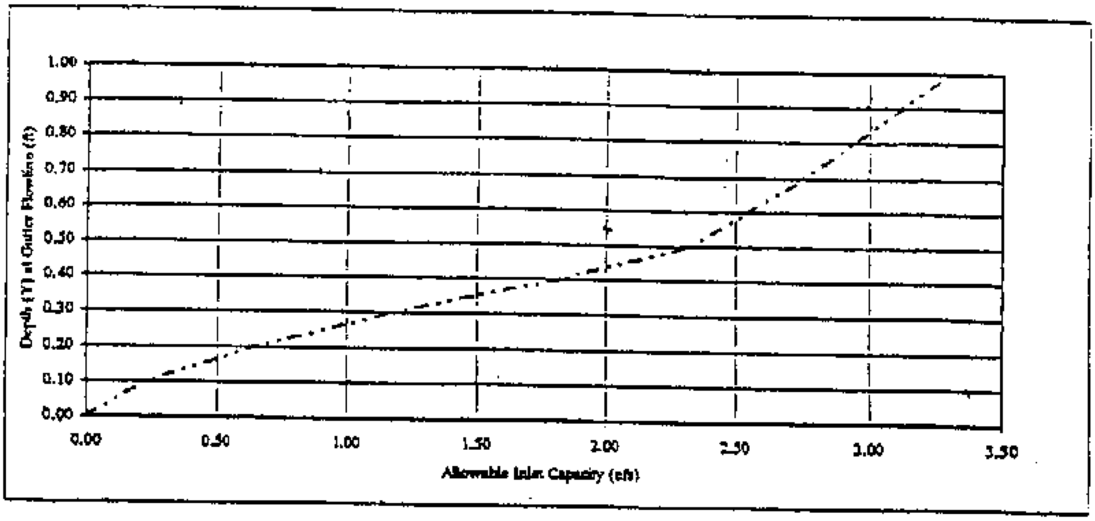
For additional information regarding Neenah Inlet Grate Capacities, please contact our Product Engineer, Steve Akkala, at 920-725-7000 or at sakkala@nfco.com.

WASHOE COUNTY

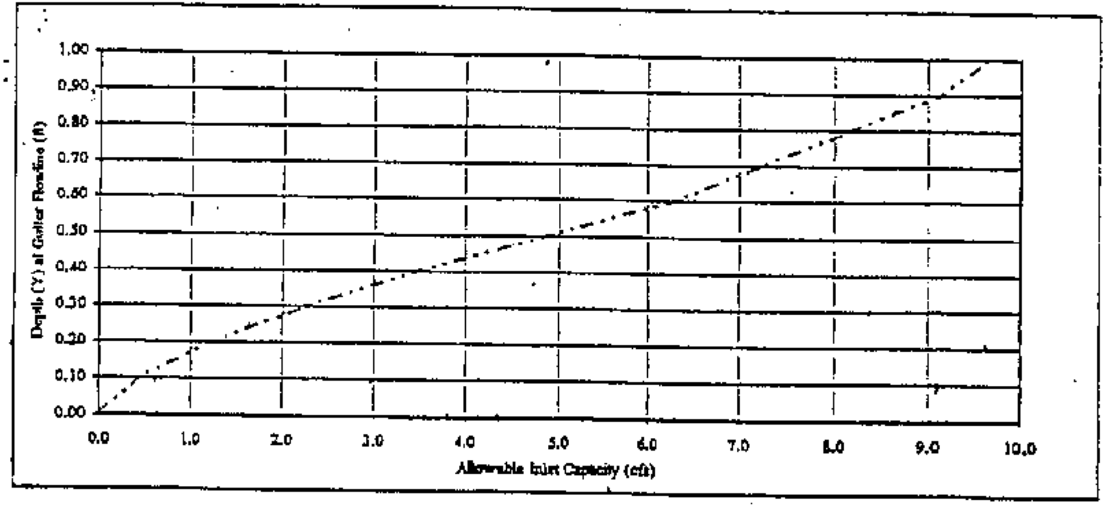
HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

ALLOWABLE INLET CAPACITY
SUMP CONDITION

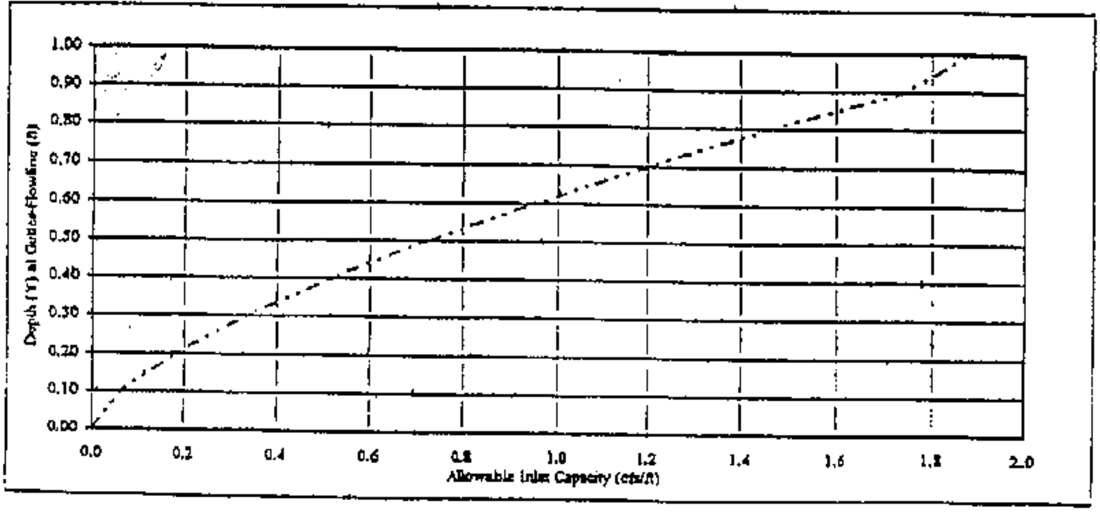
SINGLE CATCH BASIN TYPE 1



SINGLE CATCH BASIN TYPE 4-R



CATCH BASIN TYPE 2



NOTE: 1) INCLUDES CAPACITY REDUCTION FACTOR OF 0.5 FOR GRATE AND 0.7 FOR CURB OPERNING

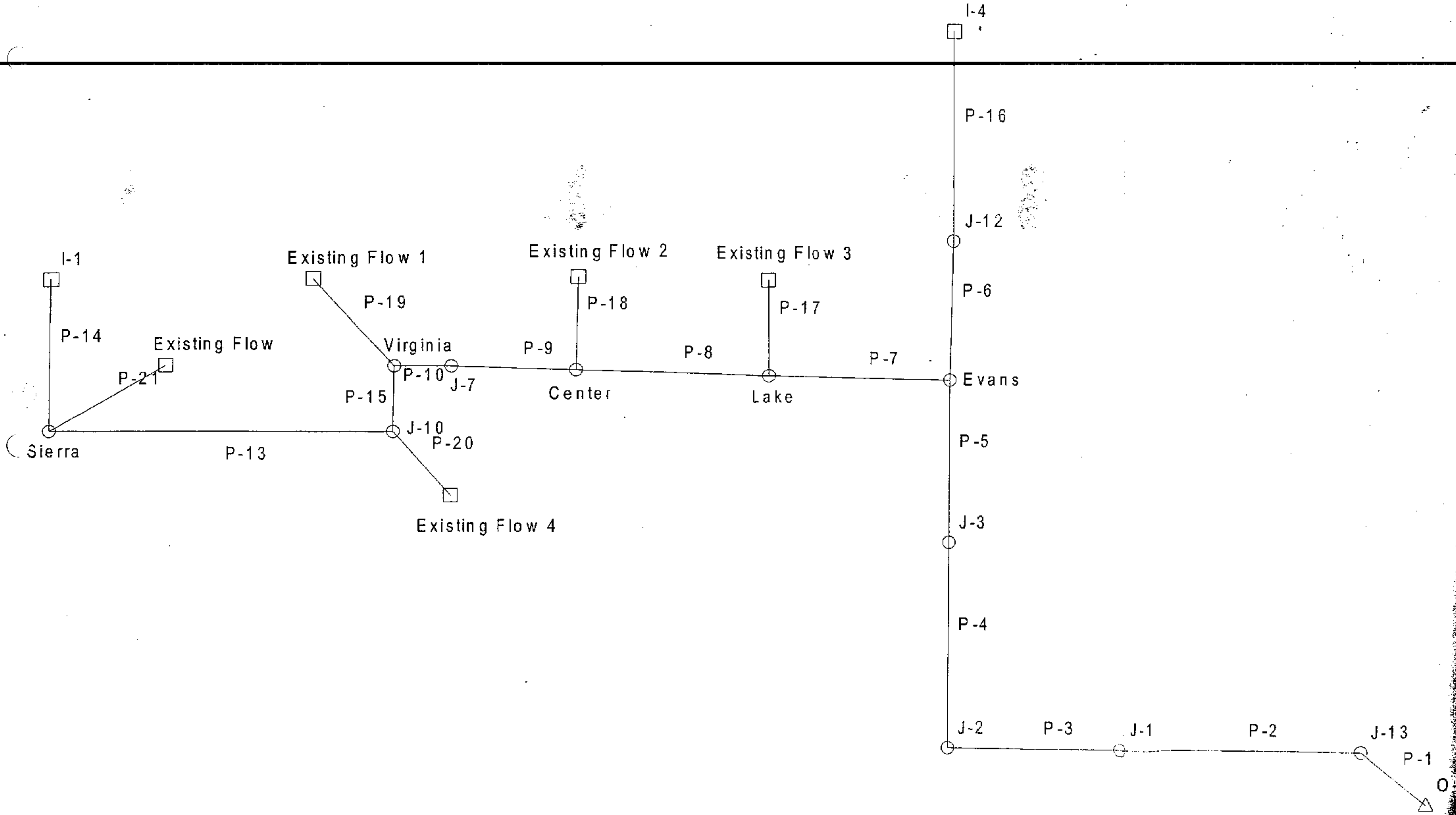
VERSION: December 2, 1996

REFERENCE:

FIGURE

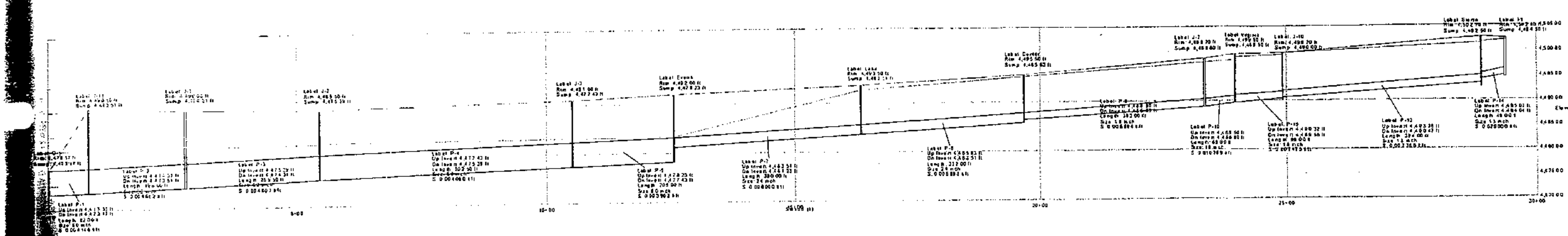
rio: Base
ISTING
Combined Pipe/Node Report

Label	Upstream Node	Downstream Node	Length (ft)	Section Size	Capacity (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Calculated Headloss (ft)	Energy Grade In (ft)	Energy Grade Ou (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Ou (ft)	Total System Flow (cfs)
P-21	Existing Fl	Sierra	50.00	18 inch	14.85	1.13	4,493.50	4,492.50	0.020000	0.02	,501.78	4,501.76	4,501.76	4,501.74	2.00
P-14	I-1	Sierra	49.00	15 inch	9.14	4.07	4,495.02	4,494.04	0.020000	0.29	,502.29	4,502.00	4,502.03	4,501.74	5.00
P-13	Sierra	J-10	394.00	18 inch	9.03	3.96	4,493.38	4,490.47	0.007386	1.75	,501.66	4,499.91	4,501.42	4,499.67	7.00
P-20	Existing Fl	J-10	50.00	18 inch	14.85	0.00	4,491.00	4,490.00	0.020000	0.00	,499.67	4,499.67	4,499.67	4,499.67	0.00
P-19	Existing Fl	Virginia	50.00	18 inch	14.85	1.13	4,490.50	4,489.50	0.020000	0.02	,498.94	4,498.92	4,498.92	4,498.90	2.00
P-15	J-10	Virginia	99.00	18 inch	9.08	3.96	4,490.32	4,489.58	0.007475	0.44	,499.59	4,499.15	4,499.34	4,498.90	7.00
P-10	Virginia	J-7	65.00	18 inch	10.90	5.09	4,489.50	4,488.80	0.010769	0.48	,498.78	4,498.30	4,498.37	4,497.89	9.00
P-18	Existing Fl	Center	50.00	24 inch	31.99	3.50	4,486.83	4,485.83	0.020000	0.12	,495.53	4,495.41	4,495.34	4,495.22	11.00
P-9	J-7	Center	363.00	18 inch	8.66	5.09	4,488.80	4,486.33	0.006804	2.67	,498.29	4,495.62	4,497.89	4,495.22	9.00
P-8	Center	Lake	332.00	24 inch	18.91	6.37	4,485.83	4,483.51	0.006988	2.60	,495.84	4,493.24	4,495.21	4,492.61	20.00
P-17	Existing Fl	Lake	50.00	24 inch	31.83	4.77	4,484.50	4,483.51	0.019800	0.22	,493.19	4,492.97	4,492.83	4,492.61	15.00
P-16	I-4	J-12	430.00	48 inch	95.73	5.23	4,482.21	4,480.30	0.004442	0.50	,484.83	4,483.80	4,484.10	4,483.60	40.00
P-7	Lake	Evans	380.00	24 inch	17.52	11.14	4,483.51	4,481.23	0.006000	9.10	,494.50	4,485.41	4,492.58	4,483.48	35.00
P-6	J-12	Evans	341.00	54 inch	125.09	2.60	4,479.61	4,478.23	0.004047	0.12	,483.71	4,483.58	4,483.60	4,483.48	40.00
P-5	Evans	J-3	205.00	60 inch	162.69	3.82	4,478.23	4,477.43	0.003902	0.17	,483.65	4,483.48	4,483.42	4,483.25	75.00
P-4	J-3	J-2	502.50	60 inch	165.93	3.82	4,477.43	4,475.39	0.004060	0.42	,483.47	4,483.06	4,483.25	4,482.83	75.00
P-3	J-2	J-1	269.50	60 inch	164.86	3.82	4,475.39	4,474.31	0.004007	0.22	,482.76	4,482.53	4,482.53	4,482.31	75.00
P-2	J-1	J-13	196.00	60 inch	166.38	3.82	4,474.31	4,473.51	0.004082	0.16	,482.53	4,482.37	4,482.30	4,482.14	75.00
P-1	J-13	O-1	82.00	60 inch	167.70	3.82	4,473.51	4,473.17	0.004146	0.07	,482.29	4,482.23	4,482.07	4,482.00	75.00


I-4
P-16
J-12
I-1
Existing Flow 1
Existing Flow 2
Existing Flow 3
P-19
P-18
P-17
P-6
P-14
Existing Flow
Virginia
P-9
P-8
P-7
P-21
P-10
J-7
Center
Lake
Evans
P-15
J-10
P-20
Sierra
P-13
P-5
Existing Flow 4
J-3
P-4
J-2
P-3
J-1
P-2
J-13
P-1
O

Scenario: Base

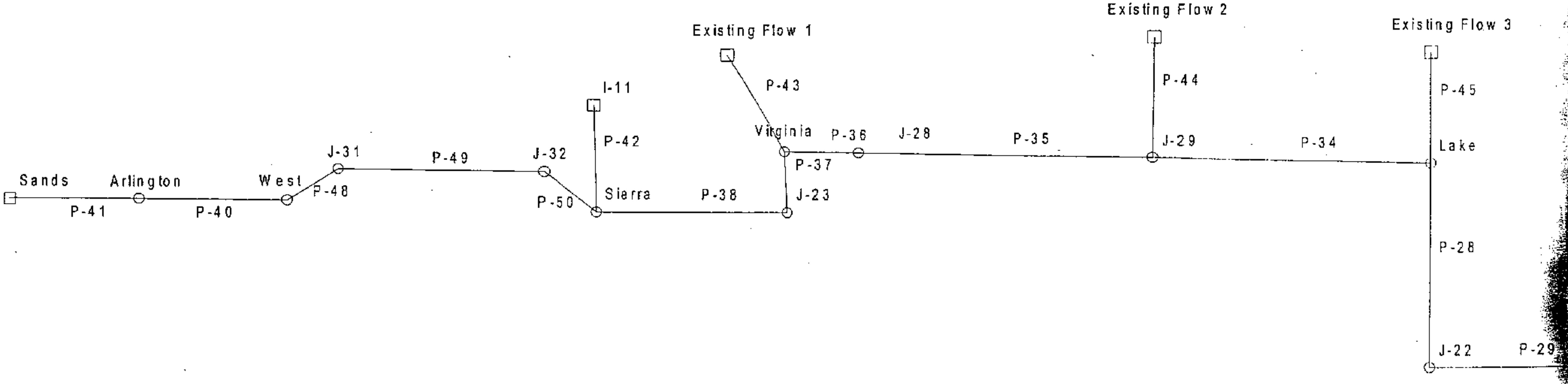
EXISTING



rio: Base
PROPOSED
Combined Pipe/Node Report

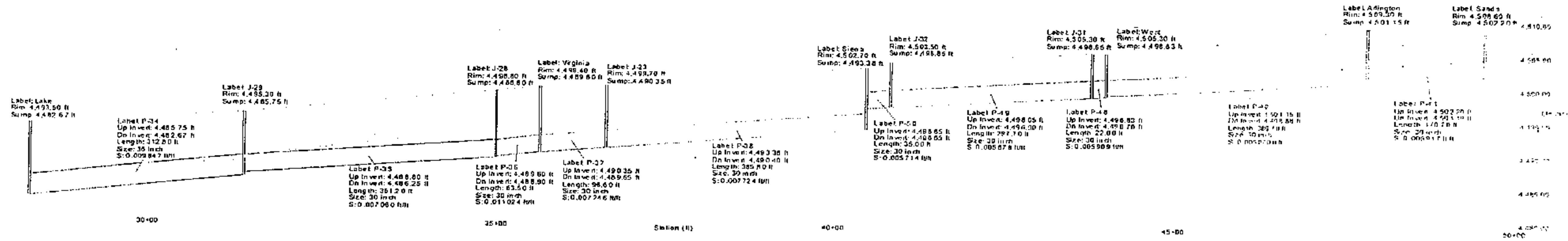
Label	Upstream Node	Downstream Node	Length (ft)	Section Size	Capacity (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Calculated Headloss (ft)	Energy Grade In (ft)	Energy Grade Ou (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Ou (ft)	Total System Flow (cfs)
P-41	Sands	Arlington	170.70	30 inch	31.55	7.54	4,502.20	4,501.19	0.005917	1.39	4,509.03	4,507.64	4,508.15	4,506.76	37.00
P-40	Arlington	West	386.70	30 inch	31.42	7.54	4,501.15	4,498.88	0.005870	3.15	4,507.63	4,504.48	4,506.74	4,503.60	37.00
P-48	West	J-31	22.00	30 inch	31.53	7.54	4,498.83	4,498.70	0.005909	0.18	4,504.37	4,504.19	4,503.49	4,503.31	37.00
P-49	J-31	J-32	297.70	30 inch	31.45	7.54	4,498.65	4,496.90	0.005878	2.42	4,504.09	4,501.67	4,503.21	4,500.78	37.00
P-50	J-32	Sierra	35.00	30 inch	31.00	7.54	4,496.85	4,496.65	0.005714	0.28	4,501.54	4,501.26	4,500.66	4,500.37	37.00
P-42	I-11	Sierra	49.00	15 inch	9.14	5.70	4,495.02	4,494.04	0.020000	0.58	4,501.46	4,500.88	4,500.95	4,500.37	7.00
P-38	Sierra	J-23	385.80	30 inch	36.05	8.96	4,493.38	4,490.40	0.007724	4.44	4,501.45	4,497.01	4,500.20	4,495.76	44.00
P-43	Existing Fl	Virginia	50.00	84 inch	857.04	0.08	4,490.50	4,489.60	0.018000	-4.14e-5	4,494.34	4,494.34	4,494.34	4,494.34	2.00
P-37	J-23	Virginia	96.60	30 inch	34.91	6.96	4,490.35	4,489.65	0.007246	1.11	4,496.70	4,495.58	4,495.45	4,494.34	44.00
P-36	Virginia	J-28	63.50	30 inch	43.06	9.37	4,489.60	4,488.90	0.011024	0.80	4,495.36	4,494.56	4,493.99	4,493.20	46.00
P-44	Existing Fl	J-29	50.00	84 inch	903.40	1.54	4,486.83	4,485.83	0.020000	-0.05	4,488.25	4,488.24	4,488.17	4,488.22	11.00
P-35	J-28	J-29	361.20	30 inch	34.46	9.64	4,488.80	4,486.25	0.007060	4.68	4,494.53	4,490.02	4,493.17	4,488.49	46.00
P-34	J-29	Lake	312.80	36 inch	66.18	8.65	4,485.75	4,482.67	0.009847	2.06	4,489.52	4,487.15	4,488.20	4,486.14	57.00
P-45	Existing Fl	Lake	50.00	84 inch	903.40	1.21	4,484.00	4,483.00	0.020000	-0.02	4,486.15	4,486.15	4,486.12	4,486.14	15.00
P-6	Evans	J-4	341.00	54 inch	125.09	4.00	4,479.61	4,478.23	0.004047	0.02	4,482.25	4,481.96	4,481.85	4,481.83	40.00
P-28	Lake	J-22	100.00	36 inch	144.59	10.49	4,483.00	4,478.30	0.047000	1.85	4,487.49	4,485.44	4,485.68	4,483.83	72.00
P-5	J-4	J-3	82.00	60 inch	165.21	2.53	4,478.23	4,477.90	0.004024	0.01	4,481.93	4,481.91	4,481.83	4,481.82	40.00
P-29	J-22	J-3	350.00	42 inch	43.35	7.48	4,478.25	4,477.60	0.001857	1.79	4,484.48	4,482.69	4,483.61	4,481.82	72.00
P-11	J-3	J-18	515.00	60 inch	246.13	7.37	4,477.10	4,472.50	0.008932	1.35	4,481.39	4,479.28	4,480.12	4,478.77	112.00
P-27	Record.	J-18	80.00	5 x 5 ft	203.06	10.81	4,475.30	4,475.00	0.003750	0.76	4,481.42	4,481.05	4,479.80	4,479.04	230.00
P-12	J-18	J-17	387.00	84 inch	454.61	10.89	4,472.50	4,470.54	0.005065	0.89	4,479.60	4,477.98	4,477.37	4,476.48	342.00
P-31	J-17	J-14	311.00	84 inch	401.73	9.53	4,470.54	4,469.31	0.003955	0.58	4,477.95	4,477.14	4,476.42	4,475.84	342.00
P-46	J-14	J-30	562.00	84 inch	405.09	9.02	4,469.26	4,467.00	0.004021	1.48	4,477.09	4,475.54	4,475.79	4,474.32	342.00
P-30	I-7	J-16	100.00	60 inch	260.43	2.43	4,469.70	4,468.70	0.010000	-1.75e-3	4,473.79	4,473.76	4,473.68	4,473.68	44.00
P-47	J-30	J-16	204.00	84 inch	417.16	8.89	4,466.97	4,466.10	0.004265	0.58	4,475.49	4,474.91	4,474.27	4,473.68	342.00
P-20	J-16	J-19	75.00	12 x 4 f	439.27	8.04	4,466.10	4,465.82	0.003733	0.22	4,474.28	4,474.07	4,473.28	4,473.06	386.00
P-25	I-3	J-20	200.00	12 inch	9.08	0.00	4,481.00	4,468.00	0.065000	8.63	4,481.00	4,472.37	4,481.00	4,472.37	0.00
P-21	J-19	J-20	235.00	12 x 4 f	331.62	8.04	4,465.80	4,465.30	0.002128	0.68	4,474.05	4,473.37	4,473.04	4,472.37	386.00
P-26	I-4	J-20	200.00	12 inch	9.76	0.00	4,483.00	4,468.00	0.075000	10.63	4,483.00	4,472.37	4,483.00	4,472.37	0.00
P-33	J-20	O-1	85.00	12 x 4 f	427.11	8.04	4,465.30	4,465.00	0.003529	0.25	4,473.25	4,473.00	4,472.25	4,472.00	386.00

Scenario: Base



Scenario: Base

PROPOSED



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Stantec Consulting Inc
© Haestad Methods, Inc. 37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Project Engineer: Stantec
StormCAD v3.0 [319]
Page 1 of 1

— W —	UNDERGROUND WATER LINE
FH	FIRE HYDRANT
WV ⋈	WATER VALVE
— G —	GAS LINE
GV ⋈	GAS VALVE
— C —	UNDERGROUND CABLE TELEVISION
— T —	UNDERGROUND TELEPHONE/TELECOMMUNICATIONS
— OHT —	OVERHEAD TELEPHONE
T	TELEPHONE VAULT
Ⓣ	TELEPHONE MANHOLE
— EU —	UNDERGROUND ELECTRIC
— OHE —	OVERHEAD ELECTRIC
— UGE/T —	UNDERGROUND ELECTRIC/TELECOMMUNICATIONS
	UTILITY POLE
— SS —	SANITARY SEWER LINE
○ S	SANITARY SEWER MANHOLE
▨ OR ◫	DROP INLET
— SD —	STORM DRAIN LINE
○ D	STORM DRAIN MANHOLE
— - - —	PROPERTY BOUNDARY
— F —	FUEL LINE
— X —	FENCE

CITY OF RENO, NEVADA

PUBLIC WORKS DEPARTMENT

Reno Transportation Rail Access Corridor (ReTRAC)

EAST THIRD STREET STORM DRAIN

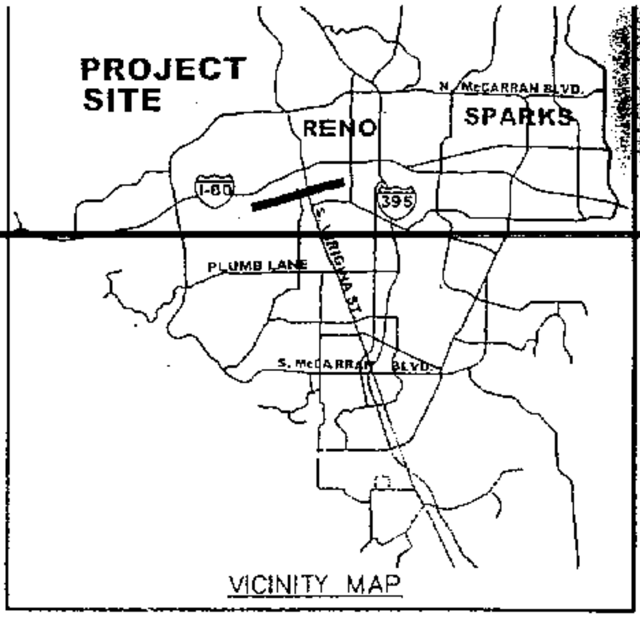
NORTH ARLINGTON AVENUE TO LAKE STREET

60% SUBMITTAL

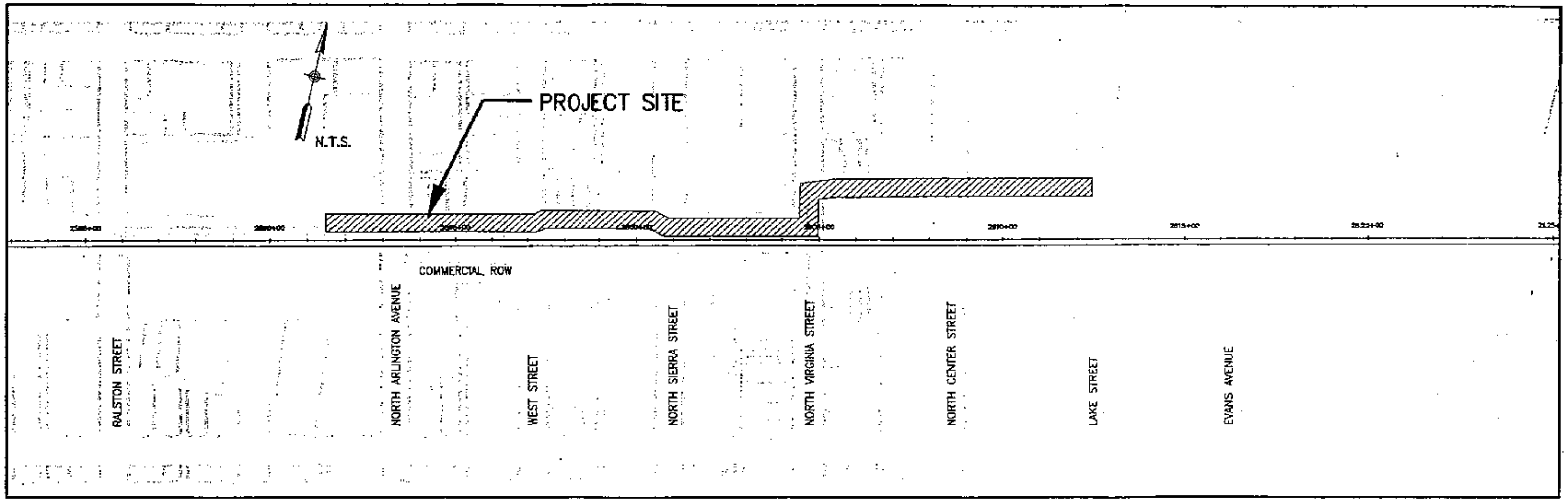
MARCH 28, 2003

TO BE SUPPLEMENTED BY ReTRAC PROJECT STANDARD DETAILS

ReTRAC THE GRANITE TEAM



VICINITY MAP



SHEET INDEX

SHEET NO.	DESCRIPTION
SD-201	PLAN/PROFILE STA. 0+00 TO STA. 6+75 N. ARLINGTON AVE. TO LAKE ST.
SD-202	PLAN/PROFILE STA. 6+75 TO STA. 13+50 N. ARLINGTON AVE. TO LAKE ST.
SD-203	PLAN/PROFILE STA. 13+50 TO STA. 19+50 N. ARLINGTON AVE. TO LAKE ST.
SD-204	PLAN/PROFILE STA. 19+50 TO STA. 21+97 N. ARLINGTON AVE. TO LAKE ST.
SD-907	STORM DRAIN MANHOLE BENDS
SD-908	EXISTING RCB CONNECTION
SD-909	STORM DRAIN DETAILS

STANDARD DETAILS

R-120	R-209A
R-121	R-209B
R-122	R-217
R-123A	R-213
R-123B	R-218
R-123C	R-221
R-206	2-12

SUBMITTED BY:

TED ROWORTH, P.E. DATE
PROJECT DESIGN MANAGER
PARSONS TRANSPORTATION GROUP

APPROVED BY:

DON OLBERT DATE
QUALITY ASSURANCE MANAGER
GRANITE CONSTRUCTION COMPANY

APPROVED BY:

JOHN SPARNICHT, P.E. DATE
ReTRAC PROJECT MANAGER
CITY OF RENO

2-WORKING DAYS Call before you Dig.
1-800-227-2600

BENCHMARK: FOR SURVEY CONTROL & BASIS OF BEARING. SEE PROJECT SURVEY CONTROL PLANS

The Contractor shall possess the Class (or Classes) of license as specified in the "Notice to Contractors".

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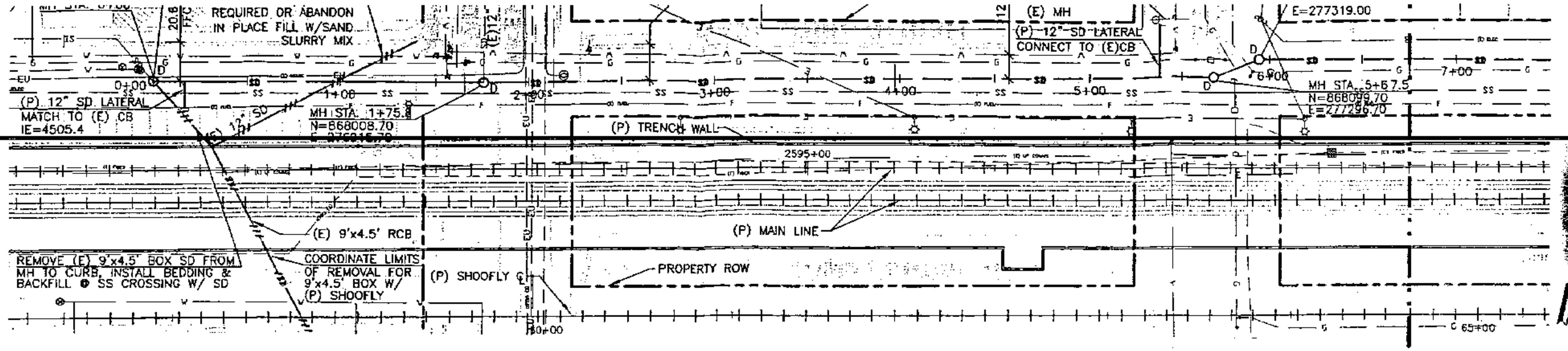
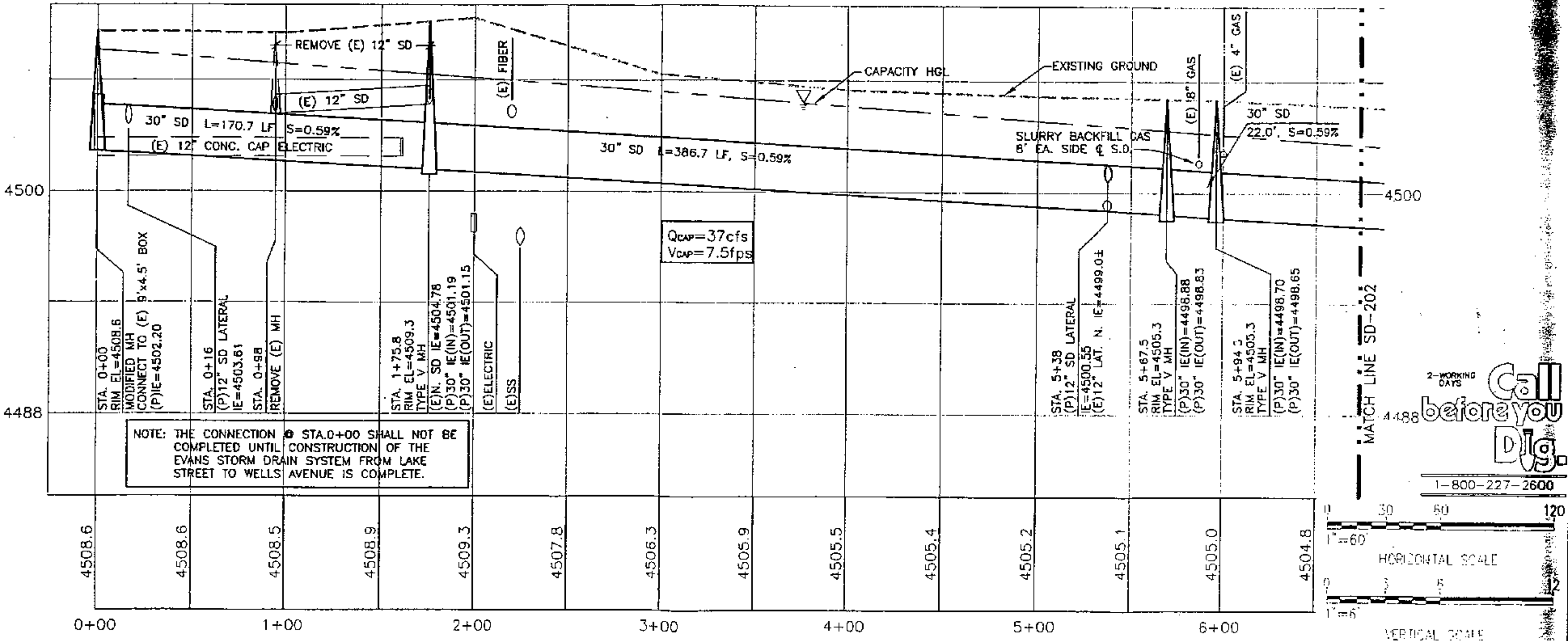


NOTES:

1. FROM STA.9+38.2 EAST TO LAKE ST. STORM DRAIN TO BE LOCATED ALONG SAME ALIGNMENT AS THE EXISTING SYSTEM.
2. CONTRACTOR TO RECONNECT ALL EXISTING STORM DRAIN CB LATERALS.
3. CONTRACTOR TO RECONNECT ALL OTHER UTILITY SERVICE LATERALS.
4. ALL MANHOLE RIM FINISHED ELEVATIONS TO BE ADJUSTED TO MATCH EXISTING AND NEW FINISHED STREET SURFACE ELEVATIONS.
5. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE PROJECT GENERAL SPECIFICATIONS AND STANDARD DETAILS.
6. REFER TO PROJECT SURVEY PLAN FOR HORIZONTAL AND VERTICAL CONTROL.
7. LINE TESTING SHALL BE IN ACCORDANCE WITH THE PROJECT GENERAL SPECIFICATIONS.

PIPE MATERIAL OPTIONS

1. CLASS III RCP TONGUE & GROOVE PIPE.
2. PVC SEWER PIPE IN ACCORDANCE WITH ASTM F679 AS MANUFACTURED BY DIAMOND PLASTICS CORP OR J-M PIPE.
3. PVC SHALL HAVE A MINIMUM PIPE STIFFNESS OF 46 psi.
4. REFER TO STANDARD DETAIL R-209A FOR TYPE V MH.



REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY LWL
DRAWN BY LWL/CF
CHECKED BY JE
IN CHARGE JE
DATE 3/28/03

60% SUBMITTAL
NOT FOR CONSTRUCTION

RENO ReTRAC
RENO WASHOE COUNTY NEVADA

ReTRAC THE GRANITE TEAM

SUBMITTED ______
APPROVED ______

RENO ReTRAC
EAST THIRD STREET STORM DRAIN
N. ARLINGTON AVE. TO LAKE ST.
PLAN/PROFILE
STA. 0+00 TO STA. 6+75

CONTRACT NO.
DRAWING NO. SD-201
REV 0
SCALE AS SHOWN
SHEET NO. 3

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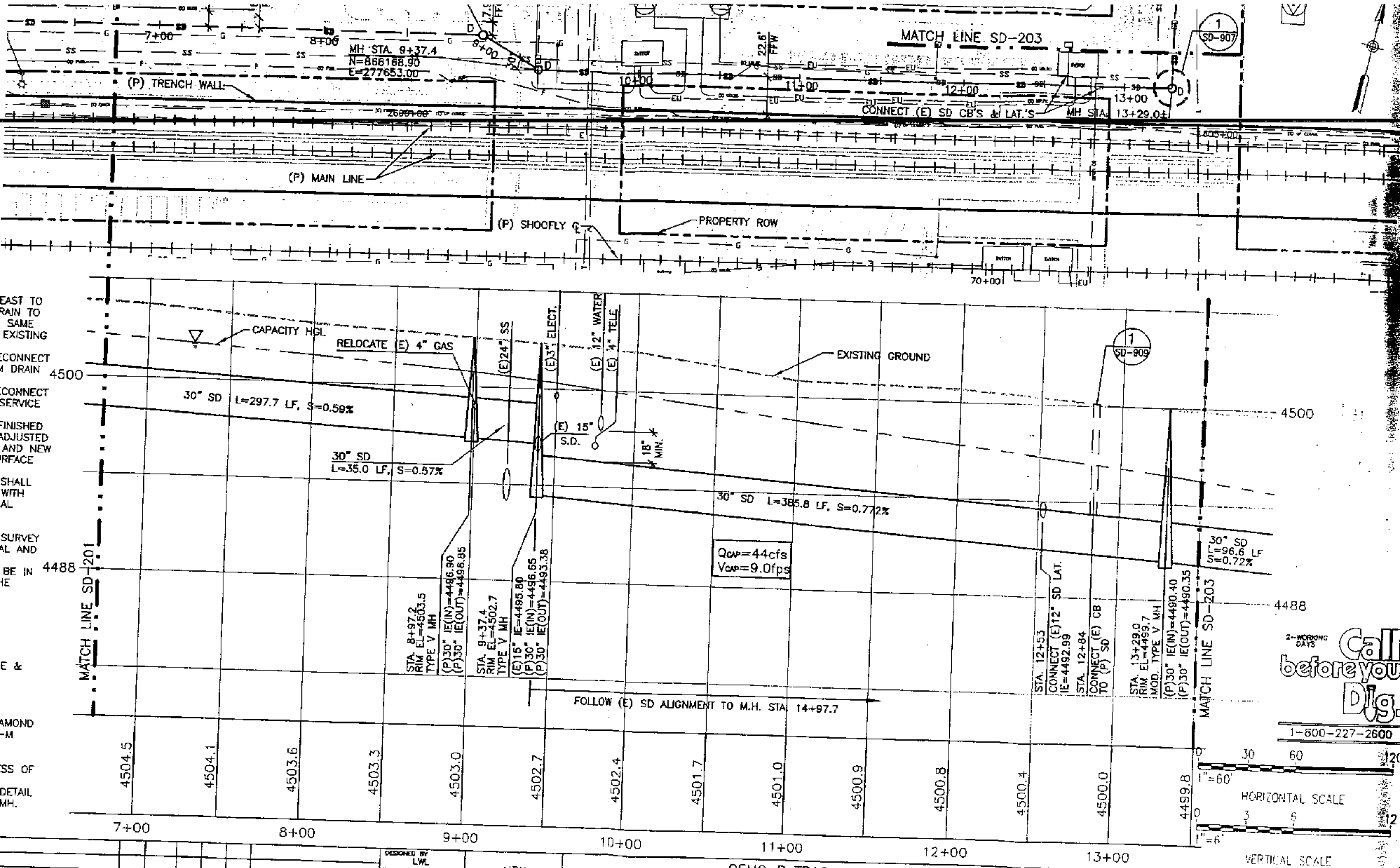

NOTES:

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REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY LWL
DRAWN BY LWL/CF
CHECKED BY JE
IN CHARGE JE
DATE 3/28/03

60% SUBMITTAL
NOT FOR CONSTRUCTION

RENO ReTRAC
RENO WASHOE COUNTY NEVADA
ReTRAC THE GRANITE TEAM
SUBMITTED
APPROVED

RENO ReTRAC
EAST THIRD STREET STORM DRAIN
N. ARLINGTON AVE. TO LAKE ST.
PLAN/PROFILE
STA. 6+75 TO STA. 13+50

CONTRACT NO.
DRAWING NO. SD-202
REV 0
SCALE AS SHOWN
SHEET NO. 8

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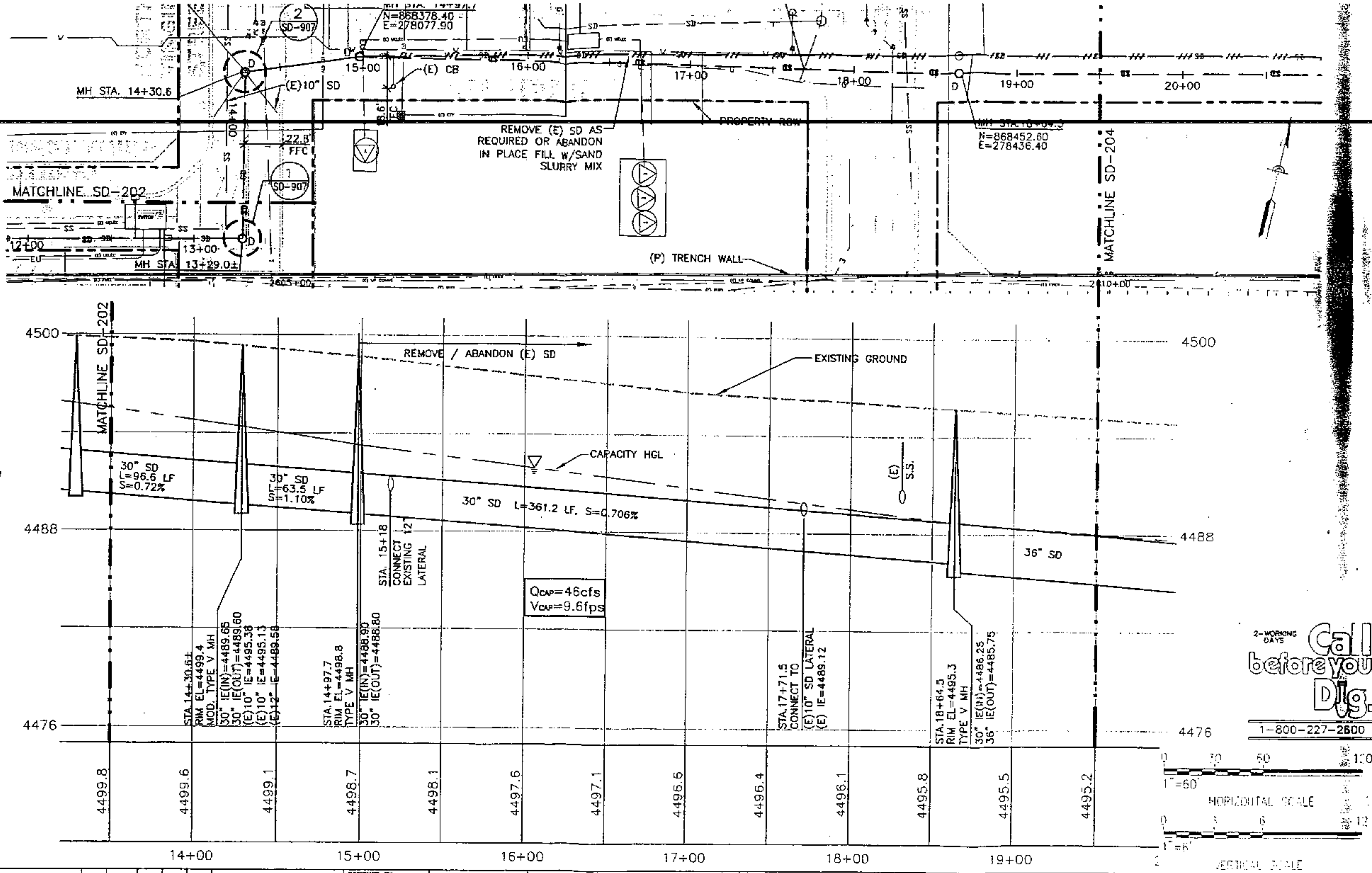


NOTES:

1. FROM STA.9+38.2 EAST TO LAKE ST. STORM DRAIN TO BE LOCATED ALONG SAME ALIGNMENT AS THE EXISTING SYSTEM.
2. CONTRACTOR TO RECONNECT ALL EXISTING STORM DRAIN CB LATERALS.
3. CONTRACTOR TO RECONNECT ALL OTHER UTILITY SERVICE LATERALS.
4. ALL MANHOLE RIM FINISHED ELEVATIONS TO BE ADJUSTED TO MATCH EXISTING AND NEW FINISHED STREET SURFACE ELEVATIONS.
5. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE PROJECT GENERAL SPECIFICATIONS AND STANDARD DETAILS.
6. REFER TO PROJECT SURVEY PLAN FOR HORIZONTAL AND VERTICAL CONTROL.
7. LINE TESTING SHALL BE IN ACCORDANCE WITH THE PROJECT GENERAL SPECIFICATIONS.

PIPE MATERIAL OPTIONS

1. CLASS III RCP TONGUE & GROOVE PIPE.
2. PVC SEWER PIPE IN ACCORDANCE WITH ASTM F679 AS MANUFACTURED BY DIAMOND PLASTICS CORP OR J-M PIPE.
3. PVC SHALL HAVE A MINIMUM PIPE STIFFNESS OF 46 psi.
4. REFER TO STANDARD DETAIL R-209A FOR TYPE V MH.

REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY LWL
DRAWN BY LWL/CF
CHECKED BY JE
IN CHARGE JE
DATE 3/28/03

60% SUBMITTAL
NOT FOR CONSTRUCTION

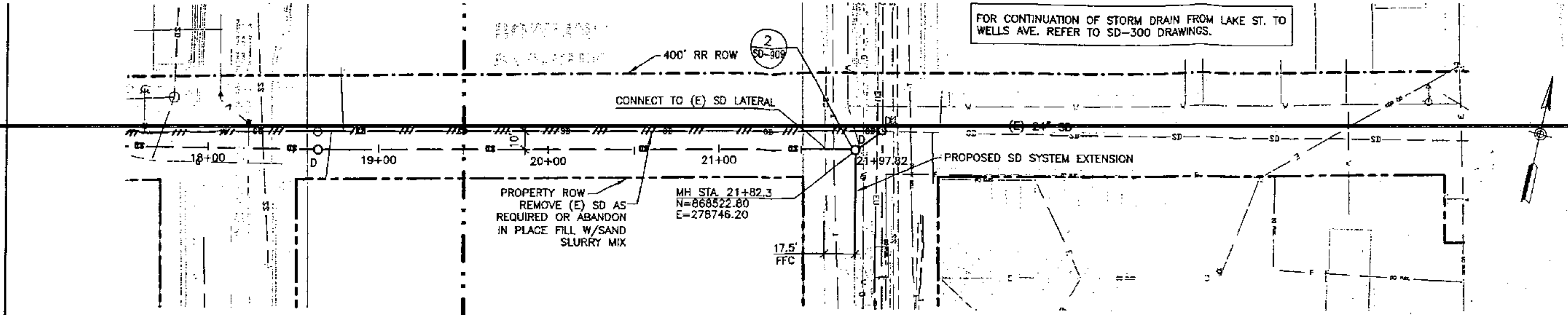
RENO ReTRAC
RENO WASHOE COUNTY NEVADA

ReTRAC THE GRANITE TEAM
SUBMITTED
APPROVED

RENO ReTRAC
EAST THIRD STREET STORM DRAIN
N. ARLINGTON AVE. TO LAKE ST.
PLAN/PROFILE
STA. 13+50 TO STA. 19+50

CONTRACT NO.
DRAWING NO. SD-203
SCALE AS SHOWN
SHEET NO. of 8

P:\18000-SD3rd\Civil\DWG\RoT[illegible] 03/28/03 03:48:51 PM

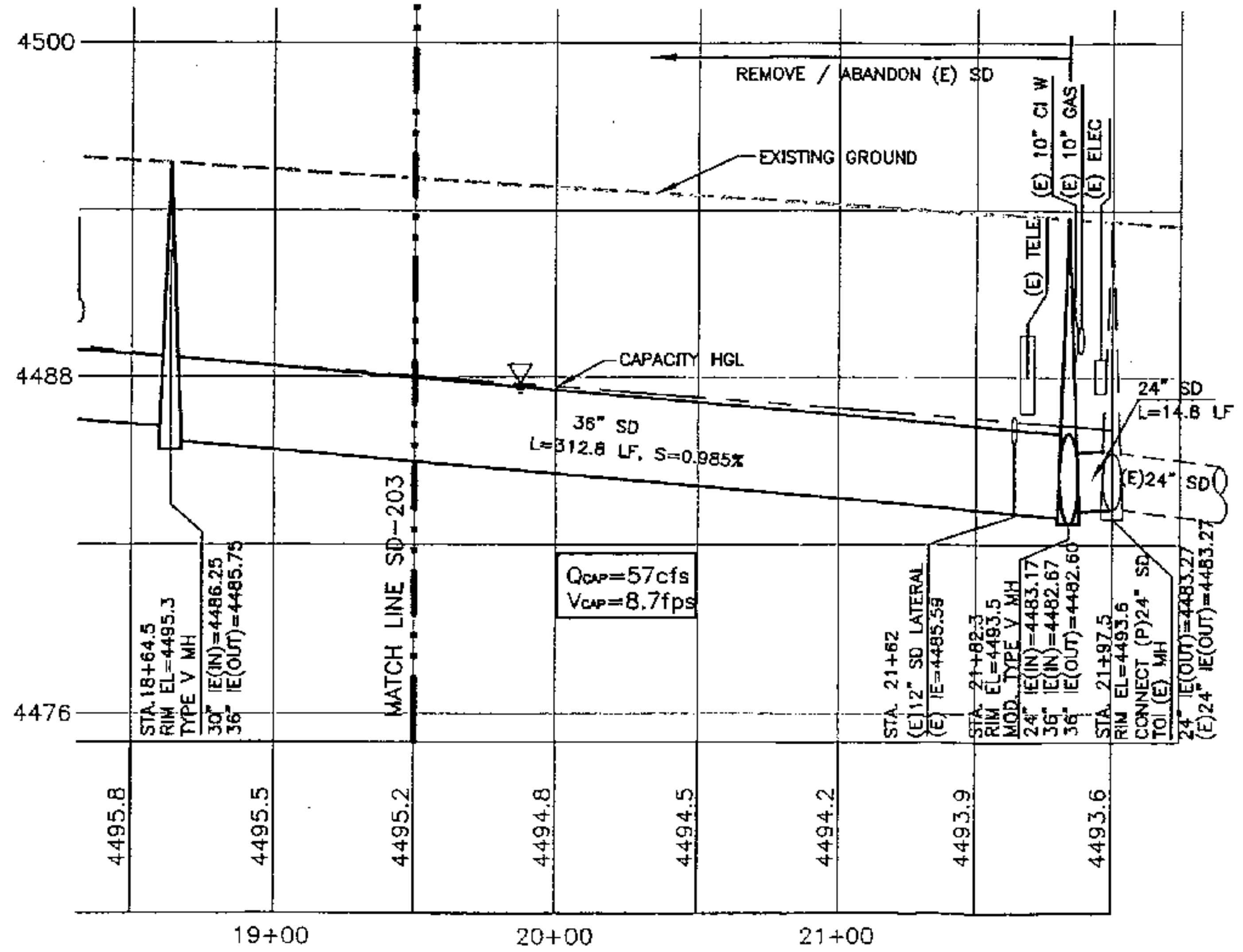


NOTES:

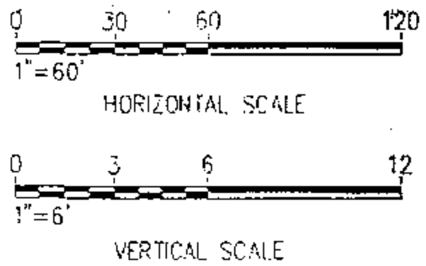
1. FROM STA.9+38.2 EAST TO LAKE ST. STORM DRAIN TO BE LOCATED ALONG SAME ALIGNMENT AS THE EXISTING SYSTEM.
2. CONTRACTOR TO RECONNECT ALL EXISTING STORM DRAIN CB LATERALS.
3. CONTRACTOR TO RECONNECT ALL OTHER UTILITY SERVICE LATERALS.
4. ALL MANHOLE RIM FINISHED ELEVATIONS TO BE ADJUSTED TO MATCH EXISTING AND NEW FINISHED STREET SURFACE ELEVATIONS.
5. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE PROJECT GENERAL SPECIFICATIONS AND STANDARD DETAILS.
6. REFER TO PROJECT SURVEY PLAN FOR HORIZONTAL AND VERTICAL CONTROL.
7. LINE TESTING SHALL BE IN ACCORDANCE WITH THE PROJECT GENERAL SPECIFICATIONS.

PIPE MATERIAL OPTIONS

1. CLASS III RCP TONGUE & GROOVE PIPE.
2. PVC SEWER PIPE IN ACCORDANCE WITH ASTM F679 AS MANUFACTURED BY DIAMOND PLASTICS CORP OR J-M PIPE.
3. PVC SHALL HAVE A MINIMUM PIPE STIFFNESS OF 46 psi.
4. REFER TO STANDARD DETAIL R-209A FOR TYPE V MH.



2-WORKING DAYS Call before you Dig.
1-800-227-2600



REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY LWL
DRAWN BY LWL/CF
CHECKED BY JE
IN CHARGE JE
DATE 3/28/03

60% SUBMITTAL
NOT FOR CONSTRUCTION

RENO ReTRAC
RENO WASHOE COUNTY NEVADA
ReTRAC THE GRANITE TEAM
SUBMITTED
APPROVED

RENO ReTRAC
EAST THIRD STREET STORM DRAIN
N. ARLINGTON AVE. TO LAKE ST.
PLAN/PROFILE
STA. 19+50 TO STA. 21+97

CONTRACT NO.
DRAWING NO. SD-204
REV 0
SCALE AS SHOWN
SHEET NO. [illegible] of 8

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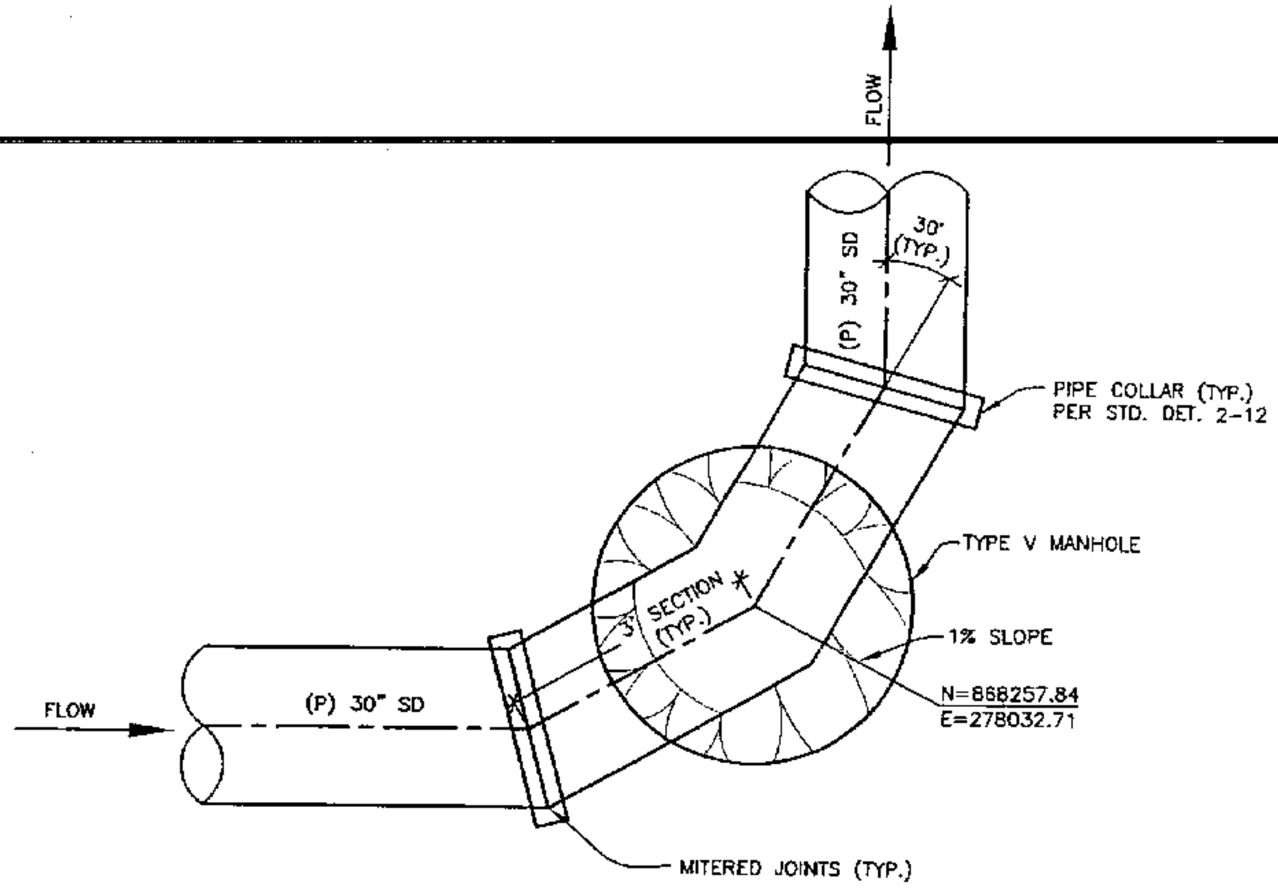
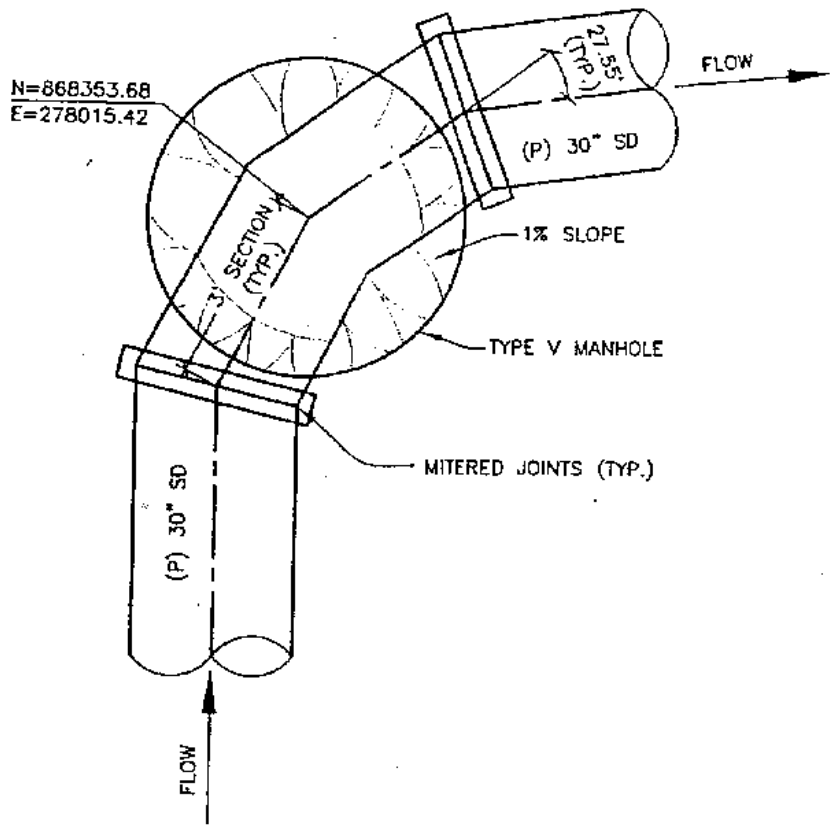


90 DEGREE BEND @ STORM DRAIN MANHOLE E. THIRD ST. / N. VIRGINIA ST.

1 SD-907

N.T.S.



82 DEGREE BEND @ STORM DRAIN MANHOLE N. VIRGINIA ST. / PLAZA ST.

2 SD-907

N.T.S.

2-WORKING DAYS
Call before you Dig.
1-800-227-2600

REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY LWL
DRAWN BY CMF
CHECKED BY JE
IN CHARGE JE
DATE 3/28/03

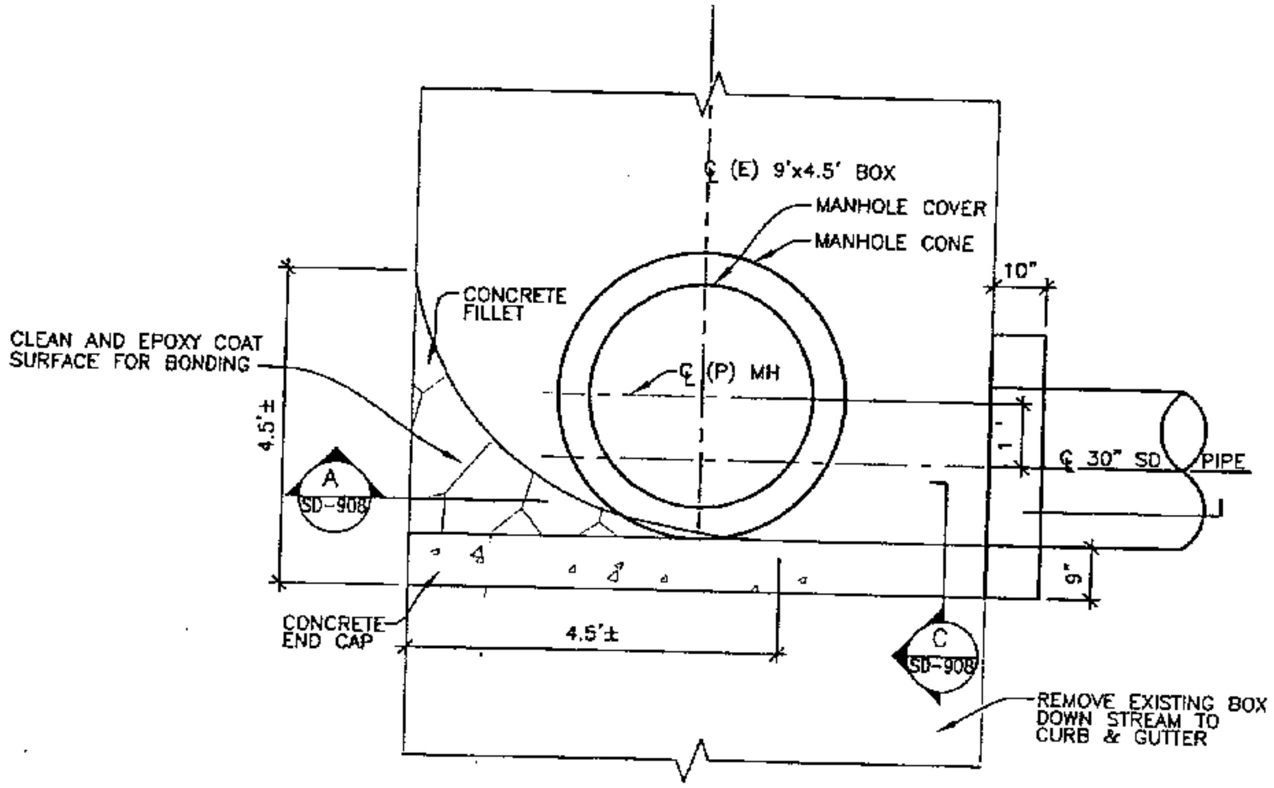
60% SUBMITTAL
NOT FOR CONSTRUCTION

RENO ReTRAC
RENO WASHOE COUNTY NEVADA
ReTRAC THE GRANITE TEAM
SUBMITTED
APPROVED

RENO ReTRAC
EAST THIRD STREET STORM DRAIN
N. ARLINGTON AVE. TO LAKE ST.
STORM DRAIN MANHOLE BENDS

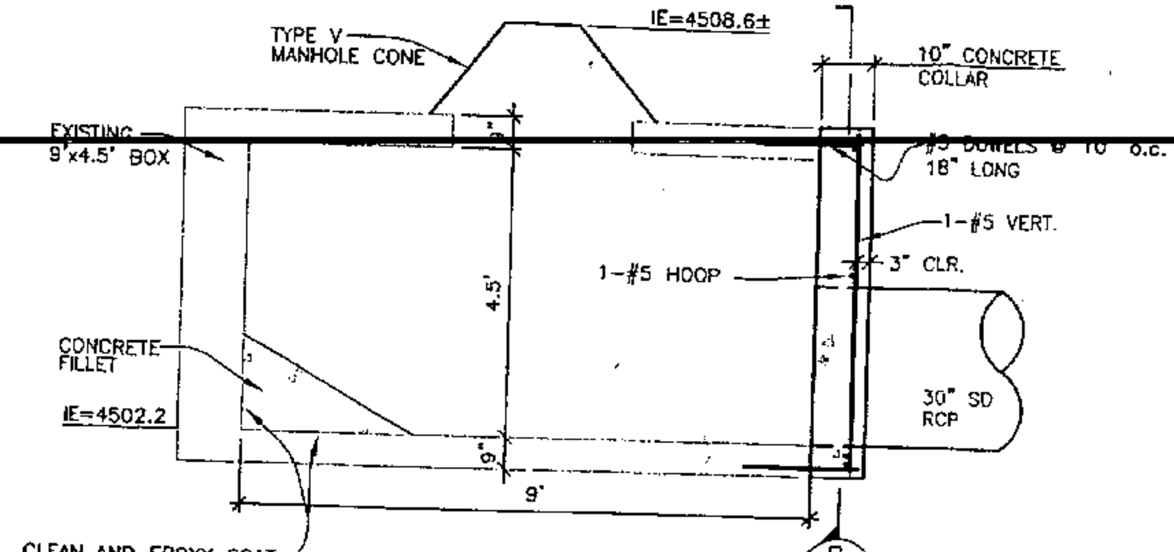
CONTRACT NO.
DRAWING NO. SD-907
SCALE AS SHOWN
SHEET NO. [illegible] of 8

P:\18000-SD3rd\Civil\DETAILS\ReT-3RD-BOXTIE-SD908.dwg, 03/28/03 04:21:52 PM

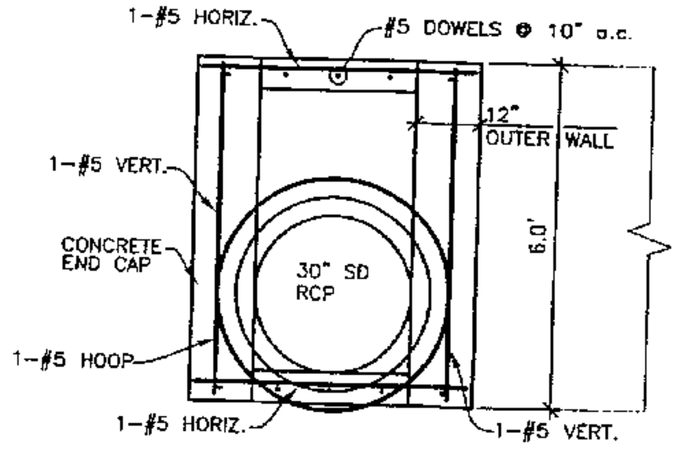


PLAN
1 SD-908 TIE-IN @ (E) RCB
N.T.S.

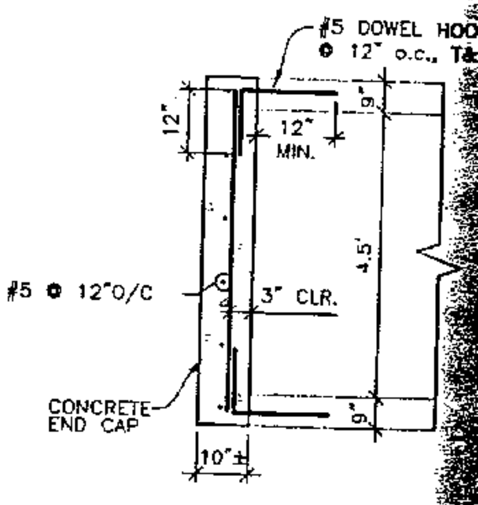
NOTE: THIS CONNECTION SHALL NOT BE CONSTRUCTED UNTIL LAKE ST. TO WELLS IS COMPLETED



SECTION
A SD-908 TIE-IN @ (E) RCB
N.T.S.



DETAIL
B SD-908 CONCRETE COLLAR
N.T.S.



SECTION
C SD-908 CONCRETE END CA
N.T.S.

2-WORKING DAYS
Call before you Dig.
1-800-227-2600

REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY LWL
DRAWN BY CMF
CHECKED BY JE
IN CHARGE JE
DATE 3/28/03

60% SUBMITTAL
NOT FOR CONSTRUCTION

RENO ReTRAC
RENO WASHOE COUNTY NEVADA
ReTRAC THE GRANITE TEAM
SUBMITTED
APPROVED

RENO ReTRAC
EAST THIRD STREET STORM DRAIN
N. ARLINGTON AVE. TO LAKE ST.
EXISTING RCB CONNECTION

CONTRACT NO.
DRAWING NO. SD-908
REV 0
SCALE AS SHOWN
SHEET NO. of 8

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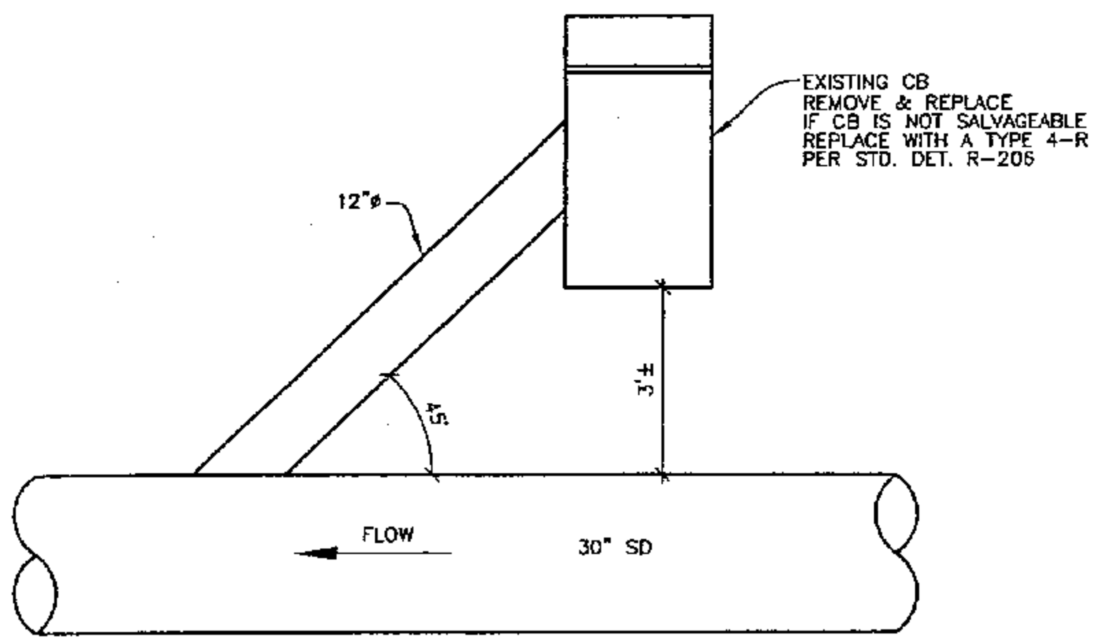
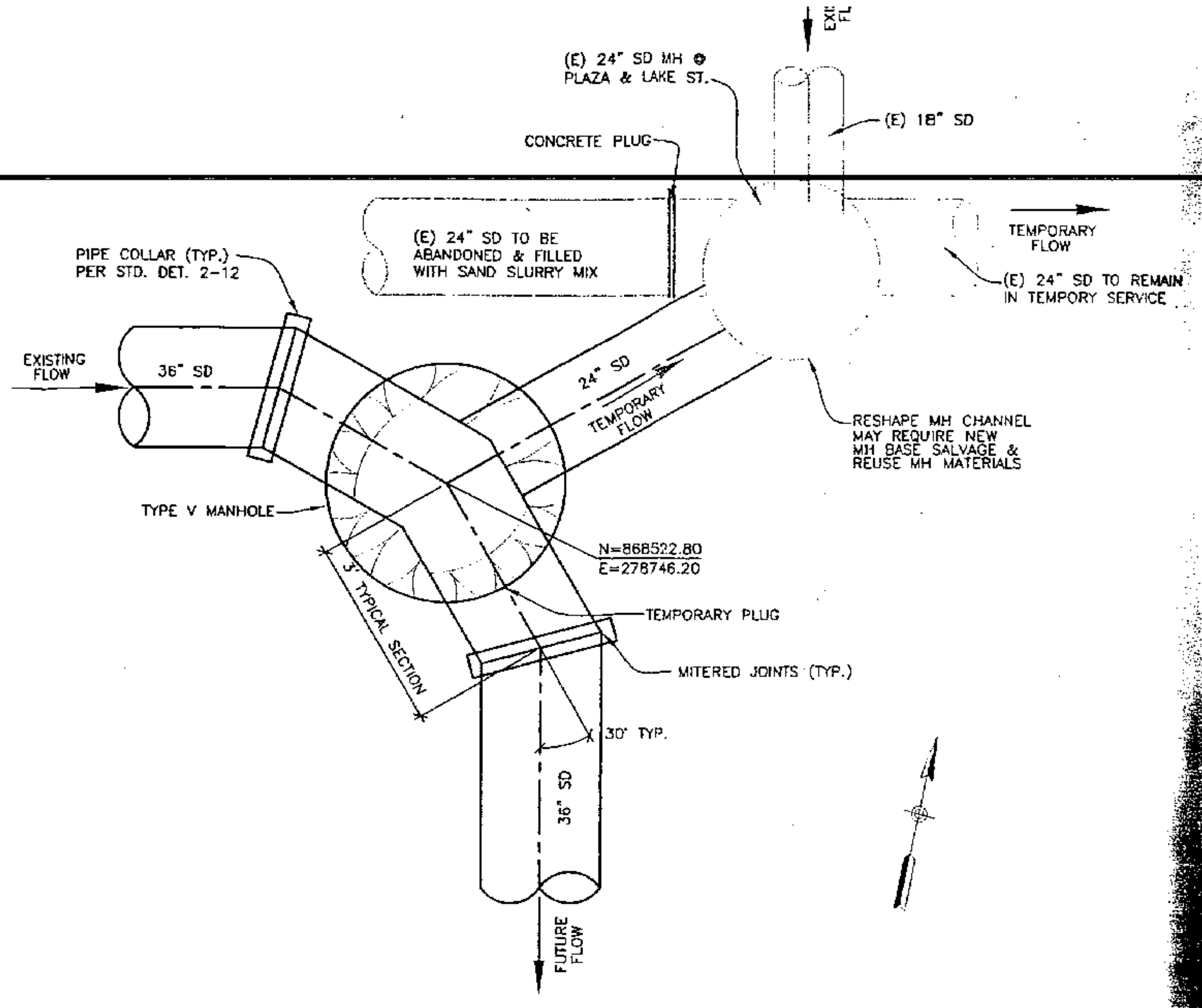


① SD-909 CATCH BASIN CONNECTION

N.T.S.



② SD-909 90 DEGREE BEND @ STORM DRAIN MANHOLE LAKE ST. / PLAZA ST.

N.T.S.

2-WORKING DAYS Call before you Dig

1-800-227-2600

REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY LWL
DRAWN BY CMF
CHECKED BY JE
IN CHARGE JE
DATE 3/28/03

60% SUBMITTAL
NOT FOR CONSTRUCTION

RENO ReTRAC
RENO WASHOE COUNTY NEVADA

ReTRAC THE GRANITE TEAM

SUBMITTED
APPROVED

RENO ReTRAC
EAST THIRD STREET STORM DRAIN
N. ARLINGTON AVE. TO LAKE ST.
STORM DRAIN DETAILS

CONTRACT NO.
DRAWING NO. SD-909
SCALE AS SHOWN
SHEET NO. 8 of 8

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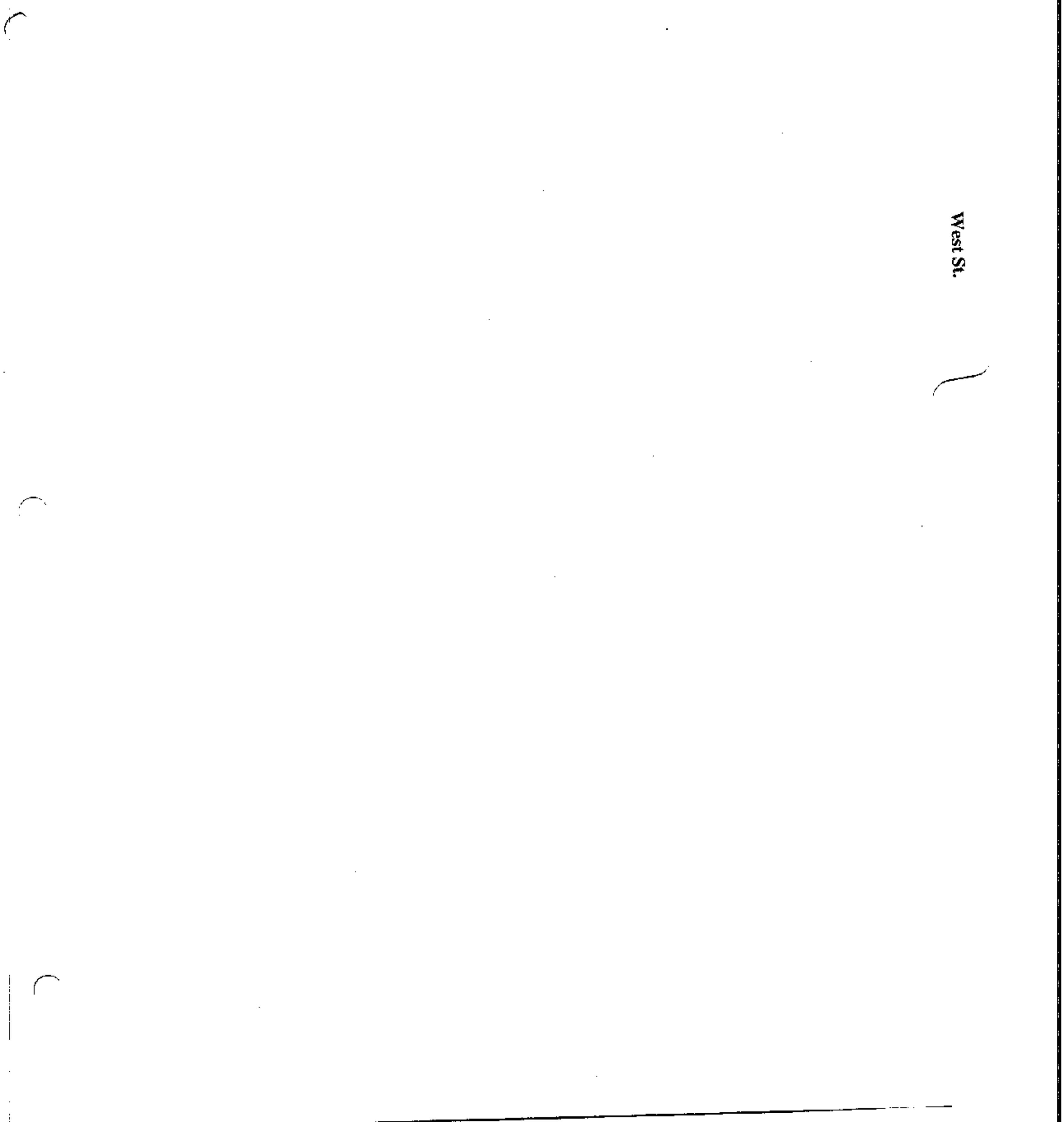
clogging factors


West St.

IFC Submittal

August 22, 2003
Project No. 80100603

Mr. Avrum Loewenstein, P.E.
ReTRAC
Parsons Transportation Group
264 Keystone Avenue
Reno, Nevada 89503

Reference: **ReTRAC Hydrologic and Hydraulic Design Memorandum for West Street Overland Drainage**

Dear Mr. Loewenstein:

This letter is to document the design parameters and assumptions for the proposed improvements of the West Street UPRR trench crossing. The proposed improvements begin at Third Street and end just south of the proposed UPRR trench. The 100-year storm event overland flow patterns were analyzed for existing and proposed conditions. There is no existing storm drainage affected by the proposed improvements.

The localized 5-year event storm drainage patterns will remain as in existing conditions and will tie into the proposed 30-inch storm drain lateral in Third Street. One existing catch basin located at the northwest corner of Third Street and West Street will be removed and three catch basins will be added: one in Third Street and two in West Street just north of the Third Street intersection. See the IFC memorandum entitled *ReTRAC Hydrologic and Hydraulic Design Memorandum for East Third Street Storm Drain System (Arlington to Lake)* located in the *IFC ReTRAC Drainage Report.*

The 100-year watershed basin was delineated and is shown in the *IFC ReTRAC Drainage Report, Volume 1.* Existing condition flow from the 100-year event affecting the intersection of West Street and Third Street is approximately 436 cfs. The entire 100-year overland flow travels east on Third Street over the West Street crown and continues east on Third Street. The water surface elevation at the existing West Street crown during the 100-year event is 4506.15-feet, as shown by the calculation sheet labeled "*3^{rd} Street 1300*".

Proposed condition flow from the 100-year event affecting the intersection of West Street and Third Street is approximately 455 cfs.The proposed crown was analyzed and the water surface elevation was found to be 4506.16-feet, as shown by the calculation sheet labeled "*Proposed 3^{rd} Street 1300*". The proposed improvements on West Street do not significantly increase the existing water surface elevation and do not alter the historic drainage pattern in the 100-year event. See the attached *West Street Plan and Profile* drawing for proposed improvements.

Sincerely,

STANTEC CONSULTING INC.

Trina M. Magoon, PE
Water Resources Project Manager

TMM:
Enclosure(s)
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3rd Street 1300
Worksheet for Irregular Channel

Project Description	
Worksheet	3rd_Street 1300 - 3rd &
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	010000	ft/ft
Dischargı	436.00	cfs

Options	
Current Roughness Methc	›ved Lotter's Method
Open Channel Weighting	›ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficieı	0.016	
Water Surface Elev	4,506.15	ft
Elevation Range	)5.50 to 4,506.60	
Flow Area	80.3	ft²
Wetted Perimeter	179.90	ft
Top Width	179.73	ft
Actual Depth	0.65	ft
Critical Elevation	4,506.28	ft
Critical Slope	0.004546	ft/ft
Velocity	5.43	ft/s
Velocity Head	0.46	ft
Specific Energy	4,506.61	ft
Froude Number	1.43	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.15415236 ft.

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	12+00	0.016

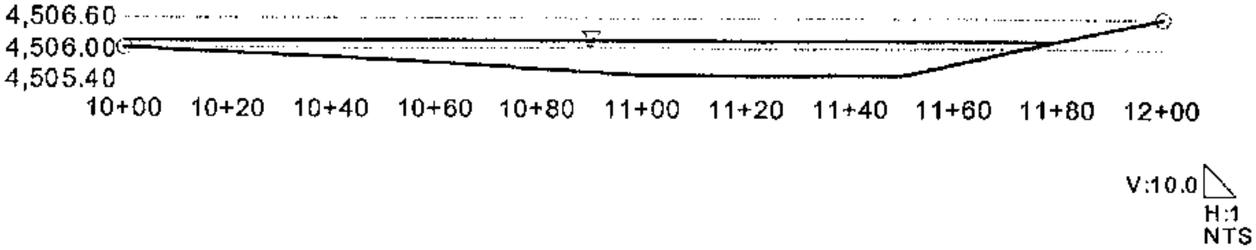
Natural Channel Points

Station (ft)	Elevation (ft)
10+00	4,506.00
10+50	4,505.80
11+00	4,505.50
11+50	4,505.50
12+00	4,506.60

3rd Street 1300
Cross Section for Irregular Channel

Project Description	
Worksheet	3rd_Street 1300 - 3rd &
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficiei	0.016	
Slope	0.010000	ft/ft
Water Surface Elev.	4,506.15	ft
Elevation Range	)5.50 to 4,506.60	
Discharge	436.00	cfs



Proposed 3rd Street 1300
Worksheet for Irregular Channel

Project Description	
Worksheet	Proposed 3rd_Street 1300 - 3r
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	010000	ft/ft
Discharg	455.00	cfs

Options	
Current Roughness Methc	›ved Lotter's Method
Open Channel Weighting	›ved Lotter's Method
Closed Channel Weighting	Horton's Method

Results		
Mannings Coefficiei	0.016	
Water Surface Elev	4,506.16	ft
Elevation Range	)5.50 to 4,506.14	
Flow Area	86.0	ft²
Wetted Perimeter	200.18	ft
Top Width	200.00	ft
Actual Depth	0.66	ft
Critical Elevation	4,506.27	ft
Critical Slope	0.004583	ft/ft
Velocity	5.29	ft/s
Velocity Head	0.43	ft
Specific Energy	4,506.59	ft
Froude Number	1.42	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.15765029 ft.

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	12+00	0.016

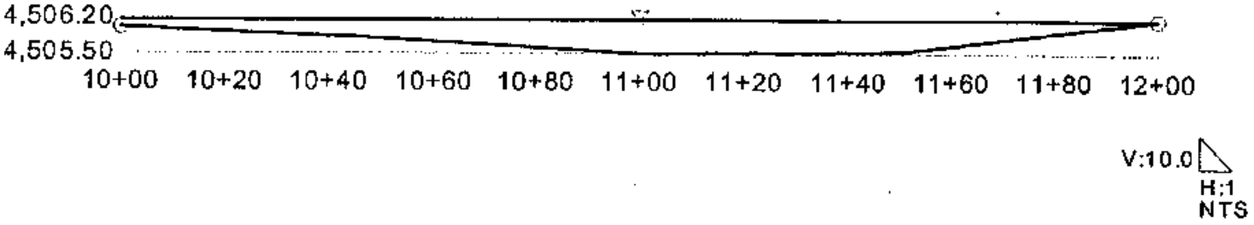
Natural Channel Points

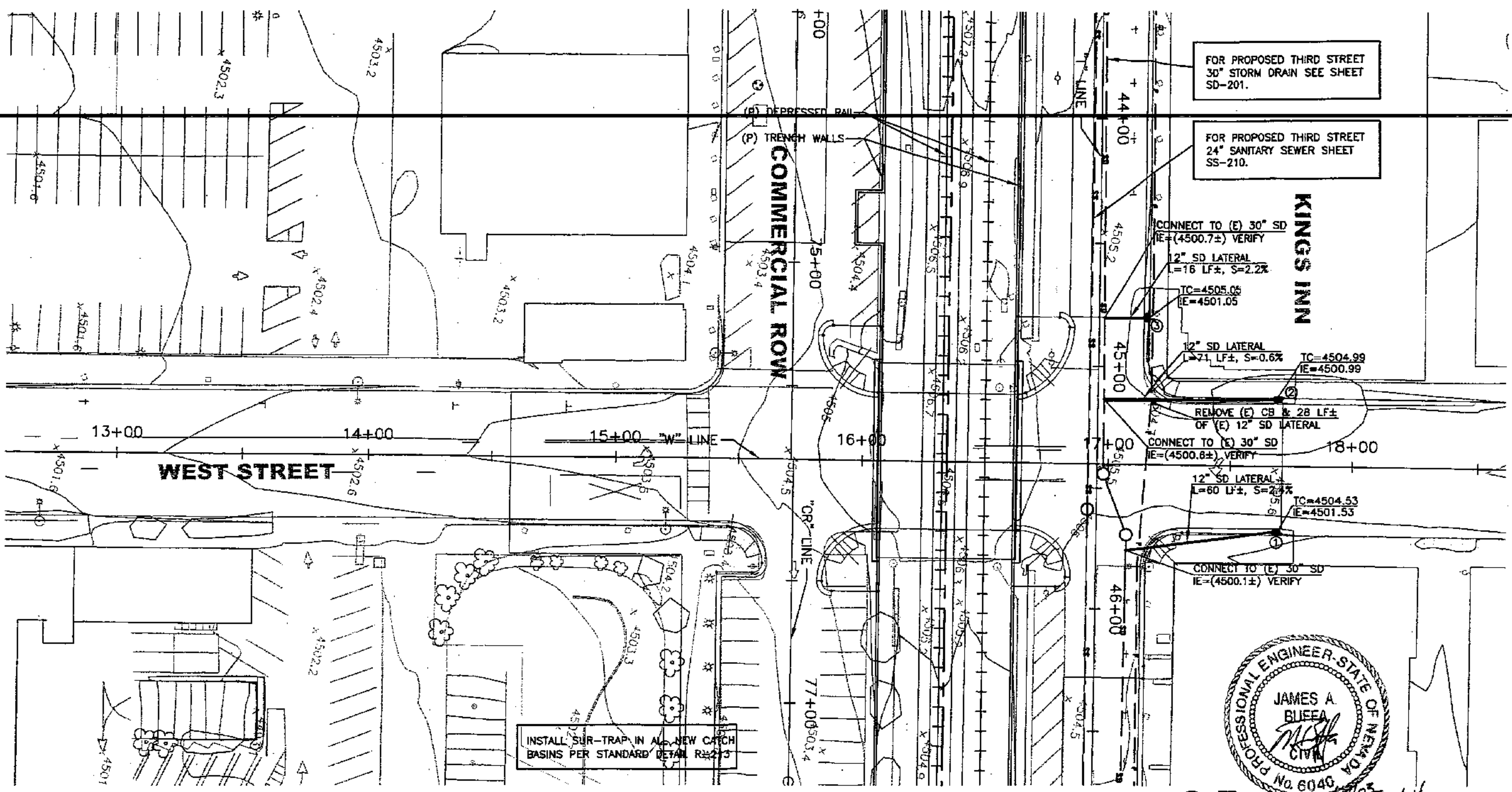
Station (ft)	Elevation (ft)
10+00	4,506.00
10+50	4,505.80
11+00	4,505.50
11+50	4,505.54
12+00	4,506.14

Proposed 3rd Street 1300
Cross Section for Irregular Channel

Project Description	
Worksheet	Proposed 3rd_Street 1300 - 3r
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficiei	0.016	
Slope	0.010000	ft/ft
Water Surface Elev.	4,506.16	ft
Elevation Range	)5.50 to 4,506.14	
Discharge	455.00	cfs





	CATCH BASIN TABLE		
	STATION	OFFSET	CB TYPE
①	"W" 17+70.00	28.00' RT	TYPE 4-R
②	"W" 17+70.00	28.00' LT	TYPE 4-R (MOD)
③	"T" 44+80.00	20.00' LT	TYPE 4-R (MOD)

PIPE MATERIAL OPTIONS

1. CLASS III SD PIPE-TONGUE & GROOVE JOINT.
2. PVC PIPE IN ACCORDANCE WITH ASTM F679 AS MANUFACTURED BY DIAMOND PLASTICS CORP. OR EQUAL.
3. PVC SOLID WALL PIPE AS MANUFACTURED BY J-M PIPE IN ACCORDANCE WITH ASTM F679.
4. PVC SHALL HAVE A MINIMUM PIPE STIFFNESS OF 46 psi.

Earth Disturbing Activities
(EDAs) Require EMC Monitor

2-WORKING DAYS
Call before you Dig.
1-800-227-2600

JAMES A. BUFFA
No. 6040
8/19/03
Exp. 12/31/04

0 20 40 80
1"=40'

REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION
0	8/19/03	JB	AL	BRD	ISSUED FOR CONSTRUCTION						

DESIGNED BY J. BUFFA
DRAWN BY C.FRENCH
CHECKED BY J. MEREDITH
IN CHARGE J. WELSH
DATE 8/15/03

ISSUED FOR
CONSTRUCTION

RENO ReTRAC
RENO WASHOE COUNTY NEVADA

ReTRAC THE GRANITE TEAM

SUBMITTED
APPROVED

RENO ReTRAC
WEST STREET
STORM DRAIN LATERAL
SURFACE DRAINAGE

CONTRACT NO.
DRAWING NO. SD-270
REV 0
SCALE AS SHOWN

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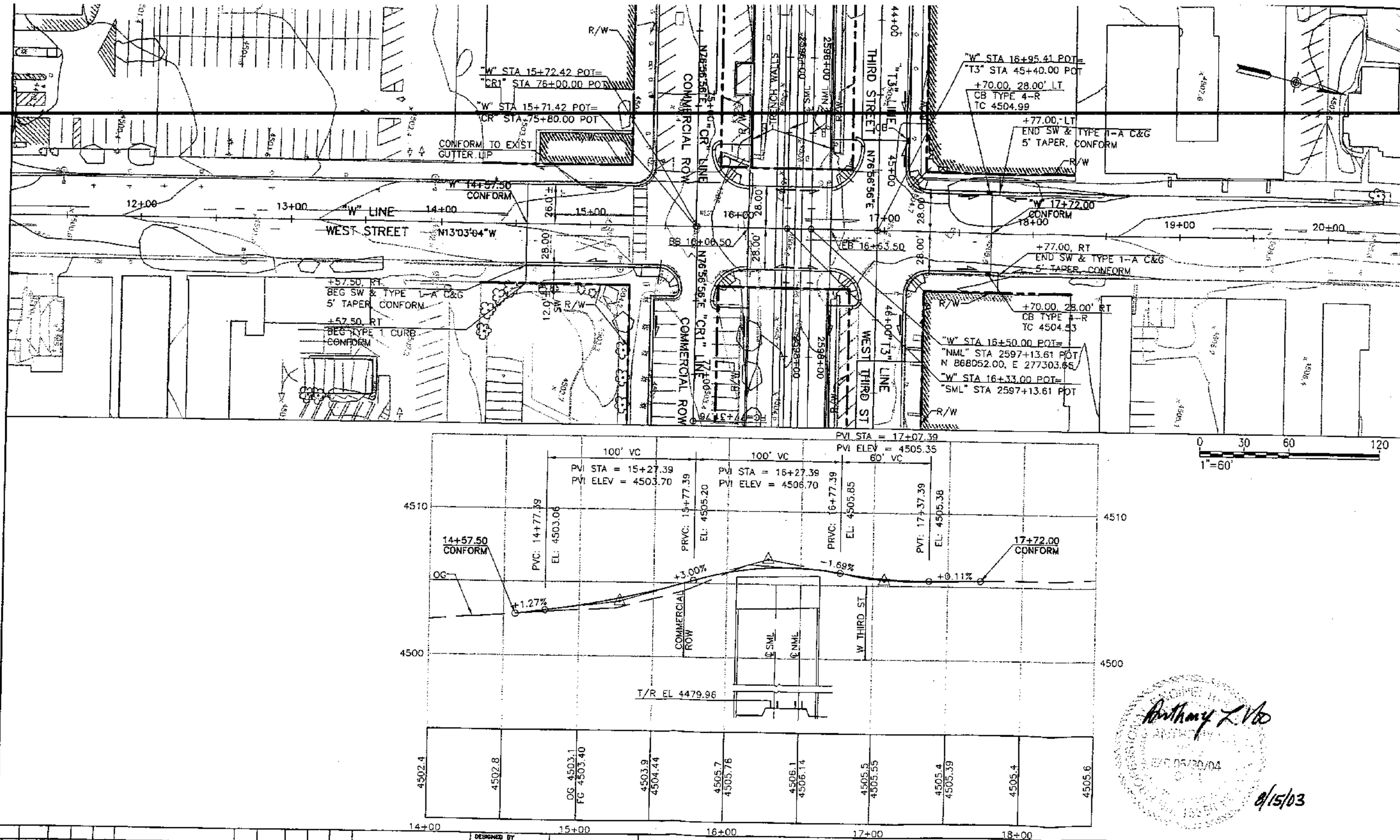


Anthony L. Voo

EXP. 06/30/04

8/15/03

REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION
D	8/15/03	AV	AL	BRD	ISSUED FOR CONSTRUCTION						

DESIGNED BY C.TRIPLET/A.VOO
DRAWN BY C. TRIPLET
CHECKED BY J. SHAFER
IN CHARGE A. VOO
DATE 08/15/03

ISSUED FOR CONSTRUCTION

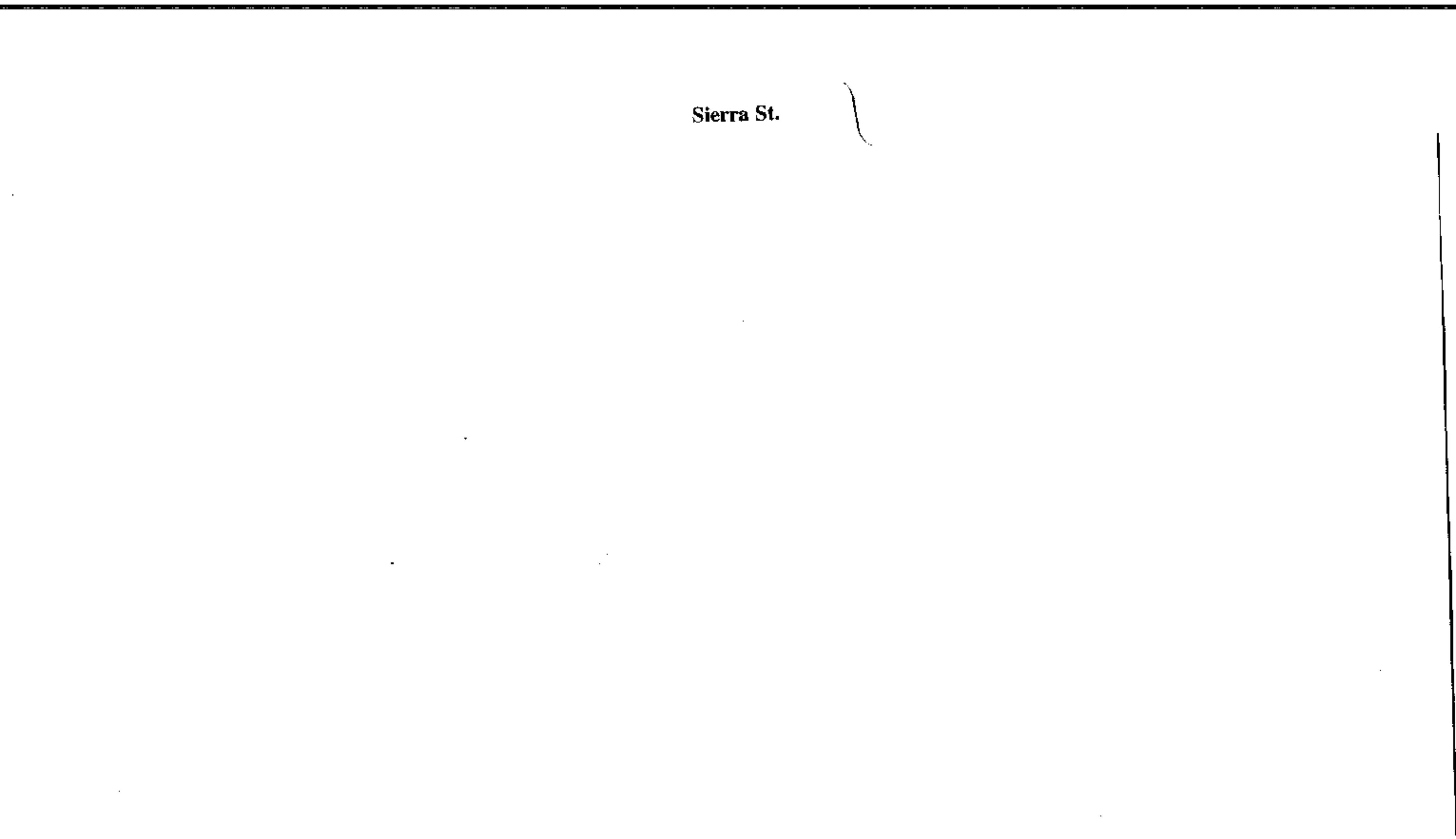
RENO ReTRAC
RENO WASHOE COUNTY NEVADA

ReTRAC THE GRANITE TEAM

SUBMITTED
APPROVED

RENO ReTRAC
WEST STREET IMPROVEMENTS
WEST STREET
PLAN AND PROFILE

CONTRACT NO.
DRAWING NO. C-003
REV 0
SCALE H:1"=60' V:1"=6'


Sierra St.

IFC Submittal

November 20, 2003
Project No. 80100603

Mr. Avrum Loewenstein
ReTRAC
Parsons Transportation Group
264 Keystone Avenue
Reno, Nevada 89503

Reference: **ReTRAC Hydrologic and Hydraulic Design Memorandum for Sierra Street Overland Drainage**

Dear Mr. Loewenstein:

This letter is to document the design parameters and assumptions for the proposed improvements of the Sierra Street UPRR trench crossing. The proposed improvements begin just south of Commercial Row and end at Third Street. The 100-year storm event overland flow patterns were analyzed for existing and proposed conditions.

The localized 5-year storm drainage patterns surrounding the proposed Sierra Street UPRR crossing will remain as existing. The proposed Sierra Street profile conforms to existing grade, leaving the localized drainage patterns unaffected. The 5-year storm drain system has been addressed in the East Third Street Storm Drain submittal.

The 100-year watershed basin has been delineated and is shown in the IFC *ReTRAC Drainage Report*. Flow from the 100-year event affecting the existing intersection of Sierra Street and Third Street is approximately 476 cfs. A portion of the 100-year overland flow travels east on Third Street to the Sierra Street crown and continues east on Third Street. The water surface elevation at the existing Sierra Street crown during the 100-year event is 4503.55-feet, as shown by the calculation sheet labeled "*3rd Street 1000.*"

The flow affecting the proposed intersection of Sierra Street and Third Street is 527cfs. This increase from existing flow is due to the elimination of weir flow west of Sierra Street by the proposed trench wall. Cross sections 1200, 1100 and 1050 will be confined by the trench wall. The additional flow will not increase the water surface elevation beyond acceptable limits (0.1'). Refer to the IFC ReTRAC Drainage Report for further details (submittal pending). The proposed crown was analyzed and the water surface elevation was found to be 4503.59-feet, as shown by the calculation sheet labeled "Proposed 3rd Street 1000" and the weir computation sheet. The proposed improvements on Sierra Street increase the water surface elevation by 0.03', which is within acceptable limits. The proposed Sierra Street section allows approximately 33 cfs to travel south on Sierra and 494 cfs to travel east on Plaza Street. See the attached Sierra Street Plan and Profile drawing for proposed improvements.

Sincerely,

STANTEC CONSULTING INC.

Trina M. Magoon, PE
Water Resources Project Manager

TMM:zrb
Enclosure(s)
V:\52801\active\80100603\H&H\Design Memorandums\MEMO H&H 3rd & Sierra St Design(IFC).doc

3rd Street 1000
Worksheet for Irregular Channel

Project Description	
Worksheet	3rd_Street 1000 - Sierra
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	007000	ft/ft
Discharg	476.00	cfs

Options	
Current Roughness Meth	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	4,503.55	ft
Elevation Range	2.80 to 4,503.60	
Flow Area	103.0	ft²
Wetted Perimeter	224.54	ft
Top Width	224.38	ft
Actual Depth	0.75	ft
Critical Elevation	4,503.61	ft
Critical Slope	0.004672	ft/ft
Velocity	4.62	ft/s
Velocity Head	0.33	ft
Specific Energy	4,503.88	ft
Froude Number	1.20	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.14980803 ft.

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	12+30	0.016

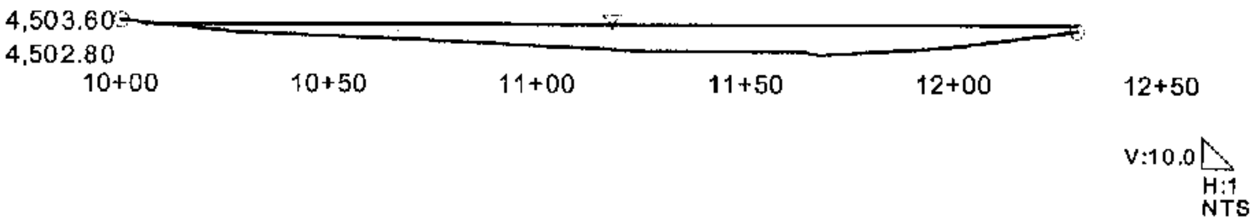
Natural Channel Points

Station (ft)	Elevation (ft)
10+00	4,503.60
10+26	4,503.35
10+80	4,503.10
11+26	4,502.90
11+63	4,502.90
11+67	4,502.80
11+98	4,503.00
12+30	4,503.40

3rd Street 1000
Cross Section for Irregular Channel

Project Description	
Worksheet	3rd_Street 1000 - Sierra
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.016	
Slope	0.007000	ft/ft
Water Surface Elev.	4,503.55	ft
Elevation Range	)2.80 to 4,503.60	
Discharge	476.00	cfs



Proposed 3rd Street 1000
Worksheet for Irregular Channel

Project Description

Worksheet	Proposed 3rd_Street 1000 - Sierra Ci
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Slope	007000	ft/ft
Water Surface Elev	,503.59	ft

Options

Current Roughness Methc	)ved Lotter's Method
Open Channel Weighting	)ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results

Mannings Coeffic	0.016	
Elevation Range	)2.78 to 4,503.40	
Discharge	493.31	cfs
Flow Area	100.7	ft²
Wetted Perimete	201.31	ft
Top Width	200.89	ft
Actual Depth	0.81	ft
Critical Elevation	4,503.66	ft
Critical Slope	0.004510	ft/ft
Velocity	4.90	ft/s
Velocity Head	0.37	ft
Specific Energy	4,503.96	ft
Froude Number	1.22	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.23 ft.

Roughness Segments

Start Station	End Station	Mannings Coefficient
9+35	11+36	0.016

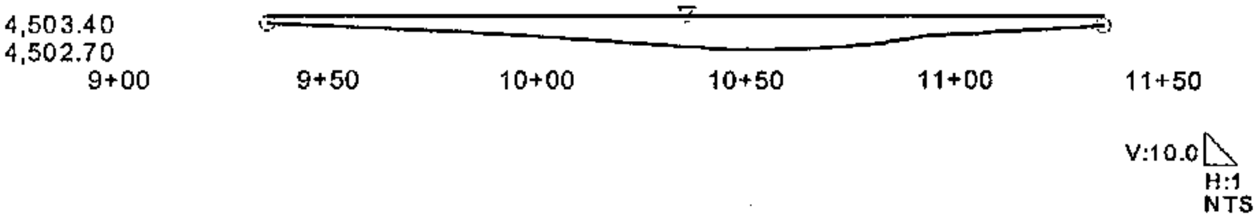
Natural Channel Points

Station (ft)	Elevation (ft)
9+35	4,503.40
9+85	4,503.20
10+00	4,503.10
10+33	4,502.86
10+46	4,502.80
10+55	4,502.78
10+71	4,502.82
10+82	4,502.90
10+93	4,503.10
11+07	4,503.19

Proposed 3rd Street 1000
Cross Section for Irregular Channel

Project Description	
Worksheet	Proposed 3rd_Street 1000 - Sierra Ci
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficiei	0.016	
Slope	0.007000	ft/ft
Water Surface Elev	4,503.59	ft
Elevation Range	)2.78 to 4,503.40	
Discharge	493.31	cfs



Proposed 3rd Street 1000
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
11+36	4,503.36

Project________________
Project No.______________
Sheet No.______of______
Calculated by_____Date_____

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CROSS SECTION PARAMETERS: FILENAME: sieropt7.SEC

No. of Cross Section Points: 8 Bed Slope:0.00500 Max Elev.:4503.83
Bank Stations..........Left: 1000.0 Right....: 1078.0 Min Elev.:4503.08
Encroachment Stations..Left: Right....: Weir Coef: 2.600

CROSS SECTION POINTS - Elevations & Stations in feet:

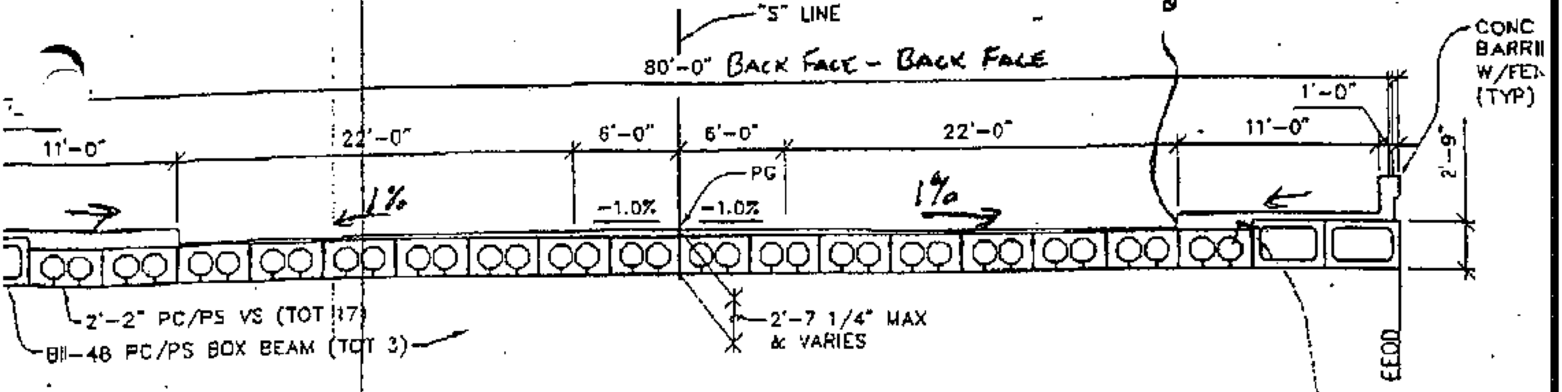
No.	Elev.	Sta.	No.	Elev.	Sta.	No.	Elev.	Sta.
1)	4503.83	1000.00	2)	4503.82	1001.00	3)	4503.75	1011.00
4)	4503.08	1011.01	5)	4503.36	1039.00	6)	4503.08	1066.99
7)	4503.75	1067.00	8)	4503.83	1078.00			

COMPUTED PARAMETERS:

WSEL(ft)	Q(cfs)	H:max(ft)	H:ave(ft)	TW(ft)	A(sf)
4503.59	33.3	0.51	0.37	56.0	20.7

NOTES:

4 of 9

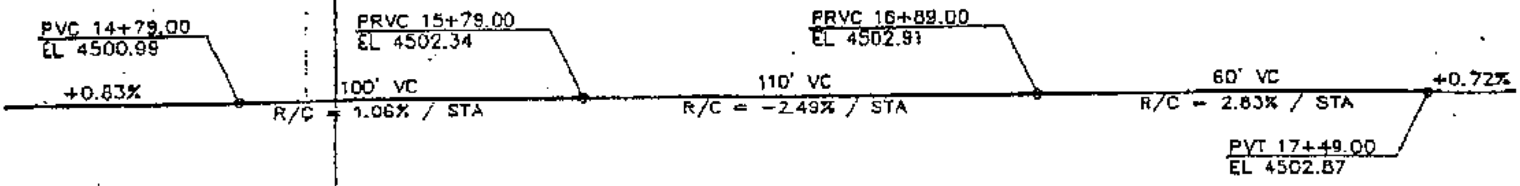


ITY AND FUTURE UTILITY
SEE DETS 20 & 25/S-004.

TYPICAL SECTION (10/001)

SCALE:3/32"=1'-0"

1" DROP TOWARDS STREET



PROFILE GRADE

SCALE:NTS

BARAJAS & ASSOC)
BRASS WELD MONUMENT IN CONCRETE
WEST CORNER OF THE INTERSECTION
IUE AND UPRR TRACKS.

NORTHING	EASTING	ELEVATION
367,917.14	276,903.32	4,508.50

D88 ADJUSTED TO NAVD29 (CITY OF RENO)

NOTES:

1. FOR INVERT SLAB AND TRENCH WALL DETAILS, SEE TRENCH PLANS.
2. ALL EXISTING UTILITIES SHALL BE RELOCATED AS REQUIRED PRIOR TO FOUNDATION CONSTRUCTION.
3. ◈ INDICATES POINT OF CRITICAL CLEARANCE.
4. FOR GENERAL NOTES, SEE SHT S-002.
5. PAINT "N SIERRA ST OH".
6. PAINT "BR NO XXXX".
7. FOR FENCING DETAILS, SEE "LANDSCAPE PLANS".
8. FOR TRENCH AND BRIDGE BARRIER INTERFACE DETAILS, SEE DETS 30 & 32/S-004.
9. ABUTMENT CENTERLINE PARALLEL TO MAINLINE.
10. BRIDGE TO BE CONSTRUCTED IN STAGES. SEE SHTS S-005 THRU S-006.

ReTRAC PROJECT STANDARD DETAILS

A10	ABBREVIATIONS
B11-54A	BARRIER RAILING DETAILS NO 1
B11-54B	BARRIER RAILING DETAILS NO 2
B26-1	2'-2" VOIDED SLAB DETAILS NO 1
B26-2	2'-2" VOIDED SLAB DETAILS NO 2
B48-1	BII-48 PRECAST PRESTRESSED BOX BEAM DETAILS NO 1
B48-2	BII-48 PRECAST PRESTRESSED BOX BEAM DETAILS NO 2
SC-01	SURVEY DATA CONTROL MAP

INDEX TO PLANS

1. GENERAL PLAN
2. DECK CONTOURS & GENERAL NOTES
3. GIRDER LAYOUT
4. TYPICAL SECTION
5. STAGED CONSTRUCTION DETAILS NO 1
6. STAGED CONSTRUCTION DETAILS NO 2

RENO ReTRAC
WASHOE COUNTY NEVADA

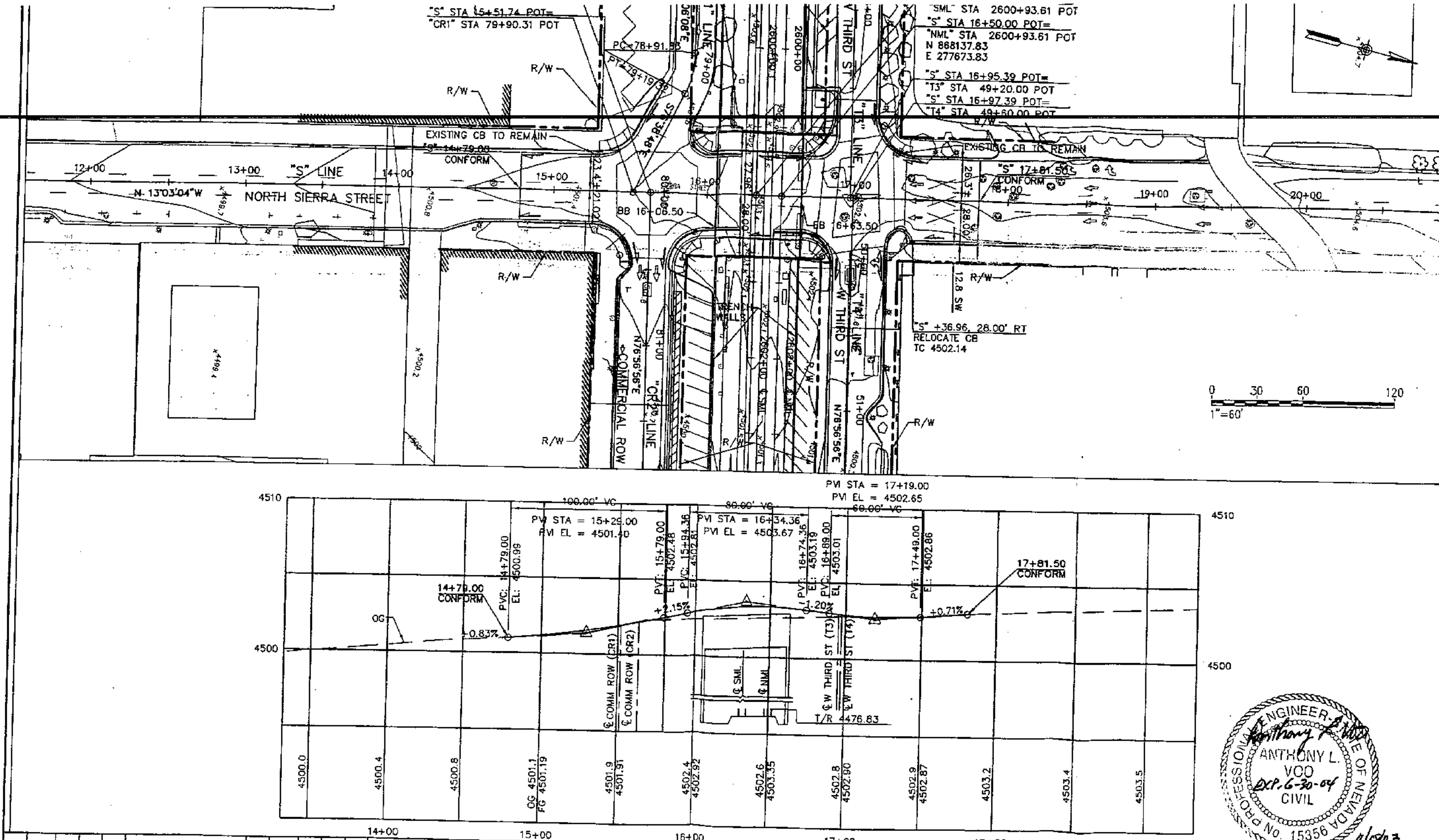
eTRAC THE GRANITE TEAM

SUBMITTED
APPROVED

RENO ReTRAC
NORTH SIERRA STREET OH
GENERAL PLAN

CONTRACT NO.
DRAWING NO. S-001
SCALE AS SHOW
SHEET NO.

P:\20700 vi\dwg\C-003.dwg, 11/18/2003 3:59:28 PM



ANTHONY L. VOO
No. 15356
EXP. 6-30-04
11/18/03

REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION
0	11/18/03	AV	AL	BRD	ISSUED FOR CONSTRUCTION						

DESIGNED BY C. TRIPLET
DRAWN BY C. TRIPLET
CHECKED BY A. VOO
IN CHARGE A. VOO
DATE 11/18/03

ISSUED FOR CONSTRUCTION

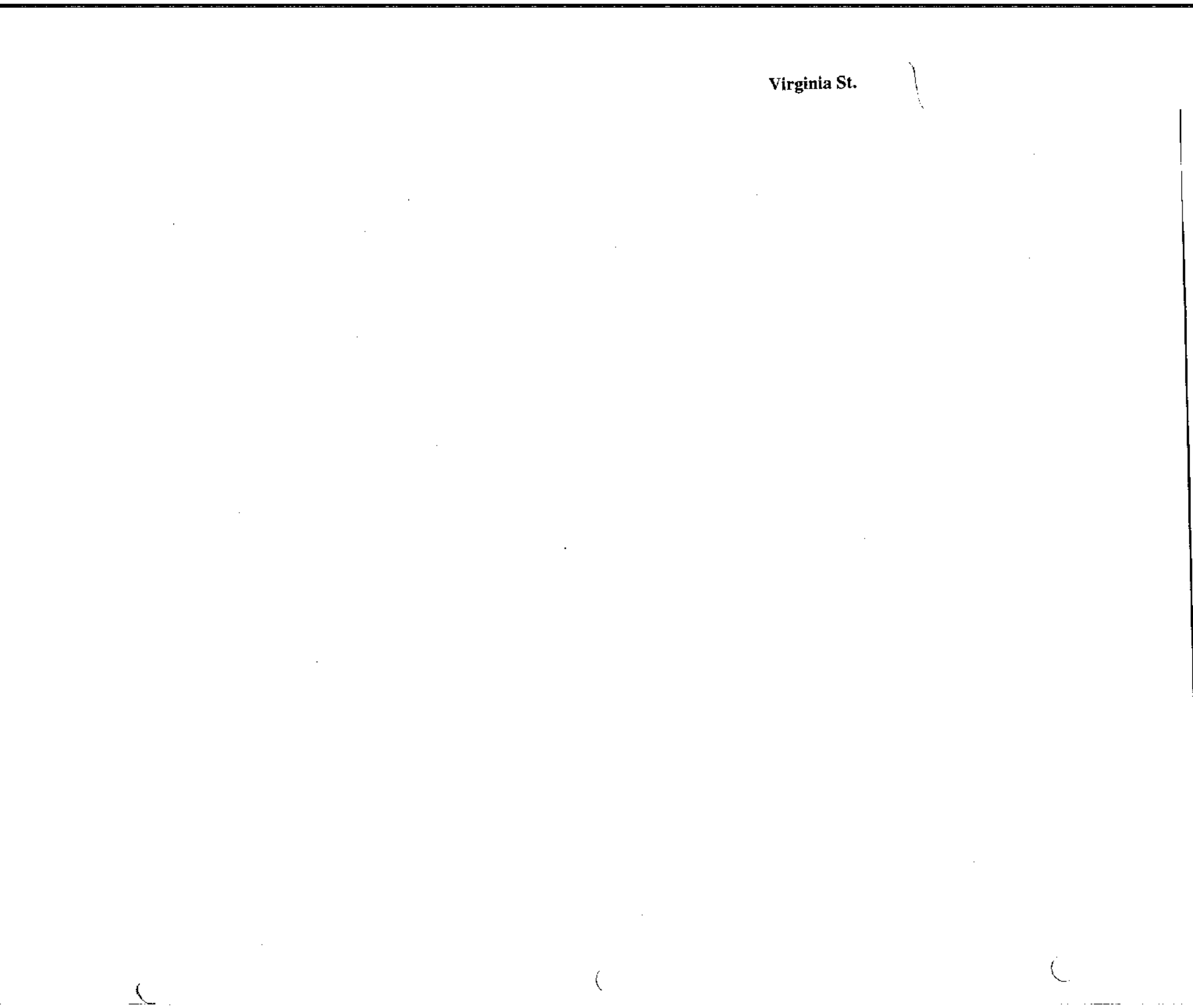
RENO ReTRAC
RENO WASHOE COUNTY NEVADA

ReTRAC THE GRANITE TEAM

SUBMITTED
APPROVED

RENO ReTRAC
NORTH SIERRA ST IMPROVEMENTS
NORTH SIERRA STREET
PLAN AND PROFILE

CONTRACT NO.
DRAWING NO. C-003
REV 0
SCALE H: 1"=60' V: 1"=6'


Virginia St.

IFC Submittal

September 17, 2003
Project No. 80100603

Mr. Avrum Loewenstein
ReTRAC
Parsons Transportation Group
264 Keystone Avenue
Reno, Nevada 89503

Reference: ReTRAC Hydrologic and Hydraulic Design Memorandum for Virginia Street Overland Drainage

Dear Mr. Loewenstein:

This letter is to document the design parameters and assumptions for the proposed improvements of the Virginia Street UPRR trench crossing. The proposed improvements begin just south of Commercial Row and end at Plaza Street. The 100-year storm event overland flow patterns were analyzed for existing and proposed conditions.

The localized 5-year storm drainage patterns surrounding the proposed Virginia Street UPRR crossing will remain as existing. The proposed Virginia Street profile conforms to existing grade, leaving the localized drainage patterns unaffected. The 5-year storm drain system has been addressed in the East Third Street Storm Drain submittal.

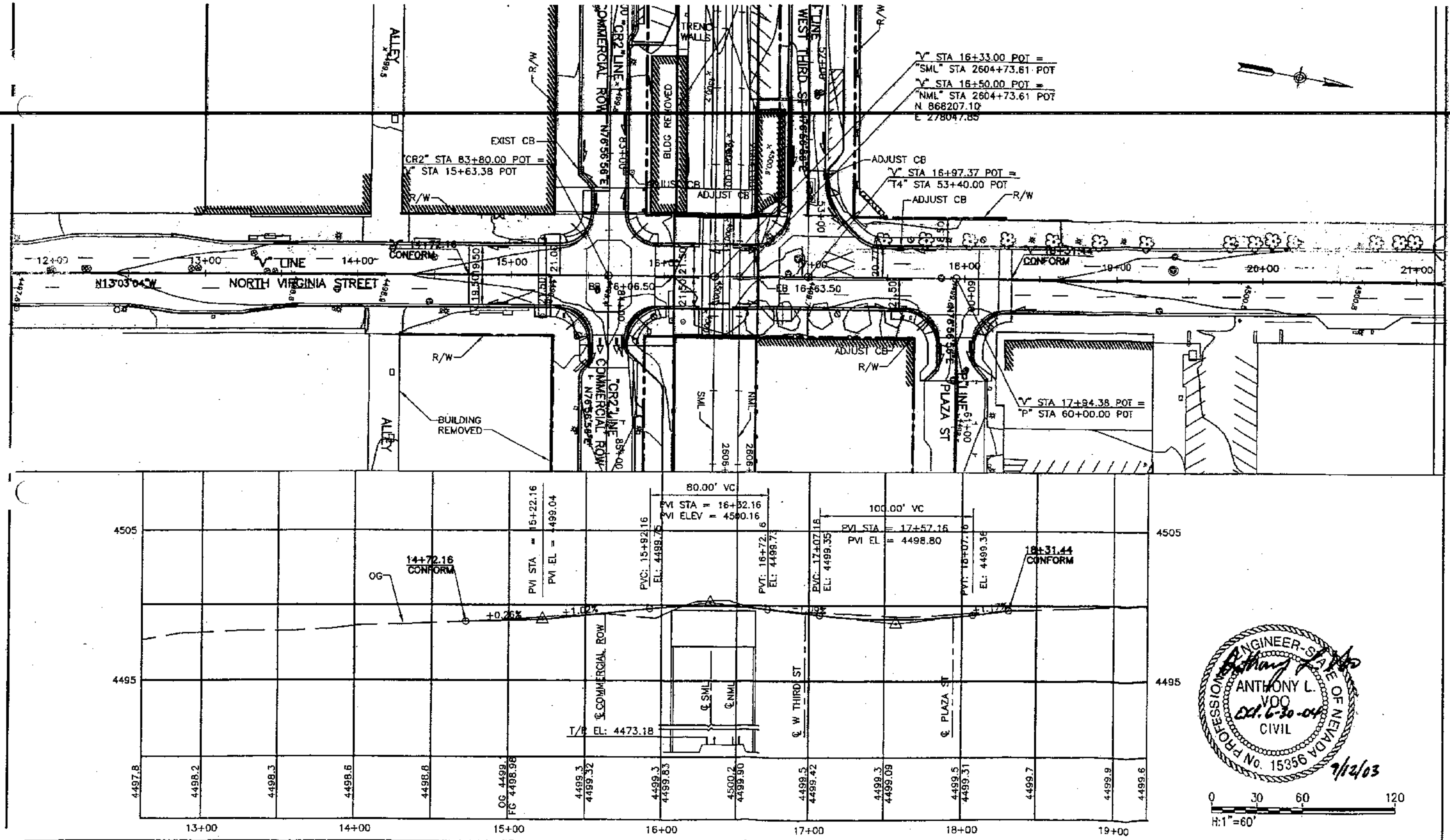
The 100-year watershed basin has been delineated and is shown in the *IFC ReTRAC Drainage Report, Volume 1*. Flow from the 100-year event affecting the existing intersection of Virginia Street and Third Street is approximately 451cfs. A portion of the 100-year overland flow travels east on Third Street to the Virginia Street crown, where the flow splits. 378cfs travels east on Plaza Street and 73 cfs travels south on Virginia Street. The water surface elevation at the existing Virginia Street crown during the 100-year event is 4500.75-feet, as shown by the weir flow computation sheets.

The proposed crown was analyzed and the water surface elevation was found to be 4500.81-feet, as shown by the weir computation sheets. The proposed improvements on Virginia Street do not significantly increase the existing water surface elevation. The proposed Virginia Street section allows 129cfs to travel south on Virginia and 400-cfs to travel east on Plaza Street. See the attached *Virginia Street Plan and Profile* drawing for proposed improvements.

Sincerely,
STANTEC CONSULTING INC.

Trina M. Magoon, PE
Water Resources Project Manager

TMM:zrb
Enclosure(s)
P:\CIVIL\80100603\H&H\Design Memorandums\MEMO H&H 3rd & Virginia St Design(60%).doc



ANTHONY L. VOO
No. 15356
Exp. 6-30-04
9/12/03

REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION
0	9/12/03	AV	AL	BRD	ISSUED FOR CONSTRUCTION						

DESIGNED BY C.TRIPLET/A.VOO
DRAWN BY C. TRIPLET
CHECKED BY J. SHAFER
IN CHARGE A. VOO
DATE 9/12/03

ISSUED FOR CONSTRUCTION

RENO ReTRAC
RENO WASHOE COUNTY NEVADA
ReTRAC THE GRANITE TEAM
SUBMITTED
APPROVED

RENO ReTRAC
NORTH VIRGINIA ST IMPROVEMENTS
NORTH VIRGINIA STREET
PLAN AND PROFILE

CONTRACT NO.
DRAWING NO. C-003
REV 0
SCALE H:1"=60' V:1"=6'

Existing Conditions

3rd Street 500
Worksheet for Irregular Channel

Project Description	
Worksheet	3rd_Street 0500 - Virginia
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	002500	ft/ft
Discharg	451.00	cfs

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.018	
Water Surface Elev.	4,500.62	ft < 4500.75 weir Controls
Elevation Range	99.25 to 4,508.00	
Flow Area	99.4	ft²
Wetted Perimeter	88.75	ft
Top Width	85.53	ft
Actual Depth	1.37	ft
Critical Elevation	4,500.41	ft
Critical Slope	0.004792	ft/ft
Velocity	4.54	ft/s
Velocity Head	0.32	ft
Specific Energy	4,500.94	ft
Froude Number	0.74	
Flow Type	Subcritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.31908548 ft.
Flow is divided.

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	13+16	0.016
13+16	13+51	0.020

Natural Channel Points

Station (ft)	Elevation (ft)
10+00	4,505.00
11+59	4,508.00
11+60	4,499.70
11+91	4,499.25
12+10	4,499.40
12+11	4,505.00
13+15	4,505.00
13+16	4,499.50

3rd Street 500
Worksheet for Irregular Channel

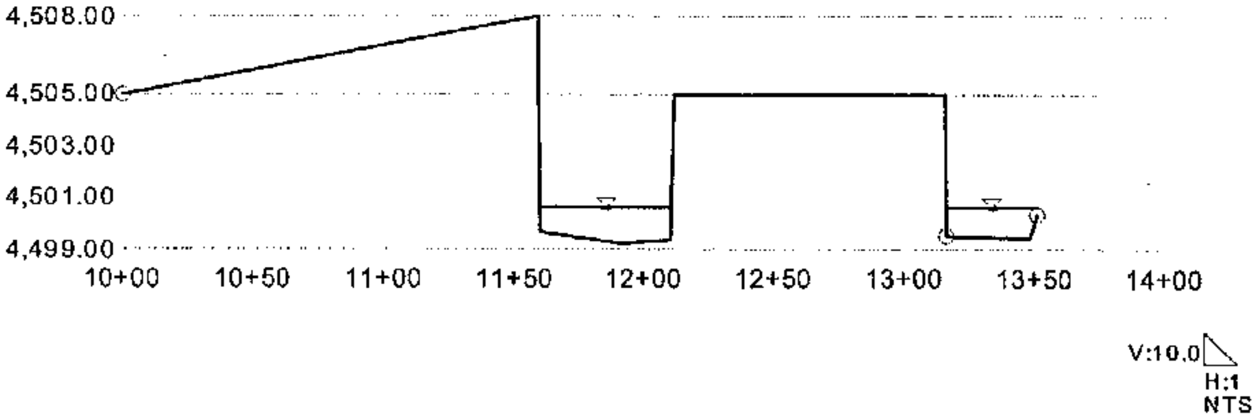
Natural Channel Points

Station (ft)	Elevation (ft)
13+48	4,499.44
13+51	4,500.30

3rd Street 500
Cross Section for Irregular Channel

Project Description	
Worksheet	3rd_Street 0500 - Virginia (
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficiei	0.018	
Slope	0.002500	ft/ft
Water Surface Elev.	4,500.62	ft
Elevation Range	39.25 to 4,508.00	
Discharge	451.00	cfs



Project____________________
Project No.__________________
Sheet No.________of________
Calculated by______Date______

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CROSS SECTION PARAMETERS: FILENAME: 450.SEC

No. of Cross Section Points: 8 Bed Slope:0.00500 Max Elev.:4510.00
Bank Stations..........Left: 1105.0 Right....: 1289.0 Min Elev.:4499.00
Encroachment Stations..Left: Right....: Weir Coef: 2.900

CROSS SECTION POINTS - Elevations & Stations in feet:

No.	Elev.	Sta.	No.	Elev.	Sta.	No.	Elev.	Sta.
1)	4499.00	1105.00	2)	4499.15	1128.00	3)	4499.00	1152.00
4)	4499.00	1160.00	5)	4510.00	1160.50	6)	4510.00	1271.00
7)	4500.00	1271.50	8)	4500.10	1289.00			

COMPUTED PARAMETERS:

WSEL(ft)	Q(cfs)	H:max(ft)	H:ave(ft)	TW(ft)	A(sf)
4500.71	364.4	1.71	1.41	72.6	102.2
00.72	368.2	1.72	1.42	72.6	102.9
0.73	371.8	1.73	1.43	72.6	103.6
00.74	375.6	1.74	1.44	72.6	104.4
4500.75	379.2	1.75	1.45	72.6	105.1
4500.76	382.9	1.76	1.46	72.6	105.8

NOTES:

Project____________________
Project No.__________________
Sheet No._________of_________
Calculated by______Date______

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CROSS SECTION PARAMETERS: FILENAME: VIRGRAIL.SEC

No. of Cross Section Points: 3 Bed Slope:0.00500 Max Elev.:4500.30
Bank Stations..........Left: 1000.0 Right....: 1083.0 Min Elev.:4500.30
Encroachment Stations..Left: Right....: Weir Coef: 2.900

CROSS SECTION POINTS - Elevations & Stations in feet:

No.	Elev.	Sta.	No.	Elev.	Sta.	No.	Elev.	Sta.
1)	4500.30	1000.00	2)	4500.30	1082.00	3)	4500.30	1083.00

COMPUTED PARAMETERS:

WSEL(ft)	Q(cfs)	H:max(ft)	H:ave(ft)	TW(ft)	A(sf)
4500.71	63.2	0.41	0.41	83.0	34.0
4500.72	65.6	0.42	0.42	83.0	34.9
4500.73	67.9	0.43	0.43	83.0	35.7
[illegible]00.74	70.4	0.44	0.44	83.0	36.6
[illegible]00.75	72.7	0.45	0.45	83.0	37.4
4500.76	75.1	0.46	0.46	83.0	38.2

NOTES:

Proposed Conditions

Proposed 3rd Street 500
Worksheet for Irregular Channel

Project Description	
Worksheet	Proposed 3rd_Street 0500 - Virgin
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	002500	ft/ft
Discharg	529.00	cfs

Options	
Current Roughness Methc	)ved Lotter's Method
Open Channel Weighting	)ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev.	4,500.29	ft < 4500.81 · Weir Controls
Elevation Range	)9.28 to 4,500.00	
Flow Area	142.6	ft²
Wetted Perimeter	199.68	ft
Top Width	198.80	ft
Actual Depth	1.01	ft
Critical Elevation	4,500.18	ft
Critical Slope	0.004433	ft/ft
Velocity	3.71	ft/s
Velocity Head	0.21	ft
Specific Energy	4,500.50	ft
Froude Number	0.77	
Flow Type	Subcritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.5906088 ft.

Roughness Segments

Start Station	End Station	Mannings Coefficient
9+69	11+68	0.016

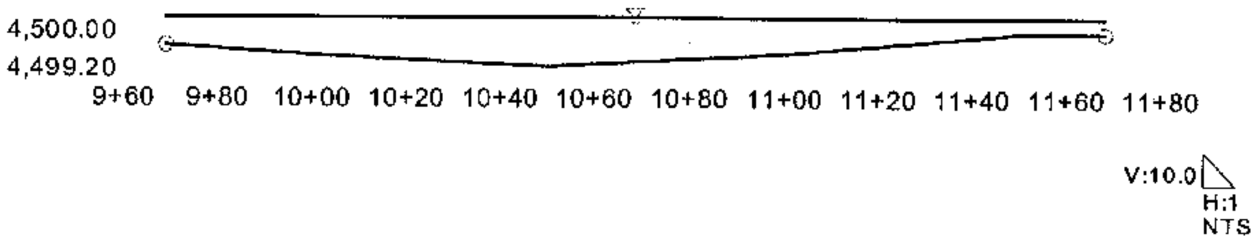
Natural Channel Points

Station (ft)	Elevation (ft)
9+69	4,499.70
10+00	4,499.49
10+50	4,499.28
11+00	4,499.55
11+50	4,499.97
11+68	4,500.00

Proposed 3rd Street 500
Cross Section for Irregular Channel

Project Description	
Worksheet	Proposed 3rd_Street 0500 - Virgin
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficiei	0.016	
Slope	0.002500	ft/ft
Water Surface Elev	4,500.29	ft
Elevation Range	99.28 to 4,500.00	
Discharge	529.00	cfs



Project___________________
Project No.___________________
Sheet No._________of_________
Calculated by______Date______

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CROSS SECTION PARAMETERS: FILENAME: 450.SEC

No. of Cross Section Points: 8 Bed Slope:0.00500 Max Elev.:4510.00
Bank Stations..........Left: 1105.0 Right....: 1289.0 Min Elev.:4499.00
Encroachment Stations..Left: Right....: Weir Coef: 2.900

CROSS SECTION POINTS - Elevations & Stations in feet:

No.	Elev.	Sta.	No.	Elev.	Sta.	No.	Elev.	Sta.
1)	4499.00	1105.00	2)	4499.15	1128.00	3)	4499.00	1152.00
4)	4499.00	1160.00	5)	4510.00	1160.50	6)	4510.00	1271.00
7)	4500.00	1271.50	8)	4500.10	1289.00			

COMPUTED PARAMETERS:

WSEL(ft)	Q(cfs)	H:max(ft)	H:ave(ft)	TW(ft)	A(sf)
4500.76	382.9	1.76	1.46	72.6	105.8
00.77	386.8	1.77	1.47	72.6	106.5
0.78	390.5	1.78	1.48	72.6	107.2
4500.79	394.4	1.79	1.49	72.6	108.0
4500.80	398.1	1.80	1.50	72.6	108.7
4500.81	402.0	1.81	1.51	72.6	109.4

NOTES:

Project
Project No.
Sheet No. of
Calculated by Date

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

```
CROSS SECTION PARAMETERS:                             FILENAME: VIRGOPT8.SEC

 No. of Cross Section Points:       7  Bed Slope:0.00500 Max Elev.:4500.48
 Bank Stations..........Left:  1000.0  Right....: 1078.0 Min Elev.:4499.73
 Encroachment Stations..Left:          Right....:          Weir Coef:  2.600
CROSS SECTION POINTS - Elevations & Stations in feet:
No.    Elev.         Sta.  No.    Elev.         Sta.  No.     Elev.        Sta.

 1)  4500.48      1000.00   2)  4500.39      1017.50   3)  4499.73     1017.51
 4)  4499.94      1039.00   5)  4499.73      1060.49   6)  4500.39     1060.50
 7)  4500.48      1078.00

COMPUTED PARAMETERS:
WSEL(ft)   Q(cfs)   H:max(ft)    H:ave(ft)    TW(ft)    A(sf)

 4500.76    116.5     1.03         0.66         78.0     51.1
  500.77    118.9     1.04         0.67         78.0     51.9
   00.78    121.3     1.05         0.68         78.0     52.7
 4500.79    123.8     1.06         0.69         78.0     53.5
 4500.80    126.2     1.07         0.70         78.0     54.2
 4500.81    128.7     1.08         0.71         78.0     55.0
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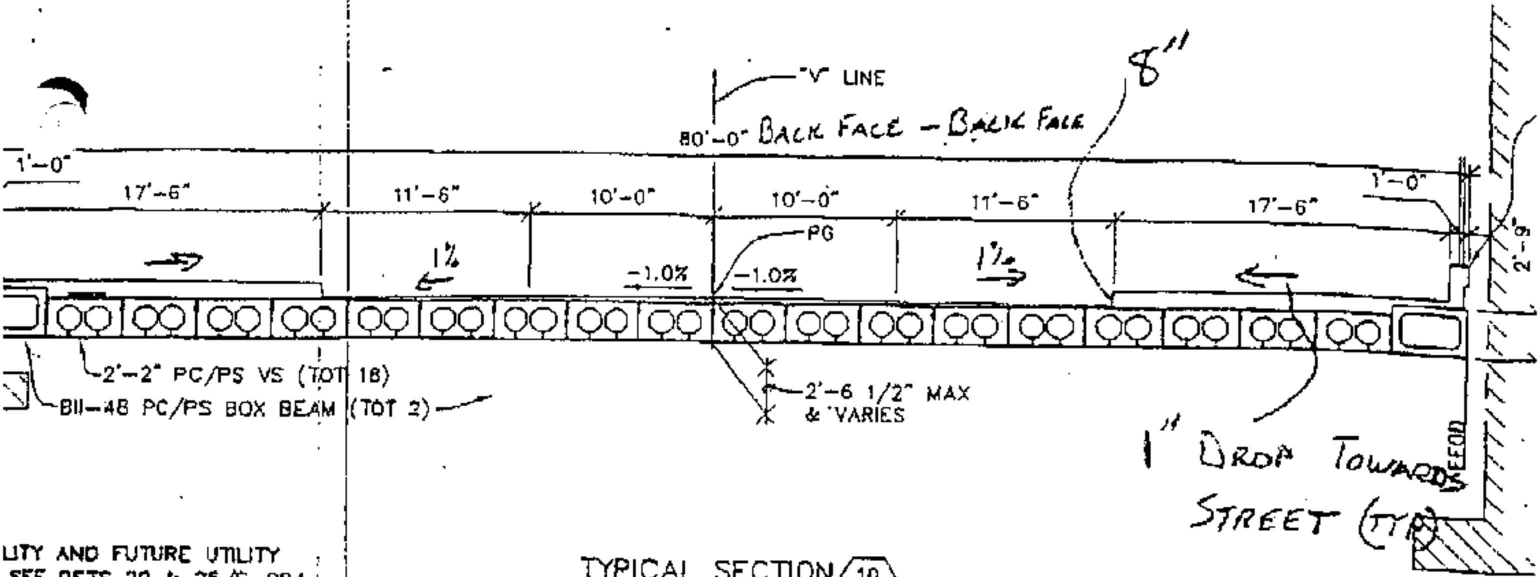
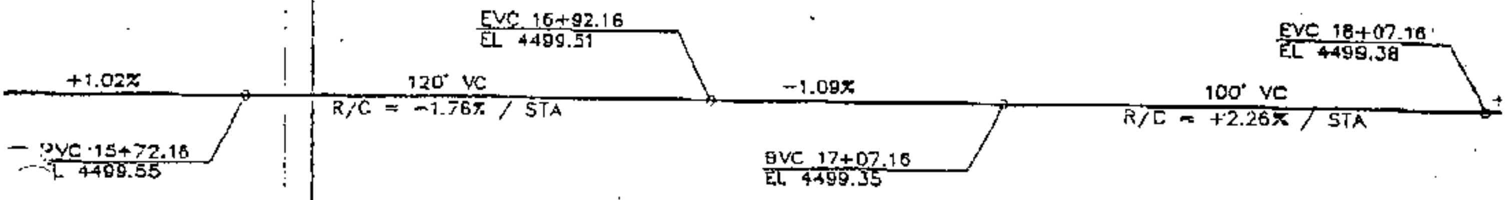
NOTES:



LITY AND FUTURE UTILITY
SEE DETS 20 & 25/S-004.

TYPICAL SECTION 10/001
SCALE:3/32"=1'-0"



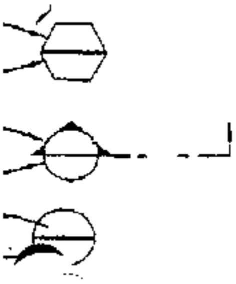
PROFILE GRADE
SCALE:NTS

BARAJAS & ASSOC.)
BRASS WELD MONUMENT IN CONCRETE
WEST CORNER OF THE INTERSECTION
UE AND UPRR TRACKS.

NORTHING	EASTING	ELEVATION
67,917.14	276,903.32	4,508.50

)88 ADJUSTED TO NAVD29 (CITY OF RENO)

NOTES:
1. FOR INVERT SLAB AND TRENCH WALL DETAILS, SEE TRENCH PLANS.
2. ALL EXISTING UTILITIES SHALL BE RELOCATED AS REQUIRED PRIOR TO FOUNDATI CONSTRUCTION.
3. ⊕ INDICATES POINT OF CRITICAL CLEARANCE.
4. FOR GENERAL NOTES, SEE SHT S-002.
5. PAINT "N VIRGINIA ST OH".
6. PAINT "BR NO XXXX".
7. FOR FENCING DETAILS, SEE "LANDSCAPE PLANS".
8. FOR TRENCH AND BRIDGE BARRIER INTERFACE DETAILS, SEE DETS 30 & 32/S-
9. ABUTMENT CENTERLINE PARALLEL TO MAINLINE.



ReTRAC PROJECT STANDARD DETAILS

A10	ABBREVIATIONS
B11-54A	BARRIER RAILING DETAILS NO 1
B11-54B	BARRIER RAILING DETAILS NO 2
B26-1	2'-2" VOIDED SLAB DETAILS NO 1
B26-2	2'-2" VOIDED SLAB DETAILS NO 2
B48-1	BII-48 PRECAST PRESTRESSED BOX BEAM DETAILS
SC-01	SURVEY DATA CONTROL MAP

INDEX TO PLANS

1. GENERAL PLAN
2. DECK CONTOURS & GENERAL NOTES
3. GIRDER LAYOUT
4. TYPICAL SECTION
5. MISCELLANEOUS DETAILS NO. 1
6. MISCELLANEOUS DETAILS NO. 2
7. THICKENED SIDEWALK DETAILS

RENO ReTRAC
WASHOE COUNTY NEVADA

TRAC THE GRANITE

SUBMITTED

RENO ReTRAC
NORTH VIRGINIA STREET ~~OH~~
GENERAL PLAN

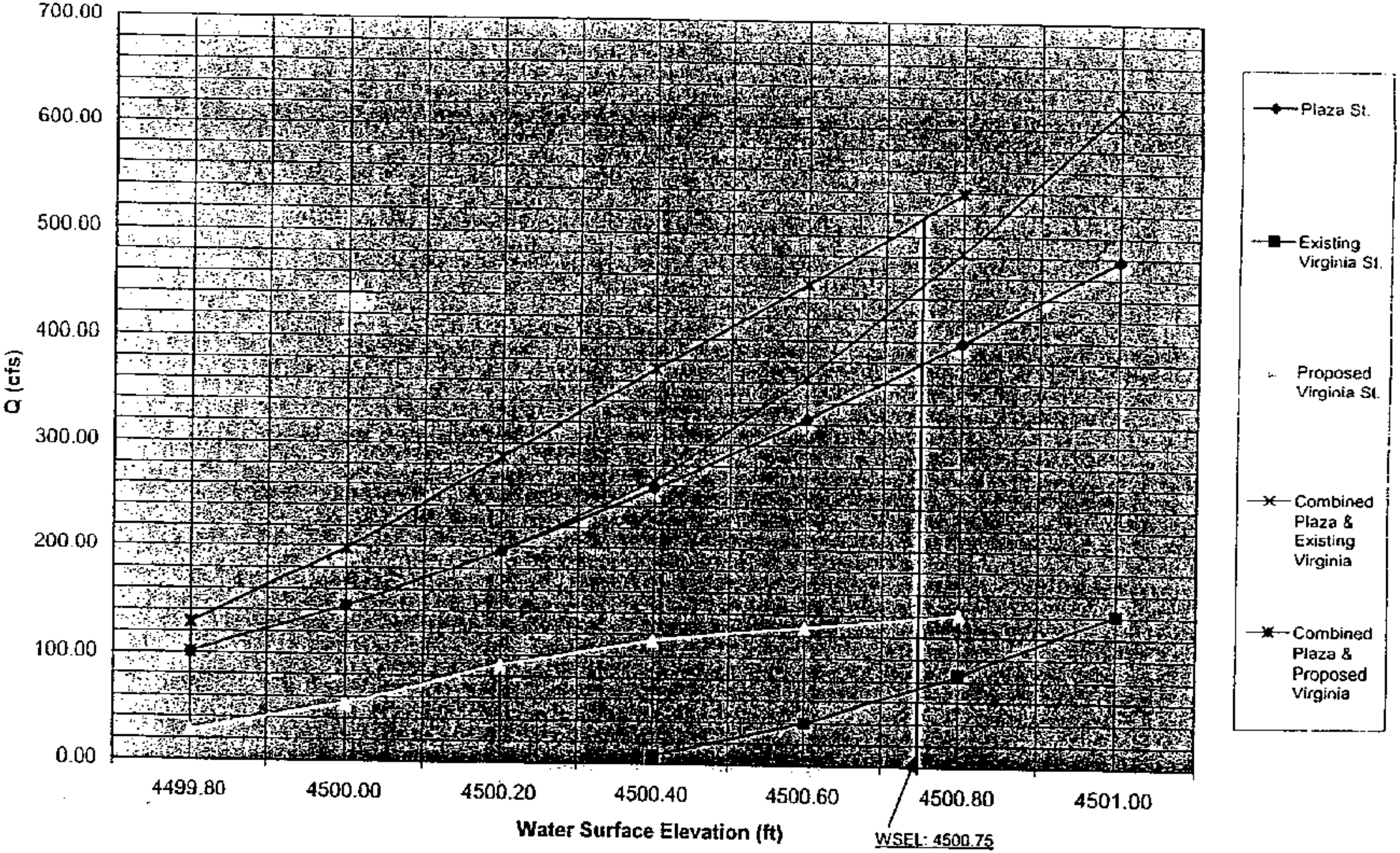
CONTRACT NO.

DRAWING NO.
S-001

SCALE
AS SH

PLAZA STREET & VIRGINIA STREET WEIR FLOW ANALYSIS

#80100603



Plaza Street Weir Section

4499.80	100.90
4500.00	144.60
4500.20	196.40
4500.40	257.00
4500.60	324.70
4500.80	398.10
4501.00	477.10

Existing Virginia Street Weir Section

4499.80	
4500.00	
4500.20	
4500.40	7.6
4500.60	39.6
4500.80	85.1
4501.00	141.0

Proposed Virginia Street Weir Section

4500.20	27.8
4500.40	53.2
4500.60	90.5
4500.70	114.4
4500.75	127.3
4500.80	140.7

Plaza Street & Existing Virginia Street Weir Flows

4499.80	100.90
4500.00	144.60
4500.20	196.40
4500.40	264.60
4500.60	364.30
4500.80	483.20
4501.00	618.10

Plaza Street & Proposed Virginia Street Weir Flows

4499.80	128.70
4500.00	197.80
4500.20	286.90
4500.40	371.40
4500.60	452.00
4500.80	538.80

Center St.

IFC Submittal

August 28, 2003
Project No. 80100603

Mr. Avrum Loewenstein, P.E.
ReTRAC
Parsons Transportation Group
264 Keystone Avenue
Reno, Nevada 89503

Reference: **ReTRAC Hydrologic and Hydraulic Design Memorandum for Center Street Overland Drainage**

Dear Mr. Loewenstein:

This letter is to document the design parameters and assumptions for the proposed improvements of the Center Street UPRR trench crossing. The proposed improvements begin just south of Commercial Row and end at Plaza Street. The 100-year storm event overland flow patterns were analyzed for existing and proposed conditions.

The localized 5-year storm drainage patterns of the proposed Center Street UPRR crossing will remain as existing. The area east of Center Street drains away from the proposed improvements and is not affected. On the west side of Center Street, localized drainage in Commercial Row is affected by the proposed profile of Center Street. Flow will be captured by two proposed catch basins. See plan sheet SD-290 for catch basin locations. Localized flow in Plaza Street will follow existing flow patterns.

The 100-year watershed basins have been delineated and are shown in the *IFC ReTRAC Drainage Report, Volume 1*. Flow from the 100-year event affecting the intersection of Center Street and Plaza Street is approximately 378cfs in existing conditions and 400cfs in proposed conditions. The 100-year overland flow travels east on Plaza Street over the Center Street crown and continues east towards the Evans Avenue Box Inlet. The water surface elevation at the existing Center Street crown during the 100-year event is 4496.71-feet, as shown by the calculation sheet labeled "*Plaza Street 400*".

Flow from the 100-year event affecting the proposed intersection of Plaza Street and Center Street is approximately 400cfs. The proposed crown was analyzed and the water surface elevation was found to be 4496.76-feet, as shown by the calculation sheet labeled "*Proposed Plaza Street 400*".

The proposed improvements on Center Street do not significantly increase the existing water surface elevation and do not alter the historic drainage pattern in the 100-year event. See the attached *North Center Street Plan and Profile* drawing for proposed improvements.

Sincerely,
STANTEC CONSULTING INC.

Trina M. Magoon, PE
Water Resources Project Manager

TMM:zrb
Enclosure(s)
P:\CIVIL\80100603\H&H\Design Memorandums\MEMO H&H Plaza & Center St Design(IFC).doc

Plaza Street 400
Worksheet for Irregular Channel

Project Description	
Worksheet	3rd_Street 0400 - Center
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	005000	ft/ft
Discharg	378.00	cfs

Options	
Current Roughness Methc	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	4,496.71	ft
Elevation Range	5.94 to 4,497.30	
Flow Area	104.0	ft²
Wetted Perimeter	252.37	ft
Top Width	252.36	ft
Actual Depth	0.77	ft
Critical Elevation	4,496.71	ft
Critical Slope	0.005014	ft/ft
Velocity	3.64	ft/s
Velocity Head	0.21	ft
Specific Energy	4,496.91	ft
Froude Number	1.00	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	14+32	0.016

Natural Channel Points

Station (ft)	Elevation (ft)
10+00	4,497.30
11+51	4,496.60
11+68	4,496.40
12+17	4,496.00
12+63	4,495.94
12+74	4,496.10
13+19	4,496.34
13+58	4,496.60
13+65	4,496.63
14+09	4,496.86
14+32	4,497.20

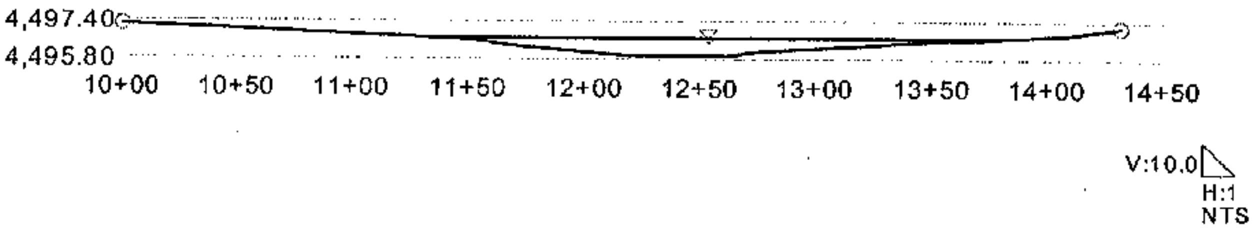
Plaza Street 400
Cross Section for Irregular Channel

Project Description

Worksheet	3rd_Street 0400 - Center
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data

Mannings Coefficiei	0.016	
Slope	0.005000	ft/ft
Water Surface Elev	4,496.71	ft
Elevation Range	35.94 to 4,497.30	
Discharge	378.00	cfs



Proposed Plaza Street 400
Worksheet for Irregular Channel

Project Description	
Worksheet	Proposed 3rd_Street 0400 - Cen
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	005000	ft/ft
Discharg	400.00	cfs

Options	
Current Roughness Methc	ɔved Lotter's Method
Open Channel Weighting	ɔved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	4,496.76	ft
Elevation Range	35.94 to 4,497.77	
Flow Area	100.7	ft²
Wetted Perimeter	214.26	ft
Top Width	214.25	ft
Actual Depth	0.82	ft
Critical Elevation	4,496.77	ft
Critical Slope	0.004787	ft/ft
Velocity	3.97	ft/s
Velocity Head	0.25	ft
Specific Energy	4,497.01	ft
Froude Number	1.02	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	14+00	0.016

Natural Channel Points

Station (ft)	Elevation (ft)
10+00	4,497.30
11+51	4,496.60
11+68	4,496.40
12+17	4,496.00
12+63	4,495.94
12+74	4,496.10
13+00	4,496.32
13+50	4,497.06
14+00	4,497.77

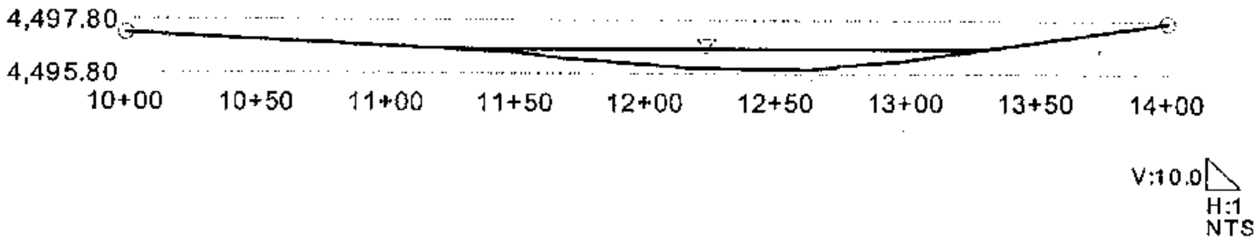
Proposed Plaza Street 400
Cross Section for Irregular Channel

Project Description

Worksheet	Proposed 3rd_Street 0400 - Cen
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data

Mannings Coefficie	0.016	
Slope	0.005000	ft/ft
Water Surface Elev.	4,496.76	ft
Elevation Range	95.94 to 4,497.77	
Discharge	400.00	cfs



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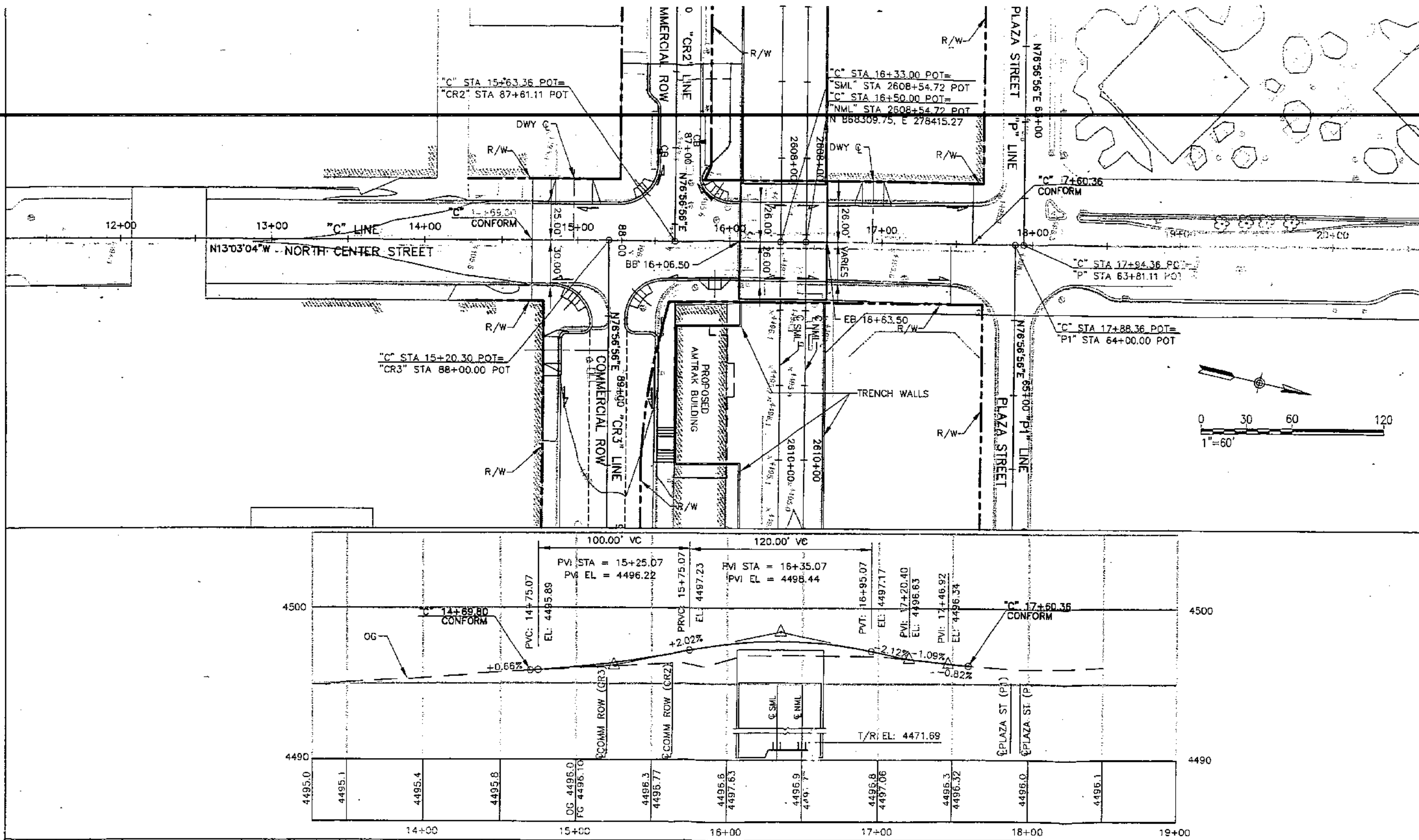

REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION
0	8/22/03	JS	AL	BRD	ISSUED FOR CONSTRUCTION						

DESIGNED BY C. TRIPLET
DRAWN BY C. TRIPLET
CHECKED BY A. VOO
IN CHARGE J. SHAFER
DATE 8/22/03

ISSUED FOR CONSTRUCTION

RENO ReTRAC
RENO WASHOE COUNTY NEVADA

ReTRAC THE GRANITE TEAM

SUBMITTED

APPROVED

RENO ReTRAC
NORTH CENTER ST IMPROVEMENTS
NORTH CENTER STREET
PLAN AND PROFILE

CONTRACT NO.
DRAWING NO. C-003
SCALE H:1"=60' V:1"=6


Lake St.

July 11, 2003
Project No. 80100603

Mr. Avrum Loewenstein, P.E.
ReTRAC
Parsons Transportation Group
264 Keystone Avenue
Reno, Nevada 89503

Reference: **ReTRAC Hydrologic and Hydraulic Design Memorandum for Lake Street Overland Drainage**

Dear Mr. Loewenstein:

This letter is to document the design parameters and assumptions for the proposed improvements of the Lake Street UPRR trench crossing. The proposed improvements begin just south of Commercial Row and end at Plaza Street. The 100-year storm event overland flow patterns were analyzed for existing and proposed conditions.

The localized 5-year storm drainage patterns surrounding the proposed Lake Street UPRR crossing will remain as existing. The 5-year storm drain system has been addressed in the East Third Street Storm Drain submittal. The area east of Lake Street drains away from the proposed improvements and is not affected by the improvements. The area west of Lake Street, between Plaza Street and the proposed trench, is covered by the bowling stadium parking facility and is not affected by flow in minor storm events. The property will need positive grading toward Plaza Street for larger storm events, where flow is not contained in Plaza Street and ponding may occur in the area.

A series of proposed catch basins will capture street drainage created by the proposed profile. See the *Lake Street Plan and Profile* drawing in the appendix for catch basin locations.

The 100-year watershed basins have been delineated and are shown in the *IFC ReTRAC Drainage Report, Volume 1*. Flow from the 100-year event affecting the intersection of Lake Street and Plaza Street is approximately 378cfs in existing conditions and 400cfs in proposed conditions. The remainder of the 100-year overland flow travels east on Plaza Street over the Lake Street crown and continues east towards the Evans Avenue Box Inlet. The water surface elevation at the existing Lake Street crown during the 100-year event is 4493.90-feet, as shown by the calculation sheet labeled "*Plaza Street 200*".

Flow from the 100-year event affecting the proposed intersection of Plaza Street and Lake Street is approximately 400cfs. The proposed crown was analyzed and the water surface elevation was found to be 4493.92-feet, as shown by the calculation sheet labeled "*Proposed Plaza Street 200*".

The proposed improvements on Lake Street do not significantly increase the existing water surface elevation and do not alter the historic drainage pattern in the 100-year event. See the attached *Lake Street Plan and Profile* drawing for proposed improvements.

Sincerely,
STANTEC CONSULTING INC.

Trina M. Magoon, PE
Water Resources Project Manager

TMM:zrb
Enclosure(s)
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Plaza Street 200
Worksheet for Irregular Channel

Project Description	
Worksheet	3rd_Street 0200 - 3rd & Lak
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	007000	ft/ft
Discharg	378.00	cfs

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	4,493.90	ft
Elevation Range	3.40 to 4,494.30	
Flow Area	120.9	ft²
Wetted Perimeter	473.95	ft
Top Width	473.95	ft
Actual Depth	0.50	ft
Critical Elevation	4,493.92	ft
Critical Slope	0.005777	ft/ft
Velocity	3.13	ft/s
Velocity Head	0.15	ft
Specific Energy	4,494.05	ft
Froude Number	1.09	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	15+58	0.016

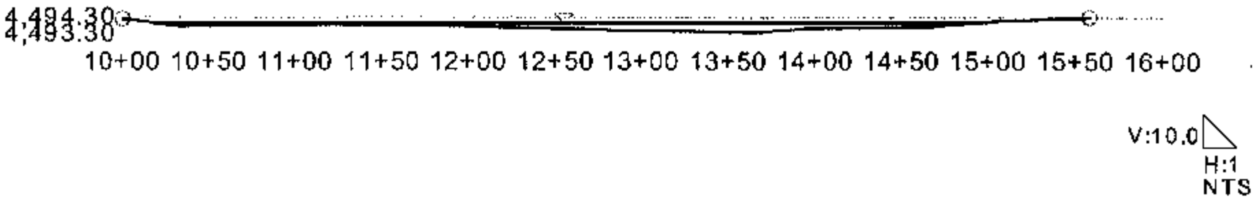
Natural Channel Points

Station (ft)	Elevation (ft)
10+00	4,494.20
10+11	4,494.00
10+32	4,493.70
11+20	4,493.80
12+06	4,493.70
12+84	4,493.50
13+65	4,493.40
13+98	4,493.60
14+67	4,493.70
15+04	4,494.00
15+58	4,494.30

Plaza Street 200
Cross Section for Irregular Channel

Project Description	
Worksheet	3rd_Street 0200 - 3rd & Lak
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.016	
Slope	0.007000	ft/ft
Water Surface Elev	4,493.90	ft
Elevation Range	3.40 to 4,494.30	
Discharge	378.00	cfs



Proposed Plaza Street 200
Worksheet for Irregular Channel

Project Description	
Worksheet	Proposed 3rd_Street 0200 - 3rd & L
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	007000	ft/ft
Discharg	400.00	cfs

Options	
Current Roughness Methc	›ved Lotter's Method
Open Channel Weighting	›ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	4,493.92	ft
Elevation Range	93.40 to 4,496.39	
Flow Area	118.3	ft²
Wetted Perimeter	411.79	ft
Top Width	411.78	ft
Actual Depth	0.52	ft
Critical Elevation	4,493.94	ft
Critical Slope	0.005530	ft/ft
Velocity	3.38	ft/s
Velocity Head	0.18	ft
Specific Energy	4,494.09	ft
Froude Number	1.11	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	15+50	0.016

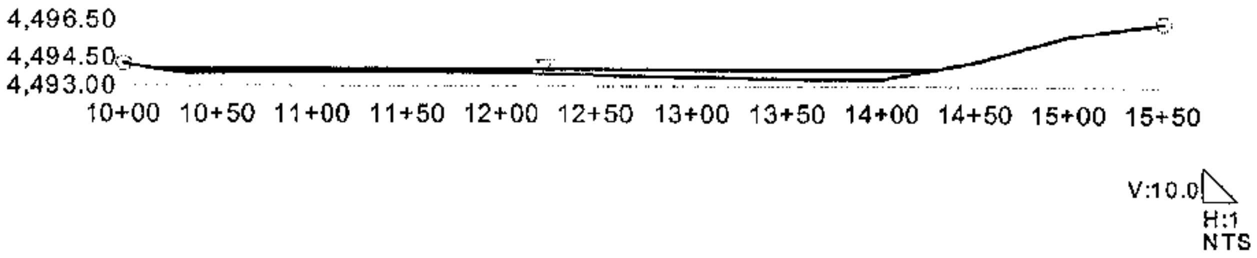
Natural Channel Points

Station (ft)	Elevation (ft)
10+00	4,494.20
10+11	4,494.00
10+32	4,493.70
11+20	4,493.80
12+06	4,493.70
12+84	4,493.50
13+65	4,493.40
14+00	4,493.40
14+50	4,494.30
15+00	4,495.64
15+50	4,496.39

Proposed Plaza Street 200
Cross Section for Irregular Channel

Project Description	
Worksheet	Proposed 3rd_Street 0200 - 3rd & L
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.016	
Slope	0.007000	ft/ft
Water Surface Elev.	4,493.92	ft
Elevation Range	33.40 to 4,496.39	
Discharge	400.00	cfs



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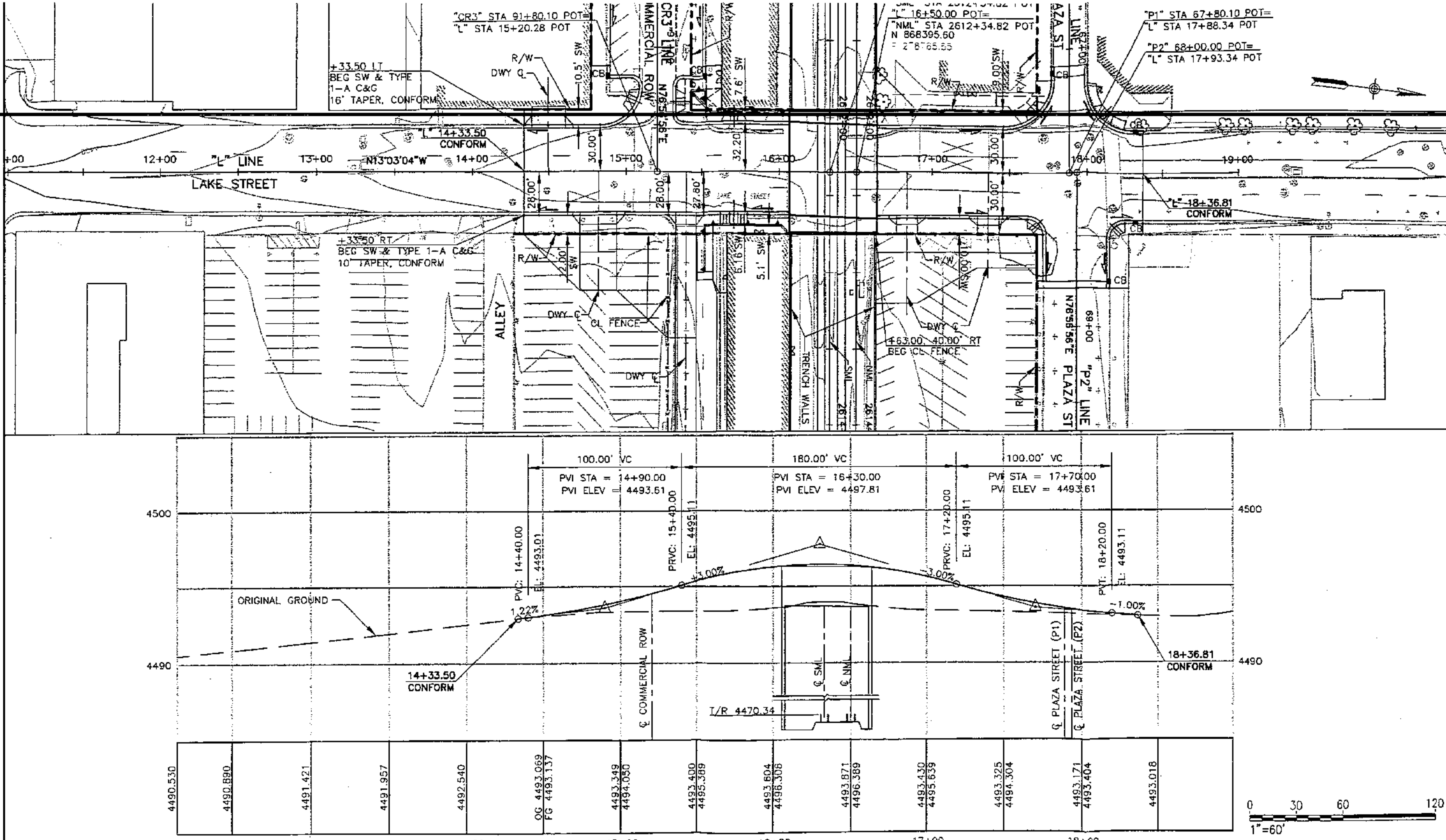


REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION
0	7/11/03	AV	AL	BRD	ISSUED FOR CONSTRUCTION						

DESIGNED BY C.TRIPLET/A.VOO
DRAWN BY C. TRIPLET
CHECKED BY J. SHAFER
IN CHARGE A. VOO
DATE 7/11/03

ISSUED FOR CONSTRUCTION

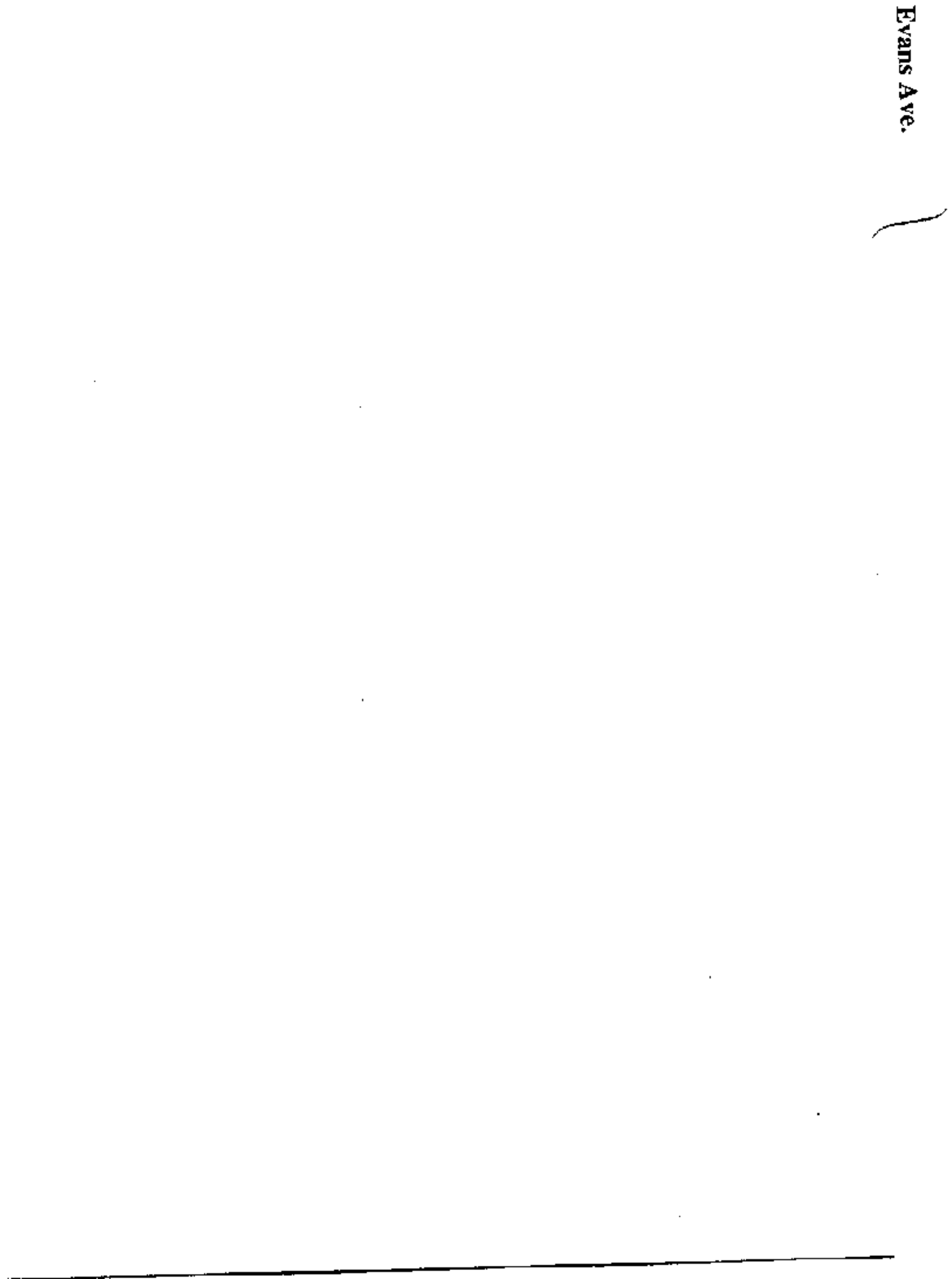
RENO ReTRAC
RENO WASHOE COUNTY NEVADA

ReTRAC THE GRANITE TEAM

SUBMITTED
APPROVED

RENO ReTRAC
LAKE STREET IMPROVEMENTS
LAKE STREET
PLAN AND PROFILE

CONTRACT NO.
DRAWING NO. C-003
SCALE H: 1"=60' V:1"=6


Evans Ave.

EVANS STORM DRAIN (LAKE TO WELLS)
IFC SUBMITTAL
NDC-033
October 10, 2003

CALCULATION PACKAGE

PROFESSIONAL ENGINEER - STATE OF NEVADA
TRINA M.
MAGOON
CIVIL
10/15/03
No 13963

Trina Magoon

exp 12/31/03

for pages 1-39

RENO ReTRAC PROJECT

IFC Submittal
NDC-033

October 10, 2003
Project No. 80100603

Mr. Avrum Loewenstein
ReTRAC
Parsons Transportation Group
264 Keystone Avenue
Reno, Nevada 89503

Reference: **ReTRAC Hydrologic and Hydraulic Design Memorandum for Evans Avenue Storm Drain (Lake to Wells)**

Dear Mr. Loewenstein:

This memorandum is intended to outline the hydraulic properties of the Evans Storm Drain System (Lake to Wells) in conjunction with the plan set labeled *Evans Ave Storm Drain / Lake St to Wells Ave*. The proposed Evans Storm Drain System will join the East Third Street Storm Drain System to the RCB/Wells Ave Outlet Structure. The system is designed for two different flow scenarios: the Downtown Peak (100-year event) and the Evans Avenue Peak (100-year event).

Scenario 1 – Downtown Peak 100-year Event

The Downtown Peak Flow concentrates at Vine Street and I-80 and travels overland through downtown Reno. Small amounts of flow enter the East Third Street Storm Drain System via catch basins. The majority of flow reaches the intersection of Plaza Street and Evans Avenue where it enters the Evans Storm Drain System via a 7'x7' box inlet. The hydraulic grade line labeled "Capacity HGL, Downtown Peak Flow" represents this scenario. This scenario occurs independently of the Evans Avenue Peak Flow due to the difference in times of concentration. The Downtown Peak Flow passes through the Evans Storm Drain System before the Evans Avenue Peak Flow produces significant discharge.

Scenario 2 – Evans Avenue Peak 100-year Event

The Evans Avenue Peak Flow concentrates at the Evans Street Bridge at I-80 and travels overland towards the Truckee River. The majority of the overland flow reaches the intersection of Fourth Street and Record Street where it enters the Evans Storm Drain System via a 9'x9' box inlet, located just south of the street intersection. The hydraulic grade line labeled "Capacity HGL, Evans Peak Flow" represents this scenario. During this scenario the Downtown Peak Flow has already passed through the system and the remaining residual flow has limited influence on the Evans Storm Drain System conveyance of the Evans Avenue Peak Flow. For this reason, the hydraulic grade line upstream of the 9'x9' box inlet has a 0% slope, representing the backwater effect.

Both inlets were designed to take the total 100-year flow. This is based on the "worst case" assumption of 100% clogging of all catch basins upstream of the inlets. This results in 100% of the peak flow traveling overland and entering the inlets. See attached calculations.

Due to the 100-year storm event design capacity of the Evans Storm Drain System, all other minor flow events, below the 100-year event, will be conveyed through the system, protecting the UPRR trench from overland flow.

Proposed RTC site evaluation

The proposed RTC site is the block surrounded by Fourth Street to the north, Lake Street to the west, UPRR tracks to the south and Evans Avenue to the east. In existing conditions, the Downtown Peak Flow (378cfs) travels overland on Plaza Street in an easterly direction. Flow crosses east over Lake Street and enters the aforementioned site. A portion of the flow splits over the tracks and travels south towards the Truckee River (Cross Sections 100-90). Refer to the hydraulic work map in the calculation package.

In proposed conditions, a 7'x7' box inlet will be constructed to capture 400cfs of Downtown Peak Flow. The inlet will be located at approximately cross section 80. The proposed raised profile of Evans Avenue creates an obstruction of the flow pattern in this area. Due to the proposed trench wall, flow will not be able to split south at historic flow locations. The result is an increase in water surface elevations at cross sections 100 and 90. Refer to cross sections calculation sheets.

The maximum water surface elevation increase is 0.5' at cross section 90. This increase is not consistent with the Technical Provisions, which state that "all drainage systems shall be accomplished without causing greater than 6-inches of backwater or excessive velocities (up to the 100-year event) which may adversely affect structure and embankment stability, adjacent property, existing storm drain facilities, natural drainage courses, or floodplain limits". The site is currently owned by the City of Reno and is planned to be redeveloped by the Regional Transportation Commission as their new RTC Transportation Center. It is anticipated that all existing buildings will be eliminated and the site can be designed to accommodate the flow and reduce the 100-year water surface elevation to pre-ReTRAC project elevations. The City of Reno was made aware of the situation and does not consider the current design to be in violation of the Technical Provisions. See attached minutes of meeting dated September 22, 2003. Existing and proposed water surface elevations should be made available to the RTC site designers for mitigation of the increase in water surface elevations to Pre-ReTRAC conditions.

If proposed improvements are not prepared in conjunction with the ReTRAC project, the City of Reno must condition the proposed RTC redevelopment to address the peak flow rates and increase in 100-year water surface elevations with the design of the site. Further conversations with Gary Stockhoff at the City of Reno have confirmed that the City will condition the site to provide these improvements in conjunction with the RTC development.

Sincerely,

STANTEC CONSULTING INC.

Trina M. Magoon, PE
Water Resources Project Manager

TMM:zrb
Enclosure(s)
c. Gary Stockhoff, Chris Robinson, John Hester

Memo

Stantec To: File

From: Zach Brandner

File:ReTRAC, 80100603

Date: September 22, 2003

Reference: **Meeting Minutes for ReTRAC Flood Improvements and RTC Site Interaction**

Attendees: **Zach Brandner (Stantec)**

Dick Howdle (Jacobs)

Gary Stockhoff (City of Reno)

Meeting consisted of discussion pertaining to the proposed RTC site in relation to ReTRAC overland drainage improvements. The proposed ReTRAC trench wall will alter historic overland flow paths in the area of the proposed RTC site and force water easterly. This flow alteration will raise the water surface elevations, up to 0.5' above existing conditions, violating the technical provisions of the ReTRAC project.

Gary stated this was not a violation but an exception to a unique situation. It was agreed that additional flood control measures (i.e. channel, additional inlets) would not be beneficial or cost effective for the area within or around the site. The best option would be to accept the raised water surface elevations and altered flow paths, and deliver the information to the RTC design team for design consideration.

A request was also made to utilize a fiberglass-reinforced pipe in the trench drainage design. Gary stated a formal submittal would be needed and consideration would be given towards the product.

c. Gary Stockhoff, Dick Howdle, Trina Magoon

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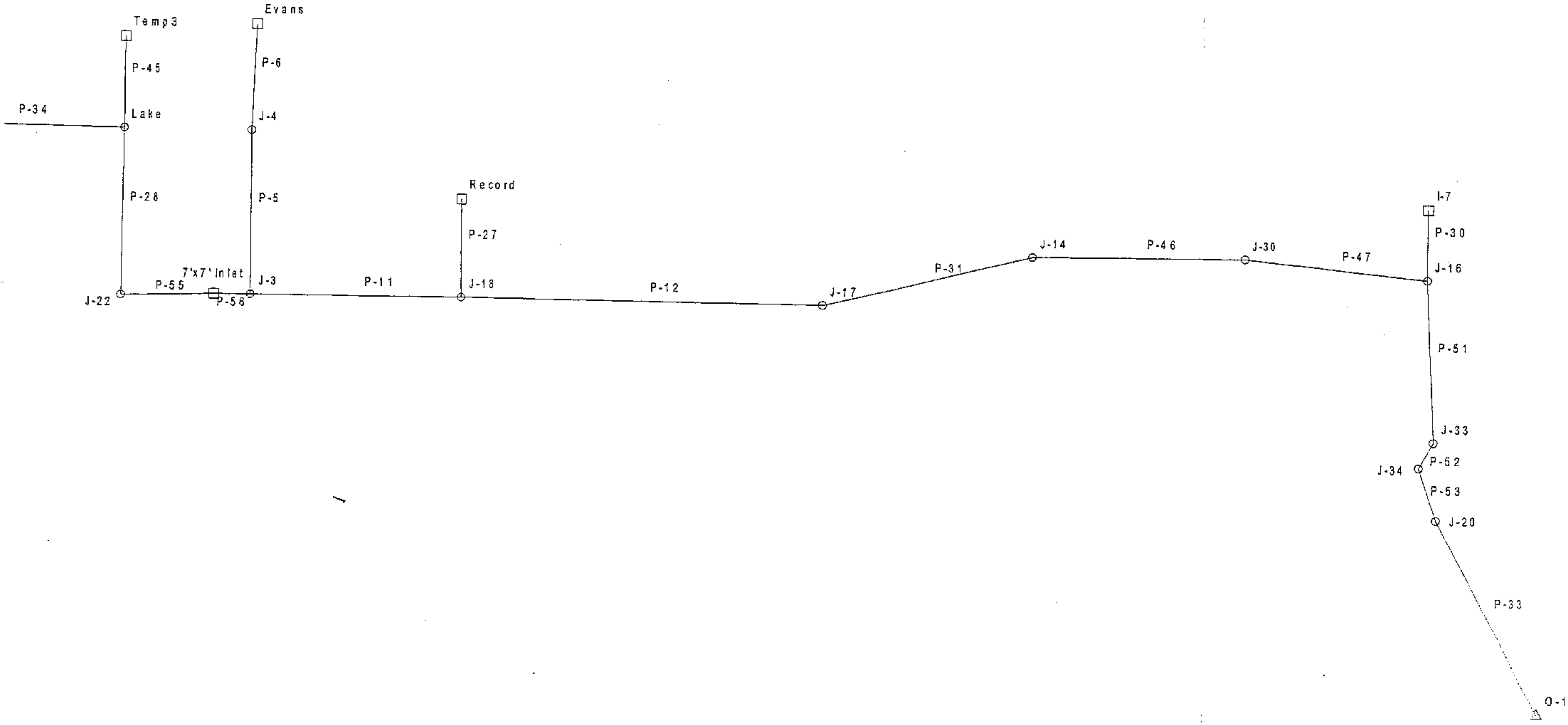
Scenario: Base



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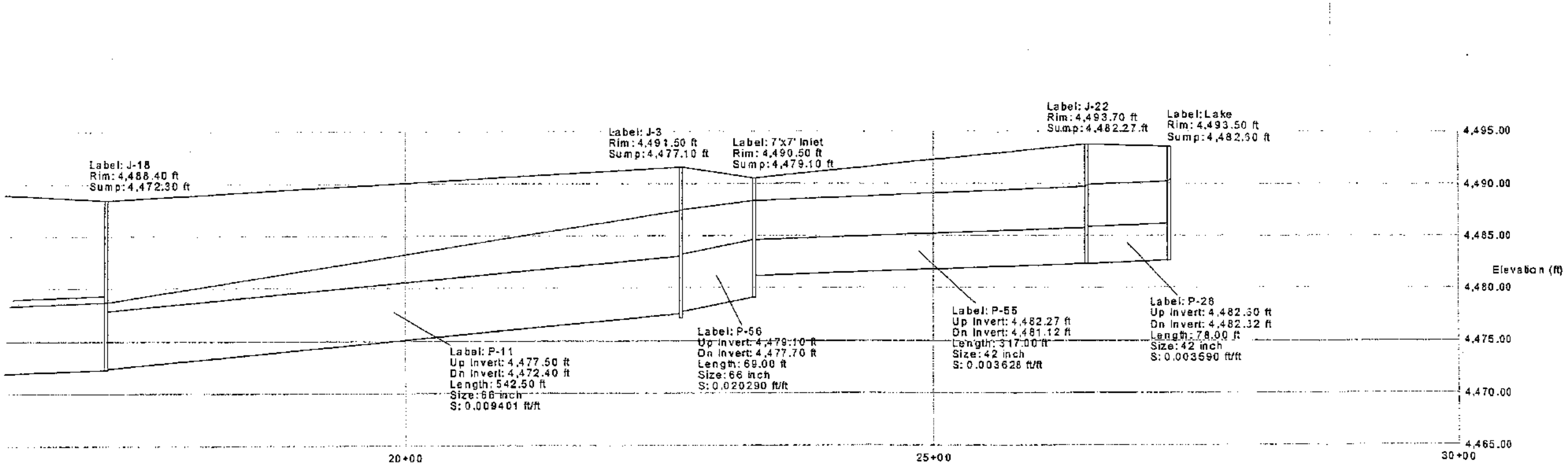
Project Engineer: Stantec
StormCAD v3.0 [319]
Page 1 of 1

Profile
Scenario: Base



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Project Engineer: Stantec
StormCAD v3.0 [319]
Page 1 of 1

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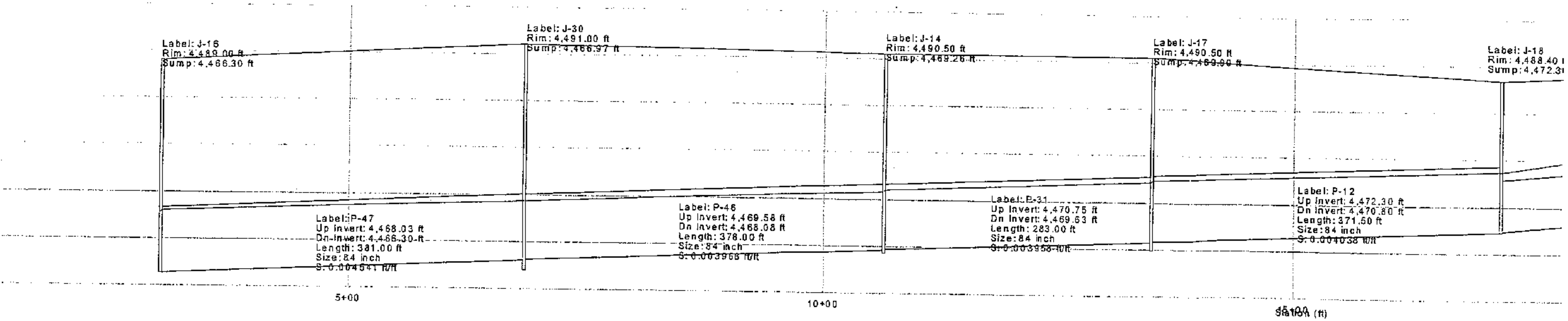
Profile
Scenario: Base



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6/49

[illegible]

S[illegible]: Base

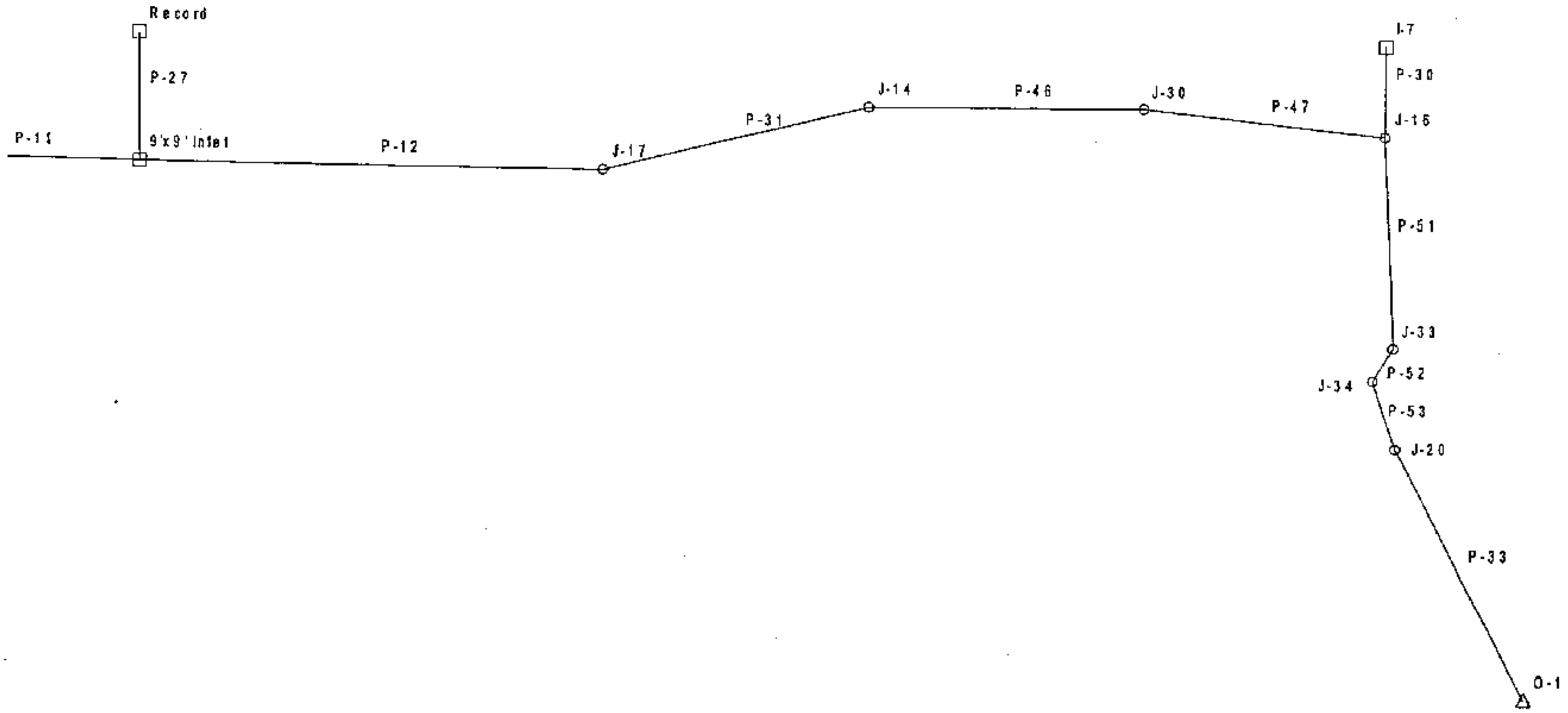
Combined Pipe/Node Report

Label	Upstream Node	Downstream Node	Length (ft)	Section Size	Capacity (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Calculated Headloss (ft)	Energy Grade In (ft)	Energy Grade Out (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)	Total System Flow (cfs)
P-41	Sands	Arlington	170.70	30 inch	31.55	6.11	4,502.20	4,501.19	0.005917	0.91	4,506.19	4,505.27	4,505.61	4,504.69	30.00
P-40	Arlington	West	386.70	30 inch	31.42	6.11	4,501.15	4,498.88	0.005870	2.07	4,505.26	4,503.19	4,504.68	4,502.61	30.00
P-48	West	J-31	22.00	30 inch	31.53	6.11	4,498.83	4,498.70	0.005909	0.12	4,503.12	4,503.01	4,502.54	4,502.42	30.00
P-49	J-31	J-32	297.70	30 inch	31.45	6.11	4,498.65	4,496.90	0.005878	1.59	4,502.94	4,501.34	4,502.36	4,500.76	30.00
P-50	J-32	Sierra	35.00	30 inch	31.00	6.11	4,496.85	4,496.65	0.005714	0.19	4,501.26	4,501.07	4,500.68	4,500.49	30.00
P-42	I-11	Sierra	49.00	15 inch	9.14	5.70	4,495.02	4,494.04	0.020000	0.58	4,501.58	4,501.00	4,501.07	4,500.49	7.00
P-38	Sierra	J-23	385.80	30 inch	36.05	7.54	4,493.38	4,490.40	0.007724	3.14	4,501.25	4,498.11	4,500.37	4,497.23	37.00
P-43	Temp2	Virginia	50.00	84 inch	857.04	0.06	4,490.50	4,489.60	0.018000	-6.58e-6	4,496.22	4,496.22	4,496.22	4,496.22	2.00
P-37	J-23	Virginia	96.60	30 inch	34.91	7.54	4,490.35	4,489.65	0.007246	0.79	4,497.89	4,497.11	4,497.01	4,496.22	37.00
P-36	Virginia	J-28	63.50	30 inch	43.06	7.95	4,489.60	4,488.90	0.011024	0.57	4,496.96	4,496.39	4,495.98	4,495.40	39.00
P-44	Temp	J-29	50.00	84 inch	903.40	0.33	4,486.83	4,485.83	0.020000	-3.68e-4	4,492.12	4,492.12	4,492.12	4,492.12	11.00
P-35	J-28	J-29	361.20	30 inch	34.46	7.95	4,488.80	4,486.25	0.007060	3.27	4,496.37	4,493.10	4,495.38	4,492.12	39.00
P-34	J-29	Lake	312.80	36 inch	66.18	7.07	4,485.75	4,482.67	0.009847	1.76	4,492.88	4,491.12	4,492.10	4,490.35	50.00
P-45	Temp3	Lake	50.00	84 inch	903.40	0.40	4,484.00	4,483.00	0.020000	1.99e-5	4,490.35	4,490.35	4,490.35	4,490.35	15.00
P-28	Lake	J-22	78.00	42 inch	60.28	6.76	4,482.60	4,482.32	0.003590	0.33	4,490.88	4,490.55	4,490.17	4,489.84	65.00
P-55	J-22	7'x7' Inlet	317.00	42 inch	60.59	6.76	4,482.27	4,481.12	0.003628	1.32	4,490.37	4,489.05	4,489.67	4,488.34	65.00
P-6	Evans	J-4	341.00	54 inch	125.09	2.77	4,479.61	4,478.23	0.004047	0.17	4,487.77	4,487.60	4,487.65	4,487.48	44.00
P-56	7'x7' Inlet	J-3	69.00	66 inch	478.31	15.99	4,479.10	4,477.70	0.020290	0.88	4,492.32	4,491.43	4,488.34	4,487.46	380.00
P-5	J-4	J-3	82.00	60 inch	165.21	2.24	4,478.23	4,477.90	0.004024	0.02	4,487.56	4,487.54	4,487.48	4,487.46	44.00
P-11	J-3	J-18	542.50	66 inch	325.58	17.85	4,477.50	4,472.40	0.009401	8.65	4,492.31	4,483.66	4,487.36	4,478.71	424.00
P-27	Record	J-18	80.00	5 x 5 ft	203.06	0.00	4,475.30	4,475.00	0.003750	0.00	4,478.71	4,478.71	4,478.71	4,478.71	0.00
P-12	J-18	J-17	371.50	84 inch	405.91	11.45	4,472.30	4,470.80	0.004038	1.37	4,480.74	4,479.31	4,478.67	4,477.30	424.00
P-31	J-17	J-14	283.00	84 inch	401.86	11.53	4,470.75	4,469.63	0.003958	1.06	4,479.17	4,478.08	4,477.09	4,476.03	424.00
P-46	J-14	J-30	378.00	84 inch	402.40	11.67	4,469.58	4,468.08	0.003968	1.45	4,477.95	4,476.47	4,475.82	4,474.37	424.00
P-30	I-7	J-16	100.00	60 inch	260.43	0.00	4,469.70	4,468.70	0.010000	0.00	4,473.00	4,473.00	4,473.00	4,473.00	0.00
P-47	J-30	J-16	381.00	84 inch	430.45	11.43	4,468.03	4,466.30	0.004541	1.29	4,476.41	4,474.94	4,474.29	4,473.00	424.00
P-51	J-16	J-33	149.60	9 x 6 ft	460.31	7.85	4,466.30	4,465.92	0.002540	0.32	4,473.67	4,473.35	4,472.71	4,472.39	424.00
P-52	J-33	J-34	10.00	9 x 6 ft	577.64	7.85	4,465.92	4,465.88	0.004000	0.02	4,473.22	4,473.19	4,472.26	4,472.24	424.00
P-53	J-34	J-20	33.90	9 x 6 ft	543.40	7.85	4,465.88	4,465.76	0.003540	0.07	4,473.06	4,472.99	4,472.10	4,472.03	424.00
P-33	J-20	O-1	110.00	9 x 6 ft	590.62	7.85	4,465.76	4,465.30	0.004182	0.24	4,472.80	4,472.56	4,471.84	4,471.60	424.00

7/11

F [illegible] AVE. PEAK

Scenario: Base



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Stantec Consulting Inc
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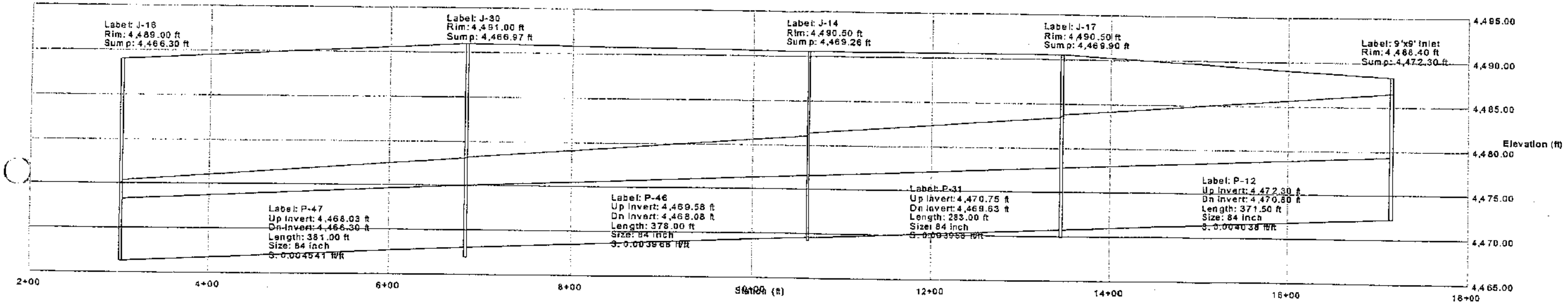
Project Engineer: Stantec
StormCAD v3.0 [319]
Page 1 of 1

Profile
Scenario: Base



9/49

EVANS MUL. PEAK

Sc io: Base

Combined Pipe/Node Report

Label	Upstream Node	Downstream Node	Length (ft)	Section Size	Capacity (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Calculated Headloss (ft)	Energy Grade In (ft)	Energy Grade Out (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)	Total System Flow (cfs)
P-41	Sands	Arlington	170.70	30 inch	31.55	6.11	4,502.20	4,501.19	0.005917	0.91	4,505.40	4,504.49	4,504.82	4,503.91	30.00
P-40	Arlington	West	386.70	30 inch	31.42	6.11	4,501.15	4,498.88	0.005870	2.07	4,504.48	4,502.41	4,503.90	4,501.83	30.00
P-48	West	J-31	22.00	30 inch	31.53	6.11	4,498.83	4,498.70	0.005909	0.12	4,502.34	4,502.22	4,501.76	4,501.64	30.00
P-49	J-31	J-32	297.70	30 inch	31.45	6.11	4,498.65	4,496.90	0.005878	1.59	4,502.15	4,500.56	4,501.57	4,499.98	30.00
P-50	J-32	Sierra	35.00	30 inch	31.00	6.11	4,496.85	4,496.65	0.005714	0.19	4,500.48	4,500.29	4,499.90	4,499.71	30.00
P-42	I-11	Sierra	49.00	15 inch	9.14	5.70	4,495.02	4,494.04	0.020000	0.58	4,500.79	4,500.21	4,500.28	4,499.71	7.00
P-38	Sierra	J-23	385.80	30 inch	36.05	7.54	4,493.38	4,490.40	0.007724	3.14	4,500.47	4,497.33	4,499.58	4,496.45	37.00
P-43	Temp2	Virginia	50.00	84 inch	857.04	0.06	4,490.50	4,489.60	0.018000	-1.53e-5	4,495.44	4,495.44	4,495.44	4,495.44	2.00
P-37	J-23	Virginia	96.60	30 inch	34.91	7.54	4,490.35	4,489.65	0.007246	0.79	4,497.11	4,496.32	4,496.22	4,495.44	37.00
P-36	Virginia	J-28	63.50	30 inch	43.06	7.95	4,489.60	4,488.90	0.011024	0.57	4,496.17	4,495.60	4,495.19	4,494.62	39.00
P-44	Temp	J-29	50.00	84 inch	903.40	0.38	4,486.83	4,485.83	0.020000	-7.5e-4	4,491.34	4,491.34	4,491.33	4,491.33	11.00
P-35	J-28	J-29	361.20	30 inch	34.46	7.95	4,488.80	4,486.25	0.007060	3.27	4,495.58	4,492.31	4,494.60	4,491.33	39.00
P-34	J-29	Lake	312.80	36 inch	66.18	7.07	4,485.75	4,482.67	0.009847	1.76	4,492.10	4,490.34	4,491.32	4,489.56	50.00
P-45	Temp3	Lake	50.00	84 inch	903.40	0.43	4,484.00	4,483.00	0.020000	-5.07e-4	4,489.56	4,489.56	4,489.56	4,489.56	15.00
P-28	Lake	J-22	78.00	42 inch	60.28	6.76	4,482.60	4,482.32	0.003590	0.33	4,490.09	4,489.77	4,489.38	4,489.06	65.00
P-55	J-22	I-13	317.00	42 inch	60.59	6.76	4,482.27	4,481.12	0.003628	1.32	4,489.59	4,488.27	4,488.88	4,487.56	65.00
P-6	Evans	J-4	341.00	54 inch	125.09	9.05	4,479.61	4,478.23	0.004047	1.83	4,490.93	4,489.10	4,489.65	4,487.82	144.00
P-56	I-13	J-3	67.50	66 inch	566.33	0.00	4,479.62	4,477.70	0.028444	0.00	4,487.56	4,487.56	4,487.56	4,487.56	0.00
P-5	J-4	J-3	82.00	60 inch	165.21	7.33	4,478.23	4,477.90	0.004024	0.25	4,488.64	4,488.39	4,487.81	4,487.56	144.00
P-11	J-3	9'x9' Inlet	542.50	66 inch	325.58	6.06	4,477.50	4,472.40	0.009401	1.00	4,488.12	4,487.12	4,487.54	4,486.55	144.00
P-27	Record	9'x9' Inlet	80.00	5 x 5 ft	203.06	0.00	4,475.30	4,475.00	0.003750	0.00	4,486.55	4,486.55	4,486.55	4,486.55	0.00
P-12	9'x9' Inlet	J-17	371.50	84 inch	405.91	14.24	4,472.30	4,470.80	0.004038	2.73	4,489.64	4,486.90	4,486.48	4,483.75	548.00
P-31	J-17	J-14	283.00	84 inch	401.86	14.24	4,470.75	4,469.63	0.003958	2.08	4,486.59	4,484.50	4,483.44	4,481.35	548.00
P-46	J-14	J-30	378.00	84 inch	402.40	14.24	4,469.58	4,468.08	0.003968	2.78	4,484.19	4,481.41	4,481.04	4,478.26	548.00
P-30	I-7	J-16	100.00	60 inch	260.43	3.82	4,469.70	4,468.70	0.010000	0.08	4,475.64	4,475.55	4,475.41	4,475.33	75.00
P-47	J-30	J-16	381.00	84 inch	430.45	14.24	4,468.03	4,466.30	0.004541	2.80	4,481.28	4,478.48	4,478.13	4,475.33	548.00
P-51	J-16	J-33	149.60	9 x 6 ft	460.31	11.54	4,466.30	4,465.92	0.002540	0.70	4,476.77	4,476.08	4,474.71	4,474.01	623.00
P-52	J-33	J-34	10.00	9 x 6 ft	577.64	11.54	4,465.92	4,465.88	0.004000	0.05	4,475.79	4,475.74	4,473.72	4,473.67	623.00
P-53	J-34	J-20	33.90	9 x 6 ft	543.40	11.54	4,465.88	4,465.76	0.003540	0.16	4,475.45	4,475.29	4,473.38	4,473.23	623.00
P-33	J-20	O-1	110.00	9 x 6 ft	590.62	11.54	4,465.76	4,465.30	0.004182	0.51	4,474.88	4,474.37	4,472.81	4,472.30	623.00

SUBJECT ICE TRAC JOB NO. ______
Evans SD (Lake to Wells) SHEET NO. ______ OF ______
MADE BY JRD DATE 9/[illegible] CHECKED BY TL DATE 9/[illegible]

60" Drop Inlet @ Wells Ave.

$Q = 89.6$ cfs

$Q = 0.6 A \sqrt{2gh}$

$89.6 = 0.6 \left(\frac{60}{24}\right)^2 \pi \sqrt{64.4h}$

$h = 0.9'$ Head Required

Rim Elev = 4479.6'

W.S.E.L = 4480.5'

Check Riser Area

$\left(\frac{60}{24}\right)^2 \pi + 1.75'\left(\frac{60}{12}\right)\pi = 47.1$ SQFT

Bar Area (SD-916)

$48(0.5')\frac{1'}{12''}(1.75) + \frac{48}{2}(0.5'')\frac{1'}{12''}(3.5) + \frac{60}{12}\pi(0.5'')\frac{1'}{12''} =$

$3.5 + 3.5 + 0.65 = 7.65$ SQ FT

Total Effective Area

$47.1 - 7.65 = 39.45$ SQ FT

25% Clogging Factor

$39.45(0.75) = 29.6$ SQFT

29.6 SQ FT

$89.6 = 0.6(29.6)\sqrt{64.4h}$

$h = 0.4'$

Top of Grate = 4481.6'

$\boxed{\text{W.S.E.L} = 4482.0'}$

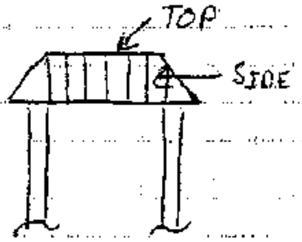
11/49

PARSONS

PARSONS TRANSPORTATION GROUP INC.
Barton-Aschman • De Leuw, Cather • Steinman

SUBJECT KETRAC JOB NO.
EVANS SD (LAKE TO WELLS) SHEET NO. OF
MADE BY ERB DATE 9/25/03 CHECKED BY JL DATE 9/25/03

AREA 7'x7 GRATE



TOP OF GRATE

7'x7'

49 SQ FT

BAR AREA (SD-913)

$11(0.5")\frac{1'}{12"}3.5' + 7(0.5")\frac{1'}{12"}3.5' = 2.63$ SQ FT

4 QUADS

2.63 × 4 = 10.5 SQ FT

— EFFECTIVE TOP AREA

49 − 10.5 = 38.5 SQ FT

SIDE OF GRATE

1.375 (7) 4 = 38.5 SQ FT

BAR AREA (SD-913)

$15(0.5")\frac{1'}{12"}(1.375) = 0.86$ SQ FT

0.86 SQ FT × 4 QUADS = 3.44 SQ FT

— EFFECTIVE SIDE AREA

38.5 SQ FT − 3.44 SQ FT = 35.1 SQ FT

TOTAL EFFECTIVE AREA

38.5 + 35.1 = 73.6 SQ FT

USE 25% CLOGGING FACTOR

73.6 × 0.75 = 55.2 SQ FT

$380\text{ CFS} = 0.6(55.2)\sqrt{64.4h}$

$h = 2.0'$

TOP OF GRATE ELEV = 4489.6'

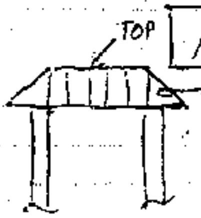
[illegible] = [illegible]

12/49

SUBJECT Ketrac JOB NO.

Evans SD (Lake to Wells) SHEET NO. OF

MADE BY ERB DATE 9/25/03 CHECKED BY DATE



AREA 9'x9' GRATE

TOP OF GRATE

9'x9'

81 SQ FT

BAR AREA (SD-913)

$14(0.5'')4.5'\frac{1'}{12''} + 9(0.5'')4.5'\frac{1'}{12''} = 4.3$ SQ FT

4 QUADRENTS

$4(4.3) = 17.2$ SQ FT

EFFECTIVE TOP AREA

$81 - 17.2 = 63.8$ SQ FT

SIDE OF GRATE

$1.375(9)4 = 49.5$ SQ FT

BAR AREA (SD-913)

$19(0.5'')\frac{1'}{12''}(1.375') = 1.1$ SQ FT

1.1 SQ FT × 4 QUADS = 4.4 SQ FT

EFFECTIVE SIDE AREA

49.5 SQ FT − 4.4 SQ FT = 45.1 SQ FT

TOTAL EFFECTIVE AREA

63.8 SQ FT + 45.1 SQ FT = 108.9 SQ FT

E. 25% CLOGGING FACTOR

108.9 × 0.75 = 81.7 SQ FT

SUBJECT Retrac JOB NO. ____
Evans SD (Lake Wells) SHEET NO. ____ OF ____
MADE BY ERB DATE 9/25/0_ CHECKED BY [illegible] DATE [illegible]

9' x 9' Inlet

$$Q = 0.6\,A\,\sqrt{2gh}$$

$$548 = 0.6\,(81.7)\,\sqrt{64.4h}$$

$$h = 1.9'$$

Top of Grate = 4487.1

$$\boxed{W.S.E.L = 4489}$$

SUBJECT [illegible] JOB NO. ____
EVANS STORM DRAIN SHEET NO. ____ OF ____
MADE BY ERD DATE 10/7/03 CHECKED BY ____ DATE ____

9' x 9' INLET

$Q = 0.6 A \sqrt{2gh}$

$548 \text{ cfs} = 0.6(81)\sqrt{64.4h}$

$h = 2.0'$

TOP OF BOX 4485.4

WATER SURFACE ELEV 4487.4' < 4489 ⇒ GRATE CONTROLS

7' x 7' INLET

$Q = 0.6 A \sqrt{2gh}$

$380 = 0.6(49)\sqrt{64.4h}$

$h = 2.6'$

TOP OF BOX 4487.9

WATER SURFACE ELEV 4490.5 < 4491.6 ⇒ GRATE CONTROLS

Parsons Transportation Group Inc. / HNTB Corporation
Joint Venture Design Team for the Tutor – Saliba Team

COMP. INDEX NO.	REV. NO.

SUBJECT RETRAC
EVANS AVE SD (LAKE TO WELLS)
PIPE CALCS
SHEET NO. ______ OF ______
MADE BY ERB DATE 7/21/03 CHECKED BY ______ DATE ______

REFERENCE CONCRETE PIPE HANDBOOK

$D_{0.01} = \frac{LL + DL}{B_f \, d}$ WHERE

$D_{0.01}$ = 0.01 INCH CRACK STRENGTH, LBS PER LINEAR FOOT

LL = LIVE LOAD lbs/ft
DL = DEAD LOAD lbs/ft
B_f = BEDDING FACTOR, CLASS B BEDDING = 1.9
d = PIPE DIAMETER

CL III SD 42" φ

CL III MAX $D_{0.01}$ = 1350 lbs/ft

No LL

$1350 = \frac{DL}{1.9\,(3.5)}$ DL = 8977.5

DL = 1.4(w) H (O.D. OF PIPE)

8977.5 = 1.4(125) H (4.17')

H = 12.3' MAX FILL HEIGHT > 6' MAX HEIGHT OVER (P) 42"
FOR CL III

OK

16/49

Parsons Transportation Group Inc. / HNTB Corporation
Joint Venture Design Team for the Tutor – Saliba Team

COMP. INDEX NO.
REV. NO.

SUBJECT RETRAC
SHEET NO. ____ OF ____
EVANS SD (LAKE TO WELLS)
PIPE CALCS

MADE BY ZRB DATE 7/21/07 CHECKED BY ____ DATE ____

— CL III SD 60" φ   CL III MAX $D_{0.01} = 1350$ lbs/ft

NO LL

$1350 = \frac{DL}{1.9(5)}$ $DL = 12825$

$DL = 1.4(w)(H)(\text{O.D. OF PIPE})$

$= 1.4(125)\,H\,(6)$

H = 12.2' MAX FILL HEIGHT FOR CL III PIPE > 10.5' MAX FILL HEIGHT OVER (P) 60" RCP

OK

— RAIL LOADED 84" φ MAX DEPTH

H = 11.6'

DL = 16917 lbs/ft

LL = 6250 lbs/ft

$D_{0.01} = \frac{DL + LL}{B_f\,d} = \frac{16917 + 6250}{1.9(7)}$

$D_{0.01} = 1742 < 2000$

USE CL IV C-WALL OK

MIN DEPTH

H = 6.5

DL = 9479

LL = 12083

$D_{0.01} = \frac{9479 + 12083}{1.9(7)}$

$D_{0.01} = 1621 < 2000$ lbs/ft

USE CL IV C-WALL

17/49

SHEET 10 OF

Design Data 3

American
Concrete Pipe
Association

Railway Loads on Concrete Pipe

FOREWORD

Historically, the American Railway Engineering Association, AREA, has published criteria for design of railways, including the method for designing and installing concrete pipe within railway right-of-way. Railway design criteria is now developed and published by the American Railway Engineering and Maintenance-of-Way Association (AREMA) in the "AREMA Manual for Railway Engineering"(1). Concrete pipe material, design, and installation is covered in Chapter 8, Part 10, "Reinforced Concrete Culvert Pipe" of the AREMA Manual(1). Each railway company may have their own modifications to the AREMA criteria. Pipe criteria should be thoroughly discussed with the specifier prior to designing the pipe for a project.

Design Data 3 provides a simple means of analyzing railway live and dead loads on concrete pipe. The loading information is applicable to circular, arch, and elliptical pipe shapes. AREMA, Part 10, specifies the indirect design method in which the installation is dependent on a combination of specific pipe strengths and details of the soil envelope supporting the pipe. More recently, the direct design method has been developed to provide a more rational means of analyzing pipe strength and specifying installation details. The method analyzes the composite strength of the soil-pipe structure used in the installation. Research by the American Concrete Pipe Association (ACPA) has provided a series of improved Standard Installation details that can be used with either the direct or the indirect design method (9).

INTRODUCTION

To determine the required design strength of concrete pipe installed within railway right-of-way, it is necessary to evaluate the effect of live loads imposed by a train, dead loads imposed by the soil, and surcharge loads imposed by structures such as bridge piers or abutments, to the top of the pipe.

METHODS OF ANALYSIS

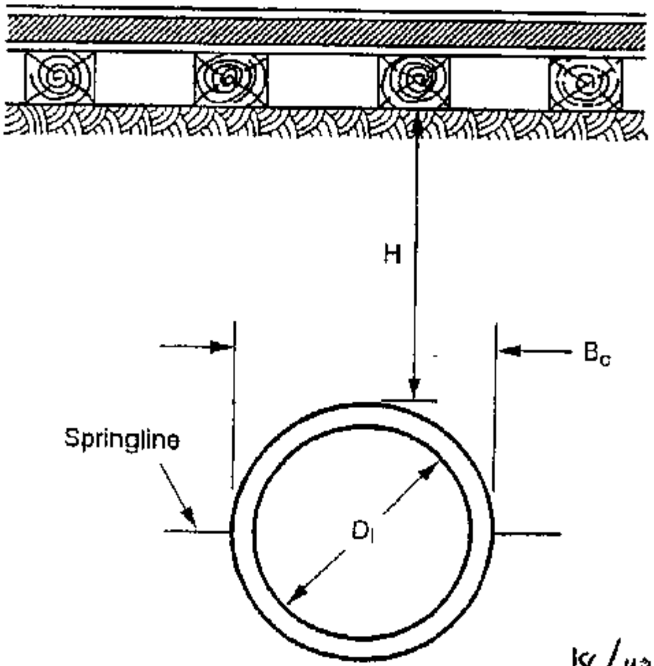
Part 10 of Chapter 8 of the AREMA Manual(1) states that satisfactory design methods utilizing more exact design procedures for dead loads are presented in the ACPA publications "Concrete Pipe Design Manual"(9) and "Concrete Pipe Handbook"(10). These ACPA publications now include the Standard Installations.

The ACPA's research resulted in a soil structure design method for buried concrete pipe, "SIDD", Standard Installation Direct Design. The SIDD Program was subsequently incorporated into the Federal Highway Administration's Pipe Culvert Analysis Reinforcing (PIPECAR) program. The program calculates concrete pipe designs for railway, highway, and airport live loads, dead loads and surcharge loads. Design Data 40, "Standard Installation and Bedding Factors for the Indirect Design Method" may be referenced for manual calculations.

LIVE LOADS

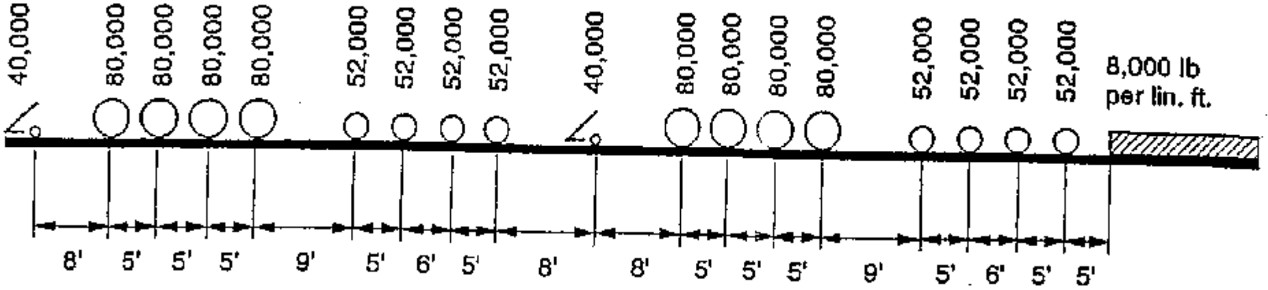
The railway supporting ties and rails are considered the track structure, which distributes train loads to the soil or bridges. Live loads are assumed to be applied, by the ties, uniformly to the surface of the ballast and then distributed through the embankment to the pipe, see Figure 1. As a design track loading, AREMA recom-

Figure 1 Height of Cover Above Top of Pipe to Bottom of Ties



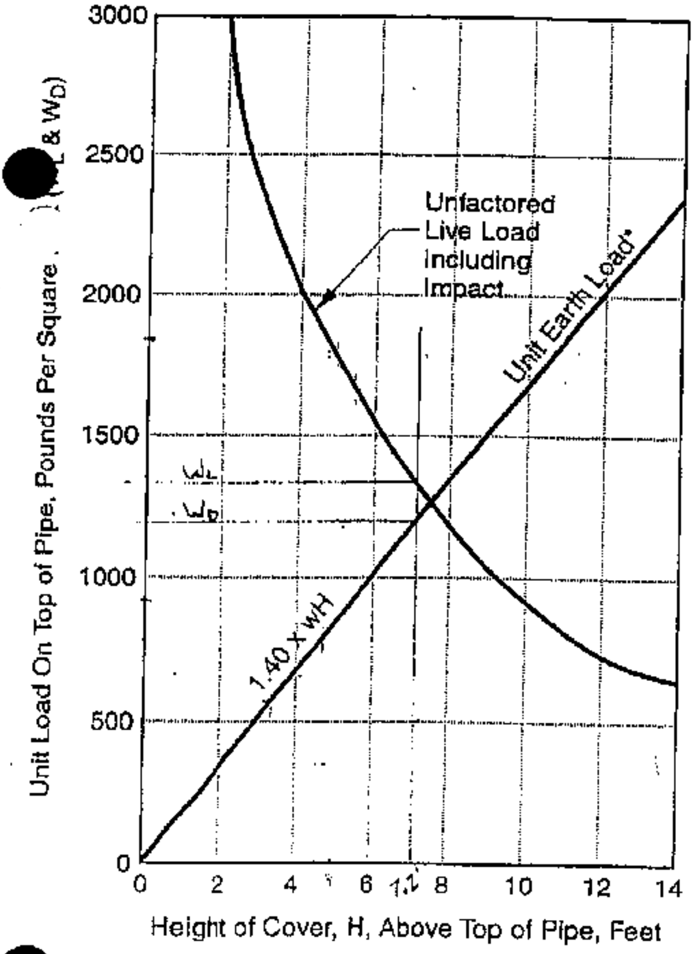
18/49

Figure 2 Cooper E 80 Wheel Loads and Axle Spacing



mends a Cooper E 80 loading, which has axle loadings and spacings as shown in Figure 2, and a linearly variable impact factor that is 40% at the bottom of the ties and zero at 10 feet of cover below the ties. Based on a uniform load distribution at the bottom of the ties and through the soil mass, the design track unit load, W_L, in pounds per square foot, is determined from the AREMA graph presented in Figure 3. To obtain the live load transmitted to the pipe in pounds per linear foot, it is necessary to multiply the unit load, W_L, from Figure 3, by the outside span, B_c, of the pipe in feet. The pipe size or equivalent pipe size and outside diameter or horizontal span is presented in Table 1 for circular, arch and elliptical pipe respectively.

Figure 3 Loads on Concrete Pipe Installed Under Railways



*Fill for embankment installations
DL/B_c = 1.40wH with w = ~~120pcf~~ 125pcf
1.40 = Vertical Arching Factor

Loadings on a pipe within a casing pipe shall be taken as the full dead load, plus live load, plus impact load without consideration of the presence of the casing pipe, unless the casing pipe is fully protected from corrosion.

Culvert or sewer pipe within the railway right-of-way, but not under the track structure, should be analyzed for the effect of live loads because of the possibility of train derailment.

EARTH LOAD

The unit fill load, in pounds per square foot (Pa), for embankment installations is given by the straight line in Figure 3. The fill load is based on a Type 2 Standard Installation, as defined in ASTM Standard C 1479, "Standard Practice for Installation of Reinforced Concrete Sewer, Storm Drain, and Culvert Pipe". A detailed explanation of the Standard Installations can also be found in ACPA's Design Data 40, "Standard Installations and Bedding Factors for the Indirect Design Method." A Type 2 Installation requires 90% compaction of a granular material up to the springline of the pipe. Most railroad industries maintain a well compacted envelope of at least 90% standard proctor around and above the pipe to support the track. The soil prism load directly above the pipe is increased by a dimensionless vertical arching factor of 1.40 to account for the additional portion of the embankment supported by the pipe. The unit fill in pounds per square foot is read directly from Figure 3. To convert the unit load W_D to pounds per linear foot, multiply by the outside horizontal span, B_C, of the pipe in feet.

SURCHARGE LOADS

Any uniform static surface surcharge load should be converted to additional height of fill to determine the to-

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tal dead load on the pipe. The ACPA "Concrete Pipe Design Manual"(9), the ACPA "Concrete Pipe Handbook"(10) and the ACPA's "PIPECAR"(11) computer program design procedures incorporate surcharge loads by converting them to additional heights of fill.

EXAMPLE

An Example follows to illustrate the determination of the railway live load for a concrete pipe installation.

GIVEN

A 48-inch diameter, B wall, circular pipe is to be installed under a railway with 4 feet of cover between the bottom of the ties and the top of the pipe.

FIND

The live load and dead load, in pounds per linear foot, on top of the pipe.

SOLUTION

Enter Figure 3 at H = 4.0 feet on the horizontal scale, "Height of Cover, H, Above Top of Pipe", and project a vertical line to the "Live Load Including Impact" curve. From the curve project a horizontal line left to the vertical scale, "Unit Load on Top of Pipe", read 2,000 pounds per square foot.

To obtain the live load in pounds per linear foot of pipe, multiply the Unit Live Load, W_L, by the outside horizontal span, B_c, of the pipe. From Table 1A, B_c = 4.83 ft. and the live load is:

LL = 2000 x 4.83 = 9,660 pounds per linear foot

To calculate the earth load, DL, use Figure 3 and the same procedure as used for finding the live load. Multiply the unit dead load, W_D, by the horizontal space, B_c, of the pipe. The dead load is:

DL = 700 x 4.83 = 3400 pounds per linear foot

SHEET 12 OF

Table 1A B_c, in feet, of Concrete Pipe

Size or Equivalent Round Size Inches	Circular Pipe			Arch Pipe Span ASTM C506	Elliptical Pipe Span ASTM C507	
	B Wall RCP ASTM C76	C Wall RCP ASTM C76	Non-Reinforced ASTM C14		Vertical Elliptical	Horizontal Elliptical
4	-	-	0.46	-	-	-
6	-	-	0.65	-	-	-
8	-	-	0.85	-	-	-
10	-	-	1.04	-	-	-
12	1.33	-	1.29	-	-	-
15	1.63	-	1.56	1.88	-	-
18	1.92	-	1.88	2.25	1.63	2.38
21	2.21	-	2.21	2.63	-	-
24	2.50	2.63	2.56	2.88	2.08	3.00
27	2.79	2.92	2.88	-	2.38	3.38
30	3.08	3.21	3.21	3.60	2.58	3.75
33	3.38	3.50	3.50	-	2.88	4.13
36	3.67	3.88	3.79	4.31	3.17	4.50
39	-	-	-	-	3.46	4.88
42	4.25	4.38	-	5.01	3.67	5.25
48	4.83	4.96	-	5.71	4.08	5.92
54	5.42	5.54	-	6.33	4:58	6.67
60	6.00	6.13	-	7.08	5.08	7.42
66	6.58	6.71	-	-	5.58	8.08
72	7.17	7.29	-	8.50	6.08	8.83
78	7.75	7.88	-	-	-	-
84	8.33	8.46	-	10.33	-	-
90	8.92	9.04	-	11.00	-	-
96	9.50	9.63	-	11.67	-	-
102	10.08	10.21	-	-	-	-
108	10.67	10.79	-	13.17	-	-
114	11.25	11.38	-	-	-	-
120	11.83	11.96	-	14.67	-	-
126	12.42	12.54	-	-	-	-
132	13.00	13.13	-	15.73	-	-
138	13.58	13.71	-	-	-	-
144	14.17	14.29	-	-	-	-

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REFERENCES

1. *"Part 10 Reinforced Concrete Culvert Pipe, Chapter 8, Concrete Structures and Foundations, AREMA Manual of Railway Engineering"*, American Railway Engineering and Maintenance-of-Way Association, 1999.

2. *"ASTM C-14-Standard Specification for Concrete Sewer, Storm Drain and Culvert Pipe"*, American Society for Testing and Materials.

3. *"ASTM C 76-Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe"*, American Society for Testing and Materials.

4. *"ASTM C 506-Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe"*, American Society for Testing and Materials.

5. *"ASTM C 507-Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe"*, American Society for Testing and Materials.

6. *"ASTM C 655-Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe"*, American Society for Testing and Materials.

7. *"ASTM C 985-Standard Specification for Nonreinforced Concrete Specified Strength Culvert, Storm Drain, and Sewer Pipe"*, American Society for Testing and Materials.

8. *"ASTM C 1417-Standard Specification for Manufacture of Reinforced Concrete Sewer, Storm Drain, and Culvert Pipe for Direct Design"*, American Society for Testing and Materials.

9. *"Concrete Pipe Design Manual"*, American Concrete Pipe Association, 2000.

10. *"Concrete Pipe Handbook"*, American Concrete Pipe Association, 1998.

11. *"PIPECAR Computer Program"*, American Concrete Pipe Association, 2001.

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PARSONS

PARSONS TRANSPORTATION GROUP INC.
Barton-Aschman • De Leuw, Cather • Steinman

SUBJECT RETRAC JOB NO. 80100603
DOWNTOWN 100YR WSEL COMPARISON SHEET NO. ______ OF ______
MADE BY ZRB DATE 9/10/03 CHECKED BY ______ DATE ______

XSXN	(CFS) Q_{EXST}	(CFS) Q_{PROP}	(FT) $WSEL_E$	(FT) $WSEL_P$	(FT) Δ WSEL
150	380	380	4493.51	4493.50	0.0
100	340	380	4493.68	4493.82	+0.1
90	210	380	4493.30	4493.83	+0.5
80	210	380	4491.61	4491.6	0.0

Plaza Street 150
Worksheet for Irregular Channel

Project Description	
Worksheet	3rd_Street 0150 - Lake & C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	002000	ft/ft
Discharg	378.00	cfs

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	4,493.51	ft
Elevation Range	2.40 to 4,493.90	
Flow Area	145.4	ft²
Wetted Perimeter	293.80	ft
Top Width	293.27	ft
Actual Depth	1.11	ft
Critical Elevation	4,493.32	ft
Critical Slope	0.004786	ft/ft
Velocity	2.60	ft/s
Velocity Head	0.10	ft
Specific Energy	4,493.61	ft
Froude Number	0.65	
Flow Type	Subcritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.50818432 ft.

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	13+16	0.016

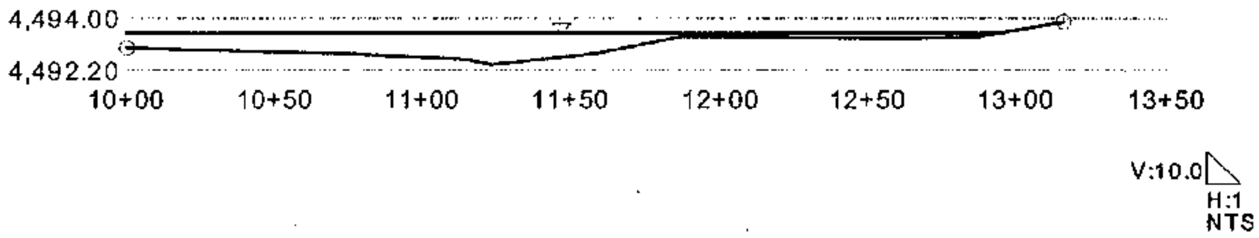
Natural Channel Points

Station (ft)	Elevation (ft)
10+00	4,493.00
10+72	4,492.80
11+14	4,492.60
11+23	4,492.40
11+58	4,492.80
11+87	4,493.40
12+10	4,493.40
12+59	4,493.30
12+87	4,493.40
13+16	4,493.90

Plaza Street 150
Cross Section for Irregular Channel

Project Description	
Worksheet	3rd_Street 0150 - Lake & Ce
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficiei	0.016	
Slope	0.002000	ft/ft
Water Surface Elev	4,493.51	ft
Elevation Range	92.40 to 4,493.90	
Discharge	378.00	cfs



Proposed Plaza Street 150
Worksheet for Irregular Channel

Project Description	
Worksheet	Proposed 3rd_Street 0150 - Lake &
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	002000	ft/ft
Discharg	400.00	cfs

Options	
Current Roughness Methc	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficiei	0.016	
Water Surface Elev	4,493.52	ft
Elevation Range	32.40 to 4,505.00	
Flow Area	146.1	ft²
Wetted Perimeter	272.75	ft
Top Width	272.00	ft
Actual Depth	1.12	ft
Critical Elevation	4,493.36	ft
Critical Slope	0.004847	ft/ft
Velocity	2.74	ft/s
Velocity Head	0.12	ft
Specific Energy	4,493.63	ft
Froude Number	0.66	
Flow Type	Subcritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.51801981 ft.

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	12+72	0.016

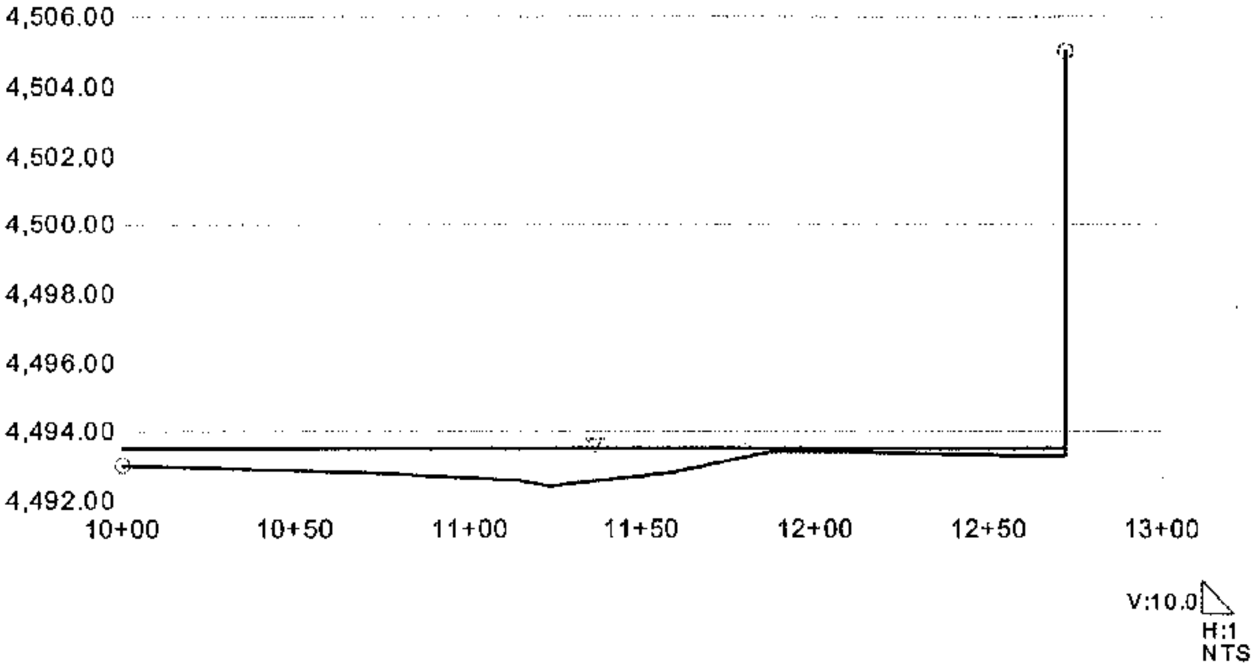
Natural Channel Points

Station (ft)	Elevation (ft)
10+00	4,493.00
10+72	4,492.80
11+14	4,492.60
11+23	4,492.40
11+58	4,492.80
11+87	4,493.40
12+10	4,493.40
12+59	4,493.30
12+72	4,493.30
12+72	4,505.00

Proposed Plaza Street 150
Cross Section for Irregular Channel

Project Description	
Worksheet	Proposed 3rd_Street 0150 - Lake &
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficiei	0.016	
Slope	0.002000	ft/ft
Water Surface Elev.	4,493.52	ft
Elevation Range	}2.40 to 4,505.00	
Discharge	400.00	cfs



Plaza Street 100
Worksheet for Irregular Channel

Project Description	
Worksheet	3rd_Street 0100 - 3rd & L:
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	001000	ft/ft
Discharg	340.00	cfs

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev.	4,493.68	ft
Elevation Range	32.50 to 4,493.40	
Flow Area	162.1	ft²
Wetted Perimeter	268.63	ft
Top Width	267.60	ft
Actual Depth	1.18	ft
Critical Elevation	4,493.44	ft
Critical Slope	0.005216	ft/ft
Velocity	2.10	ft/s
Velocity Head	0.07	ft
Specific Energy	4,493.74	ft
Froude Number	0.48	
Flow Type	Subcritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.67560042 ft.

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	12+68	0.016

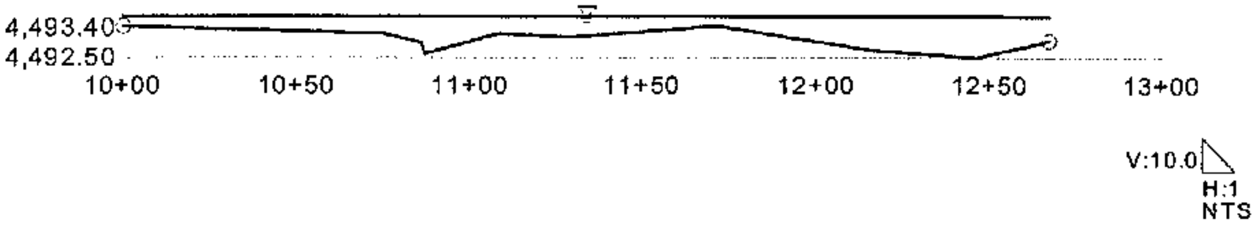
Natural Channel Points

Station (ft)	Elevation (ft)
10+00	4,493.40
10+74	4,493.20
10+86	4,492.90
10+87	4,492.60
11+09	4,493.20
11+29	4,493.10
11+72	4,493.40
12+15	4,492.70
12+46	4,492.50
12+68	4,493.00

Plaza Street 100
Cross Section for Irregular Channel

Project Description	
Worksheet	3rd_Street 0100 - 3rd & La
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficiei	0.016	
Slope	0.001000	ft/ft
Water Surface Elev.	4,493.68	ft
Elevation Range	32.50 to 4,493.40	
Discharge	340.00	cfs



Proposed Plaza Street 100
Worksheet for Irregular Channel

Project Description

Worksheet	Proposed 3rd_Street 0100 - 3rd & Lake E. (No Cl
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data

Slope	001000	ft/ft
Discharg	400.00	cfs

Options

Current Roughness Methc	›ved Lotter's Method
Open Channel Weighting	›ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results

Mannings Coefficiei	0.016	
Water Surface Elev	4,493.84	ft
Elevation Range	92.60 to 4,510.00	
Flow Area	171.0	ft²
Wetted Perimeter	240.65	ft
Top Width	239.01	ft
Actual Depth	1.24	ft
Critical Elevation	4,493.57	ft
Critical Slope	0.004923	ft/ft
Velocity	2.34	ft/s
Velocity Head	0.09	ft
Specific Energy	4,493.92	ft
Froude Number	0.49	
Flow Type	Subcritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.43808923 ft.

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	12+39	0.016

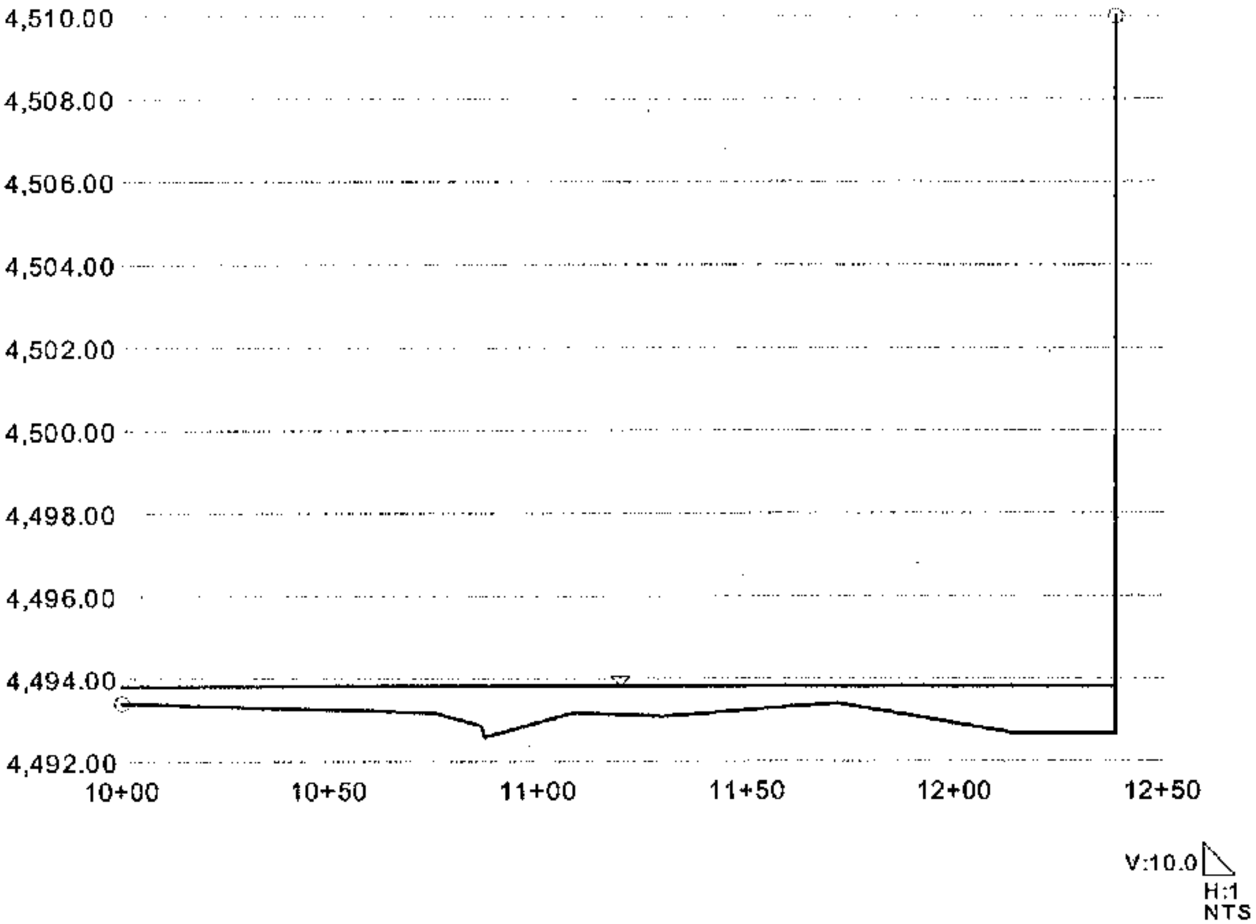
Natural Channel Points

Station (ft)	Elevation (ft)
10+00	4,493.40
10+74	4,493.20
10+86	4,492.90
10+87	4,492.60
11+09	4,493.20
11+29	4,493.10
11+72	4,493.40
12+15	4,492.70
12+39	4,492.70
12+39	4,510.00

Proposed Plaza Street 100
Cross Section for Irregular Channel

Project Description	
Worksheet	Proposed 3rd_Street 0100 - 3rd & Lake E. (No Cl
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficiei	0.016	
Slope	0.001000	ft/ft
Water Surface Elev.	4,493.84	ft
Elevation Range	}2.60 to 4,510.00	
Discharge	400.00	cfs



Plaza Street 90
Worksheet for Irregular Channel

Project Description	
Worksheet	3rd_Street 0090 - P
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	001000	ft/ft
Discharg	218.00	cfs

Options	
Current Roughness Methc	›ved Lotter's Method
Open Channel Weighting	›ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	4,493.32	ft
Elevation Range	92.00 to 4,493.30	
Flow Area	101.2	ft²
Wetted Perimeter	161.03	ft
Top Width	160.00	ft
Actual Depth	1.32	ft
Critical Elevation	4,492.84	ft
Critical Slope	0.004260	ft/ft
Velocity	2.15	ft/s
Velocity Head	0.07	ft
Specific Energy	4,493.39	ft
Froude Number	0.48	
Flow Type	Subcritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.91551847 ft.

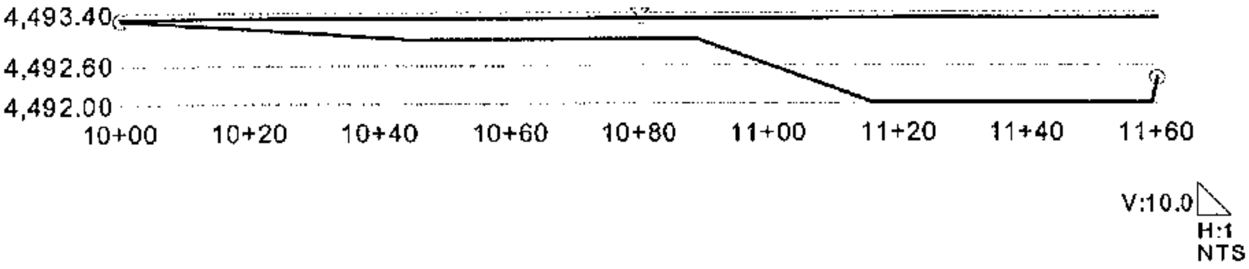
Roughness Segments		
Start Station	End Station	Mannings Coefficient
10+00	11+60	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
10+00	4,493.30
10+44	4,493.00
10+89	4,493.00
11+16	4,492.00
11+59	4,492.00
11+60	4,492.40

Plaza Street 90
Cross Section for Irregular Channel

Project Description	
Worksheet	3rd_Street 0090 - P
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficiei	0.016	
Slope	0.001000	ft/ft
Water Surface Elev.	4,493.32	ft
Elevation Range	32.00 to 4,493.30	
Discharge	218.00	cfs



Proposed Plaza Street 90
Worksheet for Irregular Channel

Project Description	
Worksheet	Proposed 3rd_Street 0090 - Plaza (No Cha
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	001000	ft/ft
Discharg	400.00	cfs

Options	
Current Roughness Methc	›ved Lotter's Method
Open Channel Weighting	›ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	4,493.86	ft
Elevation Range	)1.80 to 4,510.00	
Flow Area	134.7	ft²
Wetted Perimeter	132.45	ft
Top Width	130.01	ft
Actual Depth	2.06	ft
Critical Elevation	4,493.49	ft
Critical Slope	0.004348	ft/ft
Velocity	2.97	ft/s
Velocity Head	0.14	ft
Specific Energy	4,494.00	ft
Froude Number	0.51	
Flow Type	Subcritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.56447035 ft.

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	11+30	0.016

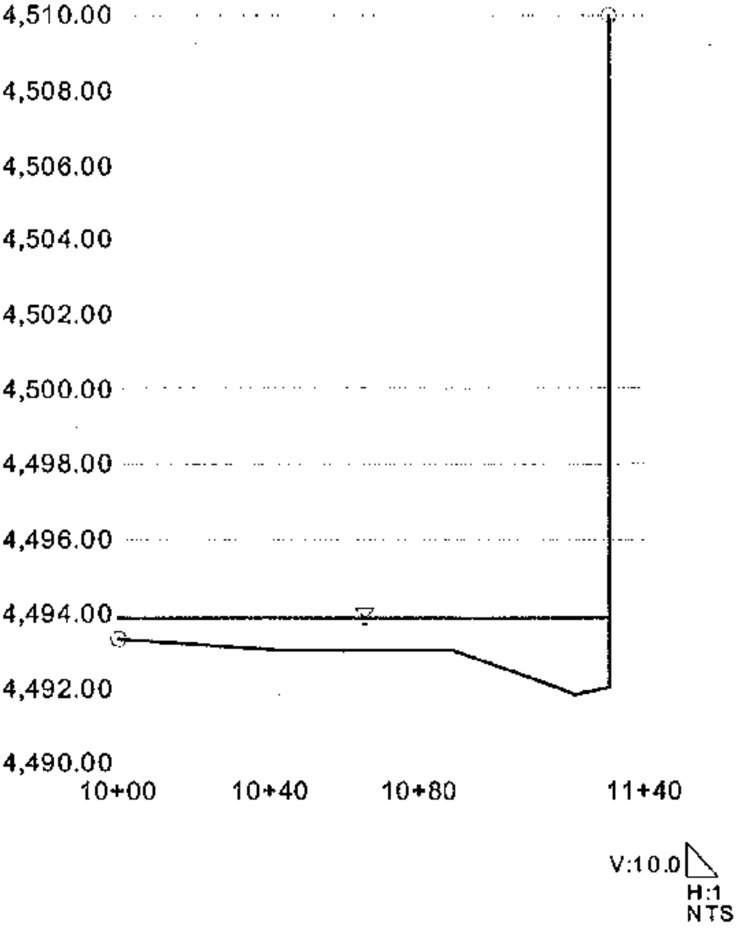
Natural Channel Points

Station (ft)	Elevation (ft)
10+00	4,493.30
10+44	4,493.00
10+89	4,493.00
11+16	4,492.00
11+21	4,491.80
11+30	4,492.00
11+30	4,510.00

Proposed Plaza Street 90
Cross Section for Irregular Channel

Project Description	
Worksheet	Proposed 3rd_Street 0090 - Plaza (No Chε
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficiei	0.016	
Slope	0.001000	ft/ft
Water Surface Elev	4,493.86	ft
Elevation Range	ϡ1.80 to 4,510.00	
Discharge	400.00	cfs



Plaza Street 80
Worksheet for Irregular Channel

Project Description	
Worksheet	3rd_Street 0080 - P
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	007000	ft/ft
Dischargı	218.00	cfs

Options	
Current Roughness Methc	›ved Lotter's Method
Open Channel Weighting	›ved Lotter's Method
Closed Channel Weightin(	Horton's Method

Results		
Mannings Coefficiel	0.016	
Water Surface Elev	4,491.62	ft
Elevation Range	)0.80 to 4,492.00	
Flow Area	43.2	ft²
Wetted Perimeter	82.46	ft
Top Width	82.43	ft
Actual Depth	0.82	ft
Critical Elevation	4,491.71	ft
Critical Slope	0.004476	ft/ft
Velocity	5.05	ft/s
Velocity Head	0.40	ft
Specific Energy	4,492.02	ft
Froude Number	1.23	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	11+03	0.016

Natural Channel Points

Station (ft)	Elevation (ft)
10+00	4,492.00
10+35	4,491.00
10+63	4,490.80
10+72	4,491.00
10+88	4,491.20
11+03	4,492.00

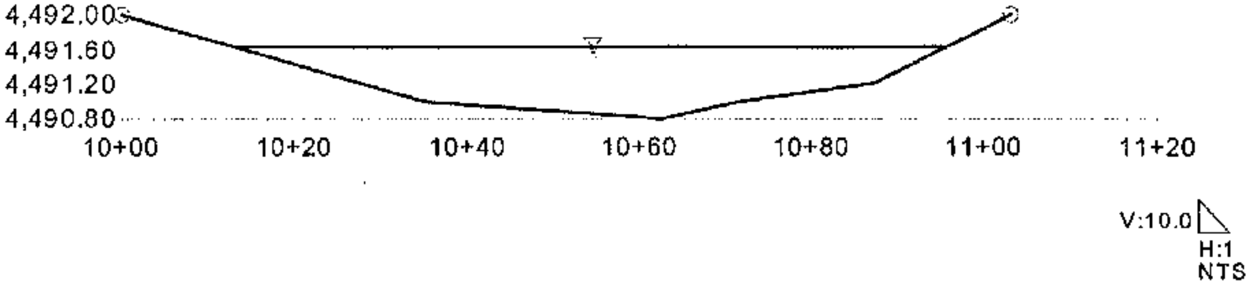
Plaza Street 80
Cross Section for Irregular Channel

Project Description

Worksheet	3rd_Street 0080 - P
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data

Mannings Coefficiei	0.016	
Slope	0.007000	ft/ft
Water Surface Elev	4,491.62	ft
Elevation Range	90.80 to 4,492.00	
Discharge	218.00	cfs



Proposed Plaza Street 80
Worksheet for Irregular Channel

Project Description	
Worksheet	Proposed 3rd_Street 0080 - Plaza (N
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	007000	ft/ft
Discharg	400.00	cfs

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	4,490.14	ft
Elevation Range	38.50 to 4,510.00	
Flow Area	45.7	ft²
Wetted Perimeter	38.15	ft
Top Width	37.68	ft
Actual Depth	1.64	ft
Critical Elevation	4,490.48	ft
Critical Slope	0.003381	ft/ft
Velocity	8.76	ft/s
Velocity Head	1.19	ft
Specific Energy	4,491.33	ft
Froude Number	1.40	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	10+78	0.016

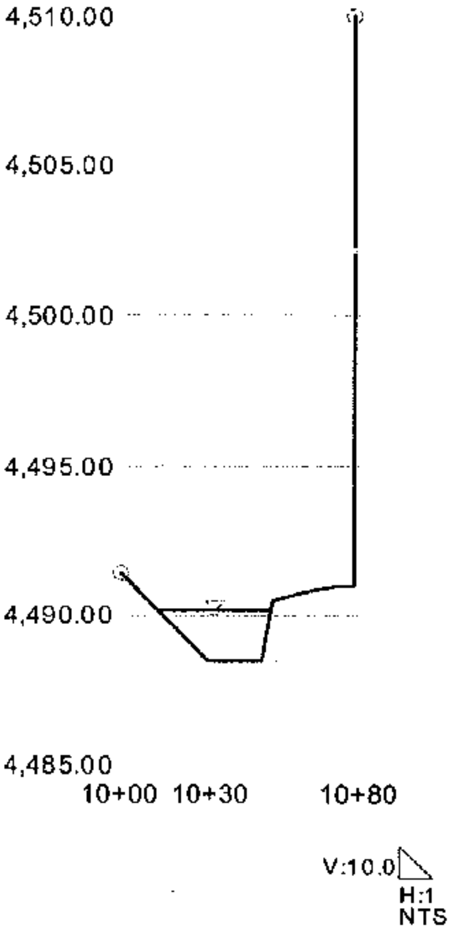
Natural Channel Points

Station (ft)	Elevation (ft)
10+00	4,491.40
10+29	4,488.50
10+47	4,488.50
10+51	4,490.50
10+63	4,490.80
10+72	4,491.00
10+78	4,491.00
10+78	4,510.00

Proposed Plaza Street 80
Cross Section for Irregular Channel

Project Description	
Worksheet	Proposed 3rd_Street 0080 - Plaza (N
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficiei	0.016	
Slope	0.007000	ft/ft
Water Surface Elev	4,490.14	ft
Elevation Range	38.50 to 4,510.00	
Discharge	400.00	cfs



JENSEN PRECAST

STRUCTURAL ANALYSIS AND DISCUSSION

MANHOLE BARREL STRENGTHS

ENGINEERING STAMPS

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CIVIL
STATE OF CALIFORNIA
2-26-96

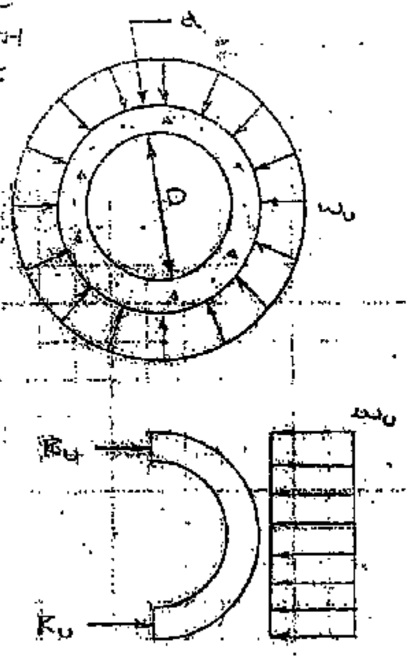
2/26/96

ENG. FILE B1

[illegible]

ANALYSIS & DISCUSSION OF LATERAL STRENGTH OF MANHOLE COMPONENTS

CASE #1) WHEN A UNIFORM LOAD IS APPLIED, THE STRENGTH OF THE ROUND STRUCTURE MAY BE DEFINED BY THE COMPRESSIVE STRENGTH OF THE CROSS SECTION.



$$2R_u = w_u(D+2d) \rightarrow$$

$$w_u = \frac{2R_u}{D+2d} \rightarrow$$

△1 $$= \frac{R_u}{(1/2)D+d}$$

△1 $R_u = bdf'_c$

△1 $$w_u = \frac{bdf'_c}{(1/2)D+d}$$

JENSEN PRECAST MANHOLE SECTIONS

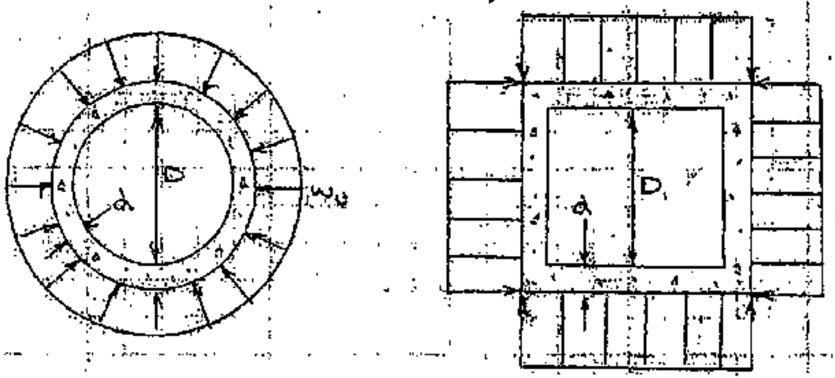
	f'_c	b	d	D	w_u △1
48" ID x 4" WALL	5500	12"	4"	48"	9428#/in = 113 K/ft
48" ID x 5" WALL	4000	12"	5"	48"	8276#/in = 99.3 K/ft
60" ID x 6" WALL	4000	12"	6"	60"	8000#/in = 96.0 K/ft
72" ID x 7" WALL	4000	12"	7"	72"	7814#/in = 93.8 K/ft

FROM OUR EXPERIENCES, THESE VALUES FOR w_u ARE UNREALISTICLY HIGH, & IT WOULD BE UNWISE TO CERTIFY THAT OUR MANHOLE PRODUCTS COULD RESIST FORCES OF THIS MAGNITUDE.

CALCULATIONS BY: V. ROSL E.I.T
REVIEWED BY: B. LOW TIN PE.

CASE #2) A MUCH MORE CONSERVATIVE APPROACH TO ANALYZING MANHOLE BARREL SECTIONS IS TO COMPARE THE STRENGTH OF A SQUARE STRUCTURE GIVEN THESE ASSUMPTIONS:

1) A ROUND MANHOLE BARREL WILL NOT FAIL BY BENDING. IT MAY ONLY FAIL BY WAY OF SHEAR.
2) A ROUND MANHOLE BARREL IS STRONGER THAN A SQUARE MANHOLE SECTION IF THE WALL THICKNESS AND INSIDE WIDTH ARE EQUAL FOR BOTH.
3) ALL PARTS OF A ROUND MANHOLE BARREL SECTION ARE IN COMPRESSION.



THE MAXIMUM w_u FOR THE SQUARE [illegible] STRUCTURE USING FORMULAS IN ACI 318 IS:

$$V_u = \frac{D(w_u)}{2} \qquad v_c = \frac{V_u}{0.85(b)(d)} \qquad v_c = 2\sqrt{f'_c}$$

$$2\sqrt{f'_c} = \frac{D(w_u)}{2(0.85)(b)(d)}$$

$$w_u = \frac{3.4(b)(d)\sqrt{f'_c}}{D}$$

	f'_c	b	d	D	w_u
48" ID x 4" WALL	5500	12"	4"	48"	252#/in = 3.0 k/ft
48" ID x 5" WALL	4000	12"	5"	48"	269#/in = 3.2 k/ft
60" ID x 6" WALL	4000	12"	6"	60"	258#/in = 3.0 k/ft
72" ID x 7" WALL	4000	12"	7"	72"	250#/in = 3.0 k/ft

IN REALITY, THE STRENGTH OF JENSEN PRECAST MANHOLE BARRELS WOULD BE SOMEWHERE BETWEEN THOSE AS GIVEN IN CASE #1 & #2. IT SHOULD THEREFORE BE SAFE TO CERTIFY THAT THE BARRELS ARE STRONG ENOUGH TO RESIST THE LOADS IN CASE #2.

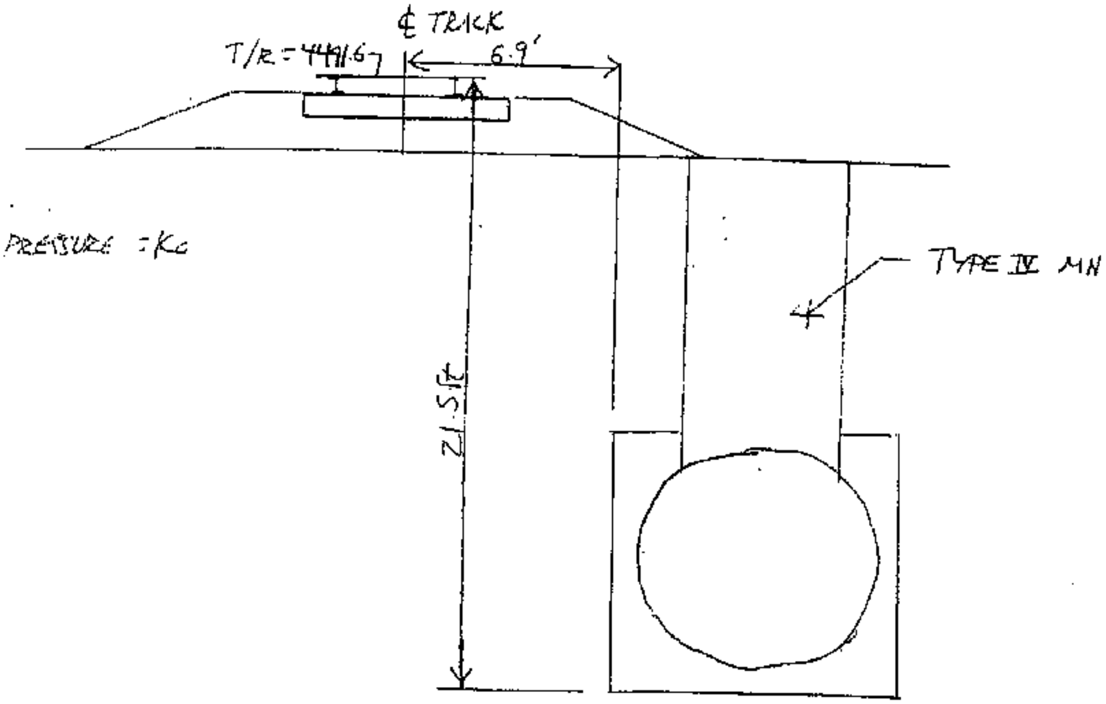
JENSEN PRECAST MANHOLE BARRELS ARE BUILT IN ACCORDANCE WITH ASTM C478, AND ARE STRONG ENOUGH TO RESIST THE FOLLOWING FACTORED LATERAL SIDEWALL PRESSURES IF THE LOADS ARE UNIFORMLY APPLIED:

48" ID x 4" WALL – 3.0 ksf
48" ID x 5" WALL – 3.2 ksf
60" ID x 6" WALL – 3.0 ksf
72" ID x 7" WALL – 3.0 ksf

PARSONS
Design Team for the Reno
ReTRAC Project

SUBJECT: EVANS STORM DRAIN
RAILROAD LOADING ON MANHOLES
BY: L. FELLONI DATE: 8/1/03
CHECKED BY: DATE:

① NORTH RENO BRANCH STA 24+58 = EVANS STORM DRAIN STA 35+84



USE PASSIVE EARTH PRESSURE = K_o

$K_o = 1 - \sin\phi$
$\phi = 38°$
$K_o = 0.38$

FROM COOPER E-80 LOADING DIAGRAM:
LIVE LOAD SURCHARGE = 9.5 ft
$\gamma = 125$ PCF
$K_o = 0.38$ (K_o USED RATHER THAN K_a ⇒ CONSERVATIVE)

MAX PRESSURE @ MANHOLE INVERT:

$P_{MAX} = (21.5+9.5)(0.125)(0.38) = 1.47$ KSF $\times 1.8 = 2.65$ KSF ← AREMA LOAD FACTOR

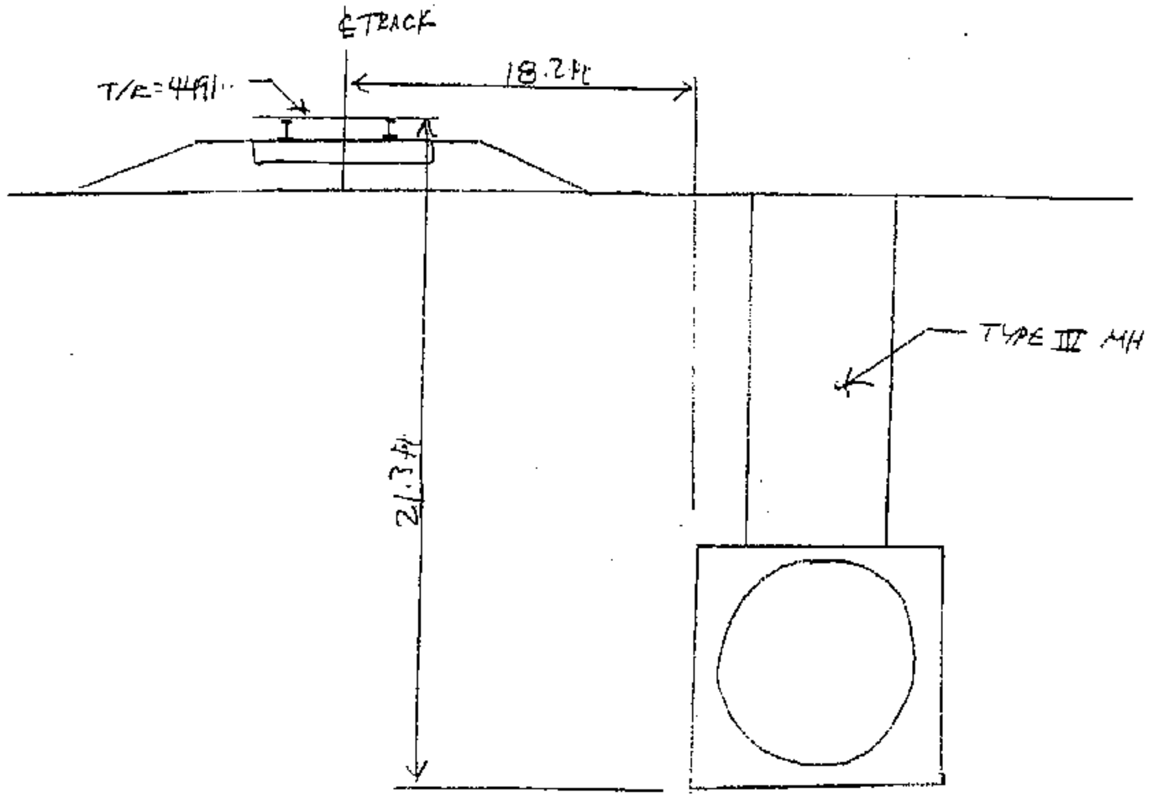
FROM JENSEN CALCS: $P_{MAX} = 3$ KSF > 2.65 KSF ∴ O.K.

PARSONS

Design Team for the Reno ReTRAC Project

SUBJECT: EVANS STORM DRAIN
RAILROAD LOADING ON MANHOLES
BY: L. FELLOWS DATE: 8/1/03
CHECKED BY: DATE:

② MARTIN IRON SPUR STA 2+03 : EVANS STORM DRAIN STA 36+62



FROM COOPER E-80 LOADING DIAGRAM:

LIVE LOAD SURCHARGE = 3.3 ft
γ = 125 PCF
K_o = 0.38

MAX PRESSURE @ MH HOLE EXTERIOR :

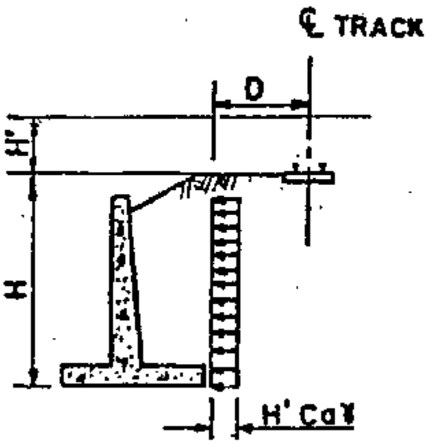
AREMA LOAD FACTOR

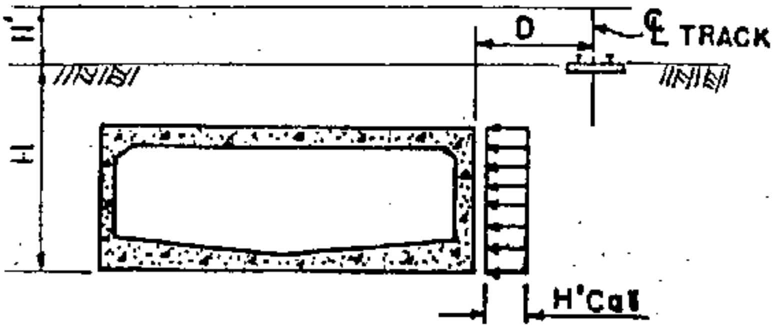
$P_{MAX} = (21.3 + 3.3) \cdot .125 (0.38) = 1.169$ KSF × 1.8 = 2.10 KSF

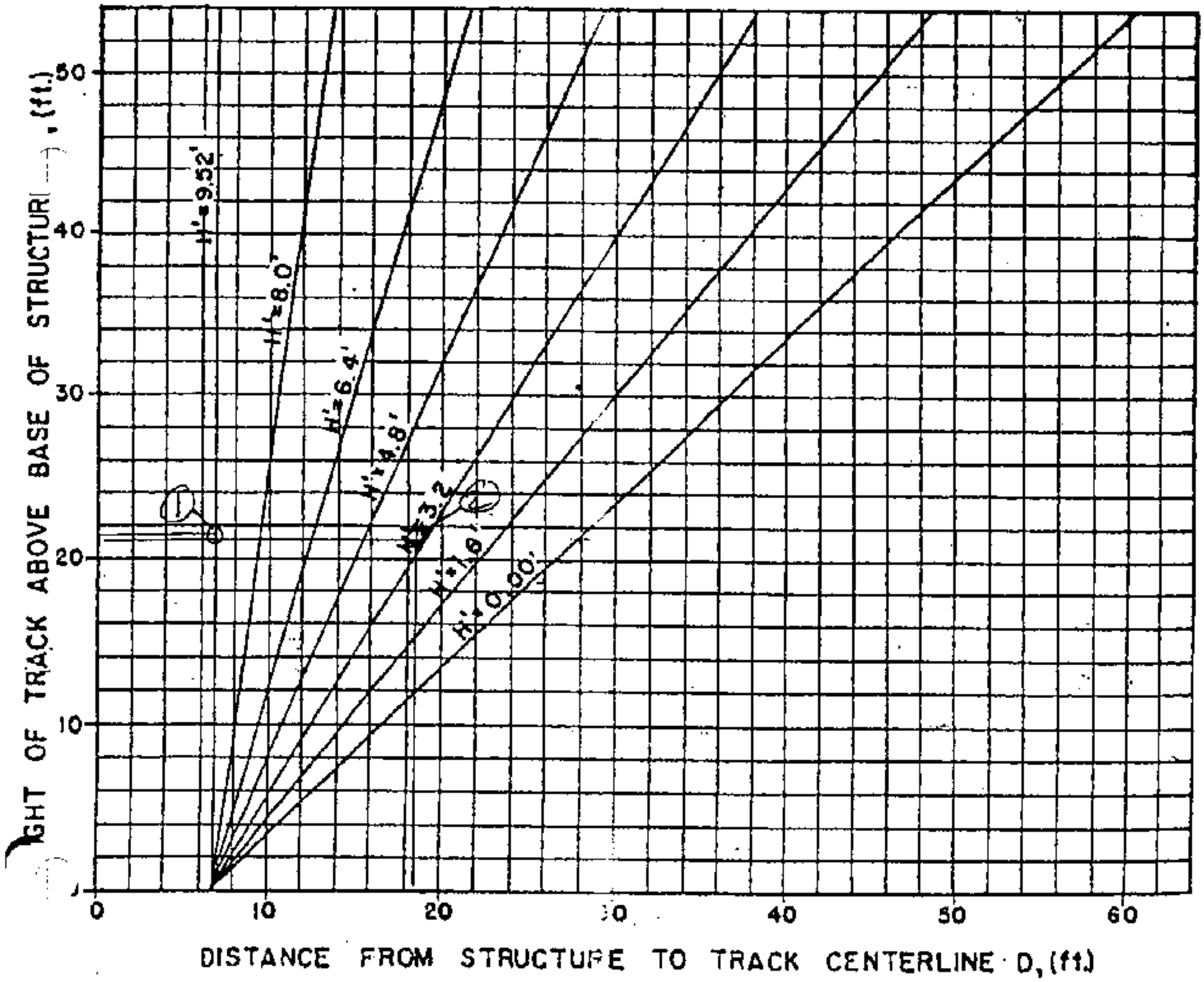
FROM JENSEN CH 5 : P_{MAX} = 3 KSF > 2.10 KSF ∴ O.K.

COOPER E80 RAILROAD LIVE LOAD ON WALL

TRACKS PARALLEL TO STRUCTURAL SECTION







DISTANCE FROM STRUCTURE TO TRACK CENTERLINE D, (ft.)

Figure H 374.2D

Calculation of L. L. SURCHARGE:

$$H' \text{ max.} = \frac{P}{s \times b \times \gamma} = \frac{80{,}000\#}{5' \times 14' \times 120\text{pcf}} = 9.52'$$

H' = live load surcharge
P = E80 axle load in lbs.
s = axle spacing in feet
γ = unit weight of backfill in lbs./ft^3
b = transverse distribution of axle load in feet
C_a = active earth pressure coefficient

Ratio side loads when other than E80 Railroad loads are appropriate.

It is necessary to consider the effect of only one track in computing the LL surcharge. The exceptional case of tracks closer than 7' can be generally ignored since the increase in surcharge is minor.

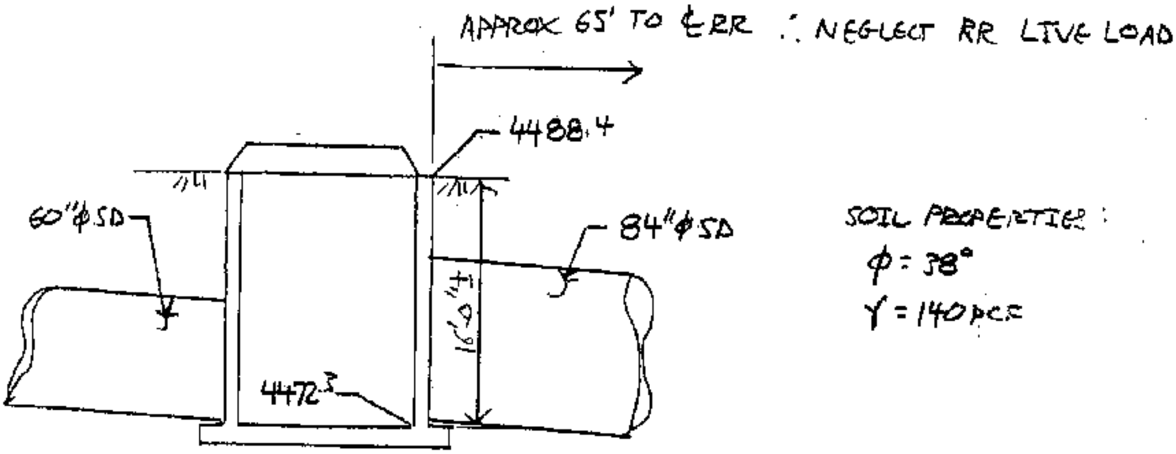
Impact loads are not applied to side walls (AREA).

Refer also to Figure H374.2C

Figure H 374.2D

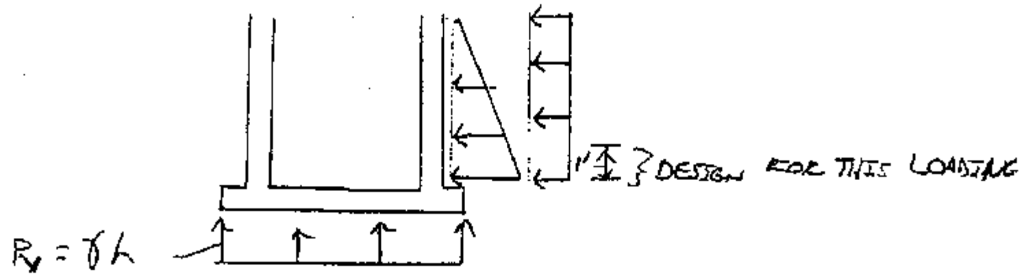
PARSONS
Design Team for the Reno ReTRAC Project

SUBJECT: EVANS AVE STORM DRAIN
9'x9' BOX INLET
BY: L. FELLOWS DATE: 6/18/03
CHECKED BY: DATE:



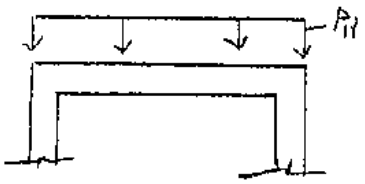
SOIL PROPERTIES:
$\phi = 38°$
$\gamma = 140$ pcf

- USE PASSIVE SOIL PRESSURE = $K_o = 1 - \sin\phi = 0.38$
- DESIGN WALLS OF SHAFT AS SIMPLY SUPPORTED SLABS SPANNING HORIZONTALLY
- DESIGN FULL HEIGHT FOR MAXIMUM PRESSURE @ BOTTOM OF BOX
- DESIGN BOTTOM SLAB FOR FULL PRESSURE @ H=16'
- ALTHOUGH BOX INLET IS WELL AWAY FROM TRAFFIC, DESIGN FOR 2' LL SURCHARGE TO ACCOUNT FOR UNFORSEEN EQUIPMENT LOADINGS.



$P_V = 1.8\,(140)(16') = 4.032$ K/FT

$P_H = 1.8(0.38)(140)(16+2) = 1.724$ K/FT



PARTIAL PLAN

PARSONS

Design Team for the Reno ReTRAC Project

SUBJECT: EVANS AVE STORM DRAIN

9'x9' BOX INLET

BY: L. FELLOWS DATE: 6/18/03

CHECKED BY: ______ DATE: ______

ASSUME 12" SLAB FOR WALLS AND INVERT

INVERT SLAB:

$$M_{MAX} = \frac{\omega l^2}{8} = \frac{4032(9)^2}{8} = 40{,}824 \text{ \#}\cdot\text{FT} = 489{,}888 \text{ \#}\cdot\text{IN}$$

$f_y = 60$ KSI

$f'_c = 4000$ PSI

ASSUME #7 @ 6 - $A_s = 1.2$ IN²/FT $\quad d = 12 - 2 - 1.5(0.875) = 8.69$ IN

$$a = \frac{A_s \cdot f_y}{0.85 \cdot b \cdot f'_c} = 1.76 \text{ IN}$$

$$M_U = 0.9(A_s)(f_y)\left(d - \frac{a}{2}\right) = 505{,}935 \text{ \#}\cdot\text{IN} > 489{,}888 \text{ \#}\cdot\text{IN} \therefore \text{O.K.}$$

| USE #7 @ 6 EW IN BOTTOM SLAB |

SIDE WALLS:

$$M_{MAX} = \frac{1724(9)^2}{8} = 17{,}455 \text{ \#}\cdot\text{FT} = 209{,}466 \text{ \#}\cdot\text{IN}$$

ASSUME #5 @ 6

$A_s = 0.62$ IN²/FT

$$d = 12 - 2 - \frac{0.625}{2} = 9.69 \text{ IN}$$

$$a = \frac{A_s \cdot F}{0.85 \cdot b \cdot F'_c} = 0.91 \text{ IN}$$

$$M_U = 0.9(A_s)(F_y)\left(d - \frac{a}{2}\right)$$

$M_U = 309, 8$ #·IN > 209,466 #·IN ∴ O.K.

| Use # @ 6 HORIZ IN WALLS |

| Use #4 @ 12 VERT IN WALLS |

Record St.

Joint Venture Design Team for the Tutor – Saliba Team
INDEX NO. NO.
SUBJECT RETRAC SHEET NO. 1 OF
RENO BRANCH DRAINAGE

MADE BY ZRB DATE 6/1/03 CHECKED BY DATE

COMPOSITE C VALUES AND BASIN AREAS

BASIN RB-1

		C_{100}
ROOF = 31,744 SQ FT	22.7%	0.87
GRAVEL = 15,371 SQ FT	11.0%	0.50
PAVED = 93,071 SQ FT	66.4%	0.93

TOTAL = 140,~~182~~ 186 SQ FT
3.22 ACRES

COMPOSITE C = 0.87

BASIN RB-2

		C_{100}
ROOF = 42,054.5 SQ FT	24.3%	0.87
GRAVEL = 24,994 SQ FT	14.4%	0.50
PAVED = 106,229.5 SQ FT	61.3%	0.93

TOTAL = 173,278 SQ FT
3.98 ACRES

COMPOSITE C = 0.85

BASIN RB-3

		C_{100}
ROOF = 13827 SQ FT	9.0%	0.87
GRAVEL = 12,623 SQ FT	8.2%	0.50
PAVED = 127,072 SQ FT	82.8%	0.92

TOTAL = 153522 SQ FT
3.52 ACRES

COMPOSITE C = 0.89

Joint Venture Design Team for the Tutor – Saliba Team

INDEX NO. NO.

SUBJECT RETRAC SHEET NO. 2 OF

RENO BRANCH DRAINAGE

MADE BY ZRB DATE 6/1/03 CHECKED BY DATE

~~BASIN RB-4~~

		~~C_{100}~~
~~GRAVEL = 17327 SQ FT~~	~~70%~~	~~0.5~~
~~PAVED = 7,432 SQ FT~~	~~30%~~	~~0.93~~

~~TOTAL = 24,759 SQ FT~~
~~0.57 ACRES~~

~~COMPOSITE C = 0.63~~

~~BASIN RB-5~~

		~~C_{100}~~
~~GRAVEL = 19,954 SQ FT~~	~~72%~~	~~0.5~~
~~PAVED = 7874 SQ FT~~	~~28%~~	~~0.93~~

~~TOTAL = 27828' SQ FT~~
~~0.64 ACRES~~

~~COMPOSITE C = 0.62~~

BASIN RB-6

		C_{100}
ROOF = 26277 SQ FT	17%	0.87
GRAVEL = 39469 SQ FT	25%	0.50
PAVED = 91342 SQ FT	58%	0.93

TOTAL = 157088 SQ FT
3.61 ACRES

COMPOSITE C = 0.81

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INDEX NO. NO.

SUBJECT RETRAC SHEET NO. 3 OF

RENO BRANCH DRAINAGE

MADE BY ZRB DATE 6/2/03 CHECKED BY DATE

BASIN RB-7

		C_{100}
GRAVEL	100%	0.5

TOTAL AREA = 0.44 ACRES

COMPOSITE C = 0.5

BASIN RB-8

		C_{100}
GRAVEL	100%	0.5

TOTAL AREA = 1.25 ACRES

COMPOSITE C = 0.5

BASIN RB
100% GRAV
AREA = O
C = 0.5

BASIN LAG TIMES AND INTENSITIES

BASIN RB-1

LENGTH = 486'

SLOPE = 0.5%

VEL = 1.4 FPS

t = 5.7 MIN ⇒ USE 10 MIN i_{100} = 3.8 in/hr i_{50} = 3.1 in/hr

BASIN RB-2

LENGTH = 873'

SLOPE = 0.5%

VEL = 1.4 FPS

t = 10.4 MIN

i_{100} = 3.7 in/hr i_{50} = 3.0 in/hr

NO.

SUBJECT RETRAC SHEET NO. 4 OF

RENO BRANCH DRAINAGE

MADE BY ERB DATE 6/7/03 CHECKED BY DATE

BASIN RB-3

LENGTH = 856'

SLOPE = 0.2%

VEL = 0.91 FPS

t = 15.7 MIN

i_{100} = 2.9 in/hr i_{50} = 2.3 in/hr

~~BASIN RB-5~~

~~LENGTH = 586'~~

~~SLOPE = 0.2%~~

~~VEL = 0.91 FPS~~

~~t = 10.7 MIN~~

~~i_{100} = 3.7 in/hr i_{50} = 3.0 in/hr~~

BASIN RB-6

LENGTH = 1155'

SLOPE = 0.2%

VEL = 0.91 FPS

t = 21.2 MIN

i_{100} = 2.4 in/hr i_{50} = 1.8 in/hr

BASIN RB-7

LENGTH = 500

SLOPE = 0.2%

VEL = 0.91 FPS

t = 9.2 MIN ⟹ USE 10 MIN

i_{100} = 3.8 in/hr i_{50} = 3.1 in/hr

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SUBJECT RETRAC SHEET NO. 5 OF

REND BRANCH DRAINAGE

MADE BY ZRB DATE 6/3/03 CHECKED BY DATE

BASIN RB-8

LENGTH = 1564'

SLOPE = 0.2%

V_{EL} = 0.91 FPS i_{50} = 1.5 in/hr

t = 28.6 MIN i_{100} = 1.9 in/hr

BASIN RB-9

LENGTH = 734

SLOPE = 0.2%

V_{EL} = 0.91 FPS

t = 13.4 MIN

i_{100} = 3.2 in/hr i_{50} = 2.6

BASIN FLOW (100 YEAR)

Q = CiA

RB-1

Q = 0.87(3.8)3.22

Q_{100} = 10.6 CFS

RB-2

Q = 0.85(3.7)3.98

Q_{100} = 12.5 CFS

RB-3

Q = 0.89(2.9)3.52

Q_{100} = 9.1 CFS

~~RB-5~~

~~Q = 0.62(3.7)0.64~~

~~Q_{100} = 1.5 CFS~~

RB-6

Q = 0.85(2.4)3.61

Q_{100} = 7.0 CFS

RB-7

Q = 0.5(3.8)0.44

Q_{100} = 0.8 CFS

RB-8

Q = 0.5(1.9)1.25

Q_{100} = 1.2 CFS

RB-9

Q = 0.5(3.2)0.7

Q_{100} = 1.1 CFS

Joint Venture Design Team for the Tutor – Saliba Team

INDEX NO.
REV. NO.

SUBJECT ReTRAC
SHEET NO. 6 OF

Reno Branch Drainage

MADE BY ZRB DATE 4/3/03 CHECKED BY DATE

Basin Flow (50 Year)

$Q = CiA$

RB-1

$Q = 0.87(3.1)3.22$

$Q_{50} = 8.7$ cfs

RB-2

$Q = 0.85(3.0)3.98$

$Q_{50} = 10.1$ cfs

RB-3

$Q = 0.89(2.3)3.52$

$Q_{50} = 7.2$ cfs

~~RB-5~~

~~$Q = 0.62(3.0)0.64$~~

~~$Q_{50} = 1.2$ cfs~~

RB-6

$Q = 0.81(1.8)3.61$

$Q_{50} = 5.3$ cfs

RB-7

$Q = 0.5(3.1)0.44$

$Q_{50} = 0.7$ cfs

RB-8

$Q = 0.5(1.5)1.25$

$Q_{50} = 0.9$ cfs

RB-9

$Q = 0.5(2.6)0.7$

$Q_{50} = 0.9$ cfs

Joint Venture Design Team for the Tutor – Saliba Team

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SUBJECT RETRAC SHEET NO. 7 OF

RENO BRANCH DRAINAGE

MADE BY ZRB DATE 6/3/03 CHECKED BY DATE

— CHECK V-DITCH CAPACITY: V-DITCH WITH MINIMUM SLOPE (0.2%) HAS A CAPACITY OF 48.5 CFS.

MAXIMUM CALCULATED Q_{50} FOR RENO BRANCH IS 10.1 C

MAXIMUM CALCULATED Q_{100} FOR RENO BRANCH IS 12.5 CF

SEE ATTACHED PRINTOUTS

PIPE CALCULATIONS

BASIN RB-1

$Q_{100} = 10.6$ CFS

FLOW TRAVELS TO NORTH SIDE RENO BRANCH WHERE V-DITCH DIRECTS FLOW EAST TO A CATCH BASIN LOCATED IMMEDIATELY BEFORE FLOOD BERM.

FLOW IS CONVEYED TO 84" RCP SD VIA A 12" RCP.
SEE ATTACHED STORM CAD MODEL AND WATERSHED MAP.

BASIN RB-2

$Q_{100} = 12.5$ CFS

FLOW TRAVELS TO NORTH SIDE OF RENO BRANCH WHERE V-DITCH DIRECTS FLOW EAST TO A CATCH BASIN LOCATED NEAR PARK STREET.

FLOW IS CONVEYED TO 84" RCP SD VIA A 15" RCP
SEE ATTACHED STORMCAD MODEL AND WATERSHED MAP.

Corporation
Joint Venture Design Team for the Tutor – Saliba Team

COMP. INDEX NO. | REV. NO.

SUBJECT RETRAC SHEET NO. 8 OF

RENO BRANCH DRAINAGE

MADE BY ZRB DATE 6/3/03 CHECKED BY DATE

BASIN RB-3

$Q_{100} = 9.1$ CFS

FLOW TRAVELS TO THE NORTH SIDE OF RENO BRANCH WHERE V-DITCH DIRECTS FLOW EAST TO A CATCH BASIN LOCATED JUST WEST OF MORRELL AVE.

FLOW IS CONVEYED TO 9'x6' RCB AT WELLS AVE VIA A 18" RC

SEE ATTACHED STORMCAD MODEL AND WATERSHED MAP

~~BASIN RB-5~~

~~$Q_{100} = 1.5$ CFS~~

~~FLOW FROM RAIL SECTION IS CONVEYED IN V-DITCH WEST TO A CATCH BASIN AT MORRELL AVE. WHICH ALSO DRAINS BASIN RB-3, RB7 & RB8. FLOW IS CONVEYED TO THE 9'x6' RCB @ WELLS AV~~

~~SEE STORMCAD MODEL AND WATERSHED MAP~~

BASIN RB-6 $Q_{100} = 7$ CFS

FLOW TRAVELS TO NORTH SIDE OF RENO BRANCH WHERE V-DITCH CONVEYS FLOW WEST TO A CATCH BASIN LOCATED AT MORRELL AVE.

FLOW IS CONVEYED TO THE 9'x6' RCB VIA AN 18" RCP.

SEE STORMCAD MODEL AND WATERSHED MAP.

Joint Venture Design Team for the Tutor – Saliba Team

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SUBJECT RETRAC SHEET NO. 9 OF

RENO BRANCH DRAINAGE

MADE BY ZRB DATE 6/3/03 CHECKED BY DATE

BASIN RB-7

$Q_{100} = 0.8$ CFS

FLOW FROM RAIL TRAVELS WEST IN V-DITCH TO CATCH BASIN AT MORRILL AVE. FLOW IS CONVEYED UNDER THE RENO BRANCH VIA A 12" RCP WHICH CONNECTS TO AN 18" RCP AND ULTIMATELY DRAINS TO A 9'x6' RCB @ WELLS AVE.

SEE STORMCAD MODEL AND WATERSHED MAP

BASIN RB-8

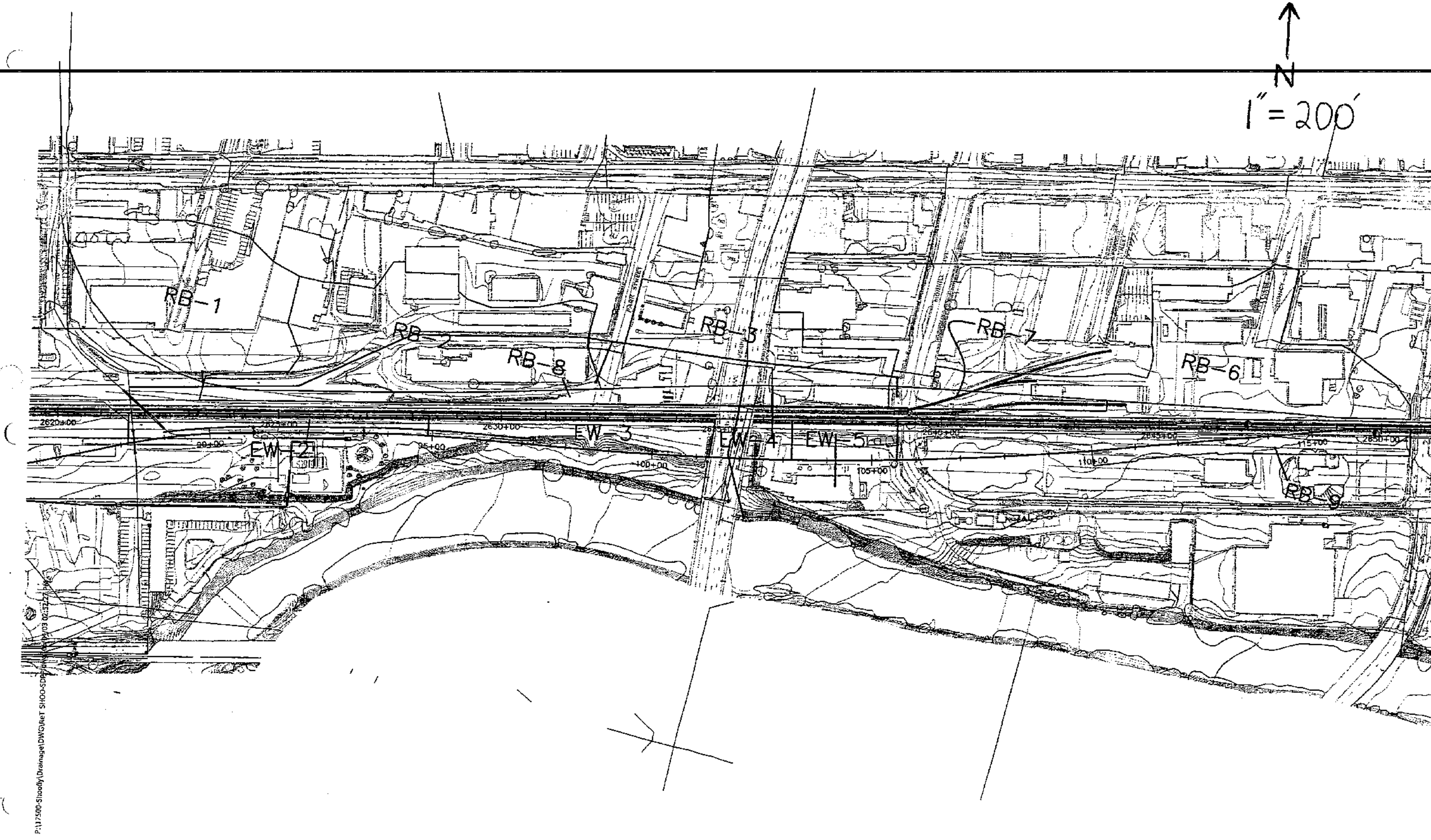
FLOW FROM SOUTH HALF OF RAIL TRAVELS EAST, VIA A V-D TO A CATCH BASIN @ MORRILL AVE. FLOW IS CONVEYED UNDER THE RENO BRANCH VIA A 12" RCP WHICH CONNECTS TO AN 18" RCP AND ULTIMATELY DRAINS TO A 9'x6' RCB @ WELLS AVE.

SEE ATTACHED STORMCAD MODEL AND WATERSHED MAP

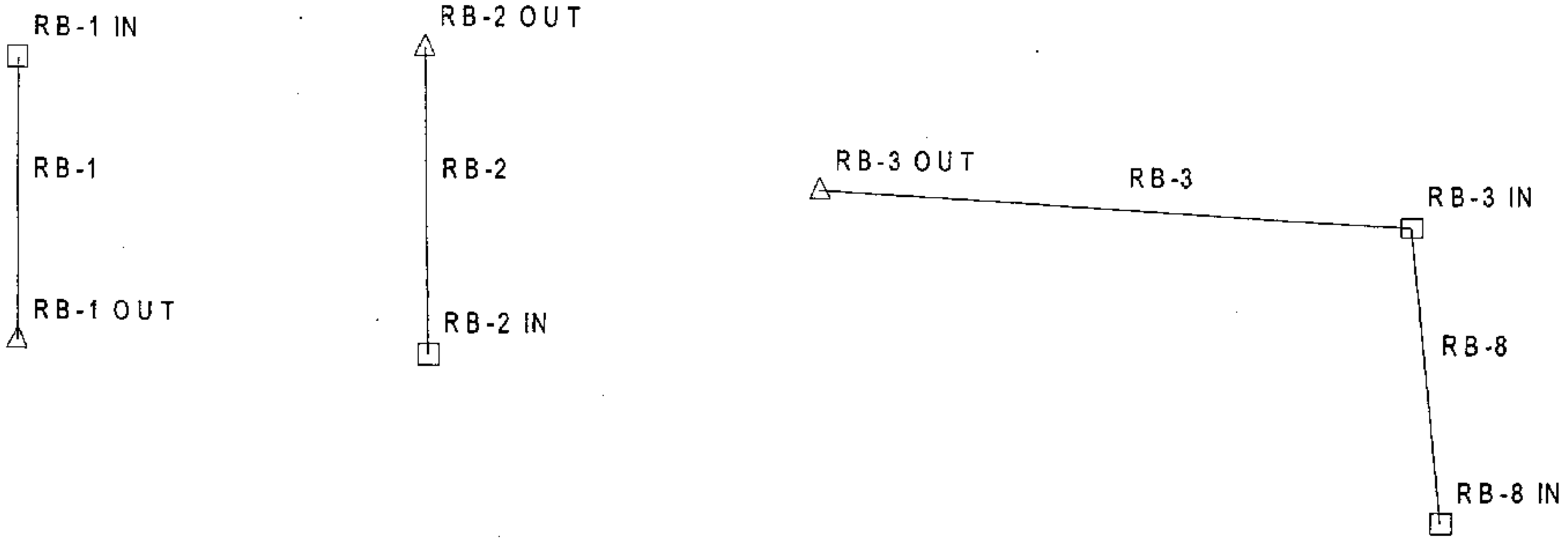
BASIN RB-9

FLOW FROM SOUTH HALF OF SHOOFLY TRAVELS WEST IN AN EDGE DRAIN TO A CATCH BASIN SERVICING ADJACENT SHOOFLY BASINS. FLOW IS CONVEYED SOUTH IN PIPE TO EXISTING SD IN MORRILL AVE.

SEE SHOOFLY HYDROLOGIC AND HYDRAULIC SUBMITTAL PACKAGE


N
1"=200'
RB-1
RB-2
RB-8
RB-3
RB-7
RB-6
RB-9
EW-2
EW-3
EW-4
EW-5
2620+00
2625+00
2630+00
2635+00
2640+00
2645+00
2650+00
90+00
95+00
100+00
105+00
110+00
115+00
PARK STREET
P:\17500-Shoofly\Drainage\DWG\ReT SHOO-SDPP

Scenario: Base

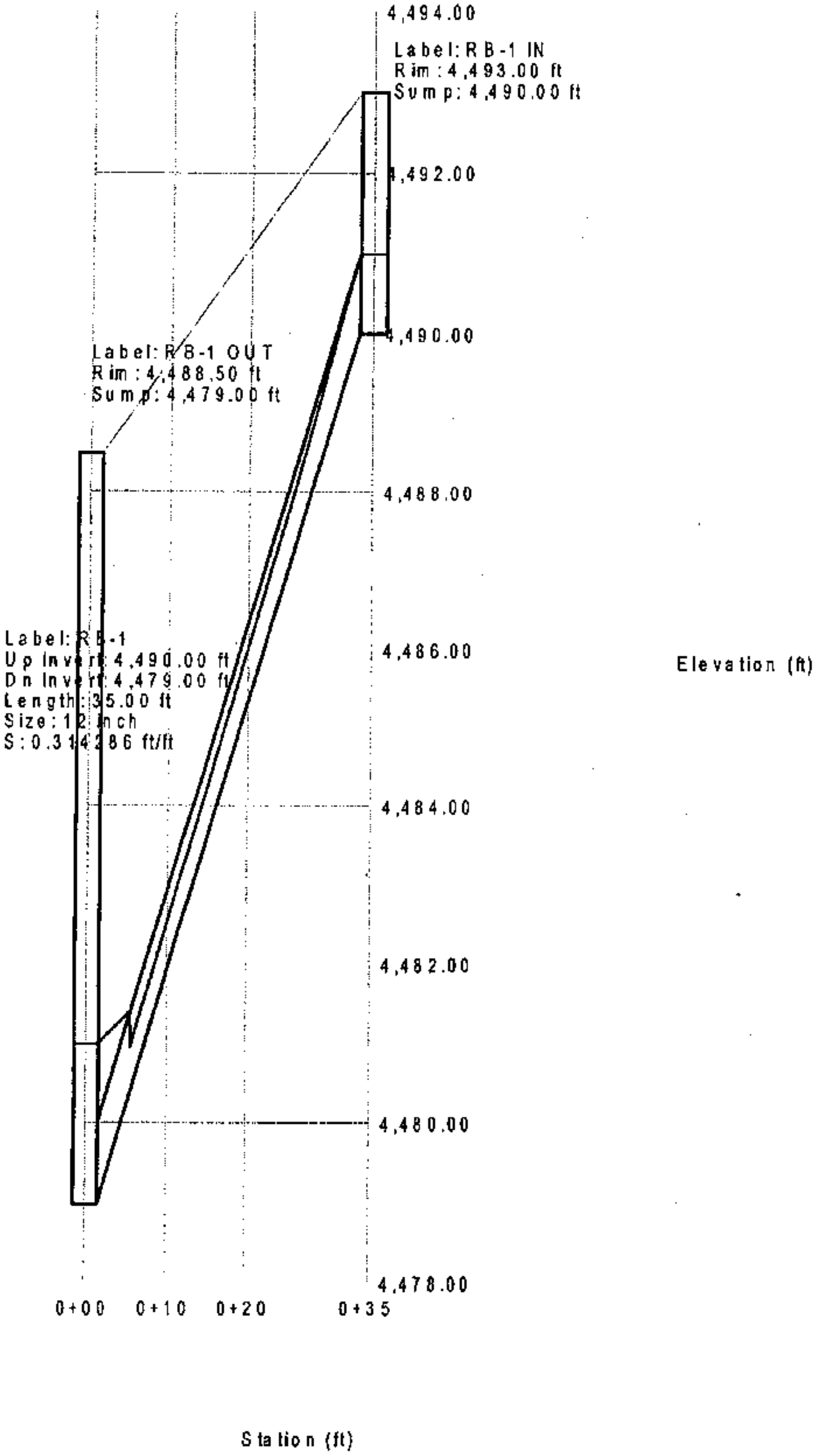


Scenario: Base

Combined Pipe/Node Report

Label	Upstream Node	Downstream Node	Length (ft)	Section Size	Capacity (cfs)	Average Velocity (ft/s)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Constructed Slope (ft/ft)	Calculated Headloss (ft)	Energy Grade In (ft)	Energy Grade Out (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)	Total System Flow (cfs)
RB-1	RB-1 IN	RB-1 OUT	35.00	12 inch	19.97	13.50	4,490.00	4,479.00	0.314286	10.00	4,493.83	4,483.83	4,491.00	4,481.00	10.60
RB-2	RB-2 IN	RB-2 OUT	100.00	15 inch	12.92	10.22	4,489.00	4,485.00	0.040000	3.97	4,491.85	4,487.86	4,490.22	4,486.25	12.50
RB-8	RB-8 IN	RB-3 IN	45.00	12 inch	3.76	2.55	4,486.50	4,486.00	0.011111	0.14	4,489.77	4,489.63	4,489.67	4,489.53	2.00
RB-3	RB-3 IN	RB-3 OUT	345.00	18 inch	19.59	10.29	4,486.00	4,474.00	0.034783	11.95	4,489.11	4,477.13	4,487.45	4,475.50	18.10

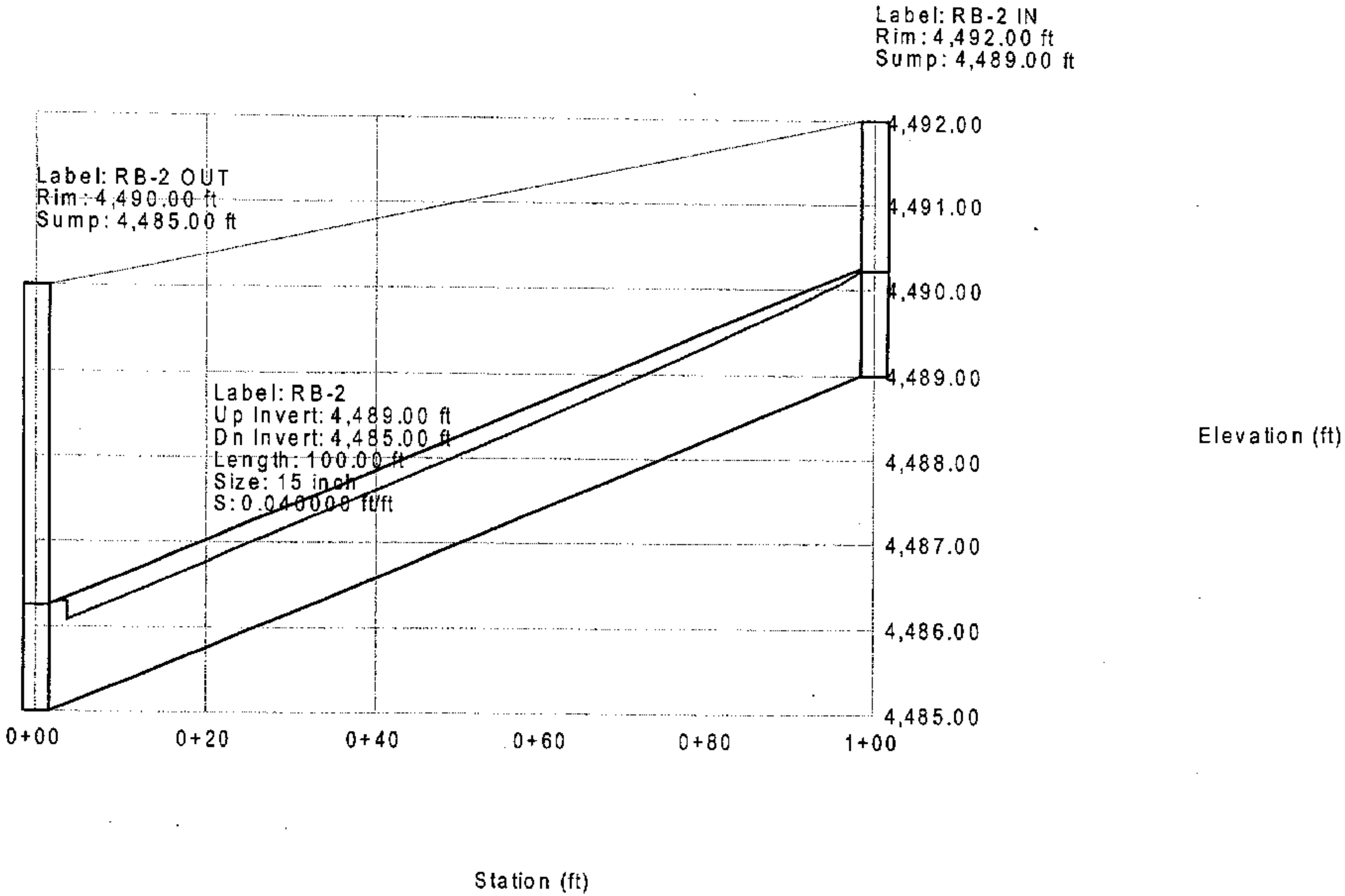
Profile
Scenario: Base



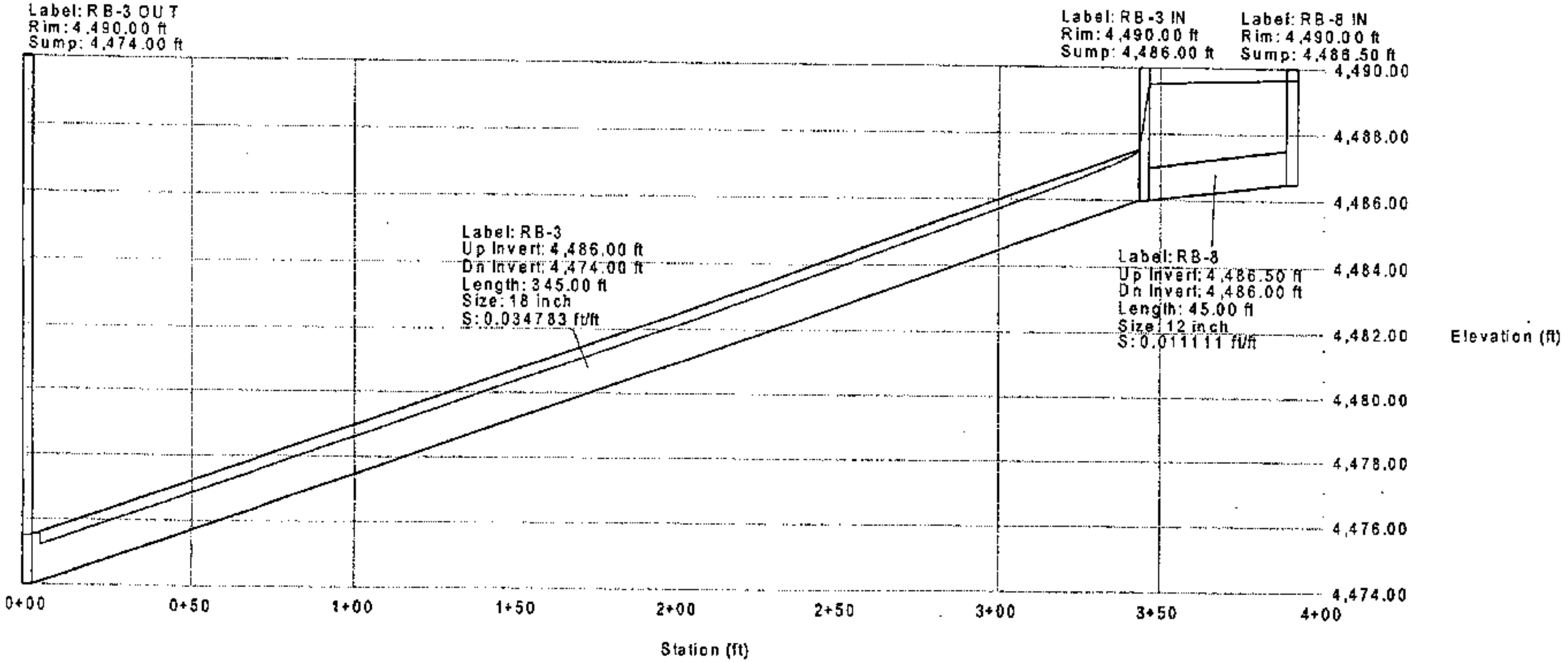
Title: ReTRAC

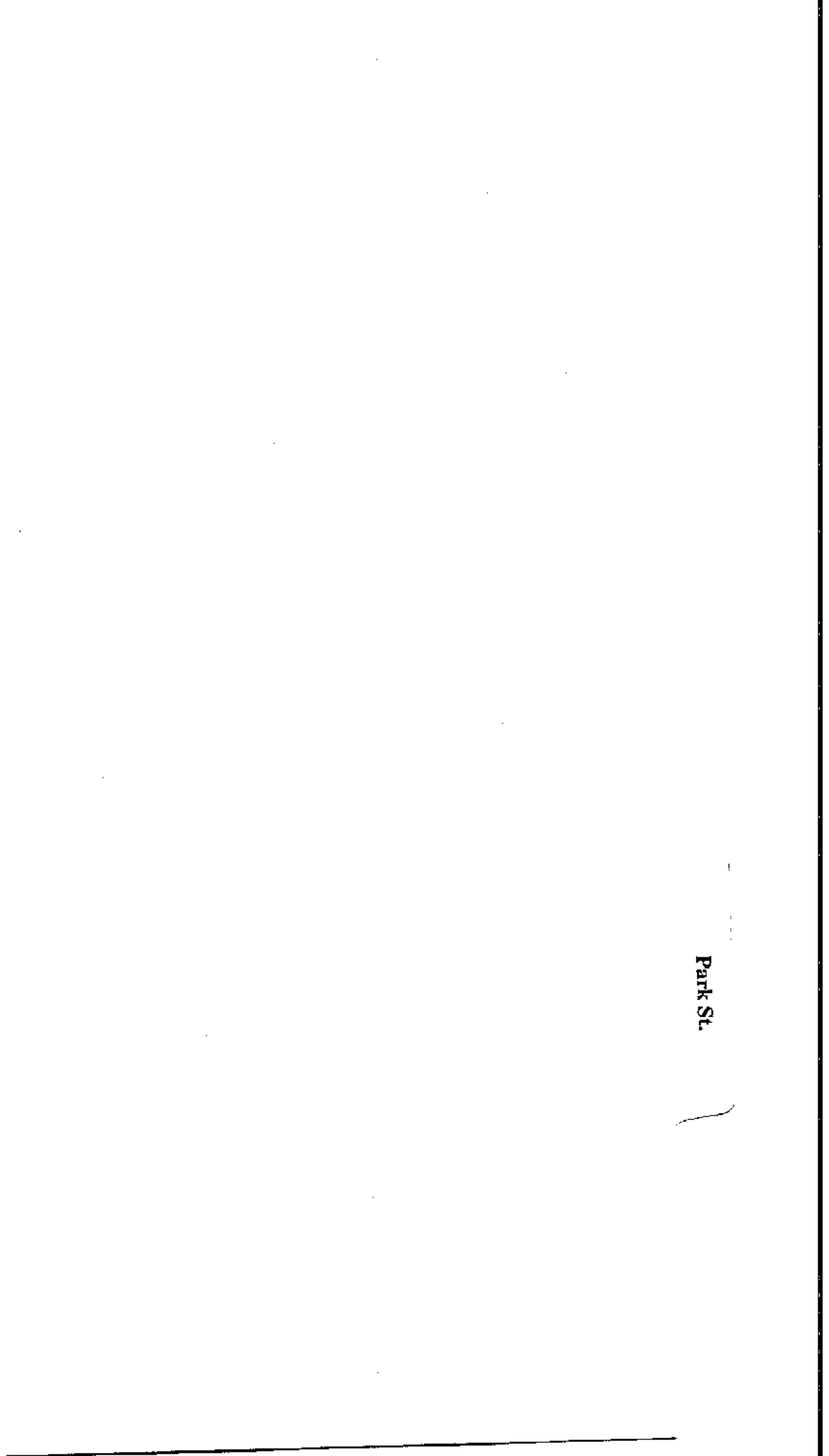
Project Engineer: Stan

Scenario: Base



Scenario: Base




Park St.

Park & 4th St E.
Worksheet for Irregular Channel

Project Description	
Worksheet	Park & 4th E.
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Channel Depth

Input Data		
Slope	005000	ft/ft
Discharg	196.00	cfs

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev	4,491.96	ft
Elevation Range	91.00 to 4,491.80	
Flow Area	43.9	ft^2
Wetted Perimeter	78.44	ft
Top Width	77.00	ft
Actual Depth	0.96	ft
Critical Elevation	4,491.97	ft
Critical Slope	0.004571	ft/ft
Velocity	4.46	ft/s
Velocity Head	0.31	ft
Specific Energy	4,492.26	ft
Froude Number	1.04	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.45543583 ft.

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	10+77	0.016

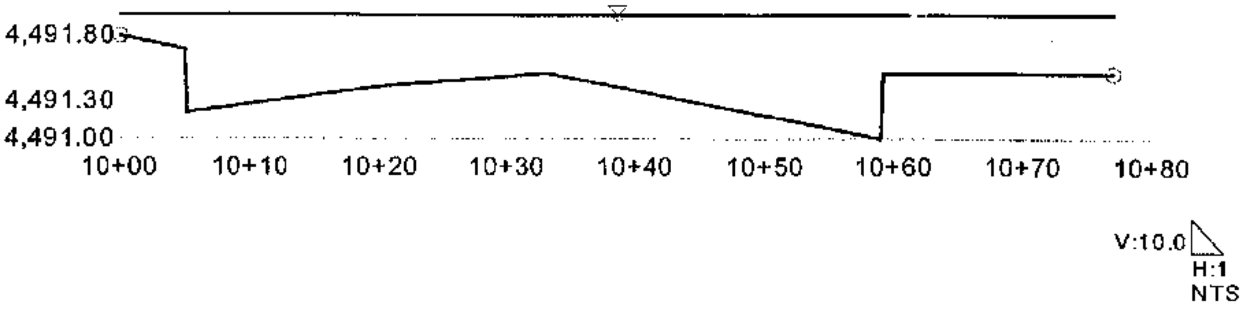
Natural Channel Points

Station (ft)	Elevation (ft)
10+00	4,491.80
10+05	4,491.70
10+05	4,491.20
10+20	4,491.40
10+33	4,491.50
10+54	4,491.10
10+59	4,491.00
10+59	4,491.50
10+77	4,491.50

Park & 4th St E.
Cross Section for Irregular Channel

Project Description	
Worksheet	Park & 4th E.
Flow Element	Irregular Chanı
Method	Manning's Forı
Solve For	Channel Depth

Section Data		
Mannings Coefficiei	0.016	
Slope	0.005000	ft/ft
Water Surface Elev.	4,491.96	ft
Elevation Range	91.00 to 4,491.80	
Discharge	196.00	cfs



Park & 4th St S.
Worksheet for Irregular Channel

Project Description	
Worksheet	Park & 4th S.
Flow Element	Irregular Chan
Method	Manning's For
Solve For	Channel Depth

Input Data		
Slope	001000	ft/ft
Discharg	75.00	cfs

Options	
Current Roughness Metho	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.016	
Water Surface Elev.	4,491.96	ft
Elevation Range	91.10 to 4,491.60	
Flow Area	45.1	ft²
Wetted Perimeter	105.95	ft
Top Width	105.00	ft
Actual Depth	0.86	ft
Critical Elevation	4,491.78	ft
Critical Slope	0.005956	ft/ft
Velocity	1.66	ft/s
Velocity Head	0.04	ft
Specific Energy	4,492.00	ft
Froude Number	0.45	
Flow Type	Subcritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.46160005 ft.

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	11+05	0.016

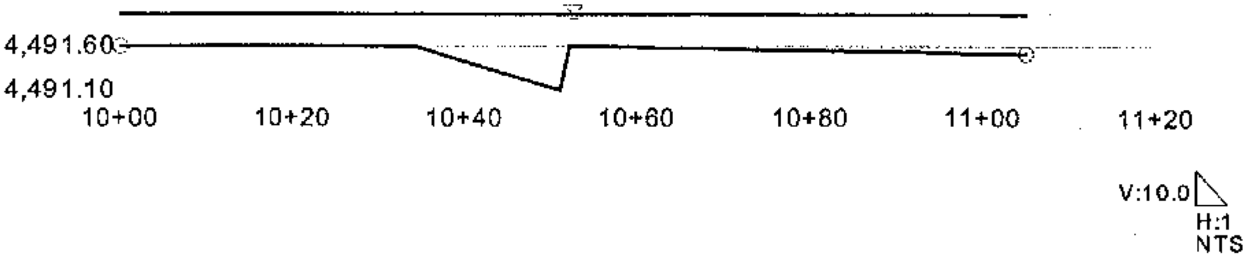
Natural Channel Points

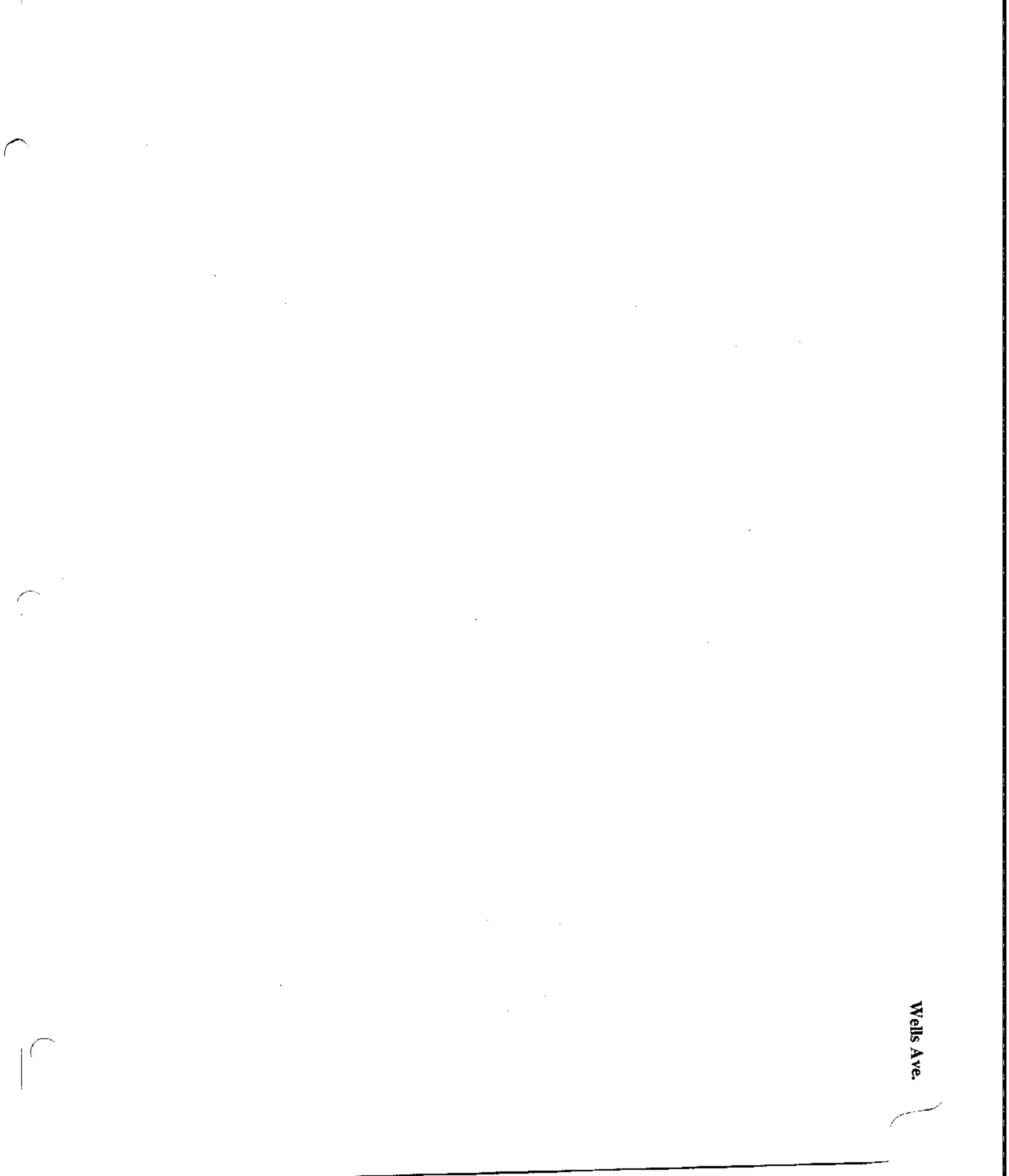
Station (ft)	Elevation (ft)
10+00	4,491.60
10+34	4,491.60
10+51	4,491.10
10+52	4,491.60
11+05	4,491.50

Park & 4th St S.
Cross Section for Irregular Channel

Project Description	
Worksheet	Park & 4th S.
Flow Element	Irregular Chani
Method	Manning's For
Solve For	Channel Depth

Section Data		
Mannings Coefficiei	0.016	
Slope	0.001000	ft/ft
Water Surface Elev.	4,491.96	ft
Elevation Range	)1.10 to 4,491.60	
Discharge	75.00	cfs




Wells Ave.

Parsons

Design Team for the Reno ReTRAC Project

TO: Ted Roworth

IOC 0168-03

FROM: Trina Magoon

Date: 4/8/03

SUBJECT: Outfall Structure at Truckee River Addendum 1

The following memo is to identify the design parameters and assumptions for the proposed Truckee River outfall structure located just downstream of the Wells Avenue overpass.

The proposed outfall structure will consist of a 12'x4' Reinforced Concrete Box (RCB) storm drain system that outlets to a combination structure of two 42-inch Reinforced Concrete Pipes (RCP's) protruding through an overflow weir. The downstream side of the RCP's will have 42-inch Tideflex Series TF-1 Check Valves attached to prevent backflow and fish migration into the storm drain system.

It was determined that the worst case scenario for fish migration into the storm drain would be when the Truckee River was experiencing low flows and the storm drain was experiencing a high flow event. This assumption was used for the design of the Tideflex and overflow weir elevation. The overflow weir elevation was set just above the Truckee River normal water surface elevation of 4470 (ordinary high water mark).

Each 42-inch outlet will convey approximately 80 cubic feet per second (cfs) at the elevation of the top of the weir (elevation 4470.2). The 23.5-foot long weir was designed to convey the remainder of the flow up to the capacity of the upstream storm drain system. The maximum capacity of the upstream storm drain system is 625cfs.

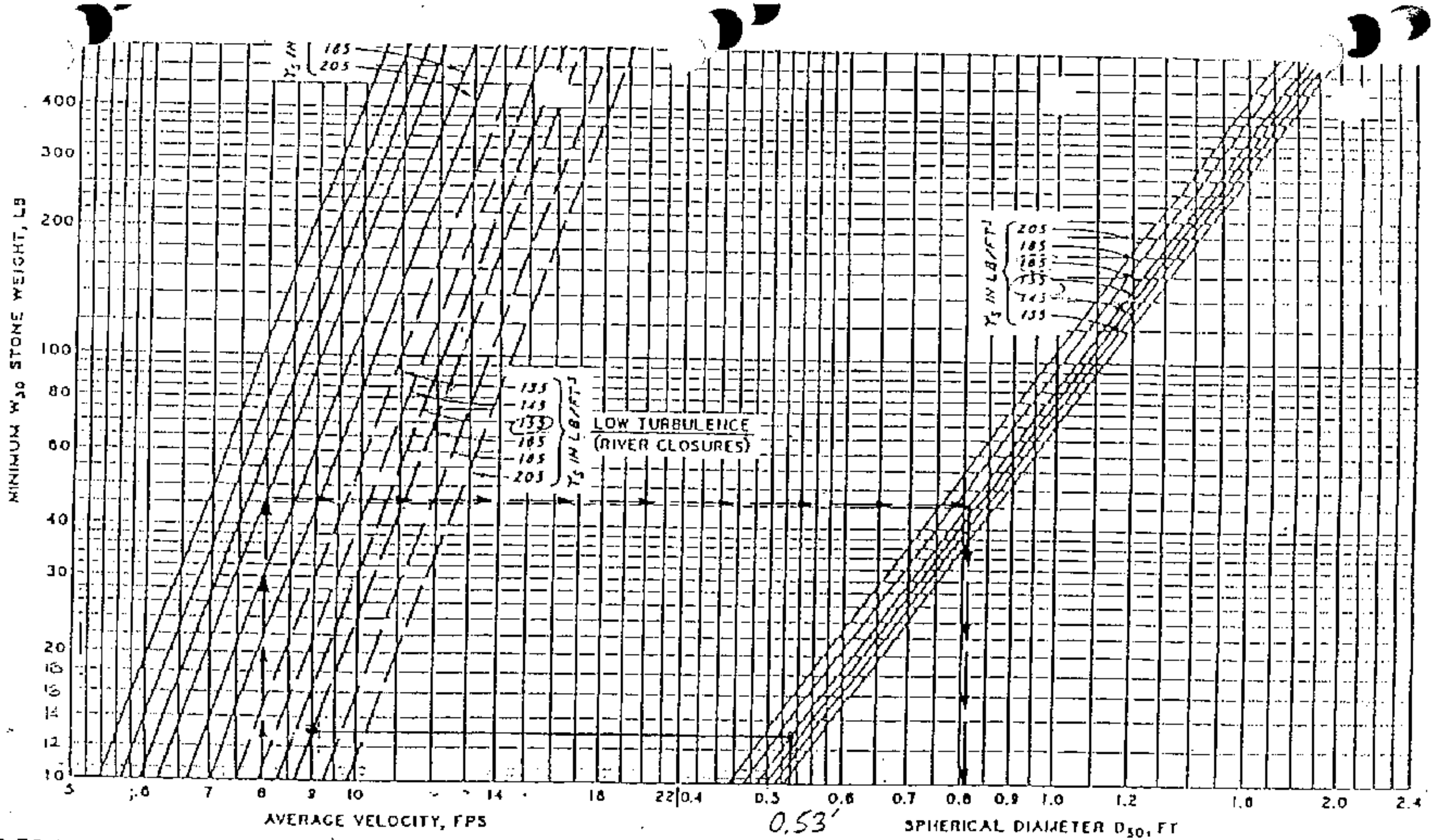
The RCP portion of the structure controls the outlet velocity of the two 42-inch structures. The outlet velocity is 10.1 feet per second (fps). This value was used to design the energy dissipation structure downstream of the outlet structure and to limit the flow velocities from the outlet to the Truckee River.

The proposed energy dissipation basin layout is shown on the attached Evans Ave. Storm Drain Wells Ave. Outlet Works Site Plan and Section. The layout shows the size and configuration of the basin, the chute blocks, the 42-inch RCP/Tideflex structures and the overflow weir. The chute blocks will be 2-feet wide by 1-foot deep by 0.5-feet tall. The rows will be spaced at 3-foot intervals with 1.3-feet between blocks within a row. The chute blocks will reduce the velocity of the outfall structure to 4.3fps at the confluence with Truckee River. All backup data and calculations have been attached.

Attachments

Stantec File: 80100603

M:\PTG IOC\PTG IOC\PTG IOC - 2003\IOC 0168-03.doc



BASIC EQUATIONS

$$V = C\left[2g\left(\frac{\gamma_S - \gamma_W}{\gamma_W}\right)\right]^{1/2}\left(D_{50}\right)^{1/2}$$

$$D_{50} = \left(\frac{6W_{50}}{\pi\gamma_s}\right)^{1/3}$$

WHERE: V = VELOCITY, FPS
γ_s = SPECIFIC STONE WEIGHT, LB/FT^3
γ_w = SPECIFIC WEIGHT OF WATER, 62.5 LB/FT^3
W_{50} = WEIGHT OF STONE. SUBSCRIPT DENOTES PERCENT OF TOTAL WEIGHT OF MATERIAL CONTAINING STONE OF LESS WEIGHT.
D_{50} = SPHERICAL DIAMETER OF STONE HAVING THE SAME WEIGHT AS W_{50}
C = ISBASH CONSTANT (0.86 FOR HIGH TURBULENCE LEVEL FLOW AND 1.20 FOR LOW TURBULENCE LEVEL FLOW)
g = ACCELERATION OF GRAVITY, FT/SEC^2

STONE STABILITY
VELOCITY VS STONE DIAMETE

HYDRAULIC DESIGN CHART 712-1
(SHEET 1 OF 2)

REV 8-58, 9-70 WES 8-57

CLASSIFICATION AND GRADATION OF LOOSE RIPRAP

RIPRAP CLASS DESIGNATION	% SMALLER THAN GIVEN SIZE BY WEIGHT	RIPRAP GRADATION (Inches)	d_{50}* (Inches)
Class 150	100	10	
	35 - 50	6	
	0 - 15	2	6**
Class 300	100	20	
	35 - 50	12	
	0 - 15	4	12
Class 400	100	26	
	35 - 50	16	
	0 - 15	6	16
Class 550	100	37	
	35 - 50	22	
	0 - 15	8	22
Class 700	100	45	
	35 - 50	28	
	0 - 15	10	28
Class 900	100	57	
	35 - 50	35	
	0 - 15	14	35

*d_{50} = mean stone size

** Bury Class 150 riprap with native top soil and re-vegetate to protect from vandalism

REFERENCE:

Draft, State of Nevada, Department of Transportation
Standard Specifications for Road and Bridge Construction,
1996

TABLE
804

The relationships presented in equation 5 can be used to estimate the probable maximum depth of scour due to natural scour and fill phenomenon in straight channels, and in channels having mild bends. Equation 5 is based on data presented by Blodgett (15). In application, the depth of scour, d_s, determined from equation 5 should be measured from the lowest elevation in the cross section. It is assumed that the low point in the cross section may eventually move adjacent to the riprap (even if this is not the case in the current survey).

$$d_s = 12 \text{ ft for } D_{50} < 0.005 \text{ ft}$$
$$d_s = 6.5\ D_{50}^{-0.11} \text{ for } D_{50} > 0.005 \text{ ft} \qquad (5)$$

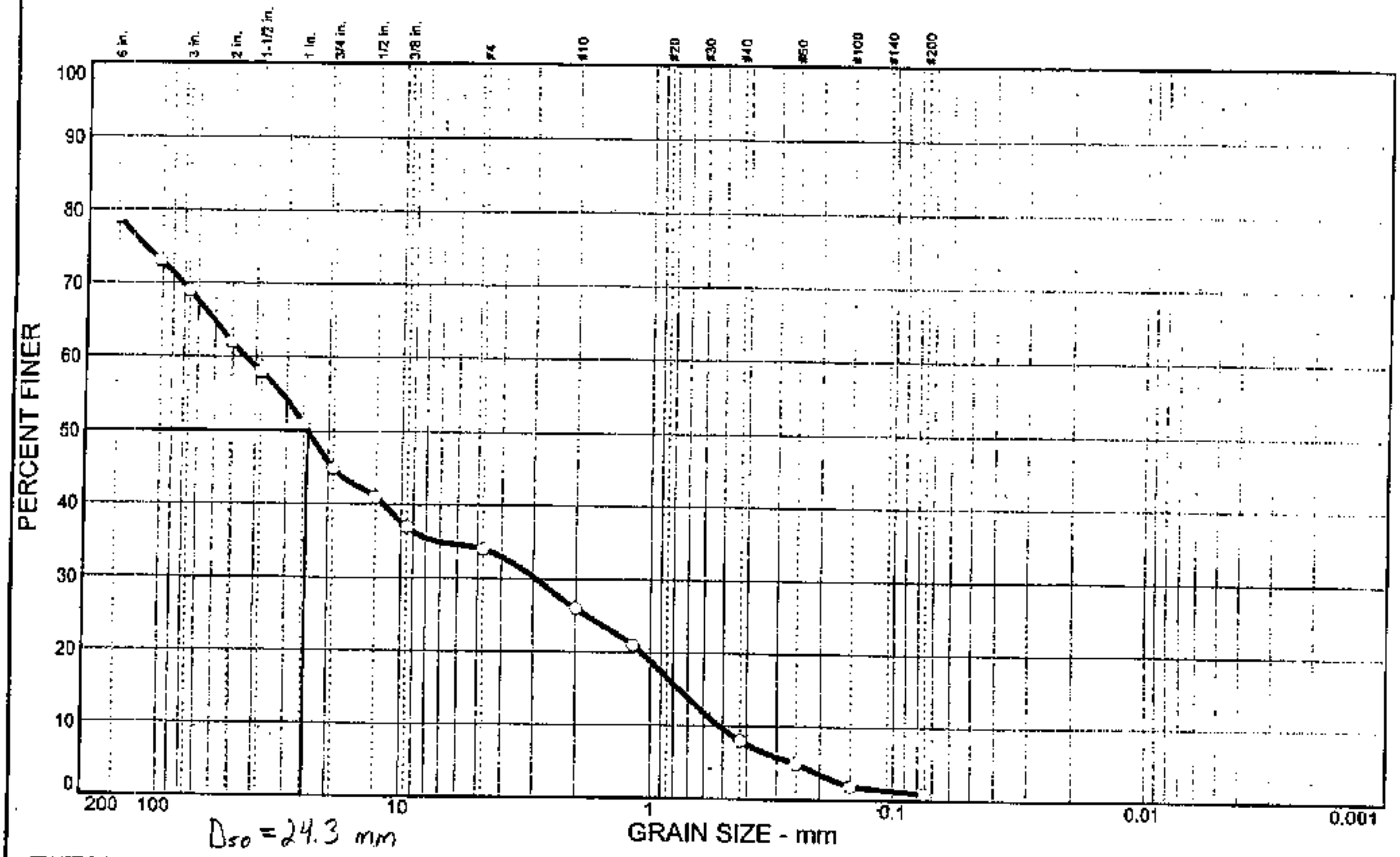
where

d_s = estimated probable maximum depth of scour, and
D_{50} = median diameter of bed material.

The depth of scour predicted by equation 5 must be added to the magnitude of predicted degradation and local scour (if any) to arrive at the total required toe depth.

$D_{50} = 0.08'$
$d_s = 8.6'$

Particle Size Distribution Report



D_{50} = 24.3 mm

	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	31.0	35.0	33.0	1.0					

SIEVE inches size	PERCENT FINER ○		
6	79.0		
4	73.0		
3	69.0		
2	62.0		
1.5	58.0		
1	51.0		
3/4	45.0		
1/2	41.0		
3/8	37.0		
	GRAIN SIZE		
D_{60}	44.2		
D_{30}	2.91		
D_{10}	0.518		
	COEFFICIENTS		
C_c	0.37		
C_u	85.38		

SIEVE number size	PERCENT FINER ○		
#4	34.0		
#10	26.0		
#16	21.0		
#40	8.0		
#60	5.0		
#100	2.0		
#200	1.0		

SOIL DESCRIPTION

○ -

REMARKS:

○

○ Source: RETRAC

Sample No.: NO. 69

STANTEC CONSULTING INC.
950 INDUSTRIAL WAY
SPARKS, NV. 89431
PHONE (775) 358-6931
FAX (775) 358-6954

Stantec

Client: ReTRAC

Project: FROM CROSS TOWN SEWER INTERCEPTOR
SITE WAS APPROX. 3000' AWAY FROM PROPOSED OUTFALL

Project No.: ~~[illegible]~~

Plate

OUTFALL STRUCTURE SHEET NO. ____ OF ____
MADE BY ZRB DATE 4/17/03 CHECKED BY TN DATE 4/17/03

TAILWATER ELEV.

$Q = 625$ CFS

TRY 7.5' ABOVE WALL INVERT

TIDEFLEX w/ 7.5' HEAD 108 CFS

TOTAL WEIR FLOW 409 CFS

SHARP CRESTED WEIR

$$Q = \tfrac{2}{3}\sqrt{2g}\,L\,H^{3/2}$$

$$409 = \tfrac{2}{3}\sqrt{64.4}\,(23.5')\,H^{3/2}$$

$$H = 2.2'$$

Check

$$C_d = 0.59 + .05\left[\frac{y_1}{Z_w} - 1\right]$$

$$= 0.59 + 0.05\left[\frac{7.2}{5.1} - 1\right]$$

$$= 0.62$$

$$Q = C_d\, b \sqrt{g}\,(y_1 - Z_w)^{3/2}$$

$$413 = 0.62\,(23.5)(32.2)^{1/2}\,(y_1 - 5.1)^{3/2}$$

$$y_1 = 7.25\ ✓$$

TRY 7.2' ABOVE WALL INVERT

TIDEFLEX w/ 7.2' HEAD 106 CFS

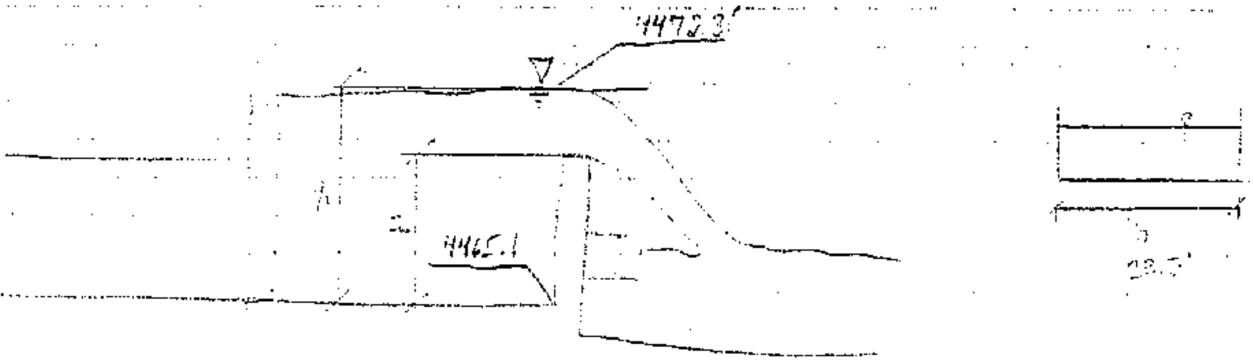
TOTAL WEIR FLOW 413 CFS

$$413 = \tfrac{2}{3}\sqrt{64.4}\,(23.5')\,H^{3/2}$$

$$H = 2.2'$$

WALL INVERT 4465.1'

WATER SURFACE ELEV w/ 625 CFS ⇒ 4472.3'



$$\left[\quad \text{sec}^2 \quad \right]$$

nen

$$\frac{y_2}{y_1} = \frac{1}{2}[\sqrt{1 + 8(7.17)^2} - 1] = 9.65$$

d

$$y_2 = 9.65\ y_1 = 9.65 \times 0.0563 \text{ m} = 0.543 \text{ m} \qquad y_2$$

so

$$\frac{h_l}{E_1} = \frac{[\sqrt{1 + 8(7.17)^2} - 3]^3}{8[\sqrt{1 + 8(7.17)^2} - 1][(7.17)^2 + 2]} = 0.629$$

ice

$$E_1 = \frac{V_1^2}{2g} + y_1 = \frac{1}{2} \times \frac{(5.33)^2 \text{ m}^2}{\text{sec}^2} \times \frac{\text{sec}^2}{9.81 \text{ m}} + 0.0563 \text{ m} = 1.50 \text{ m}$$

n

$$h_l = 0.629\ E_1 = (0.629)\ 1.50 \text{ m} = 0.944 \text{ m} \qquad h_l$$

is hydraulic jump dissipates nearly 63 percent of the specific energy of the incoming flow.

MEASUREMENTS IN OPEN-CHANNEL FLOW

) basic methods are available to measure flow rates in open channels. At a critical ion, the flow speed is equal to the critical speed, so the flow rate may be calculated 1 a depth measurement. At an obstruction in a channel (a *weir*), flow depth elates with the rate of flow.

.1 Sharp-Crested Weirs

v over a sharp-crested weir is sketched in Fig. 10.14. It is tempting to apply the 1oulli equation from far upstream to flow at the weir *nappe*. Near the weir crest, the amlines are highly curved, making the assumptions of uniform flow and rostatic pressure variation poor. Consequently, accurate calculation of flow over a p-crested weir requires use of an empirically determined discharge coefficient.

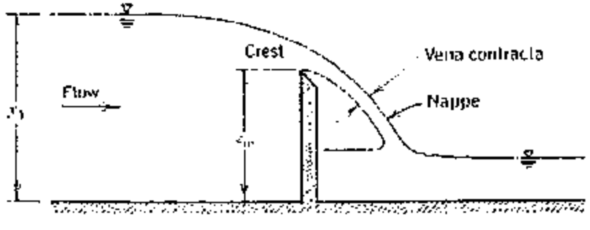


Fig. 10.14 Section view of flow over a sharp-crested weir.

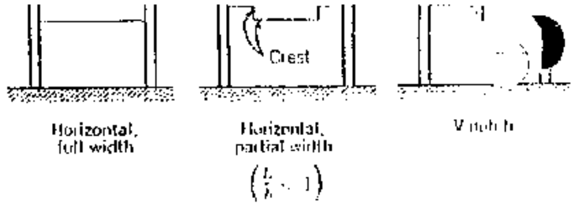


Fig. 10.15 Principal types of sharp-crested weirs

Many experiments have been run on a variety of weir configurations. Figure 1 illustrates three principal types of sharp-crested weirs.

The flow area across a horizontal weir is proportional to the height differe $y_1 - z_w$. Thus

$$A \sim b\left(\frac{L}{b}\right)(y_1 - z_w)$$

If we neglect the upstream velocity, the velocity across the weir may be deterr approximately from the Bernoulli equation as

$$V \approx \sqrt{g(y_1 - z_w)}$$

Combining these equations yields

$$Q \sim b\left(\frac{L}{b}\right)\sqrt{g}(y_1 - z_w)^{3/2}$$

Introducing the empirically determined discharge coefficient, C_d, to accou velocity nonuniformity, stream contraction, and frictional effects, then

$$Q = C_d b\left(\frac{L}{b}\right)\sqrt{g}(y_1 - z_w)^{3/2} \qquad ($$

Many correlations have been suggested for the discharge coefficient. A s equation of the form [4]

$$C_d = 0.59 + 0.08\left[\frac{y_1}{z_w} - 1\right] \qquad ($$

gives satisfactory results for many cases.

The nappe (Fig. 10.14) of a full-width horizontal weir must be aerated (ventil the atmosphere). If the nappe is not aerated, entrainment forms a low-pressure r causing the discharge to increase for a given head.

Aeration is automatic when the weir spans only part of the channel. Ho additional contraction of the stream is caused by the sharp vertical edges of th For approximate calculations [4,5], the length, L, used in Eq. 10.60 may be redu $0.2(y_1 - z_w)$.

Fox, Robert W and McDonald, Alan T.
Intro to Fluid Mechanics, Third Ed

[illegible] = 10 : (Culvert [illegible])

$Y_o = 3.5'$

Fr = 0.94 $F = \frac{V_o}{(gY_o)^{1/2}} = \frac{10}{[(32.2)(3.5)]^{1/2}}$

$Q = 80$ [illegible]

$\frac{V_A}{V_o} = 1.4$ $V_A = 14$ fps

$Y_A = \frac{80}{14(11)}$

$Y_A = 0.52'$

$\frac{W_B}{W_o} = 3.14$

5 rows
3' Dem rows
17 blocks ([illegible])

2'w x 0.5 tall x 1' deep

Begin 7' from end of [illegible]

$Y_? = 0.91$ $h = 0.5'$

$L/h = 6$ $L = 3'$ between blocks.

$N_r = 5$ rows Use 2' wide blocks 3.5 blocks/row

$1.94(10)80 + 0.55(62.4)(3.5^2/2)3.5 = 0.2(1)17(1.94)14^2/2 + 1.94\,V_B\,80$

$+ 62.4\;80^2/2\,V_B^2\,11$

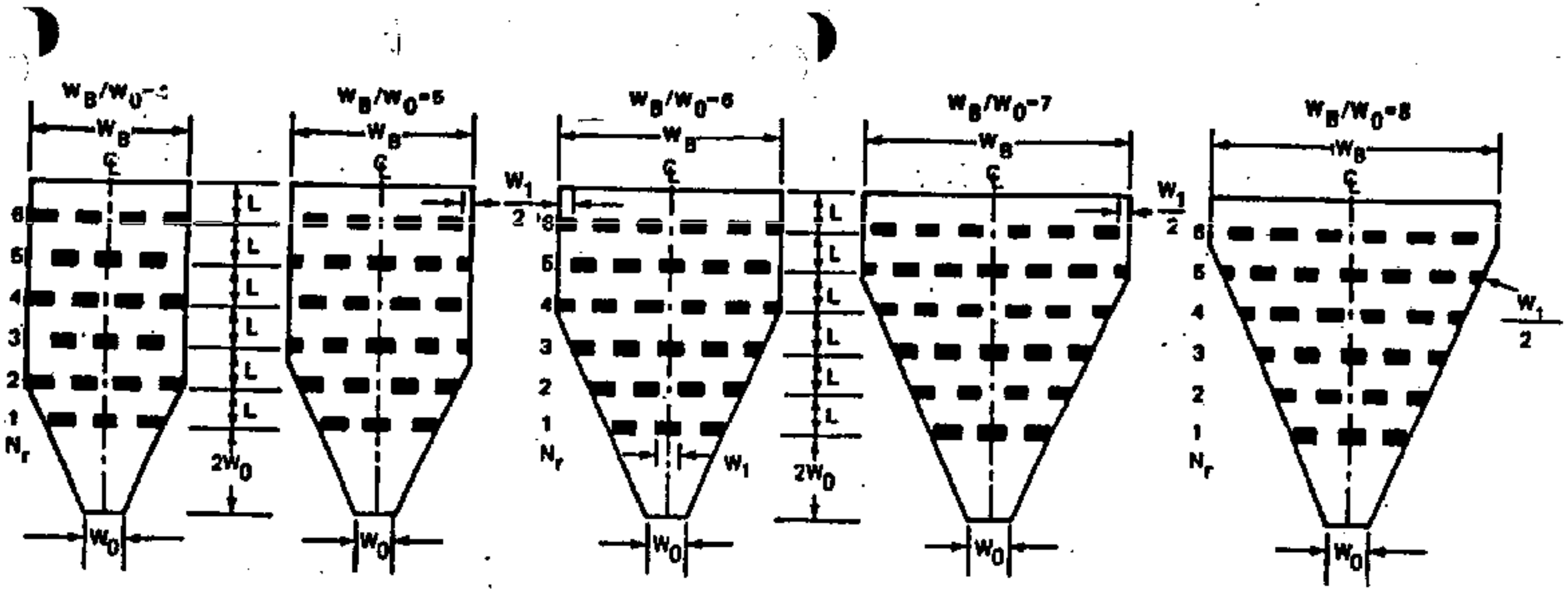
$1552 + 755.7 = 646.4 + 155.2 V_B + \frac{18152.7}{V_B^2}$

$\frac{18152.7}{V_B^2} + 155.2 V_B - 1641.3 = 0$

$V_B = 9.2$ & 4.2 fps

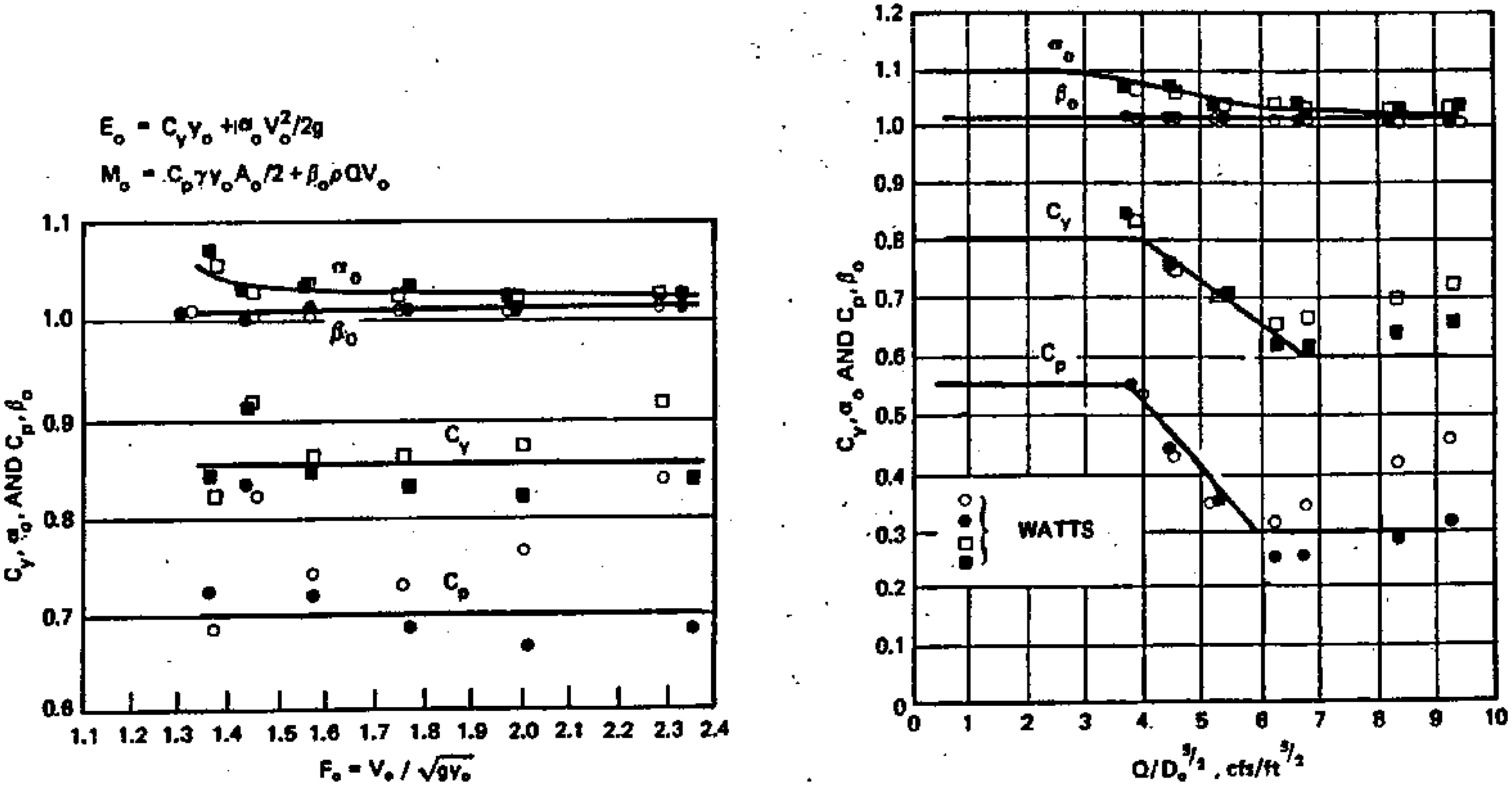
Downstream Flow Subcritical

$V_B = 4.8$ fps



	W_B/W_0		2 TO 4			5			6			7		8
	W_1/W_0		.57			.63			.6			.58		.62
	NO. ROWS (N_r)		4	5	6	4	5	6	4	5	6	5	6	6
	NO. ELEMENTS (N)		14	17	21	15	19	23	17	22	27	24	30	30
	h/Y_A	L/h	C_B FOR ROUGHNESS ELEMENT DISSIPATORS											
RECTANGULAR	0.91	6	0.32	0.28	0.24	0.32	0.28	0.24	0.31	0.27	0.23	0.26	0.22	0.22
	0.71	6	0.44	0.40	0.37	0.42	0.38	0.36	0.40	0.36	0.33	0.34	0.31	0.29
	0.48	12	0.60	0.55	0.51	0.56	0.51	0.47	0.53	0.48	0.43	0.46	0.39	0.35
	0.37	12	0.68	0.66	0.65	0.65	0.62	0.60	0.62	0.58	0.56	0.54	0.50	0.45
CIRCULAR	0.91	6	0.21	0.20	0.48	0.21	0.19	0.17	0.21	0.19	0.17	0.18	0.16	
	0.71	6	0.29	0.27	0.40	0.27	0.25	0.23	0.25	0.23	0.22	0.22	0.20	
	0.31	6	0.38	0.36	0.34	0.36	0.34	0.32	0.34	0.32	0.30	0.30	0.28	
	0.48	12	0.45	0.42	0.25	0.40	0.38	0.36	0.36	0.34	0.32	0.30	0.28	
	0.37	12	0.52	0.50	0.18	0.48	0.46	0.44	0.44	0.42	0.40	0.38	0.36	

FIGURE VII-A-5 DESIGN VALUES FOR ROUGHNESS ELEMENT DISSIPATORS



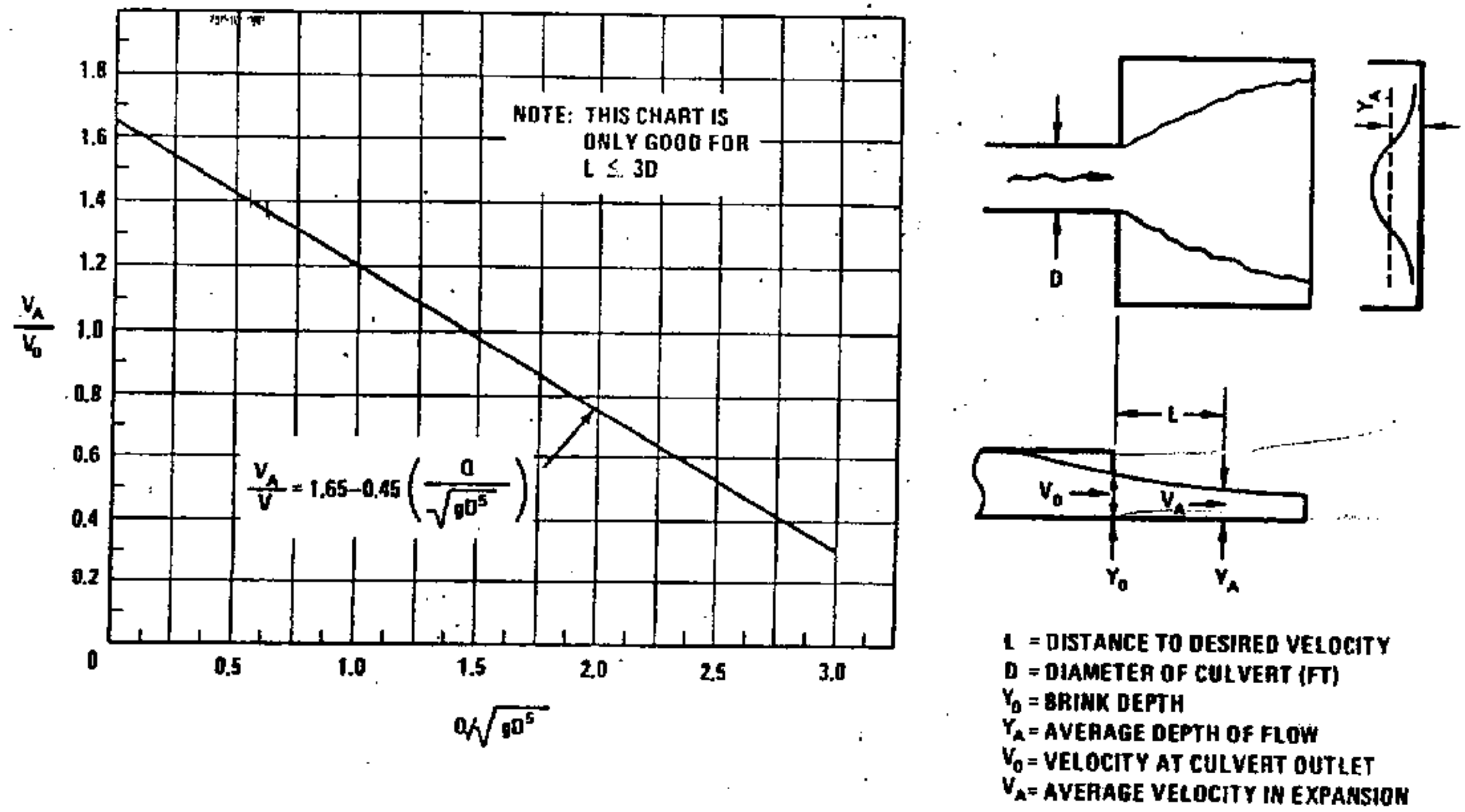
$$E_o = C_y y_o + \alpha_o V_o^2/2g$$

$$M_o = C_p \gamma y_o A_o/2 + \beta_o \rho Q V_o$$

(a) RECTANGULAR CULVERTS

(b) CIRCULAR CULVERTS

Figure VII - A - 4 ENERGY AND MOMENTUM COEFFICIENTS
(FROM WATTS AND SIMONS REFERENCE VII-A-1)



L = DISTANCE TO DESIRED VELOCITY
D = DIAMETER OF CULVERT (FT)
Y_0 = BRINK DEPTH
Y_A = AVERAGE DEPTH OF FLOW
V_0 = VELOCITY AT CULVERT OUTLET
V_A = AVERAGE VELOCITY IN EXPANSION

FIGURE IV-A-3. AVERAGE VELOCITY FOR ABRUPT EXPANSION BELOW CIRCULAR OUTLET FROM REFERENCE IV-A-1

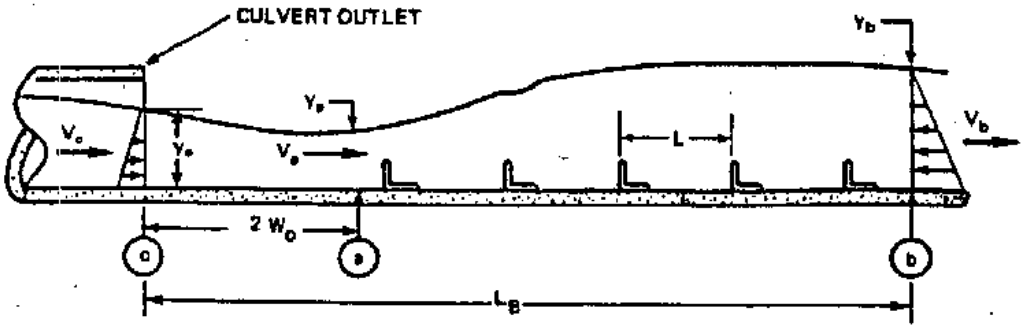


FIGURE VII-A-2. DEFINITIVE SKETCH FOR THE MOMENTUM EQUATION

The CSU test indicate several design limitations. The height, h, of the roughness elements must be between 0.31 and 0.91 of the approach flow average depth (y_A); and, the relative spacing, L/h, between rows of elements, must be either 6 or 12. The latter is not a severe restriction since relative spacing is normally a fixed parameter in a design procedure and other tests (VII-A-2) have shown that the best range for energy dissipation is from 6 to 12.

Although the tests were made with abrupt expansions, the configurations recommended for use are the combination flared-abrupt expansion basins shown in figure VII-A-5. These basins contain the same number of roughness elements as the abrupt expansion basin.

The flare divergence, u_e, is a function of the longitudinal spacing between rows of elements, L, and the culvert barrel width, W_O:

$$u_e = 4/7 + (10/7)L/W_O$$

The values of the basin drag, C_B, for each basin configuration are given in figure VII-A-5. The C_B values listed are for expansion ratios (W_B/W_O) from 4 to 8. They are also valid for lower ratios (2 to 4) if the same number of roughness elements, N, are placed in the basin. This requires additional rows of elements for basins with expansion ratios less than 4. The arrangements of the elements for all basins is symmetrical about the basin centerline. All basins are flared to the width W_B of the corresponding abrupt expansion basin.

The basic design equation is:

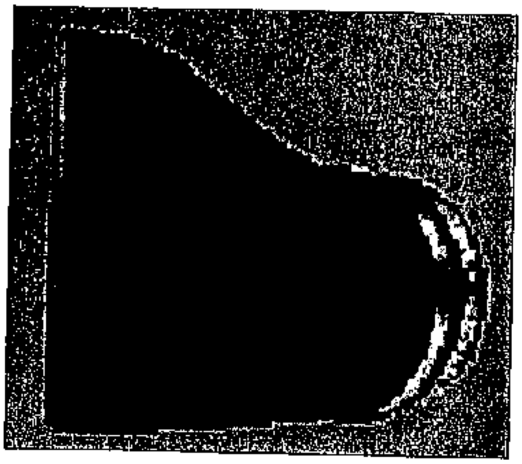
$$\rho V_O Q + C_P \gamma (Y_O{}^2/2) W_O = \left[C_B A_F N \rho V_A{}^2/2\right] + \left[\rho V_B Q\right] + \left[\gamma Q^2/2V_B)^2 W_B\right] \quad . \ .\text{VII-A-1}$$

Series TF-1

Tideflex® Check Valve

Red Valve Company, Inc.

- ▶ Ideal for manhole installations
- ▶ Lightweight, all-elastomer design
- ▶ Seals around entrapped solids
- ▶ Cost-effective, maintenance-free design



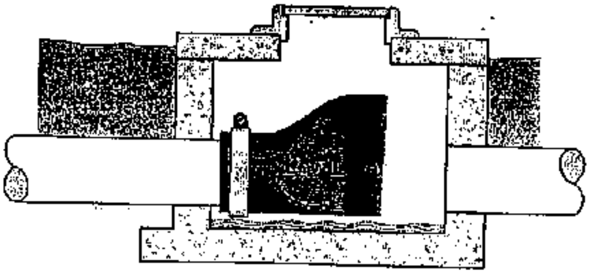
Materials of Construction

- ▶ *Elastomers available in Pure Gum Rubber, Neoprene, Hypalon®, Chlorobutyl, Buna-N, EPDM, and Viton®*

We are pleased to announce the introduction of the revolutionary TF-1 Check Valve. It functions and operates under the same simple principle of operation as the original TF-2 Tideflex®.

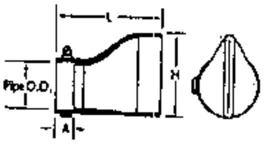
This design is ideal for existing manhole installations where the invert of the pipe is close to the floor of the vault. There are many check valves in interceptors, manholes, and vaults. These vaults are designed so that there would be a maximum gravity head; thus, the invert pipe is as close to the base as possible. The TF-1 allows installations in such applications.

The Red Valve Series TF-1 Tideflex® Check Valve is designed for applications in manholes, where the bottom of the manhole is close to the invert of the pipe. The TF-1 configuration allows the valve to be properly installed without manhole modification, ensuring positive backflow prevention and a lifetime of maintenance-free performance.

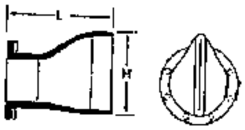


Dimensions Series TF-1 Tideflex® Check Valve

The TF-1 slip-on connection is based on the O.D. of the mating Pipe. For in-between sizes, consult factory.



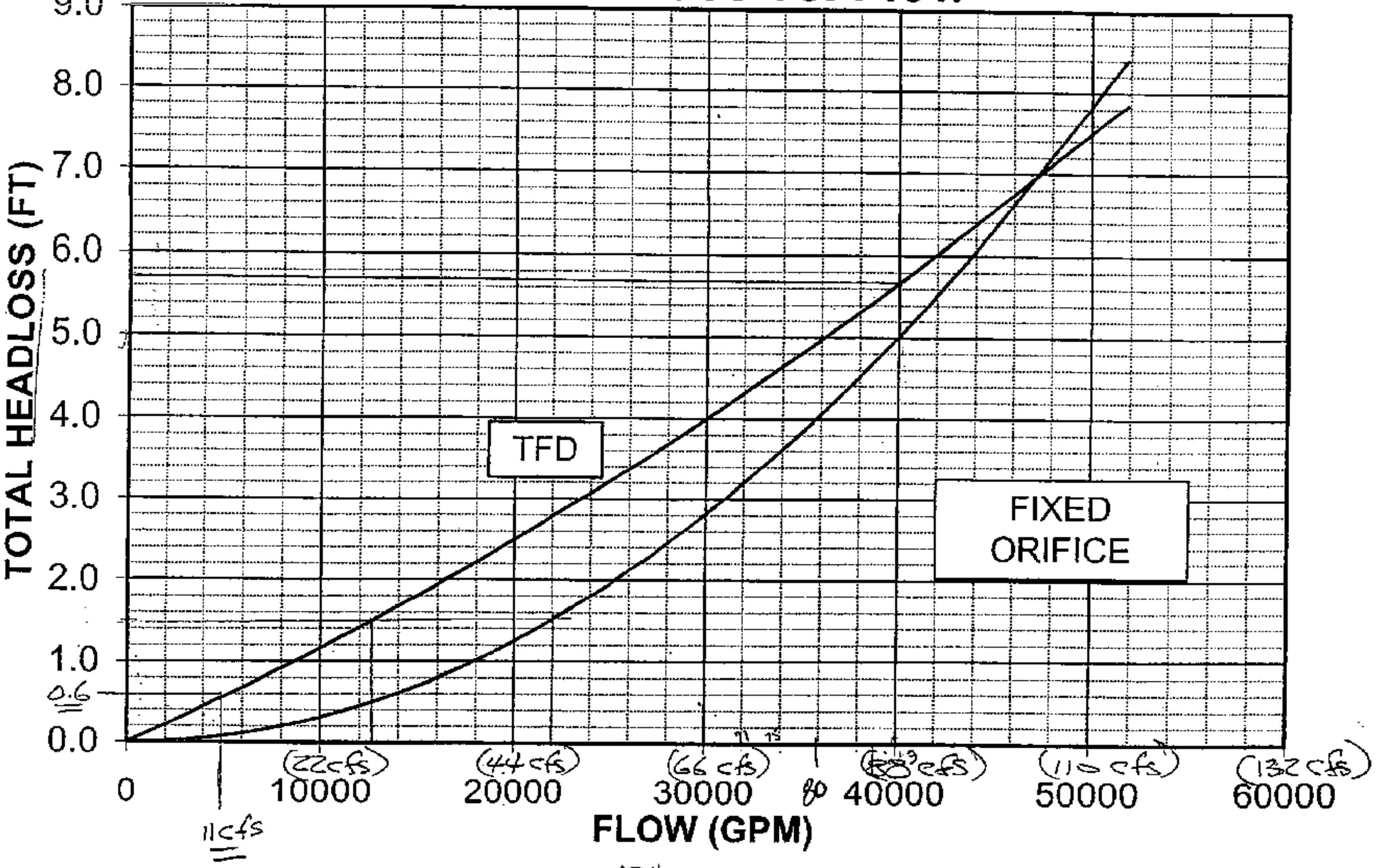
Tideflex® TF-1



Flanged Style TF-1

Pipe O.D.	Tideflex® TF-1 Cuff Slip-On Length A	TF-1 Flanged ANSI Flange Size	Maximum Length L	Maximum Height H
6"	2"	6"	14"	12"
8"	2"	8"	17-1/4"	15-1/4"
10"	3"	10"	21-1/2"	18-3/4"
12"	4"	12"	26"	22"
16"	5"	16"	32"	29"
20"	8"	20"	40"	36"
24"	8"	24"	46"	43"
30"	9"	30"	55-1/4"	54-3/4
36"	10"	36"	65"	69"
42"	10"	42"	59-1/2"	70-1/2
48"	10"	48"	71"	91"
60"	13"	60"	80-3/4"	95"

Total Headloss vs. Flow



42"

Culvert Calculator Report
Outlet Structure 42" RCP

[illegible]ve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	4,470.20 ft	Headwater Depth/ Height	1.45
Computed Headwater Elevation	4,470.27 ft	Discharge	80.00 cfs
Inlet Control HW Elev	4,470.27 ft	Tailwater Elevation	4,465.19 ft
Outlet Control HW Elev	4,470.18 ft	Control Type	Inlet Control

Grades

Upstream Invert	4,465.19 ft	Downstream Invert	4,465.14 ft
Length	5.00 ft	Constructed Slope	0.010000 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	2.69 ft
Slope Type	Steep	Normal Depth	2.49 ft
Flow Regime	Supercritical	Critical Depth	2.79 ft
Velocity Downstream	10.09 ft/s	Critical Slope	0.007706 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.014
Section Material	Concrete	Span	3.50 ft
Section Size	42 inch	Rise	3.50 ft
Number Sections	1		

[illegible]let Control Properties

[illegible] Control HW Elev	4,470.18 ft	Upstream Velocity Head	1.47 ft
Ke	0.50	Entrance Loss	0.73 ft

Inlet Control Properties

Inlet Control HW Elev	4,470.27 ft	Flow Control	Submerged
Inlet Type	Square edge w/headwall	Area Full	9.6 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Memorandum

PARSONS

Design Team for the Reno ReTRAC Project

TO: Avrum Loewenstein, P.E.

IOC 0643-03

FROM: Zach Brandner

Date: 10/22/03

SUBJECT: Revised trench wall elevations for the 100-year storm event

Enclosed are the revised trench wall elevations as dictated by the 100-year storm water surface elevations. Elevation adjustments were due to design progress of the trench wall limits, design progress of Evans Storm Drain (Lake to Wells), additional Truckee River flood information and revisions of Sierra Street and Virginia Street trench crossings.

Cc: Stephen Hu, P.E.

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File: DA 400.01

NORTH TRENCH WALL ELEVATIONS

Description	Approx. Station	100YR WSEL	100YR WSEL w/ freeboard
Start of Wall Just W. of Keystone	2568+00	4525	4526
xs 2500	2577+50	4518.59	4519.59
xs 2400 CL Washington	2578+00	4518.59	4519.59
xs 2300	2584+50	4514.68	4515.68
xs 2200 CL Ralston	2585+75	4514.68	4515.68
xs 2100	2586+00	4513.54	4514.54
xs 2000	2588+00	4511.89	4512.89
xs 1900	2590+00	4510.84	4511.84
xs 1800	2592+00	4508.93	4509.93
xs 1700	2593+00	4508.93	4509.93
xs 1600 CL Arlington	2593+50	4508.93	4509.93
xs 1550	2593+75	4508.16	4509.16
xs 1500	2594+75	4506.87	4507.87
xs 1400	2596+50	4506.27	4507.27
xs 1300 CL West	2597+20	4506.16	4507.16
xs 1250	2597+70	4505.11	4506.11
xs 1200	2598+00	4505.11	4506.11
xs 1100	2600+00	4504.21	4505.21
xs 1050	2600+50	4503.59	4504.59
xs 1000 CL Sierra	2601+00	4503.59	4504.59
xs 900	2601+50	4502.61	4503.61
xs 800	2602+50	4501.55	4502.55
xs 700	2603+50	4501.55	4502.55
xs 600	2604+50	4500.81	4501.81
xs 500 CL Virginia	2604+75	4500.81	4501.81
xs 425	2608+10	4496.76	4497.76
xs 400 CL Center	2608+50	4496.76	4497.76
xs 300	2609+00	4496.37	4497.37
xs 250	2612+00	4493.92	4494.92
xs 200 CL Lake	2612+50	4493.92	4494.92
xs 150	2612+75	4493.86	4494.86
xs 100	2613+50	4493.86	4494.86
xs 90	2614+75	4493.86	4494.86
xs 80	2615+50	4490.14	4491.14
Record Inlet	2620+00	4490.00	4491.00

North Trench Wall Elevations
Reno Branch Corridor

North Mainline Station	Min. North Trench Wall Elevations (Bottom of Barrier) in Feet	
2624+38.74	4490	
2624+42	4488.4	
2625+00	4488.2	
2626+02	4487.9	
2627+00	4487.6	
2628+00	4487.3	
2629+00	4487	
2630+00	4486.7	
2631+00	4486.4	
2631+69.3	4486.4	Pedestrian overcrossing
2633+86.8	4486.4	area may dictate wall elevations
2634+01	4486.4	
2635+01	4486.1	
2635+47	4482	
2639+00	4482	
2640+00	4482.3	

SOUTH TRENCH WALL ELEVATIONS

Approx. NML Station	W.S. w/ freeboard
2542+80	4528
2555+00	4523
2560+00	4522.5
2568.5+00	4522
2575+00	4508
2590+00	4507.5
2599+00	4505
2605+00	4503
2609+00	4497
2612+00	4496
2620+00	4487
2624+00	4481
2633+00	4480
2637+00	4479
2645+00	4473.5