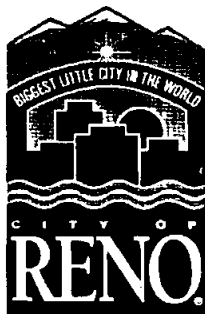


# ***Drainage Master Plan Stead, Nevada***

**Prepared for:**



**Prepared by:**



**Stantec**

**August 2000**

**Project No. 80100208**

## **Appendices**

### **APPENDIX 1 – Volume 2 (under a separate cover)**

7. Existing Conditions Hydrologic Model Parameters (alphabetized by basin)
8. Existing Conditions 100-Year, 24-Hour Event HEC-1 Model
9. Existing Conditions 5-Year, 24-Hour Event HEC-1 Model

### **APPENDIX 2 – Volume 3 (under a separate cover)**

7. Proposed Conditions Hydrologic Model Parameters (alphabetized by basin)
8. Proposed Conditions 100-Year, 24-Hour Event HEC-1 Model
9. Proposed Conditions 5-Year, 24-Hour Event HEC-1 model

### **APPENDIX 3 – Volume 4**

17. Correspondence
18. Previous Studies
19. Existing Conditions Hydrologic and Hydraulic Backup Data (alphabetized by basin)
20. Proposed Conditions Hydrologic Backup Data (alphabetized by basin)
21. Proposed Conditions Hydraulic Backup Data
22. Quantities and Cost Estimates
23. Survey Data
24. References

**Correspondence** **1**

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**Previous Studies** **2**

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**Existing Conditions Hydrologic  
and Hydraulic Backup Data** **3**

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**Proposed Conditions  
Hydrologic Backup Data** **4**

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**Proposed Conditions Hydraulic  
Backup Data** **5**

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**Quantities and Cost Estimates** **6**

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**Survey Data** **7**

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**References** **8**

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**Correspondence** **1**

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**Previous Studies** **2**

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**Existing Conditions Hydrologic  
and Hydraulic Backup Data** **3**

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**Proposed Conditions  
Hydrologic Backup Data** **4**

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**Proposed Conditions Hydraulic  
Backup Data** **5**

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**Quantities and Cost Estimates** **6**

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**Survey Data** **7**

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**References** **8**

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Stantech Consulting Inc.  
(formerly SEA, Incorporated)  
950 Industrial Way  
Sparks, Nevada 89431  
(702) 358-6931 • Fax 358-6954

① YS  
② FA  
③ PE

# MEMO

## MINUTES OF MEETING

TO: MEETING ATTENDEES  
FROM: PETE ETCHART  
DATE: DECEMBER 24, 1997  
DATE OF MEETING: DECEMBER 19, 1997  
LOCATION OF MEETING: CITY OF RENO  
PROJECT NO.: 26000209  
REGARDING: CITY OF RENO, STEAD HYDROLOGIC AND DRAINAGE MASTER PLAN  
IN ATTENDANCE: GARY STOCKHOFF - CITY OF RENO  
FRANK ALVERSON - STANTECH  
PETE ETCHART - STANTECH

At the Stead Hydrologic and Drainage Master Plan kick-off meeting, the following items were discussed and/or agreed upon:

1. Stantech would like to request all available existing hydrologic and hydraulic studies that have been completed in the Stead Watershed.
2. Stantech would also like to request any statistical rainfall or runoff data that has been accumulated for the watershed.
3. It was agreed that the hydrologic criteria from the Draft Washoe County Hydrologic Criteria and Drainage Design Manual would be used for this study. This data shall include:
  - a. Rainfall data from the National Weather Service's Southwest Semi-Arid Precipitation Frequency Study, 1997.
  - b. Depth Area Reduction Factors from NOAA Atlas No. 2, 1973.
  - c. Hydrologic channel routing shall utilize the Muskingum-Cunge method for channelized flow and the Muskingum method for overland flow.
  - d. Reservoir Routing shall utilize the Modified Puls routing method.
  - e. Regional Growth Factors from the Washoe County Manual.
4. When the preliminary storm drain improvement locations are determined, Stantech would like to request all available Geotechnical Studies that have been completed in the area.

5. The City of Reno will arrange a meeting between the City of Reno GIS computer personnel and Stantech. Stantech would like to find out if the following information is available in GIS or AutoCAD format: Utility information, FEMA flood plain delineations, zoning information, soil information, and parcel base information.
6. Stantech would like to request from the City of Reno any information regarding known drainage problem areas in the watershed.
7. Stantech will talk with Washoe County about potential development of the County land in the watershed.

If you have any comments or corrections for these minutes, please contact me at your earliest convenience."

August 11, 1998  
Project No. 26000207

Mr. Bob Gottsacker, P.E.  
**CITY OF RENO**  
**COMMUNITY DEVELOPMENT DEPARTMENT**  
450 Sinclair Street  
Reno, NV 89505

**RE: Drainage Plans Associated with Stead Drainage Master Plan**

Dear Mr. Gottsacker:

Stantech is currently performing hydrologic and hydraulic analysis for the Stead drainage basin in north Reno. In order to minimize duplication of efforts, we are requesting that your office send us all available information pertaining to the Stead watershed, including:

- Hydrologic Analyses
- Drainage Reports
- Commercial & Residential Drainage Plans
- Roadway Drainage Plans
- Storm Drain Plans

We appreciate your cooperation in this matter, and look forward to working with you on this project. Should you have any questions or concerns, please feel free to contact us at your convenience.

Sincerely,

**STANTECH CONSULTING INC.**

Jim Bachand

cc: Gary Stockhoff  
Chris Robinson

**STANTECH CONSULTING INC.**

Formerly SEA, Incorporated

950 Industrial Way  
Sparks, NV 89431-6092  
(702) 358-6931  
Fax: 358-6954JOB NO. 26000208

SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT Stead Drainage Master Plan DATE 6/17/99  
SUBJECT Meeting w/ Gary DESIGNED \_\_\_\_\_ CHECKED \_\_\_\_\_

➔ Existing Conditions 100-year, 24-hour HEC-1 Model

BA ➔ Basin Delineation based upon  
➔ U.S.G.S 7.5" Quad  
➔ 2' Contour Map  
➔ Field StudyPM ➔ Precipitation ➔ used Balanced Storm Distribution  
based upon NOAA Atlas 14, Volume 1,  
Semi-Arid Southwest United States.➔ Converted 2-Year to 100-year Per Washoe  
County ManualLaf ➔ Per Washoe County Manual.  
for  $< 1 \text{ mi}^2$  &  $< 10\%$  Basin slope ➔ used  $t_1 + t_2$   
for all other basins ➔ used USBR method.CN ➔ Soil & land use information from GIS  
field study to estimate vegetation type and  
cover density.  
TR-55 tables were used to estimate CNRouting ➔ Muskingum Curve Method was used  
Kinematic Wave used for two routings only.Detention ➔ Detention rating @ R.R. ➔ used USGS & field survey  
Basin " " @ Highway ➔ Highway Plans ① ESB ② PW4.  
Detention within proposed & developed areas.  
➔ Sky Vista ➔ 2 - ① Calc. ② ➔ used Codegen.  
➔ Silver Lake ➔ 2 - ① SSB ② SL3A  
Within 2' topo ➔ ① Moya.XX Need a Plan from either the City or FFE for  
the detention basin within SL3A.XX Due to higher rainfall, some det ➔ overlapping the spillway.  
Split flows ➔ Based upon field survey, and 2' topo.① Splits along R.R. due to undersized culverts.  
② splits at other locations.

**STANTECH CONSULTING INC.**

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950 Industrial Way  
Sparks, NV 89431-6092  
(702) 358-6931  
Fax: 358-6954

JOB NO. \_\_\_\_\_

SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT \_\_\_\_\_

DATE \_\_\_\_\_

SUBJECT \_\_\_\_\_

DESIGNED \_\_\_\_\_

CHECKED \_\_\_\_\_

Challenges → ① Splits & Diversions forced us to model the south portion of the Basin in Detail.  
(99 Basins.)

② A lot of time spent to estimate split flows

③ Data Gathering Process → Really, not much help from the city.

④ CLOMR report which could have saved us a lot of time and effort.

From Here, where do we go ??

① RTC Stand Blvd Project.

↳ Does the City want to include the improvement with the RTC Project ??



**Stantec**

## Minutes of Meeting Memo

DATE OF MEETING: June 17, 1999

REFERENCE: Meeting with City of Reno - Stead Master Plan  
FILE: 80100208

ATTENDEES: Gary Stockhoff - City of Reno  
Pete Etchart, Yong Song, Jim Bachand - Stantec

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The Stead Master Plan meeting took place on June 17<sup>th</sup> at the City of Reno offices. If any of the following items does not reflect your interpretation of what was discussed, please contact me as soon as possible.

Yong said that the existing conditions 100-year model for the Stead Master Plan was essentially complete (less minor refinements). He explained how we initially modeled the area with large basins, but had to make them smaller in more developed areas, including lands adjacent to Stead Blvd. He also elaborated on the numerous split flows and detention basins in the area, including those caused by the railroad, and explained how Stantec modeled the significant ones for the study.

Yong defined the hydrology components of the HEC-1 model used to develop flow rates for the Stead Master Plan, and highlighted major flows on the maps. Basin delineation was performed using USGS quad maps, and the City of Reno 2-foot topographic map. SCS curve numbers were developed utilizing land use information and field investigations. Lag times were calculated using USBR and velocity methods. Precipitation values were taken from the latest NOAA Atlas 14 rainfall maps, as opposed to using a Type-2 distribution. Yong explained that our precipitation values, which are converted from 2-year figures, are higher than those used in previous studies, but that our information is the best available and adheres to Washoe County standards.

The City and Stantec agreed upon designing storm drain systems to handle 5-year events, and open channels to handle 100-year events. Stantec will prepare a 5-year HEC-1 model in order to identify deficiencies associated with a 5-year storm event. Stantec will then compile a list of "hot spots" for review at the next scheduled meeting. Current problem areas include Stead Boulevard, JC Penney, and Military Road southeast of Lear Boulevard.

In addition to the overall Master Plan, Gary would like Stantec to provide him with a list of areas requiring improvement, perhaps with a benefit to cost ratio and priority rating associated with each, so that he may budget capital improvement money toward specific problems. He also expressed interest in making improvements to the segment of Stead Boulevard that does not contain storm drain pipe (north of Silver Lake to Craftsman Press building) before construction begins on that street.

Pete thought that a determination should be made regarding ingress and egress along Stead Boulevard for future planning and/or design purposes. Stantec identified substantial flow in the street beginning north of Silver Lake Boulevard, continuing to the intersection with Lear Boulevard. Gary said that decisions regarding street flow capacity ultimately rest with the City of Reno.

Stantec (Yong) will extend an invitation to Washoe County to attend the next meeting, scheduled for July 8 at 10:00 A.M. Mr. Bob Gottsacker should also be in attendance. Goals of the meeting will be to discuss

any future plans or projects and their impact upon the Master Plan, add any critical areas to ones already identified, and address any related concerns the County may have with the overall plan.

The foregoing is considered to be a true and accurate record of all items discussed. If any discrepancies or inconsistencies are noted, please contact the writer immediately.

Distribution:

Attendees

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## MEETING NOTES

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# Stantec

TO: Meeting Attendees

DATE: July 12, 1999

DATE OF MEETING: July 8, 1999

LOCATION: City of Reno

FILE: 80100208

ATTENDEES: Gary Stockhoff, Chris Robinson - City of Reno  
Paul Urban - Washoe County  
Steven Richard - Airport Authority of Washoe County  
Yong Song - Stantec Consulting

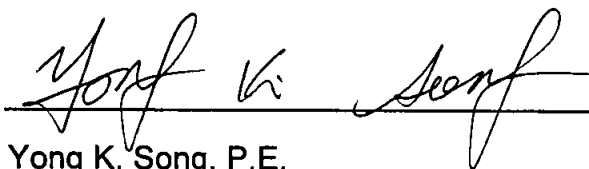
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The following items were discussed and agreed upon in regards to the Stead Drainage Master Plan Project. Please contact us as soon as possible if the items do not reflect your understanding of the issues discussed, or if you have additional comments.

1. Stantec explained that the existing conditions 5- and 100-year, 24-hour hydrologic models (HEC-1) are essentially completed based upon the drainage guidelines outlined in the Final Draft Washoe County Drainage Manual. Stantec also explained a grading plan for the Silver Shores existing detention basin is needed to complete the model. The City will try to obtain the grading plan from FPE/Pyramid Engineers.
2. Washoe County stated they are planning to construct a retention/groundwater recharge basin immediately north of the Stead airport property. Steve, from the Airport Authority, stated that a flood control channel may be constructed along their western property boundary to convey flood flows to the Silver Lake area. The City of Reno suggested that the County and Airport Authority should discuss and coordinate their flood control planning efforts.
3. The City of Reno explained that the Peek's Project is about to construct a collection/diversion channel along Military Road. The City, CFA, and Stantec should have a meeting to discuss the proposed Peek's flood control plans and difference in the calculated peak flow rates. Stantec will include the proposed peek's development in the ultimate conditions hydrologic models.
4. Stantec stated that the existing ditch along the west side of the railroad, near JCPenney and the Stead Blvd. storm drain system will be further analyzed to define the existing flooding problems. Stantec will prepare a master plan level design alternatives for the identified flooding problems and present them to the City.

5. The City of Reno requested Stantec to calculate the 100-year flood elevations of the both lakes using our HEC-1 models, and compare the lake elevations to the previous studies.

The foregoing is considered to be a true and accurate record of all items discussed. If any discrepancies or inconsistencies are noted, please contact the writer immediately.

A handwritten signature in black ink, appearing to read "Yong K. Song", is written over a horizontal line.

Yong K. Song, P.E.  
Manager, Water Resources

YKS:eb  
p:\civil\6000208\wpdocs\litr-memo\7-8minutes.doc



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## MEETING NOTES

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**Stantec**

TO: Meeting Attendees

DATE: September 26, 1999

DATE OF MEETING: September 20, 1999

LOCATION: Stantec Office

FILE: 80100208

ATTENDEES: Gary Stockhoff, Charla Honey - City of Reno  
Frank Alverson, Jon Ericson, Jim Bachand - Stantec Consulting

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The following items were discussed and agreed upon with regard to the Stead Drainage Master Plan and Stead Boulevard Storm Drain Projects. Please contact us as soon as possible if the items do not reflect your understanding of the issues discussed, or if you have additional comments.

1. Improvements proposed by Kennedy Jenks Consultants from their previous study of the area do not need to be included within the proposed conditions Master Plan hydrologic models, although their recommendations should be noted in the report. The Peek Project between Military Road and Lemmon Drive will be included in the proposed conditions hydrologic models.
2. The City does not plan to channelize any 100-year flows independent of Stead Boulevard. The roadway itself will continue to carry flow north to Lear Boulevard.
3. The City does plan to install new storm drain, curb and gutter, and sidewalk for the existing open ditch section between Silver Lake Blvd and the 6' x 6' drop inlet on the west side of the street.
4. Stantec will identify property ownership for the subdivision bordering Stead Blvd on the east, across from JCPenney. Stantec will also contact JCPenney regarding the possibility of locating drainage improvements within their property.



**Correspondence 1**

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**Previous Studies 2**

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**Existing Conditions Hydrologic  
and Hydraulic Backup Data 3**

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**Proposed Conditions  
Hydrologic Backup Data 4**

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**Proposed Conditions Hydraulic  
Backup Data 5**

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**Quantities and Cost Estimates 6**

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**Survey Data 7**

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**References 8**

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**STANTECH CONSULTING INC.**

Formerly SEA, Incorporated  
950 Industrial Way  
Sparks, NV 89431-6092  
(702) 358-6931  
Fax: 358-6954

JOB NO. 26000202

SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT City of Reno Stead Drainage Master Plan DATE 7/7/99  
SUBJECT Previous Studies DESIGNED \_\_\_\_\_ CHECKED \_\_\_\_\_

1. Nimbus Engineers, Hydrologic and Hydraulic Analysis for Silver Shores #8, Prepared for Lewis Homes of Nevada, April 1993,
2. Jeff Codega Planning/Design, Inc., Sky Vista Drainageway Master Plan, Prepared for Greater Mountain Financial, Inc, August 1994.
3. Schaaf & Wheeler, Request for a Conditional Letter of Map Revision (CLOMR), Hydrology Only, Peek Lemmon Valley Property Washoe County, Nevada, March 28, 1996.
4. Schaaf & Wheeler, Request for a Conditional Letter of Map Revision (CLOMR), Southwest Lemmon Valley Flood Control Channels, Washoe County, Nevada, June 10, 1998.
5. Schaaf & Wheeler, Southwest Lemmon Valley Flood ~~Control~~ Channel Master Plan, Prepared for CFA, June 1998.
6. Summit Engineering, Hydrology Report for Sky Vista Parkway From Silver Lake Road to Lemmon Drive, Prepared for Silverwing Development, January 1999.
7. Pyramid Engineers & Land Surveyors, Inc., Hydrology Report for Silver Lake Apartments, Prepared for ERGS, Inc, January 1998
8. Pyramid Engineers & Land Surveyors, Inc., Interim Hydrology Report for Silver Shores Grading, Prepared for Leareno Development Company, December 1997.
9. ~~Pyramid~~ Pyramid Engineers & Land Surveyors, Inc., Preliminary Hydrology Report for Silver Terrace Grading, Prepared for Leareno Development Company, May 1997.
10. Pyramid Engineers & Land Surveyors, Inc., Supplemental Hydrology to Silver Shores Unit #31, Prepared for Lewis Homes of Nevada, January 1998.
- 11.



October 25, 1984

Mr. Brian R. Mrazik, PhD  
Chief, Risk Studies Division  
Room 514  
500 "C" Street, S.W.  
Washington D.C. 20024

Donnelley

Attention: Mr. Phillip Meyer

Re: Request for Map Amendment  
Leareno Industrial Park  
Reno, Nevada

Dear Sir:

We are enclosing the additional information you requested in your September 28, 1984 letter for issuing a Belief Letter that will allow construction of the improvements in the Leareno Industrial Park. This information is found in the enclosed Flood Study Report "Proposed Drainage Plan," and consists of:

1. The General Grading Plan for the proposed improvements, including existing and proposed contours for the drainage layout; shown in Exhibits 1, 2, and 3.
2. The 100-year water-surface profile for the proposed conditions; shown in Exhibit 3.
  - a. The discharge used in the computations was the one approved in your September 28, 1984 letter.
  - b. Hydraulic computations for the 100-year flood are shown in "Computation Sheets," "Computer Input Data," and "Computer Output Summary."
3. Delineation of the revised <sup>100</sup>~~40~~-year flood boundary is shown in Exhibit 1.
4. Levees were not used in the improvements.

The final results of the flood study indicate that with the Proposed Drainage Plan, all the Leareno Industrial Park improvements will be protected against flooding from the 100-year flood event. Water entering the park from the south will be temporarily contained in the Perimeter Basin and then released to the east and to the west outside the park. The water's maximum elevation inside the Perimeter Basin will be 4971.0 and 4968.0 in the Outlet Channel. All improvements will be above these elevations.

NOW IN OUR FIFTIETH YEAR OF SERVICE

1525 SOUTH SIXTH STREET ■ SPRINGFIELD, ILLINOIS 62703-2886 ■ 217/788-2450 ■ TWX 910-242-0519  
SPRINGFIELD, ILLINOIS ■ PEORIA, ILLINOIS ■ ROCKFORD, ILLINOIS

Directors: Walter L. Hanson, Leo J. Dondanville, Jr., John M. Healy, John P. Hine, Richard K. Miller, Donald D. Oglesby, Eugene K. Wilkinson

We hope this information will be sufficient for you to issue the Belief Letter. Your prompt reply will be greatly appreciated.

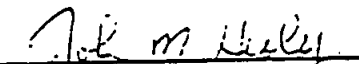
Please let us know if you have any questions concerning the information provided.

Very truly yours,

HANSON ENGINEERS INCORPORATED



John P. Hine, P.E.  
Vice President

Approved by: 

John M. Healy, P.E.  
#2603 Nevada

Attachments

cc: Dan Delimata, R.R. Donnelley  
Bill Vann, City of Reno





HYDROLOGIC-HYDRAULIC STUDY

LEARENO INDUSTRIAL PARK  
PROPOSED DRAINAGE PLAN

Hydrologic-Hydraulic Study

General:

The proposed drainage plan has been prepared for the Leareno Industrial Park to control flooding from a 100-year frequency storm. The enclosed data provide information requested for issuance of a Belief Letter from FEMA.

The drainage plan provides control for storing and discharging the peak runoff of 428 cubic feet per second (cfs) for the 100 year flood event. This peak discharge, computed previously in our "Second Supplemental Data" report and approved by FEMA in their September 28, 1984 letter, was assumed to occur at the intersection of Stead Boulevard and Lear Boulevard.

The drainage plan includes a detention pond (Perimeter Basin) to temporarily store runoff from the 100 year flood event, and two pipes and an outlet channel to drain the basin (see Exhibits 1, 2, and 3).

The results of routing the 100 year flood indicated that the water will reach a maximum elevation of 4972.18 as it flows over Lear Boulevard and a maximum elevation of 4971.0 inside the Perimeter Basin (see "Summary of the Computer Output"). All proposed improvements for Leareno Industrial Park will be above the basin elevation to eliminate possible flooding during the 100 year flood.

Assumptions:

A hydrologic analysis was done using the computer program HEC-1 from the U.S. Corps of Engineers. The input data of the previous approved model were modified at the end of the routine to include the Lear Boulevard profile and storage-discharge characteristics of the Perimeter Basin (see "Computer Input Data").

The analysis assumed that the entire volume of the hydrograph that produced the 428 cfs peak discharge will enter the Perimeter Basin, except for 60 cfs that will be carried to the east, out of the site, by the existing 42 in. RCP under Stead Boulevard. This pipe is connected to J. C. Penney's underground drainage system and inlets along Stead Boulevard. The analysis also included the portion of internal drainage from Leareno Industrial Park that flows toward the Stead-Lear intersection or the Perimeter Basin.

The capacity of the existing 36 in. CMP and the 42 in. RCP (that flow east from Stead Boulevard) was investigated. Both pipes discharge to the east into two 54 in. RCP's. These two pipes discharge into an asphalt paved 79 in. by 49 in. corrugated steel pipe arch (CSPA), which controls the flow of the system to 100 cfs maximum. The maximum capacity of the 36 in. CMP was estimated at 40 cfs, and the 42 in. RCP was estimated at 60 cfs (see "Computation Sheets").

The existing junction box in the Industrial Park at the entrance of the 36 in. CMP will be modified to improve entrance flow conditions and assure maximum pipe discharge capacity. The existing 1 ft by 3 ft opening will be replaced by two 2 ft by 3 ft openings (see Exhibit 4 for details).

#### Perimeter Basin:

The Perimeter Basin has a trapezoidal section with a bottom width of 40 ft and 3:1 side slopes. The basin will store 18 acre ft at maximum water surface elevation of 4971.0 during the 100 year flood event. The basin will drain to the east through the existing 36 in. CMP under Stead Boulevard and to the west to Playa #3 through a proposed 30 in. RCP and the Outlet Channel.

Plotting of the inflow and outflow hydrographs at Leareno Industrial Park (see computer printout) indicated that it will take about two hours for the water to reach the maximum elevation of 4971.0 inside the Perimeter Basin after water starts flowing over Lear Boulevard. The combined capacity of the two outlet pipes will then be 85 cfs, and the level in the basin will start to recede slowly; inflow starts to become smaller than outflow. It will take about four hours for the water level to reduce from 4971.0 to 4968.0 (outlet flows between 85 and 28 cfs); then, it will take about two more hours to empty the basin almost completely.

#### Outlet Channel:

The Outlet Channel was designed to carry to Playa #3 the discharge from the 30 in. RCP from the Perimeter Basin and the remaining of the internal drainage from the Leareno Industrial Park. The channel reach between the Perimeter Basin and the railroad embankment will have a bottom width of 5 ft and 3:1 side slopes, and it will cross under the railroad through two 36 in. RCP's. After the railroad crossing, the Outlet Channel increases to a bottom width of 10 ft and 3:1 side slopes.

Maximum flow depth in the Outlet Channel will vary from 3.0 ft to 3.8 ft.

#### Conclusions:

The final results of the flood study indicate that with the Proposed Drainage Plan, all the Leareno Industrial Park improvements will be protected against flooding from the 100 year flood event. Water entering the park from the south will be temporarily contained in the Perimeter Basin and then released to the east and to the west outside the park. The water's maximum elevation inside the Perimeter Basin will be 4971.0 and 4968.0 in the Outlet Channel. All improvements will be above these elevations.

NJM

10-11-84

HANSON ENGINEERS, INC.

ENGINEERS - CONSULTANTS

2 of 9

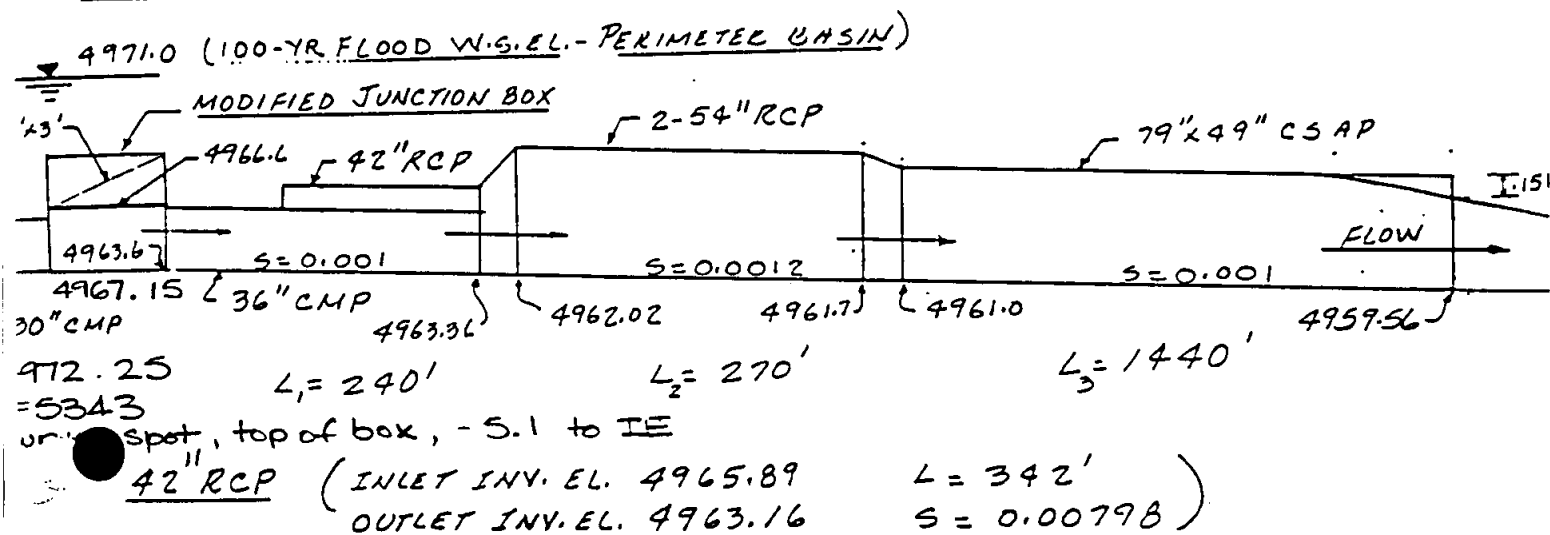
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LEARENO INDUSTRIAL PARK  
FLOOD STUDY - RENO, NEVADA

CAPACITY OF EXISTING PIPES (36" CMP & 42" RCP)

BOTH PIPES FLOW EAST, UNDER STEAD BLVD., INTO 2-54" RCP'S  
THE 2-54" RCP'S DISCHARGE INTO A 79" x 49" ASPHALT PAVED CORRUG.  
STEEL ARCH PIPE (CSAP).

SCHEMATIC



SUMMARY:

| PIPE                | AREA<br>(ft <sup>2</sup> ) | LENGTH<br>(ft) | SLOPE<br>(S) | W.S. EL.<br>(AT ENTRANCE) | ENTRANCE CONTROL<br>(H/D) | Q (cfs)    | PIPE FLOW FULL<br>(H <sub>e</sub> ) | Q (cfs)    |
|---------------------|----------------------------|----------------|--------------|---------------------------|---------------------------|------------|-------------------------------------|------------|
| 36" CMP             | 7.07                       | 240            | 0.001        | 4971.0                    | 2.47                      | 80         | 4.64                                | 45         |
| 42" RCP             | 9.62                       | 342            | 0.008        | 4972.16                   | 1.79                      | 100        | 5.5                                 | 102        |
| 2-54" RCP           | 2(15.90)                   | 270            | 0.0012       | 4966.52<br>4967.52        | 1.00<br>1.22              | 190<br>240 | 1.0<br>2.0                          | 110<br>160 |
| 79" x 49"<br>(CSAP) | 21.3                       | 1440           | 0.001        | 4965.08<br>4966.08        | 1.0<br>1.25               | 140<br>190 | 2.05<br>3.05                        | 102<br>125 |

CONCLUSION: FLOW WILL BE CONTROL BY THE 79" x 49" CSAP

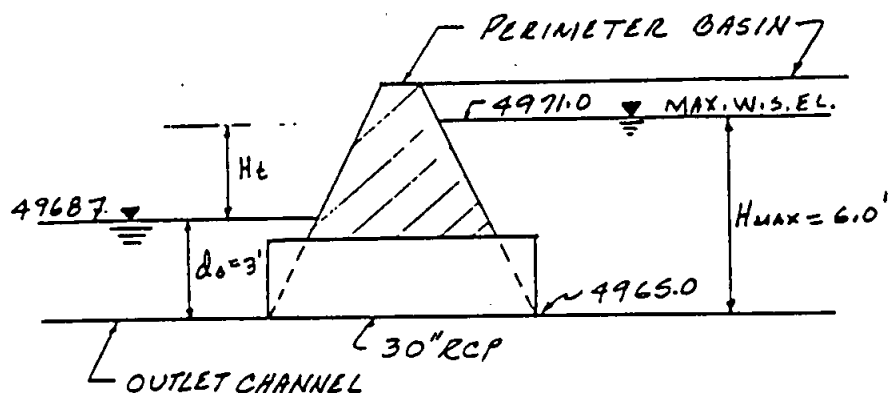
Q<sub>MAX</sub> ≈ 100 cfs (ASSUMING NO-HEAD) USE { 40 cfs FOR 36" CMP }  
{ 60 cfs FOR 42" RCP }

(CONT'D)

LEARENDO INDUSTRIAL PARK  
FLOOD STUDY - RENO, NV.

RATING CURVE (CONT.)

II- 30" RCP - DISCHARGE INTO PROPOSED OUTLET CHANNEL



FOR RATING PURPOSES  
ASSUME W.S.E. IN THE OUTLET  
CHANNEL IS 4968.0 ( $d_0 = 3.0'$ )  
(FULL PIPE FLOW CONDITION)  
CONSERVATIVE

$$L = 100' \quad K_e = 0.5$$

PERIM. BASIN

| <u>W.S.E.L.</u> | <u>Ht (ft)</u> | <u>Q (cfs)</u> |
|-----------------|----------------|----------------|
| 4968.0          | 0              | 0              |
| 4969.0          | 1.0            | 26             |
| 4970.0          | 2.0            | 37             |
| 4971.0          | 3.0            | 45             |
| 4972.0          | 4.0            | 52             |

PERIMETER BASIN - OUTLET PIPES - RATING CURVE - TOTAL

|         | <u>W.S.E.L.</u> | <u>EXISTING</u><br><u>36" RCP</u> | <u>PROPOSED</u><br><u>30" RCP</u> | <u>TOTAL</u><br><u>(cfs)</u> |
|---------|-----------------|-----------------------------------|-----------------------------------|------------------------------|
| 4970.15 | 4966.6          | 0                                 | -                                 | 0                            |
| 4970.55 | 4967.0          | 4                                 | -                                 | 4                            |
| 4971.55 | 4968.0          | 28 25                             | 0                                 | 28 25                        |
| 4972.55 | 4969.0          | 35 25                             | 26                                | 61 51                        |
| 4973.55 | 4970.0          | 40 25                             | 37                                | 77 62                        |
| 4974.55 | 4971.0          | 40 25                             | 45                                | 85 70                        |
| 4975.55 | 4972.0          | 40 25                             | 52                                | 92 77                        |

↑ USED IN THE COMPUTER INPUT

Adjusted elevations based upon survey spot #5343, top of concrete box, -5.1' to IE.  
Adjusted rating curve to account for 15 cfs already in pipe system from basin LEA.

|    | 0                                                                      | 90      | 180    | 450     | 720    | 900   | 1080 |
|----|------------------------------------------------------------------------|---------|--------|---------|--------|-------|------|
| KA | JCP                                                                    |         |        |         |        |       |      |
| KM | INFLOW HYDROGRAPH FOR AREA J. C. PENNEY                                |         |        |         |        |       |      |
| BA | 0.31                                                                   |         |        | YES     | 100    | 100   | 100  |
| PM | 2.7                                                                    | 1.0     |        |         |        |       |      |
| LS | 0                                                                      | 90      | 0      |         |        |       |      |
| UD | 0.30                                                                   |         |        |         |        |       |      |
| BF | 0                                                                      | -0.1    | 2      |         |        |       |      |
| KK | LEAR                                                                   |         |        |         |        |       |      |
| KM | RETRIEVE DIVERSION FROM STD1                                           |         |        |         |        |       |      |
| DR | STD1                                                                   |         |        |         |        |       |      |
| KK | LEAR                                                                   |         |        |         |        |       |      |
| KO | 3                                                                      | 2       |        |         |        |       |      |
| KM | COMBINE 3 HYDROGRAPHS AT LEAR                                          |         |        |         |        |       |      |
| HC | 3                                                                      |         |        |         |        |       |      |
| KK | LEAR                                                                   |         |        |         |        |       |      |
| KO | 3                                                                      | 0       |        |         |        |       |      |
| KM | DIVERT 60 CFS THROUGH 42" RCP                                          |         |        |         |        |       |      |
| DT | 42RCP                                                                  |         |        |         |        |       |      |
| DI | 0                                                                      | 25      | 50     | 60      | 100    | 200   | 400  |
| DG | 0                                                                      | 25      | 50     | 60      | 60     | 60    | 60   |
| KK | LEAR                                                                   |         |        |         |        |       |      |
| KO | 1                                                                      | 2       |        |         |        |       |      |
| KM | ROUTING THROUGH LEAR BLVD PROFILE                                      |         |        |         |        |       |      |
| RS | 1                                                                      | ELEV    | 4965.5 |         |        |       |      |
|    | 0                                                                      | .2      |        |         |        |       |      |
|    | 4965.5                                                                 | 4973.0  |        |         |        |       |      |
| SQ | 0                                                                      | 13      | 24     | 35      |        |       |      |
| SE | 4965.5                                                                 | 4968    | 4970   | 4973    |        |       |      |
| SS | 4965.5                                                                 |         |        |         |        |       |      |
| SW | 0                                                                      | 52      | 363    | 538     | 971    |       |      |
| SE | 4971.5                                                                 | 4971.64 | 4972.0 | 4972.26 | 4973.0 |       |      |
| KK | PARK                                                                   |         |        |         |        |       |      |
| KM | INFLOW HYDROGRAPH FOR THE CONTRIBUTING INDUSTRIAL PARK AREA            |         |        |         |        |       |      |
| BA | 0.050                                                                  |         |        | YES     | 100    | 100   | 100  |
| PM | 2.7                                                                    | 1.0     |        |         |        |       |      |
| LS | 0                                                                      | 90      | 0      |         |        |       |      |
| UD | 0.18                                                                   |         |        |         |        |       |      |
| BF | 0                                                                      | -0.1    | 2      |         |        |       |      |
| KK | PARK                                                                   |         |        |         |        |       |      |
| KO | 3                                                                      |         |        |         |        |       |      |
| KM | COMBINE 2 HYDROGRAPHS AT PARK                                          |         |        |         |        |       |      |
| HC | 2                                                                      |         |        |         |        |       |      |
| KK | 36CMP                                                                  |         |        |         |        |       |      |
| KO | 1                                                                      | 2       |        |         |        |       |      |
| KM | ROUTING THROUGH 36" CMP AT JUNCTION BOX AND 30" RCP INTO OUTLET CHANNE |         |        |         |        |       |      |
| RS | 1                                                                      | ELEV    | 4966.6 |         |        |       |      |
| SV | 1.13                                                                   | 1.89    | 4.91   | 8.97    | 13.42  | 18.37 |      |
| SE | 4966.6                                                                 | 4967    | 4968   | 4969    | 4970   | 4971  |      |
| SQ | 0                                                                      | 4       | 28     | 61      | 77     | 85    | 92   |
|    | 4966.6                                                                 | 4967    | 4968   | 4969    | 4970   | 4971  | 4972 |
| ST | 4972                                                                   | 1000    | 3.0    | 1.5     |        |       |      |
| ZZ |                                                                        |         |        |         |        |       |      |

✓ PE

# HYDROLOGIC ANALYSIS OF SILVER LAKE AND LEMMON VALLEY PLAYAS

LOCATED IN CI  
WASHOE COUN

TO: MILLARD REED

TO BE INCLUDED

WITH FLOOD INSURANCE<sup>D</sup>

STUDY PACKAGE.

RECEIVED

DEC 10 1987

Engineering Div.

FOR:

FEDERAL EMERGENCY MANAGEMENT AGENCY  
(CONTRACT #EMW-86-C-2239)

JULY 1987

REVISED DECEMBER 1987

Mark Forest, P.E.  
Senior Water Resources Engineer

Nimbus  
Engineers

NIMBUS JOB #8601

3710 Grant Drive, Suite D • Reno, NV 89509 • (702) 689-8630



## Nimbus Engineers

240 Linden St., Suite B • Reno, NV 89502  
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# APPENDIX C



\*\*\*\*  
FLOOD HYDROGRAPH PACKAGE HED-1 (NEW AT ELEM VERSION) -FEB 1, 1966  
U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616  
\*\*\*\*

THIS HED-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

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

|    |    |                                                                       |      |      |      |       |       |       |       |       |       |  |
|----|----|-----------------------------------------------------------------------|------|------|------|-------|-------|-------|-------|-------|-------|--|
| 1  | ID | FLOOD INSURANCE RE-STUDY, WASHOE COUNTY & CITY OF RENO, NEVADA        |      |      |      |       |       |       |       |       |       |  |
| 2  | ID | BY NIMBUS ENGINEERS, RENO, NEVADA (FILE NV2.601, NIMBUS JOB #8601)    |      |      |      |       |       |       |       |       |       |  |
| 3  | ID | NORTH VALLEYS HYDROLOGY, 100 YEAR, 10 DAY MODEL SEPTEMBER 1987        |      |      |      |       |       |       |       |       |       |  |
| 4  | IT | 60                                                                    | 300  |      |      |       |       |       |       |       |       |  |
| 5  | IO | 3                                                                     |      |      |      |       |       |       |       |       |       |  |
| 6  | KK | SL                                                                    |      |      |      |       |       |       |       |       |       |  |
| 7  | KM | RUNOFF FROM ENTIRE SILVER LAKE WATERSHED, USING CALIBRATED LOSS RATES |      |      |      |       |       |       |       |       |       |  |
| 8  | PH | 1                                                                     | 10   | .33  | .57  | .99   | 1.30  | 1.55  | 2.15  | 3.25  | 4.41  |  |
| 9  | PH | 6.00                                                                  | 7.90 | 9.50 | 10.1 |       |       |       |       |       |       |  |
| 10 | BA | 53.8                                                                  |      |      |      |       |       |       |       |       |       |  |
| 11 | LU | 0.30                                                                  | 0.14 | 3    |      |       |       |       |       |       |       |  |
| 12 | UD | 8                                                                     |      |      |      |       |       |       |       |       |       |  |
| 13 | KK | SLWSE                                                                 |      |      |      |       |       |       |       |       |       |  |
| 14 | KM | ROUTING ROUTINE TO CALCULATE LAKE LEVEL USING MODIFIED PULS METHOD    |      |      |      |       |       |       |       |       |       |  |
| 15 | RS | 1                                                                     | STOR | 0    | 0    |       |       |       |       |       |       |  |
| 16 | SA | 0                                                                     | 1    | 5.7  | 21.2 | 113.9 | 220.5 | 314.4 | 377.5 | 441.9 | 525.0 |  |
| 17 | SA | 596.0                                                                 | 940  | 1320 |      |       |       |       |       |       |       |  |
| 18 | SB | 0                                                                     | 0    | 0    | 0    | 0     | 0     | 0     | 0     | 0     | 0     |  |
| 19 | SB | 0                                                                     | 0    | 0    |      |       |       |       |       |       |       |  |
| 20 | SE | 4950                                                                  | 4951 | 4952 | 4953 | 4954  | 4955  | 4956  | 4957  | 4958  | 4959  |  |
| 21 | SE | 4960                                                                  | 4965 | 4970 |      |       |       |       |       |       |       |  |

|    |    |                                                                      |      |      |      |     |      |      |      |      |      |  |
|----|----|----------------------------------------------------------------------|------|------|------|-----|------|------|------|------|------|--|
| 22 | KK | LL                                                                   |      |      |      |     |      |      |      |      |      |  |
| 23 | KM | RUNOFF FROM ENTIRE LEMMON LAKE WATERSHED USING CALIBRATED LOSS RATES |      |      |      |     |      |      |      |      |      |  |
| 24 | PH | 1                                                                    | 10   | .33  | .57  | .99 | 1.30 | 1.55 | 2.15 | 3.25 | 4.41 |  |
| 25 | PH | 6.00                                                                 | 7.90 | 9.50 | 10.1 |     |      |      |      |      |      |  |
| 26 | BA | 43.02                                                                |      |      |      |     |      |      |      |      |      |  |
| 27 | LU | .30                                                                  | .072 | 8.89 |      |     |      |      |      |      |      |  |
| 28 | UD | 3.5                                                                  |      |      |      |     |      |      |      |      |      |  |

|    |    |                                                                    |        |      |      |       |       |       |       |       |       |  |
|----|----|--------------------------------------------------------------------|--------|------|------|-------|-------|-------|-------|-------|-------|--|
| 29 | KK | LLWSE                                                              |        |      |      |       |       |       |       |       |       |  |
| 30 | KM | ROUTING ROUTINE TO CALCULATE LAKE LEVEL USING MODIFIED PULS METHOD |        |      |      |       |       |       |       |       |       |  |
| 31 | RS | 1                                                                  | STOR   | 0    | 0    |       |       |       |       |       |       |  |
| 32 | SA | 0                                                                  | 1      | 3.2  | 21.6 | 194.2 | 486.7 | 686.4 | 794.8 | 872.8 | 940.3 |  |
| 33 | SA | 1000.5                                                             | 1075.1 | 1215 | 1365 | 1480  | 1644  | 3650  |       |       |       |  |
| 34 | SB | 0                                                                  | 0      | 0    | 0    | 0     | 0     | 0     | 0     | 0     | 0     |  |
| 35 | SB | 0                                                                  | 0      | 0    | 0    | 0     | 0     | 0     | 0     | 0     | 0     |  |
| 36 | SE | 4905                                                               | 4906   | 4907 | 4908 | 4909  | 4910  | 4911  | 4912  | 4913  | 4914  |  |
| 37 | SE | 4915                                                               | 4916   | 4917 | 4918 | 4919  | 4920  | 4940  |       |       |       |  |

|    |    |                                                                      |                                          |      |      |     |      |      |      |      |      |  |
|----|----|----------------------------------------------------------------------|------------------------------------------|------|------|-----|------|------|------|------|------|--|
| 38 | KK | SL+5                                                                 | RUNOFF + 5 YEAR RUNOFF VOLUME IN STORAGE |      |      |     |      |      |      |      |      |  |
| 39 | KM | RUNOFF FROM ENTIRE SILVER LAKE WATERSHED USING CALIBRATED LOSS RATES |                                          |      |      |     |      |      |      |      |      |  |
| 40 | PH | 1                                                                    | 10                                       | .33  | .57  | .99 | 1.30 | 1.55 | 2.15 | 3.25 | 4.41 |  |
| 41 | PH | 6.00                                                                 | 7.90                                     | 9.50 | 10.1 |     |      |      |      |      |      |  |
| 42 | BA | 53.8                                                                 |                                          |      |      |     |      |      |      |      |      |  |
| 43 | LU | 0.30                                                                 | 0.14                                     | 3    |      |     |      |      |      |      |      |  |
| 44 | UD | 8                                                                    |                                          |      |      |     |      |      |      |      |      |  |



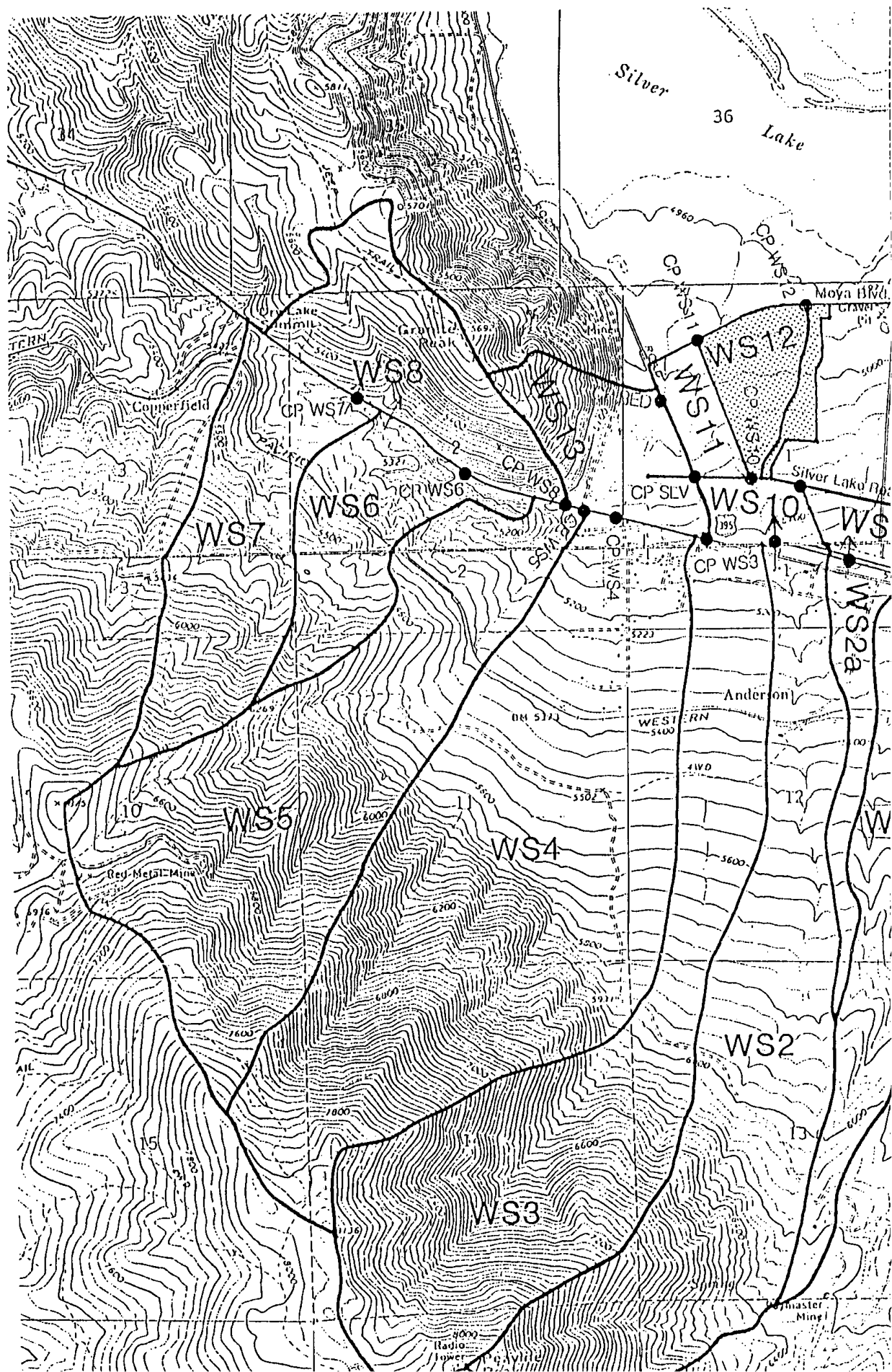
| LINE | ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10         |
|------|-------------------------------------------------------------------------|
| 93   | KK LL+10W                                                               |
| 94   | KM ROUTING ROUTINE TO CALCULATE LAKE LEVEL USING MODIFIED PULS METHOD   |
| 95   | RS 1 STOR 2917 0                                                        |
| 96   | SA 0 1 3.2 21.6 194.2 486.7 686.4 794.8 872.8 940.3                     |
| 97   | SA 1000.5 1075.1 1215 1365 1480 1644 3650                               |
| 98   | SB 0 0 0 0 0 0 0 0 0 0                                                  |
| 99   | SB 0 0 0 0 0 0 0 0 0 0                                                  |
| 100  | SE 4905 4906 4907 4908 4909 4910 4911 4912 4913 4914                    |
| 101  | SE 4915 4916 4917 4918 4919 4920 4940                                   |
| 102  | KK SL+25                                                                |
| 103  | KM RUNOFF FROM ENTIRE SILVER LAKE WATERSHED USING CALIBRATED LOSS RATES |
| 104  | PH 1 10 .33 .57 .99 1.30 1.55 2.15 3.25 4.41                            |
| 105  | PH 6.00 7.90 9.50 10.1                                                  |
| 106  | BA 53.8                                                                 |
| 107  | LU 0.30 0.14 3                                                          |
| 108  | UD 8                                                                    |
| 109  | KK SL+25W                                                               |
| 110  | KM ROUTING ROUTINE TO CALCULATE LAKE LEVEL USING MODIFIED PULS METHOD   |
| 111  | RS 1 STOR 2728 0                                                        |
| 112  | SA 0 1 5.7 21.2 113.9 220.5 314.4 377.5 441.9 525.0                     |
| 113  | SA 596.0 940 1320                                                       |
| 114  | SB 0 0 0 0 0 0 0 0 0 0                                                  |
| 115  | SB 0 0 0                                                                |
| 116  | SE 4950 4951 4952 4953 4954 4955 4956 4957 4958 4959                    |
| 117  | SE 4960 4965 4970                                                       |
| 118  | KK LL+25                                                                |
| 119  | KM RUNOFF FROM ENTIRE LEMMON LAKE WATERSHED USING CALIBRATED LOSS RATES |
| 120  | PH 1 10 .33 .57 .99 1.30 1.55 2.15 3.25 4.41                            |
| 121  | PH 6.00 7.90 9.50 10.1                                                  |
| 122  | BA 43.02                                                                |
| 123  | LU .30 .072 8.89                                                        |
| 124  | UD 3.5                                                                  |
| 125  | KK LL+25W                                                               |
| 126  | KM ROUTING ROUTINE TO CALCULATE LAKE LEVEL USING MODIFIED PULS METHOD   |
| 127  | RS 1 STOR 4004 0                                                        |
| 128  | SA 0 1 3.2 21.6 194.2 486.7 686.4 794.8 872.8 940.3                     |
| 129  | SA 1000.5 1075.1 1215 1365 1480 1644 3650                               |
| 130  | SB 0 0 0 0 0 0 0 0 0 0                                                  |
| 131  | SB 0 0 0 0 0 0 0 0 0 0                                                  |
| 132  | SE 4905 4906 4907 4908 4909 4910 4911 4912 4913 4914                    |
| 133  | SE 4915 4916 4917 4918 4919 4920 4940                                   |
| 134  | KK SL+50                                                                |
| 135  | KM RUNOFF FROM ENTIRE SILVER LAKE WATERSHED USING CALIBRATED LOSS RATES |
| 136  | PH 1 10 .33 .57 .99 1.30 1.55 2.15 3.25 4.41                            |
| 137  | PH 6.00 7.90 9.50 10.1                                                  |
| 138  | BA 53.8                                                                 |
| 139  | LU 0.30 0.14 3                                                          |
| 140  | UD 8                                                                    |

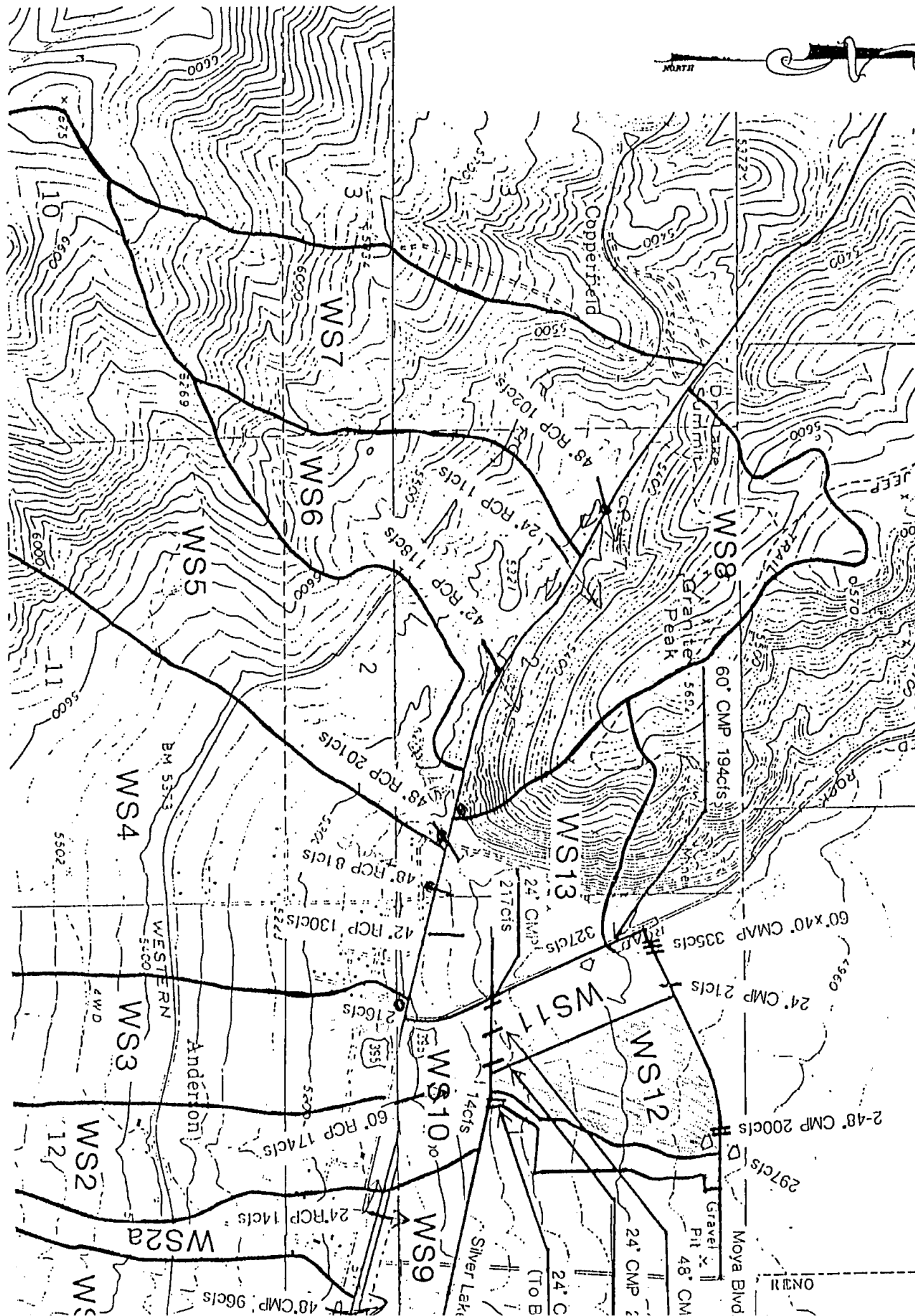
| LINE | ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10         |
|------|-------------------------------------------------------------------------|
| 141  | KK SL+50W                                                               |
| 142  | KM ROUTING ROUTINE TO CALCULATE LAKE LEVEL USING MODIFIED PULS METHOD   |
| 143  | RS 1 STOR 3424 0                                                        |
| 144  | SA 0 1 5.7 21.2 113.9 220.5 314.4 377.5 441.9 525.0                     |
| 145  | SA 596.0 940 1320                                                       |
| 146  | SB 0 0 0 0 0 0 0 0 0 0                                                  |
| 147  | SB 0 0 0                                                                |
| 148  | SE 4950 4951 4952 4953 4954 4955 4956 4957 4958 4959                    |
| 149  | SE 4960 4965 4970                                                       |
| 150  | KK LL+50                                                                |
| 151  | KM RUNOFF FROM ENTIRE LEMMON LAKE WATERSHED USING CALIBRATED LOSS RATES |
| 152  | PH 1 10 .33 .57 .99 1.30 1.55 2.15 3.25 4.41                            |
| 153  | PH 6.00 7.90 9.50 10.1                                                  |
| 154  | BA 43.02                                                                |
| 155  | LU .30 .072 8.89                                                        |
| 156  | UD 3.5                                                                  |
| 157  | KK LL+50W                                                               |
| 158  | KM ROUTING ROUTINE TO CALCULATE LAKE LEVEL USING MODIFIED PULS METHOD   |
| 159  | RS 1 STOR 4855 0                                                        |
| 160  | SA 0 1 3.2 21.6 194.2 486.7 686.4 794.8 972.8 940.3                     |
| 161  | SA 1000.5 1075.1 1215 1365 1480 1644 3650                               |
| 162  | SB 0 0 0 0 0 0 0 0 0 0                                                  |
| 163  | SB 0 0 0 0 0 0 0 0 0 0                                                  |
| 164  | SE 4905 4906 4907 4908 4909 4910 4911 4912 4913 4914                    |
| 165  | SE 4915 4916 4917 4918 4919 4920 4940                                   |
| 166  | ZZ                                                                      |

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

| OPERATION     | STATION | PEAK FLOW | TIME OF PEAK | AVERAGE FLOW FOR MAXIMUM PERIOD |         |         | BASIN AREA | MAXIMUM STAGE | TIME OF MAX STAGE |
|---------------|---------|-----------|--------------|---------------------------------|---------|---------|------------|---------------|-------------------|
|               |         |           |              | 6-HOUR                          | 24-HOUR | 72-HOUR |            |               |                   |
| HYDROGRAPH AT | SL      | 4354.     | 129.00       | 4081.                           | 2213.   | 809.    | 53.80      |               |                   |
| ROUTED TO     | SLWSE   | 0.        | 1.00         | 0.                              | 0.      | 0.      | 53.80      | 4963.64       | 259.00            |
| HYDROGRAPH AT | LL      | 8180.     | 124.00       | 6791.                           | 3179.   | 1171.   | 43.02      |               |                   |
| ROUTED TO     | LLWSE   | 0.        | 1.00         | 0.                              | 0.      | 0.      | 43.02      | 4917.73       | 248.00            |
| HYDROGRAPH AT | SL+5    | 4354.     | 129.00       | 4081.                           | 2213.   | 809.    | 53.80      |               |                   |
| ROUTED TO     | SL+SWS  | 0.        | 1.00         | 0.                              | 0.      | 0.      | 53.80      | 4965.22       | 256.00            |
| HYDROGRAPH AT | LL+5    | 8180.     | 124.00       | 6791.                           | 3179.   | 1171.   | 43.02      |               |                   |
| ROUTED TO     | LL+SWS  | 0.        | 1.00         | 0.                              | 0.      | 0.      | 43.02      | 4919.22       | 248.00            |
| HYDROGRAPH AT | SL+10   | 4354.     | 129.00       | 4081.                           | 2213.   | 809.    | 53.80      |               |                   |
| ROUTED TO     | SL+10W  | 0.        | 1.00         | 0.                              | 0.      | 0.      | 53.80      | 4965.74       | 260.00            |
| HYDROGRAPH AT | LL+10   | 8180.     | 124.00       | 6791.                           | 3179.   | 1171.   | 43.02      |               |                   |
| ROUTED TO     | LL+10W  | 0.        | 1.00         | 0.                              | 0.      | 0.      | 43.02      | 4919.73       | 247.00            |
| HYDROGRAPH AT | SL+25   | 4354.     | 129.00       | 4081.                           | 2213.   | 809.    | 53.80      |               |                   |
| ROUTED TO     | SL+25W  | 0.        | 1.00         | 0.                              | 0.      | 0.      | 53.80      | 4966.51       | 260.00            |
| HYDROGRAPH AT | LL+25   | 8180.     | 124.00       | 6791.                           | 3179.   | 1171.   | 43.02      |               |                   |
| ROUTED TO     | LL+25W  | 0.        | 1.00         | 0.                              | 0.      | 0.      | 43.02      | 4920.26       | 246.00            |
| HYDROGRAPH AT | SL+50   | 4354.     | 129.00       | 4081.                           | 2213.   | 809.    | 53.80      |               |                   |
| ROUTED TO     | SL+50W  | 0.        | 1.00         | 0.                              | 0.      | 0.      | 53.80      | 4967.12       | 256.00            |
| HYDROGRAPH AT | LL+50   | 8180.     | 124.00       | 6791.                           | 3179.   | 1171.   | 43.02      |               |                   |
| ROUTED TO     | LL+50W  | 0.        | 1.00         | 0.                              | 0.      | 0.      | 43.02      | 4920.59       | 246.00            |

\*\*\* NORMAL END OF HEC-1 \*\*\*







RENO DRAINAGE STUDY  
ANALYSIS OF THE EVANS CREEK  
DRAINAGE DEFICIENCY AREA

#0  
Old State Complex

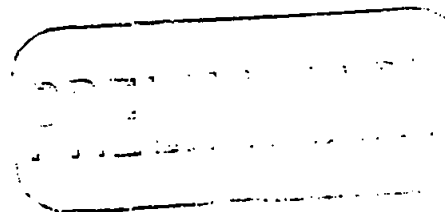
MAY 1985

Prepared for:

City of Reno

Prepared by:

Winzler & Kelly  
1201 Terminal Way  
Suite 215  
Reno, Nevada 89502



## CHAPTER III

### FIELD ANALYSIS AND CONCLUSIONS

#### A. INTRODUCTION

The Stead area is a large drainage system consisting of approximately 4000 acres. (Refer to Figure 8 attached to the back of this report.) It is a relatively narrow drainage running north and south, extending north of Lemmon Drive and south of U.S. 395. Included within the drainage basin are Stead Boulevard running north and south essentially down the middle of the drainage system, the old State Complex and a majority of the Reno-Stead Airport. Approximately 1250 acres of the 4000 acre drainage are located south of U.S. 395.

There is significant street flooding along Stead Boulevard and in certain locations in the old State Complex during periods of intense rainfall. Until recently, little storm drainage planning was considered, although the area is a prime candidate for future growth both as a residential site and an industrial/manufacturing site.

#### B. FIELD ANALYSIS

The Stead drainage area consists largely of unimproved grassy hillsides with sparse sagebrush and other vegetation. This is particularly true both in the north and the south. The drainage system is bounded by hills on both the north and south with a flat broad plain in the middle. Silver Lake lies to the west and Lemmon Valley to the east of this low lying plain. Most of the existing development is located bordering Stead Boulevard and to the north in the Old State Complex. Development consists of several residential developments as well as warehouse facilities, most notably the large J.C. Penney Catalog warehouse complex.

The storm water runoff flows both north and south towards this central plain. The runoff from the north crosses Lemmon Drive through a 15-inch CMP, continuing south as overland flow through undeveloped land until reaching the Reno-Stead Airport. Runoff is increased off the airport pavement and streets of the Old State Complex.

The drainage system is quite old and there is little mapping defining the existing system. From what mapping does exist and from field analysis, it appears that the flows from the north all exit to the west via three separate systems. There is an RCP system running from the east to the west at the northern boundary of the State Complex just north of Texas Avenue. It begins in the east as a 30-inch RCP increasing to a 36-inch RCP, exiting into a large drainage ditch behind the Lear Fan Ltd. complex. There are numerous drop inlets along this RCP drainage system to pick up flows from the north.

A short section of this pipe proceeds east to a drop inlet meeting flows from an 18-inch RCP flowing west and ties into a pipe network on Alpha Avenue. However, most of the flows south of Texas Avenue proceed as street and overland flow entering a pipe network at various drop inlets. This pipe network begins on Alpha Avenue near the intersection with Mt. Vida Street as a 12-inch RCP. It proceeds west on Alpha Avenue and turns south on Mt. Charleston Street. At Mt. Charleston Street and Bravo Avenue it becomes an 18-inch RCP. It turns west on Cocoa Avenue. Some flows are diverted south in an 18-inch RCP on Mt. Lola Street and continue southwest in several overland swales to the intersection of Echo Avenue and Mt. Babcock Street. Flows are picked up here in a drainage ditch that flows southwest traversing around the large Desert Research Institute Building. Flows cross Mt. Bismark in five 15-inch RCPs that are badly silted in with a great deal of brush and garbage blocking the inlets. The flows proceed south in a roadside ditch on the west side of Mt. Bismark

to a 36-inch RCP at Mt. Anderson Street. This ties to a M.H. and a 42-inch storm drain that runs west on Mt. Anderson before turning south and discharging to a ditch north of the J.C. Penney warehouse flowing west towards Silver Lake.

The remaining flows continue west on Cocoa Avenue in a 21-inch RCP to Mt. Bismark Street and turn south on Bt. Bismark in a 24-inch RCP. The existing mapping indicates that this 24-inch RCP changes to dual 15-inch; 12-inch RCPs just north of the outlet of the five 15-inch RCPs that cross Mt. Bismark Street mentioned above. The flow discharges to the ditch on the west side of Mt. Bismark and proceed across Mt. Anderson and west towards Silver Lake. At the intersection of Mt. Bismark Street and Echo Avenue there are drop inlets that collect gutter flow and proceed west on Echo Avenue in a 10-inch RCP that exits into a ditch running south along the west side of Mt. Anderson Street. These flows cross the old railroad grade in a wooden box culvert approximately 15 inches high x 28 inches wide and then cross an old road grade in a 24-inch steel culvert, continuing west towards Silver Lake.

There are approximately 1250 acres south of U.S. 395 that contribute to the Stead drainage. Most of the flow from this area crosses North Virginia Street through dual 36-inch CMPs that show considerable inlet siltation, and continues under U.S. 395 in a 36-inch RCP.

Just to the west of the 36-inch RCP under U.S. 395 there is a 48-inch pipe. The inlet is CMP, the outlet is RCP. It is probable that the change occurs in the freeway median strip where there is a drop inlet. There does not appear to be much flow that can reach this 48-inch pipe from the south. There is no culvert crossing of North Virginia upstream, although it appears that some of the ground has been filled between North Virginia and the freeway. It is possible that at one time a significant portion of the flow through the dual 36-inch CMPs across North Virginia reached this 48-inch pipe.

**Sedimentation.** One characteristic of alluvial streams in arid regions is that they transport large amounts of loose, cohesionless material such as sand and gravel during storms. Sediment is eroded from the upper watershed where streams are relatively steep and flow velocity high, and deposited in milder areas along the valley floor, where backwater or ponding conditions prevail and velocities are lower. This may occur at culvert entrances, which can trap sediments. Local experience suggests that Military Road culverts become clogged while Lemmon Drive crossing culverts remain clear. In 1986, culverts along Military Road filled with sediment causing the roads to be overtopped with storm runoff and several road washouts that have since been repaired. However, the basic cause of the washouts (deposition within culverts and channels) will continue in the future since the sediment transport capacity of culverts and channels was not changed. Annual maintenance along Lemmon Drive is apparently sufficient to keep the channel free of debris and sediment. Also the area east of Lemmon Drive above the most upstream culvert appears to act as a natural sediment trap. Analyses reflect this local experience (i.e. the Military Road culverts are considered plugged, while Lemmon Drive culverts are considered to be clear.)

### Peek's Project Hydrology

**Lemmon Valley Site.** Lemmon Drive traverses the eastern edge of Lemmon Valley, against the base of hills to the east. The creek draining Golden Valley and areas above Highway 395 crosses under Lemmon Drive in a ten-foot by four-foot reinforced box culvert which leads to a trapezoidal drainage channel between the north- and south-bound lanes of the road. As Lemmon Drive intersects cross streets, culverts carry the channelized water.

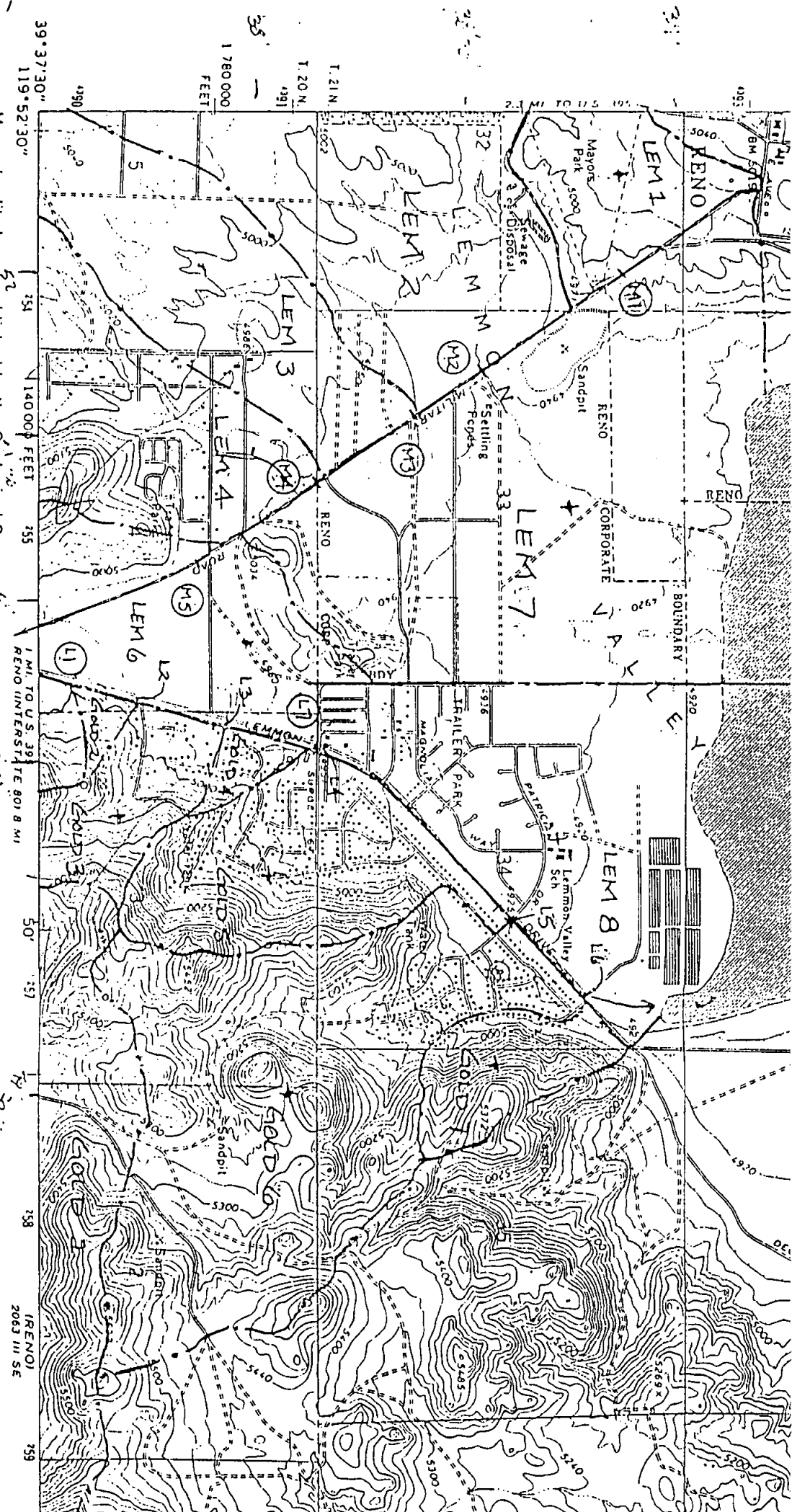
A drainage channel located between the north bound and south bound lanes can carry roughly 750 cfs. Triple 5' by 4' culverts however limit the net capacity of this drainage facility to about 450 cfs. Flow in excess of this capacity will overtop Lemmon Drive to the west enter the Lemmon Valley Site. This flow will follow a drainage swale across the site to the north where it leaves the site through a residential area at Surge Street. Buildings and fences effectively block the flow, so water surface elevations on the Lemmon Valley Site are controlled by the energy it takes to force the runoff (about 1,050 cfs) through the gap between the residences and a pair of hills that trend across the north end of the Lemmon Valley Site from the southwest to northeast. The resulting flood plain has been mapped as an AE Zone with base flood elevations shown at two foot intervals.

About 50 cfs from a culvert at Military Road and Tholl Drive crosses across the site just to the south of the hills at a very shallow depth (0.1 foot). Areas outside of the Zone AE within the Lemmon Valley Site are identified as Zone X, which indicates areas of shallow flooding less than one foot deep. Flooding within this area is that typical to alluvial fan areas, with unpredictable flow paths since new channels may be scoured during individual storms, since much of the sediment load is taken out at upstream culverts.

**Military Road Site.** Runoff from the hills flows into a ditch along the west side of Military Road. As with Lemmon Drive, there are several culverts parallel to Military Road at individual cross streets. An easterly ditch along the road also drains runoff, but there are only four places where a culvert crosses beneath Military Road from the western ditch into the site.

| LINE | ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10              |
|------|------------------------------------------------------------------------------|
| 789  | KK L2 Bournoulli Street                                                      |
| 790  | HC 2                                                                         |
|      | * .....                                                                      |
| 791  | KK L3                                                                        |
| 792  | KM Route to L3 (V=5 fps)                                                     |
| 793  | RM 1 0.07 0.4                                                                |
|      | * .....                                                                      |
| 794  | KK GOLD3                                                                     |
| 795  | BA 0.19                                                                      |
| 796  | PB 3.15                                                                      |
| 797  | LS 72.3 5.                                                                   |
| 798  | UD 0.42                                                                      |
|      | * .....                                                                      |
| 799  | KK L3 Hydraulic Street                                                       |
| 800  | HC 2                                                                         |
|      | * .....                                                                      |
| 801  | KK L3                                                                        |
| 802  | KM Flow Split at Hydraulic Street; Flow down Lemmon Drive Limited to 450 cfs |
| 803  | DT L3D                                                                       |
| 804  | DI 0 121 235 391 590 - 827 1098 1401 1736 2102                               |
| 805  | DD 0 0 0 18 57 115 190 283 394 523                                           |
|      | * .....                                                                      |
| 806  | KK L7                                                                        |
| 807  | KM Route to Surge Street (V = 5 fps)                                         |
| 808  | RM 1 0.11 0.4                                                                |
|      | * .....                                                                      |
| 809  | KK LEM5                                                                      |
| 810  | BA 0.28                                                                      |
| 811  | PB 3.25                                                                      |
| 812  | LS 74.5                                                                      |
| 813  | UD 1.18                                                                      |
|      | * .....                                                                      |
| 814  | KK L7                                                                        |
| 815  | KM Route to Surge Street (5 fps)                                             |
| 816  | RM 1 0.14 0.4                                                                |
|      | * .....                                                                      |
| 817  | KK LEM6                                                                      |
| 818  | KM Peak Development                                                          |
| 819  | BA 0.39                                                                      |
| 820  | PB 3.25                                                                      |
| 821  | LS 66.7 0.5                                                                  |
| 822  | UD 2.38                                                                      |
|      | * .....                                                                      |

This is a detailed topographic map of the Reno, Nevada area. The map features the Truckee River flowing through the center, with numerous contour lines indicating elevation. Key landmarks include the Reno-Tahoe International Airport in the upper right, the city of Reno in the lower right, and the town of Gardnerville in the lower left. The map is overlaid with a grid showing coordinates: 115° 15' W to 115° 45' W and 39° 15' N to 39° 45' N. A scale bar at the bottom indicates distances up to 10 miles. The map also shows various roads, including Highway 10, and several smaller towns and communities like Gardnerville, Verdi, and Battle Mountain.



VERDII SW  
2063 III SE

Mapped, edited, and published by the Geological Survey

Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial  
photographs taken 1966. Field checked 1967

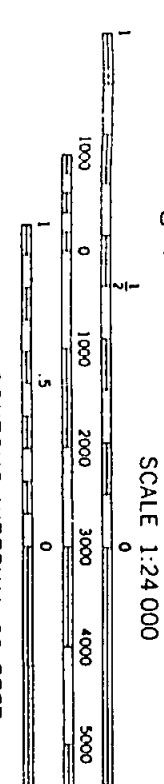
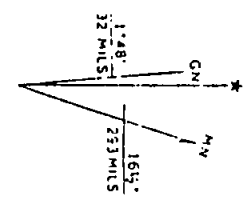
Polyconic projection. 1927 North American datum  
10,000-foot grid based on Nevada coordinate system,  
west zone

1000-meter Universal Transverse Mercator grid ticks,  
zone 11, shown in blue

To place on the predicted North American Datum 1983  
move the projection lines 14 meters north and  
87 meters east as shown by dashed corner ticks

Fine red dashed lines indicate selected fence lines.

UTM GRID AND 1982 MAGNETIC NORTH  
DECLINATION AT CENTER OF SHEET



CONTOUR INTERVAL 20 FEET  
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY ST  
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225. OR  
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILA



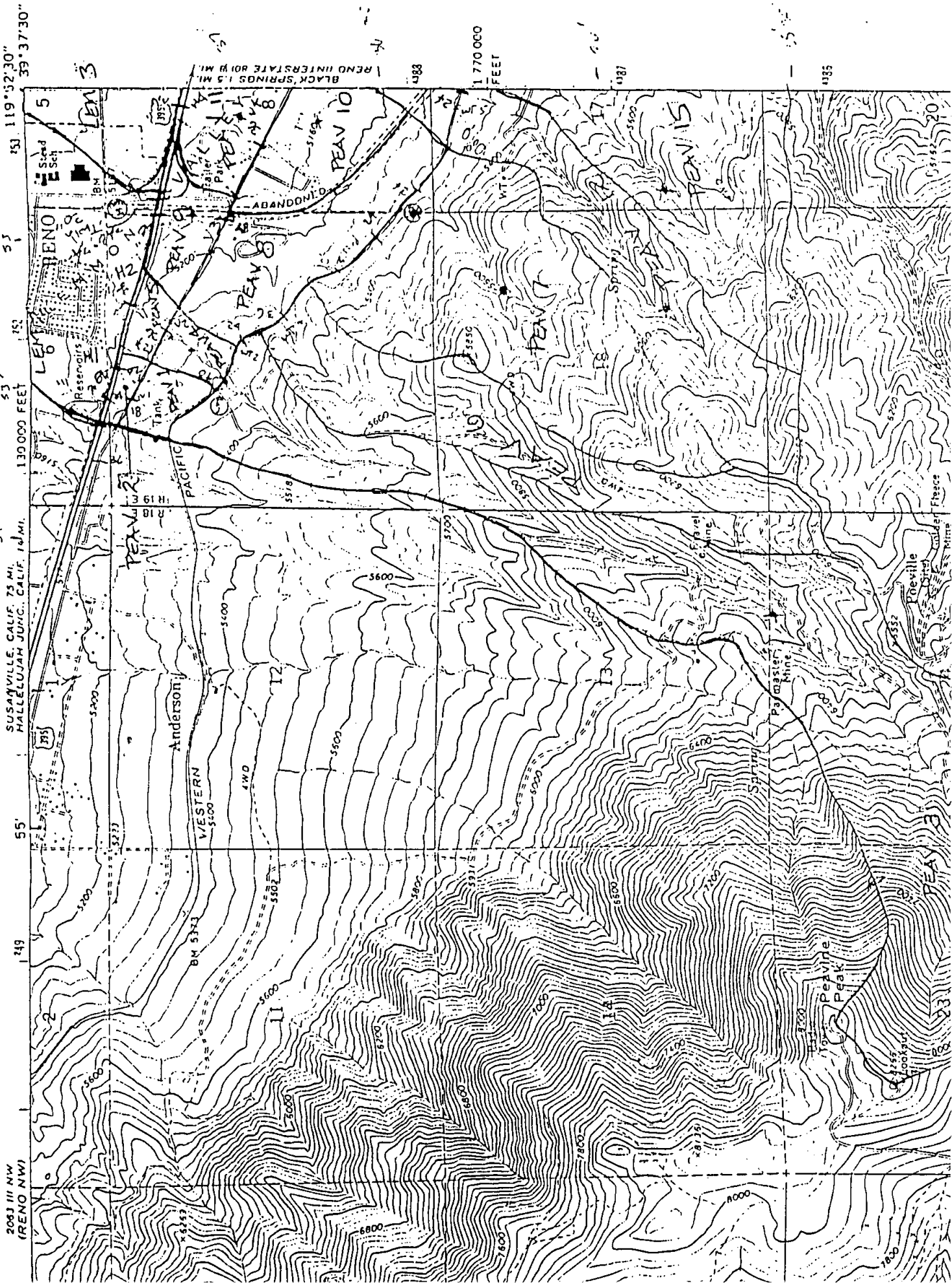
VERDI QUADRANGLE  
NEVADA - WASHOE CO.

7 5 MINUTE SERIES (TOPOGRAPHIC)

S.W. FENO 15. QUADRANGLE

SUSANVILLE. CALIF. 75 MI.  
HALLELUJAH JUNG., CALIF. 14 MI.

206J 111 NW  
RENO NW1





(RENO)  
2063 III

ROAD CLASSIFICATION

1 MILE

SCALE 1:24 000  
2063 III SW  
(VERDII) 143

BLACK SPRINGS 3.5 MI.  
RENO (INTERSTATE 80) 10 MI.  
INTERIOR-GEOLOGICAL SURVEY, RECON. VIRG. 1983  
1:50,000 E

39° 37' 30"  
119° 52' 30"

| Table 6<br>Estimated 100-Year Discharge |                          |
|-----------------------------------------|--------------------------|
| Location                                | 100-Year Discharge (cfs) |
| Military Road                           |                          |
| M1                                      | 20                       |
| M2                                      | 890                      |
| M3                                      | 160                      |
| M4                                      | 1070                     |
| M5                                      | 50                       |
| Lemmon Lake                             | 1940                     |
| Lemmon Drive                            |                          |
| L1 (East Side of Lemmon Drive)          | 1430                     |
| Channel Flow at Surge Street            | 460                      |
| Overflow at Surge Street                | 1050                     |
| Lemmon Lake                             | 1450                     |

**Future Development.** Estimated discharge from Table 6 is predicated upon existing conditions as of November 1995 (based on available information). As more of the watershed develops, peak discharges could increase, as could the volume of runoff passing through the site to Lemmon Lake. The increase in both peak rate and volume could be very significant and cause tremendous flooding. Since the Lemmon Valley is a closed basin with no outlet for flood runoff other than evaporation, increased impervious areas *anywhere* in the valley can cause the amount of water entering the playa, and thus the level of the playa to increase.

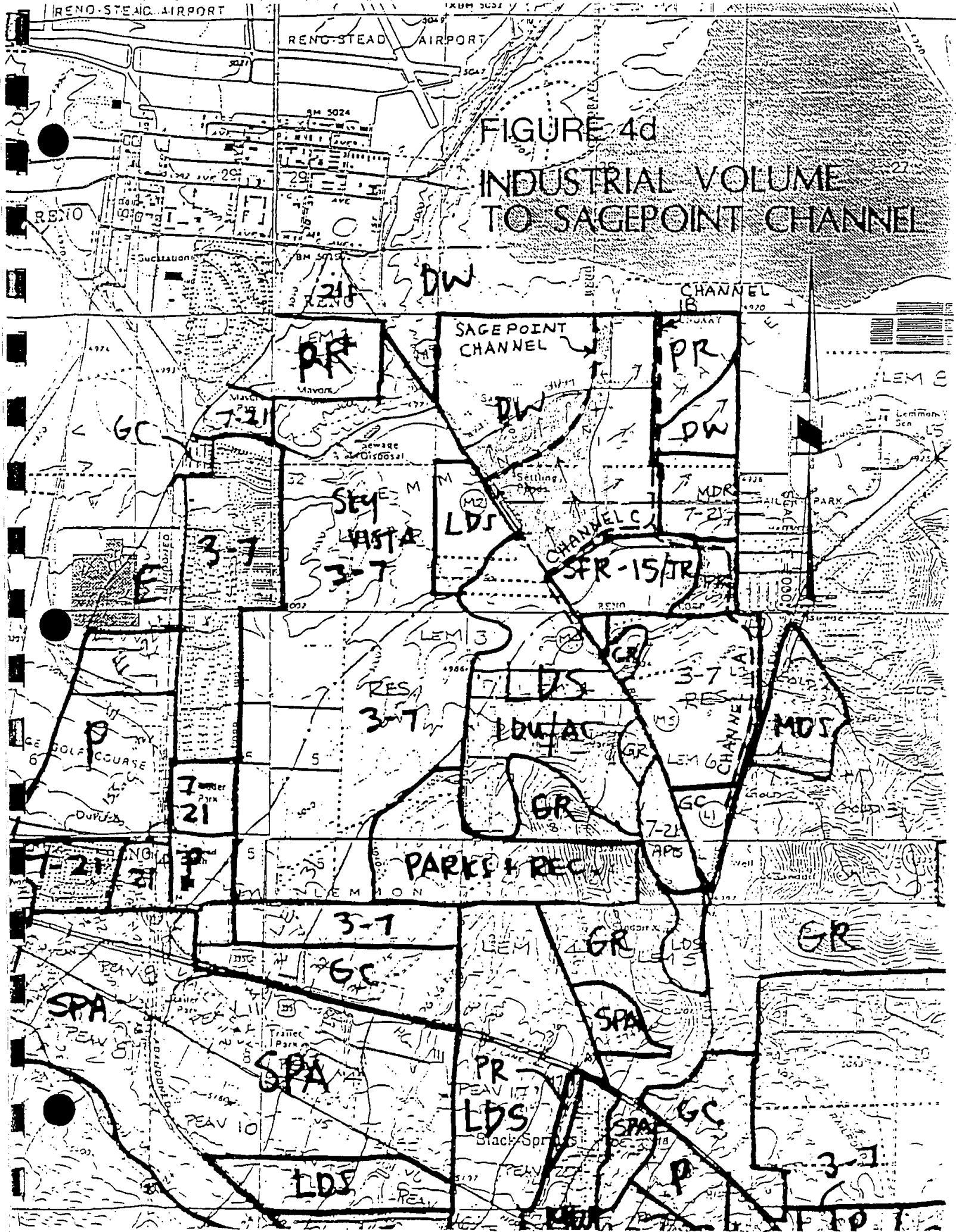
It is not clear at this time how the hydrologic impact of future development within the watershed will be regulated, but in any event FEMA mapping must be based on existing conditions.

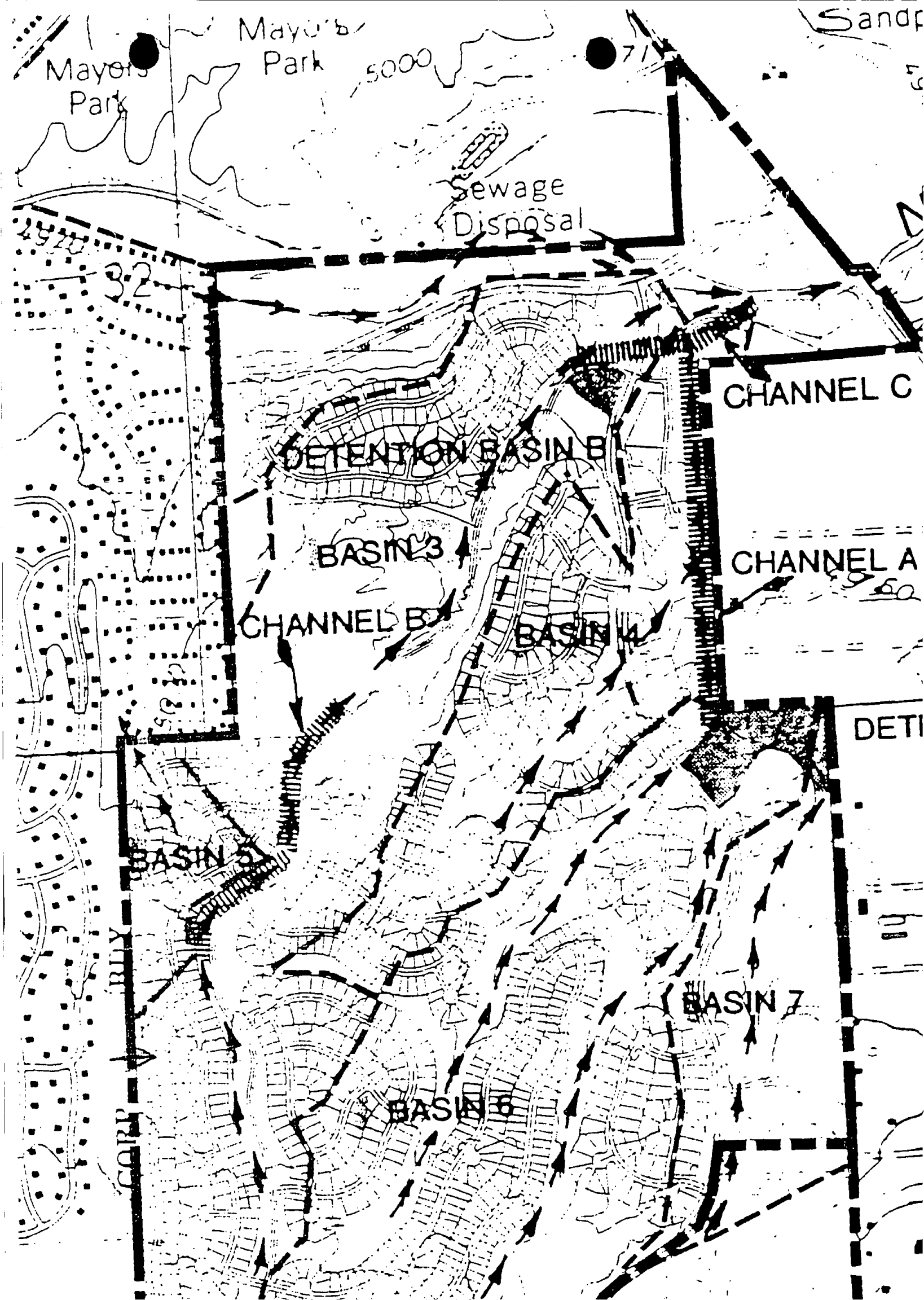
## HYDRAULIC ANALYSES

Hydraulic analyses are concerned with the distribution of peak flowrates from Table 6 through the property toward Lemmon Lake. Figure 3 shows resulting flood plain designations based on the analyses of Appendix F. More detailed mapping is enclosed separately. Detailed analyses have been broken into two areas of concern: (1) Peek property between Lemmon Drive, Military Road and the boundary between Townships 20N and 21N (Lemmon Valley Site); and (2) property between the Township 20N/21N boundary and Lemmon Lake to the east of Military Road (Military Road Site).

Hydraulic Analyses have been made using the HEC-2 backwater program and hand calculations as appropriate. Effective Flood Insurance Rate Maps (September 30, 1994) show a 100-year flood zone determined by approximate methods (Zone A) on almost the entire Lemmon Valley Site, and another Zone A covering the middle quarter of the Military Road Site. The 100-year elevation of Lemmon Lake has been established by detailed methods as 4920.

INDUSTRIAL VOLUME 27  
TO SAGEPOINT CHANNEL





Mayer's  
Park

Mayer's  
Park

5000

71

Sewage  
Disposal

32

CHANNEL C

DETENTION BASIN B

BASIN 3

CHANNEL B

BASIN 4

CHANNEL A

BASIN 5

DETI

BASIN 7

BASIN 6

CORP



**Correspondence** **1**

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**Previous Studies** **2**

---

**Existing Conditions Hydrologic  
and Hydraulic Backup Data** **3**

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**Proposed Conditions  
Hydrologic Backup Data** **4**

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**Proposed Conditions Hydraulic  
Backup Data** **5**

---

**Quantities and Cost Estimates** **6**

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**Survey Data** **7**

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**References** **8**

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Stead Basin AW1  
24" CMP IE= 14.64

| Elevation | $Q_{culv}$          | $Q_{road}$          | $Q_{rail}$         | $Q_{total}$ |
|-----------|---------------------|---------------------|--------------------|-------------|
| 18.9      | 25 ✓                | 0 ✓                 | 0                  | 25 ✓        |
| 21.0      | 32 ✓                | 7 ✓                 | 0                  | 39 ✓        |
| 21.5      | 34 ✓                | 39 ✓                | 0                  | 73 ✓        |
| 22.0      | 35 ✓                | 93 ✓                | 0                  | 128 ✓       |
| 22.5      | 36 ✓                | 164 ✓               | 0                  | 200 ✓       |
|           | ↑<br>100<br>= 14.64 | ↑<br>100<br>= 20.64 | ↑<br>100<br>= 23.4 |             |

|                           |   |    |    |    |     |     |
|---------------------------|---|----|----|----|-----|-----|
| Total flow → DI           | 0 | 25 | 39 | 73 | 128 | 200 |
| → DQ                      | 0 | 0  | 7  | 39 | 93  | 164 |
| Diversion to<br>Basin AW2 |   |    |    |    |     |     |



PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

January 11, 1999  
Stead basin AW1 ✓  
24" Railroad culvert  
Rating capacity

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 2.00 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 2 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0240 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 40.0 ✓   |
| Culvert Slope (feet per foot).....                    | 0.0212 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth<br>(ft) | Headwater (ft)<br>Inlet Control | Headwater (ft)<br>Outlet Control | Normal Depth<br>(ft) | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|----------------------------|---------------------------------|----------------------------------|----------------------|------------------------|-------------------------|--------------------------|
| 25.0               | 2.00                       | 3.78                            | 4.28                             | 2.00                 | 1.76                   | 2.00                    | 7.96                     |
| 31.0               | 2.00                       | 5.07                            | 5.97                             | 2.00                 | 1.88                   | 2.00                    | 9.87                     |
| 32.0               | 2.00                       | 5.31                            | 6.28                             | 2.00                 | 1.89                   | 2.00                    | 10.19 ← 21.00            |
| 34.0               | 2.00                       | 5.82                            | 6.94                             | 2.00                 | 1.91                   | 2.00                    | 10.82                    |
| 35.0               | 2.00                       | 6.08                            | 7.29                             | 2.00                 | 1.92                   | 2.00                    | 11.14                    |
| 37.0               | 2.00                       | 6.64                            | 8.01                             | 2.00                 | 1.94                   | 2.00                    | 11.78                    |
| 36.0               | 2.00                       | 6.36                            | 7.64                             | 2.00                 | 1.93                   | 2.00                    | 11.46                    |
| 38.0               | 2.00                       | 6.92                            | 8.38                             | 2.00                 | 1.94                   | 2.00                    | 12.10                    |
| 39.0               | 2.00                       | 7.22                            | 8.77                             | 2.00                 | 1.95                   | 2.00                    | 12.41                    |
| 40.0               | 2.00                       | 7.52                            | 9.17                             | 2.00                 | 1.95                   | 2.00                    | 12.73                    |

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Project stead Master  
Project No. 208  
Sheet No.      of       
Calculated by JB Date     

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Ditch Cross-section

CROSS SECTION PARAMETERS:

FILENAME: AW1ROAD.SEC

No. of Cross Section Points: 8 ~~Bed Slope = 0.0010~~ Max Elev.: 25.51  
Bank Stations.....Left: 0.0 Right.....: 47.5 Min Elev.: 20.64  
Encroachment Stations..Left: 0.0 Right.....: Weir Coef: 2.650

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev. | Sta. No. | Elev. | Sta. No. | Elev. | Sta. |       |       |
|-----|-------|----------|-------|----------|-------|------|-------|-------|
| 1)  | 23.41 | 0.00     | 2)    | 22.59    | 0.10  | 3)   | 22.59 | 3.00  |
| 4)  | 21.40 | 6.00     | 5)    | 20.74    | 15.00 | 6)   | 20.64 | 23.50 |
| 7)  | 20.98 | 33.00    | 8)    | 25.51    | 47.50 |      |       |       |

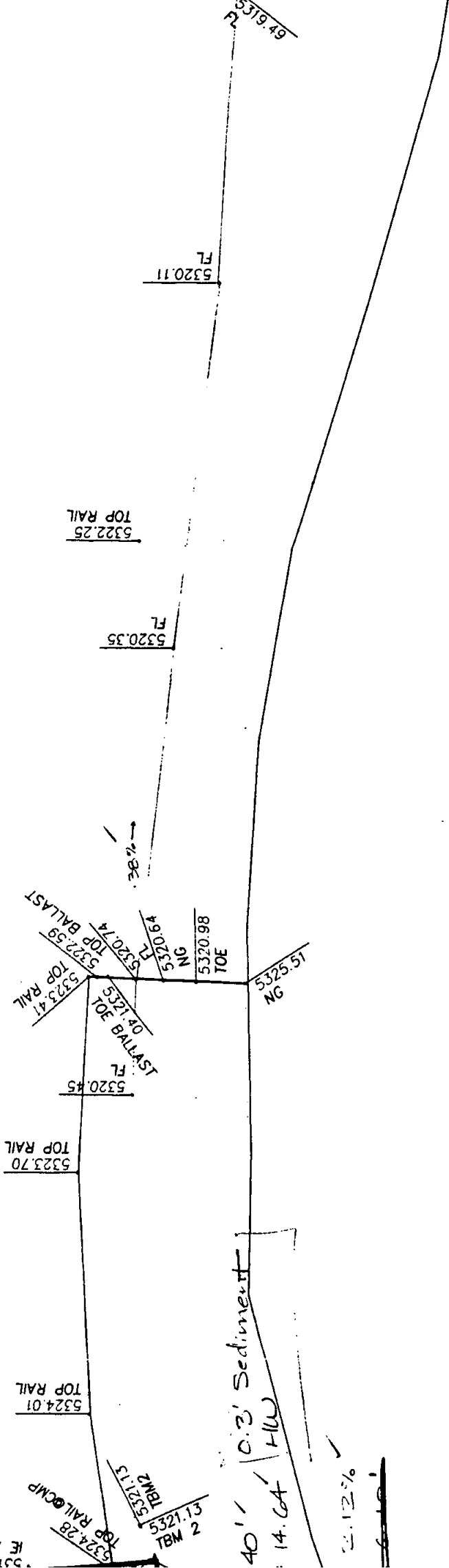
COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H:max(ft) | H:ave(ft) | TW(ft) | A(sf) |
|----------|--------|-----------|-----------|--------|-------|
| 1.00     | 6.7    | 0.36      | 0.23      | 21.6   | 4.9   |
| 1.50     | 38.9   | 0.86      | 0.61      | 28.9   | 17.8  |
| 22.00    | 92.6   | 1.36      | 1.04      | 31.8   | 32.9  |
| 22.50    | 164.3  | 1.86      | 1.43      | 34.6   | 49.5  |

NOTES:

Basin AWI outlet

5313.19  
IE 24" CMP



| Rail |       | Road   |       |
|------|-------|--------|-------|
| 1000 | 23.41 | 1000   | 23.41 |
| 1060 | 23.70 | 1000.1 | 22.59 |
| 1134 | 24.01 | 1003   | 22.59 |

6 ~ 32 cfs

PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

January 12, 1999  
Stead basin AW2  
36" Railroad culvert  
Rating capacity

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 3.00 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 2 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0240 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 130.0 ✓  |
| Culvert Slope (feet per foot).....                    | 0.0895 ✓ |

*INV = 85.82*

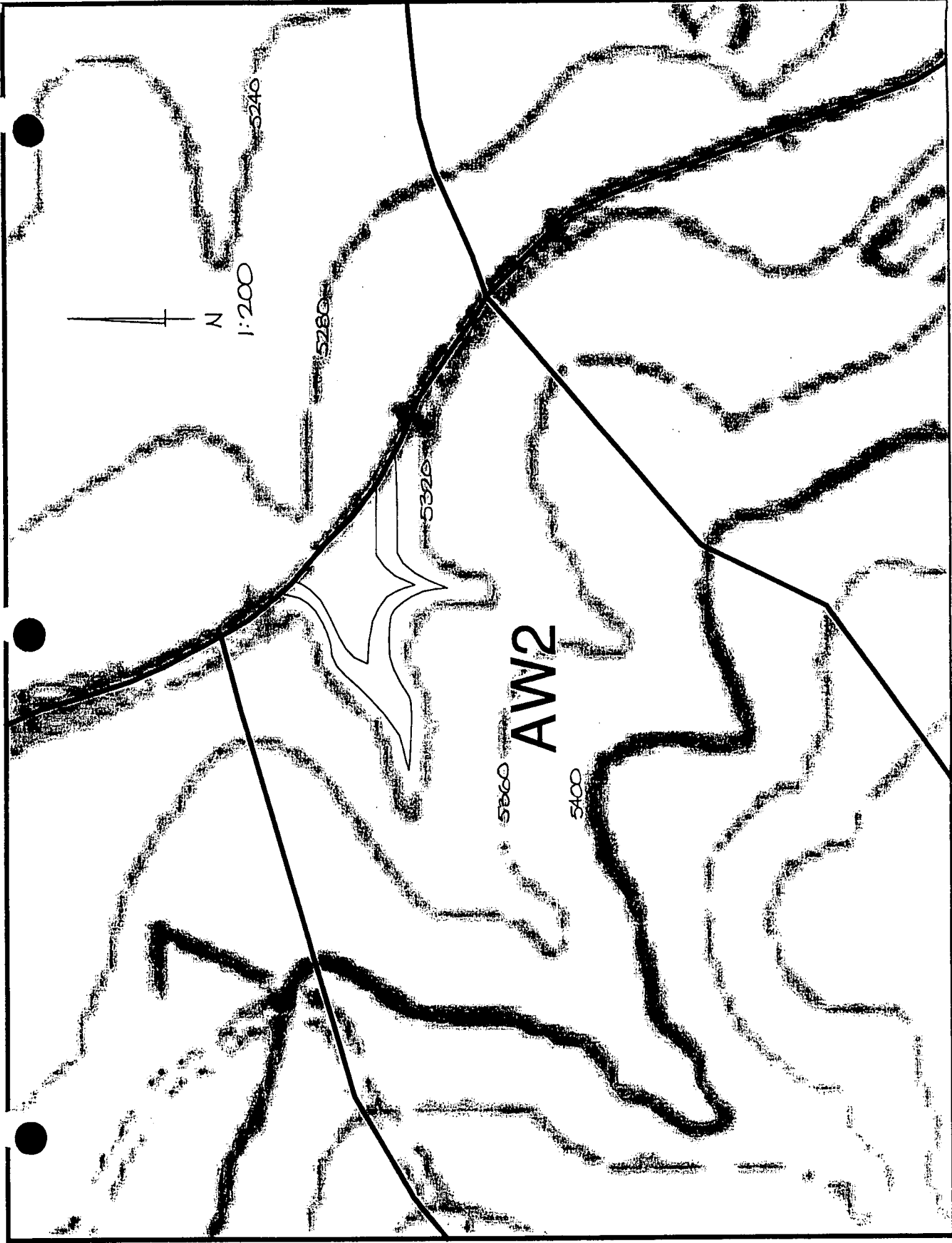
PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater<br>Inlet Control<br>(ft) | Normal Depth<br>Outlet Control<br>(ft) | Critical Depth<br>(ft) | Depth at<br>(ft) | Outlet<br>Depth (ft) | Outlet<br>Velocity (fps) |
|--------------------|-------------------------|------------------------------------|----------------------------------------|------------------------|------------------|----------------------|--------------------------|
| 100.0              | 0.00                    | 9.64                               | 5.88                                   | 2.28                   | 2.90             | 2.28                 | 17.38                    |
| 125.0              | 0.00                    | 13.91                              | 14.10                                  | 3.00                   | 2.96             | 2.96                 | 17.74                    |
| 126.0              | 0.00                    | 14.10                              | 14.47                                  | 3.00                   | 2.96             | 2.96                 | 17.88                    |
| 126.0              | 3.00                    | 14.10                              | 14.49                                  | 3.00                   | 2.96             | 3.00                 | 17.83                    |
| 125.0              | 3.00                    | 13.91                              | 14.12                                  | 3.00                   | 2.96             | 3.00                 | 17.68                    |
| 159.0              | 3.00                    | 21.23                              | 28.19                                  | 3.00                   | 2.98             | 3.00                 | 22.49                    |

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*Detention      Rating      @ CP AW2*

| <i>Elev.</i>    | <i>Area</i>  | <i>Q (36" CMP)</i> |
|-----------------|--------------|--------------------|
| <i>5285.8 ✓</i> | <i>0 ✓</i>   | <i>0 ✓</i>         |
| <i>5300.0 ✓</i> | <i>0.5 ✓</i> | <i>125 ✓</i>       |
| <i>5314 ✓</i>   | <i>1.1 ✓</i> | <i>160 ✓</i>       |



Basin AW2 outlet

Detention

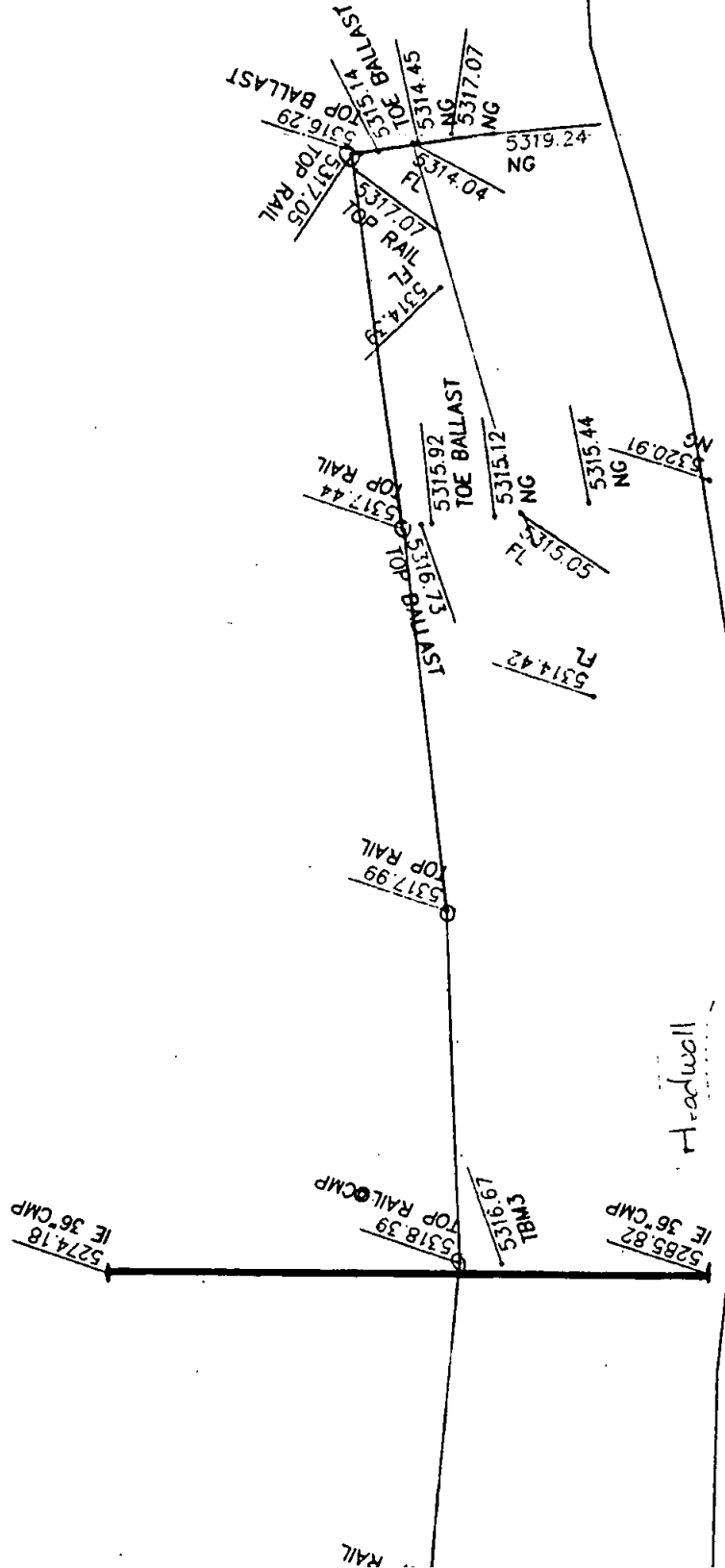
$100 \rightarrow 5285.82$   
 $5300' \rightarrow 0.53 \text{ acres}$   
 $5314' \rightarrow 1.07 \text{ acres}$

$\theta$

$h = 14.18'$

$h = 28.2'$

Scale 1:40



Do.1

L=120'

10 sections

~~Stead Basin AW3  
Road split prior to 18" CMP~~

| Elevation | $Q_{ditch}$ | $Q_{CL}$ | $Q_{total}$ |
|-----------|-------------|----------|-------------|
| 32.9      | 18          | 0        | 12          |
| 33.0      | 18          | 0        | 18          |
| 33.2      | 47          | 2        | 49          |
| 33.4      | 86          | 9        | 95          |
| 33.6      | 135         | 21       | 156         |

Stead Basin AW3 ✓  
18" CMP IE= 18.09 ✓

| Elevation | $Q_{culv}$ | $Q_{CL}$ | $Q_{driveway}$ | $Q_{total}$ |
|-----------|------------|----------|----------------|-------------|
| 21.5 ✓    | 11 ✓       | 0        | 0 ✓            | 11 ✓        |
| 21.6 ✓    | 11 ✓       | 0        | 3 ✓            | 14 ✓        |
| 21.8 ✓    | 11 ✓       | 10       | 19 ✓           | 31 30 ✓     |
| 22.0 ✓    | 12 ✓       | 11       | 48 ✓           | 64 61 ✓     |
| 22.2 ✓    | 12 ✓       | 10.5     | 90 ✓           | 112 107 ✓   |

↓  
DQ

↑  
DI

Diversion Rating @ 18" CMP Inlet.

| DI | 0' | 11' | 14' | 30' | 61' | 107' |
|----|----|-----|-----|-----|-----|------|
| DQ | 0' | 11' | 11' | 11' | 13' | 17'  |

↙  
Diversion to SRS thru 18" CMP & weir

Project stead  
Project No. 2-08  
Sheet No.      of       
Calculated by JB Date     

**WEIR FLOW COMPUTATIONS**

**LOCATION/DESCRIPTION:**

Basin AW3

**CROSS SECTION PARAMETERS:**

FILENAME: AW35572.SEC

No. of Cross Section Points: 7 ~~Bed Slope: 0.0040~~ Max Elev.: 22.04  
Bank Stations.....Left: 16.0 Right.....: 43.0 Min Elev.: 21.40  
Encroachment Stations..Left: 28.5 Right.....: Weir Coef: 2.650

**CROSS SECTION POINTS - Elevations & Stations in feet:**

| No. | Elev. | Sta.   | No. | Elev. | Sta.  | No. | Elev. | Sta.  |
|-----|-------|--------|-----|-------|-------|-----|-------|-------|
| 1)  | 21.76 | 0.00   | 2)  | 20.41 | 6.00  | 3)  | 21.42 | 16.00 |
| 4)  | 21.76 | 28.50  | 5)  | 21.40 | 43.00 | 6)  | 21.69 | 84.00 |
| 7)  | 22.04 | 109.00 |     |       |       |     |       |       |

**COMPUTED PARAMETERS:**

| WSEL(ft) | Q(cfs) | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) | $h_{pwe}$ |
|----------|--------|------------|------------|--------|-------|-----------|
| 21.50    | 0.6    | 0.10       | 0.05       | 18.2   | 0.9   | 3.4       |
| 21.60    | 3.4    | 0.20       | 0.10       | 36.3   | 3.6   | 3.5       |
| 21.80    | 19.2   | 0.40       | 0.22       | 63.4   | 14.1  | 3.7       |
| 22.00    | 48.5   | 0.60       | 0.36       | 77.6   | 28.2  | 3.9       |
| 22.20    | 90.2   | 0.80       | 0.55       | 80.5   | 44.2  | 4.1       |
| 22.40    | 141.2  | 1.00       | 0.75       | 80.5   | 60.3  | 4.3       |

**NOTES:**

Weir flow @ roadside ditch/driveway  
just east of 18" CMP beneath  
N Virginia



PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

May 7, 1999  
STEAD BASIN AW3 ✓  
18" CMP BENEATH N. VIRGINIA ✓  
CAPACITY RATING ✓

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 1.50 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 2 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0240 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.35 ✓   |
| Culvert Length (feet).....                            | 62.0 ✓   |
| Culvert Slope (feet per foot).....                    | 0.0190 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth Inlet<br>(ft) | Headwater<br>Depth Control<br>(ft) | Normal Depth<br>Outlet Control<br>(ft) | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|----------------------------------|------------------------------------|----------------------------------------|------------------------|-------------------------|--------------------------|
| 10.0               | 0.50                             | 2.25                               | 2.78                                   | 1.50                   | 1.27                    | 6.29                     |
| 11.0               | 1.00                             | 2.50                               | 3.32                                   | 1.50                   | 1.27                    | 6.89                     |
| 12.0               | 1.00                             | 2.78                               | 3.96                                   | 1.50                   | 1.31                    | 7.31                     |
| 13.0               | 1.00                             | 3.09                               | 4.60                                   | 1.50                   | 1.35                    | 7.76                     |
| 14.0               | 1.00                             | 3.41                               | 5.31                                   | 1.50                   | 1.38                    | 8.23                     |

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Project Stead Master  
Project No. 2-08  
Sheet No.      of       
Calculated by Js Date     

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

AW3,  
E. N. Virginia st, near 18" CMP

CROSS SECTION PARAMETERS:

FILENAME: AW3-18WR.SEC

No. of Cross Section Points: 3 ~~Ded=Stops=10-00500~~ Max Elev.: 27.72  
Bank Stations.....Left: 1000.0 Right.....: 1224.0 Min Elev.: 21.76  
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)  | 21.76 | 1000.00  | 2)    | 25.28    | 1115.00 | 3)   | 27.72 | 1224.00 |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) |
|----------|--------|------------|------------|--------|-------|
| 21.80    | 0.0    | 0.04       | 0.02       | 1.3    | 0.0   |
| 21.90    | 0.3    | 0.14       | 0.07       | 4.6    | 0.3   |
| 22.00    | 1.1    | 0.24       | 0.12       | 7.8    | 0.9   |
| 22.10    | 2.6    | 0.34       | 0.17       | 11.1   | 1.9   |
| 22.20    | 4.9    | 0.44       | 0.22       | 14.4   | 3.2   |

NOTES:

Weir flow rating over  
N. Virginia st. near  
the 18" CMP.

|    |    |       |   |
|----|----|-------|---|
| 4  | 0  | 21.76 | ✓ |
| 6  | 6  | 20.41 | ✓ |
| 16 | 16 | 21.42 | ✓ |

Basin AW3

18" CMP

Scale 1:20

5220

5218.40  
TOP 18" CMP  
IF = 16.9

5220.41  
FL

5221.76  
CL

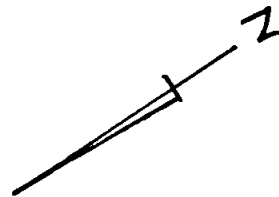
5225.28  
CL

5218.09  
IF 18" CMP

CL - HWALL

$l = 62'$   
 $s = 1.9\%$

$h = 3.3'$



Project \_\_\_\_\_  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CROSS SECTION PARAMETERS:

FILENAME: AW35561.SEC

No. of Cross Section Points: 2 Bed Slope: 0.00010 Max Elev.: 36.40  
Bank Stations.....Left: 0.0 Right.....: 194.0 Min Elev.: 32.94  
Encroachment Stations..Left: 0.0 Right.....: Weir Coef: 2.650

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev. | Sta. | No. | Elev. | Sta.   | No. | Elev. | Sta. |
|-----|-------|------|-----|-------|--------|-----|-------|------|
| 1)  | 32.94 | 0.00 | 2)  | 36.40 | 194.00 |     |       |      |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) |
|----------|--------|------------|------------|--------|-------|
| 33.00    | 0.1    | 0.06       | 0.03       | 3.4    | 0.1   |
| 33.20    | 2.0    | 0.26       | 0.13       | 14.6   | 1.9   |
| 33.40    | 8.5    | 0.46       | 0.23       | 25.8   | 5.9   |
| 33.60    | 21.0   | 0.66       | 0.33       | 37.0   | 12.2  |

NOTES:

W Virginia Q in conjunction  
with section AW35563.sec  
Flow over Q enters basin  
SPS

Project \_\_\_\_\_  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CROSS SECTION PARAMETERS:

FILENAME: AW35563.SEC

No. of Cross Section Points: 7 Bed Slope: 0.01780 Max Elev.: 34.35  
Bank Stations.....Left: 15.0 Right.....: 38.0 Min Elev.: 32.21  
Encroachment Stations..Left: 27.0 Right.....:  
Manning-n Values.....LOB: 0.025 CHANNEL...: 0.016 ROB.....: 0.025  
CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev. | Sta.  | No. | Elev. | Sta.  | No. | Elev. | Sta.  |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| 1)  | 31.57 | 0.00  | 2)  | 32.48 | 15.00 | 3)  | 32.94 | 27.00 |
| 4)  | 32.80 | 38.00 | 5)  | 32.21 | 42.00 | 6)  | 32.34 | 43.50 |
| 7)  | 34.35 | 47.50 |     |       |       |     |       |       |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft) | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|--------|----------|
| 32.94    | 11.8   | 3.1    | 1.24 | 0.023 | 1.2 | 17.7  | 3.9    | 17.9  | 32.98  |          |
| 33.00    | 18.2   | 3.7    | 1.30 | 0.023 | 1.1 | 17.8  | 4.9    | 18.0  | 33.06  |          |
| 33.20    | 47.2   | 5.5    | 1.43 | 0.021 | 1.0 | 18.2  | 8.5    | 18.5  | 33.32  |          |
| 33.40    | 86.4   | 7.1    | 1.55 | 0.021 | 1.0 | 18.6  | 12.2   | 18.9  | 33.62  |          |
| 33.60    | 134.5  | 8.4    | 1.66 | 0.021 | 1.1 | 19.0  | 16.0   | 19.4  | 33.94  |          |

NOTES:

Roadside ditch capacity  
along south side of N Virginia,  
east of PA-4 outlet CMP's



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JOB NO.

260002-08

SHEET OF

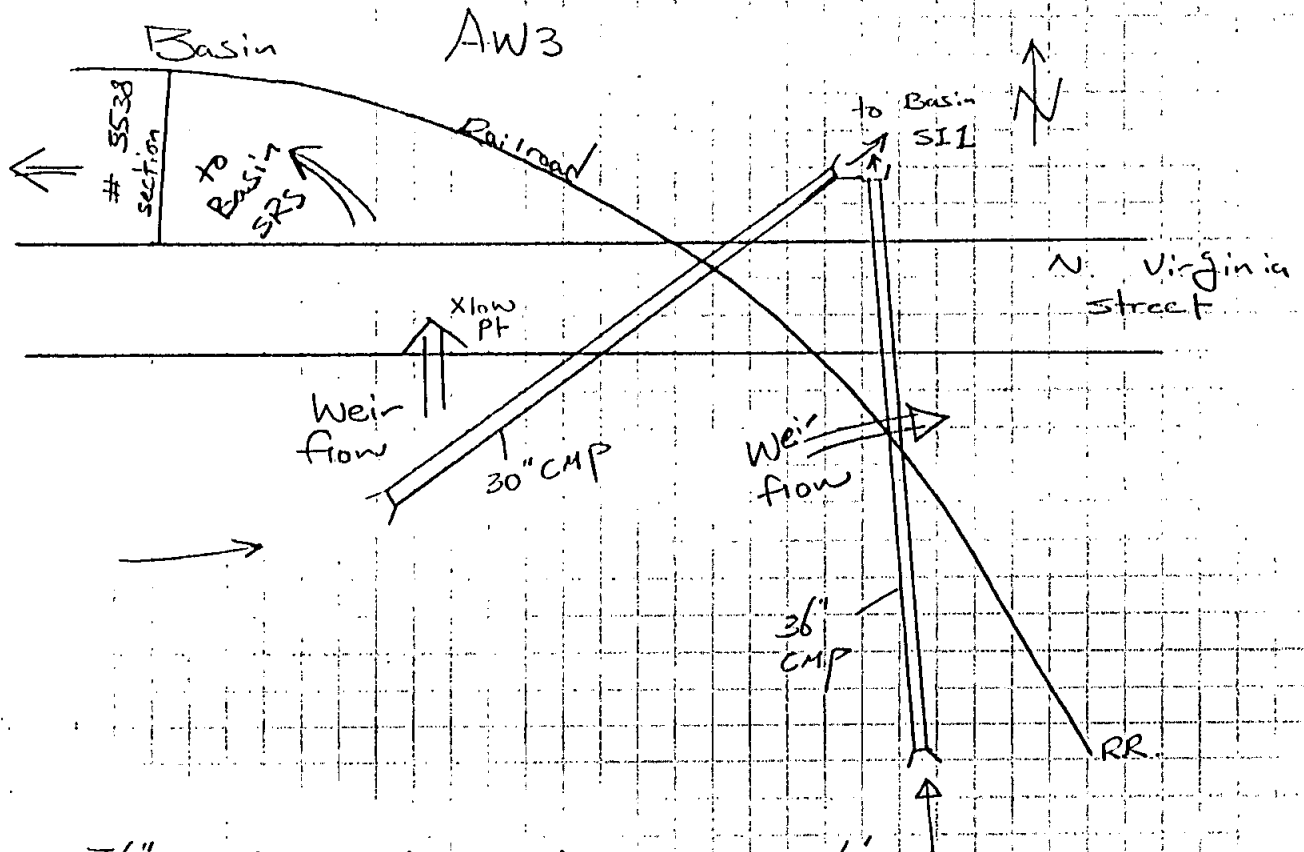
PROJECT Stead Master Plan

DATE 5/7/99

SUBJECT Diversion Rating

DESIGNED

CHECKED



$\therefore 36" \text{ CMP} \Rightarrow \text{D.I. Depth} \approx 3.6'$

$\therefore \text{Divert} \Rightarrow \text{Convergent Capacity @ } h = 3.6' \approx 45 \text{ cfs}$   
 $\therefore \text{Divert } 45 \text{ cfs to Basin SII}$

| Elev.             | 30" CMP    |       | $Q_{\text{weir (total)}}$ | $Q_{\text{total}}$ |
|-------------------|------------|-------|---------------------------|--------------------|
| 65.87 (inv.)      | 0          |       | 0                         | 0                  |
| 68.76 (weir inv.) | 27         | (2.9) | 0                         | 27                 |
| 69.0              | 28         | (3.1) | 7                         | 35                 |
| 69.2              | 29         | (3.3) | 30                        | 59                 |
| 69.4              | 30         | (3.5) | 76                        | 106                |
| 69.6              | 31         | (3.7) | 147                       | 178                |
| 69.8              | 32         | (3.9) | 243                       | 275                |
|                   | $\uparrow$ |       |                           | $\uparrow$         |
|                   | DQ         |       |                           | DI                 |

PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

May 7, 1999  
36" CMP BENEATH N. VIRGINIA STREET  
PIPE OUTLET TO BASIN S11

Basin AW3

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 3.00 ✓   |
| FIWA Chart Number (1,2 or 3).....                     | 2 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0240 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 195.0 ✓  |
| Culvert Slope (feet per foot).....                    | 0.0620 ✓ |

PROGRAM RESULTS:

| Flow Rate (cfs) | Tailwater Depth (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | Normal Depth (ft) | Critical Depth (ft) | Depth at Outlet (ft) | Outlet Velocity (fps) |
|-----------------|----------------------|--------------------------|---------------------------|-------------------|---------------------|----------------------|-----------------------|
| 40.0            | 1.00                 | 3.23                     | -6.44                     | 1.40              | 2.06                | 1.40                 | 12.33                 |
| 42.0            | 2.00                 | 3.35                     | -6.09                     | 1.44              | 2.11                | 1.44                 | 12.57                 |
| 44.0            | 3.00                 | 3.53                     | -5.31                     | 1.48              | 2.16                | 1.48                 | 12.66                 |
| 45.0            | 3.00                 | 3.63                     | -5.14                     | 2.25              | 2.19                | 2.25                 | 7.91                  |
| 50.0            | 3.00                 | 3.96                     | -4.21                     | 1.60              | 2.30                | 1.60                 | 13.07                 |
| 55.0            | 3.00                 | 4.36                     | -3.19                     | 1.69              | 2.41                | 1.69                 | 13.37                 |
| 60.0            | 3.00                 | 4.79                     | -2.06                     | 1.79              | 2.50                | 1.79                 | 13.63                 |

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Depth of D.I = 3.6'

$Q @ 3.6' = 45 \text{ cfs}$

↑  
Divert 45 cfs to  
Basin S11

PIPE CULVERT ANALYSIS ✓  
COMPUTATION OF CULVERT PERFORMANCE CURVE ✓

May 7, 1999 ✓  
30" CMP BENEATH N VIRGINIA STREET ✓  
PIPE OUTLET TO BASIN S11 ✓

Basin AW3

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 2.50 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 2 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 2 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0240 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.80 ✓   |
| Culvert Length (feet).....                            | 175.0 ✓  |
| Culvert Slope (feet per foot).....                    | 0.0440 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater (ft)<br>Inlet Control | Normal Depth<br>Outlet Control | Critical Depth<br>(ft) | Depth at<br>(ft) | Outlet Velocity<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|---------------------------------|--------------------------------|------------------------|------------------|-------------------------|--------------------------|
| 27.0               | 1.00                    | 2.86                            | -2.15                          | 1.37                   | 1.77             | 1.37                    | 9.85                     |
| 28.0               | 1.00                    | 3.10                            | -1.87                          | 1.40                   | 1.80             | 1.40                    | 9.89                     |
| 29.0               | 2.00                    | 3.33                            | -1.59                          | 1.43                   | 1.84             | 1.43                    | 10.02                    |
| 30.0               | 2.00                    | 3.54                            | -1.30                          | 1.46                   | 1.87             | 1.46                    | 10.10                    |
| 31.0               | 2.00                    | 3.72                            | -1.00                          | 1.49                   | 1.90             | 1.49                    | 10.16                    |
| 32.0               | 2.00                    | 3.84                            | -0.69                          | 1.52                   | 1.93             | 1.52                    | 10.23                    |

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Project Stead Master  
Project No. 208  
Sheet No.      of       
Calculated by      Date     

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

N. Virginia St. E Profile  
@ CP AW3

CROSS SECTION PARAMETERS:

FILENAME: AW35275.SEC

No. of Cross Section Points: 7 ~~Bed Slope: 0.0000~~ Max Elev.: 76.47  
Bank Stations.....Left: 0.0 Right.....: 369.0 Min Elev.: 68.76  
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)  | 76.47 ✓ | 0.00 ✓   | 2)    | 70.86 ✓  | 108.00 ✓ | 3)   | 68.76 ✓ | 214.00 ✓ |
| 4)  | 69.28 ✓ | 292.00 ✓ | 5)    | 69.32 ✓  | 298.00 ✓ | 6)   | 69.68 ✓ | 325.00 ✓ |
| 7)  | 70.22 ✓ | 369.00 ✓ |       |          |          |      |         |          |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) |
|----------|--------|------------|------------|--------|-------|
| 68.80    | 0.1    | 0.04       | 0.02       | 8.0    | 0.2   |
| 69.00    | 6.6    | 0.24       | 0.12       | 48.1   | 5.8   |
| 69.20    | 29.9   | 0.44       | 0.22       | 88.2   | 19.4  |
| 69.40    | 76.0   | 0.64       | 0.33       | 122.3  | 40.8  |
| 69.60    | 146.8  | 0.84       | 0.46       | 147.4  | 67.8  |
| 69.80    | 242.7  | 1.04       | 0.58       | 173.3  | 99.8  |

NOTES:

Weir flow over N Virginia  
Street

Weir between stations 0 to 298 ⇒ to basin SRS  
" " 298 to 369 ⇒ to basin ESB & see  
encroached  
section

Project Stead Master  
Project No. 208  
Sheet No.      of       
Calculated by      Date     

**WEIR FLOW COMPUTATIONS**

**LOCATION/DESCRIPTION:**

Weir Control Section @ CP AW3  
encroached Section

**CROSS SECTION PARAMETERS:**

FILENAME: AW35275.SEC

No. of Cross Section Points: 7 ~~Bed Slope: 0.00010~~ Max Elev.: 70.22  
Bank Stations.....Left: 0.0 Right.....: 369.0 Min Elev.: 69.32  
Encroachment Stations..Left: 298.0 Right.....: 369.0 Weir Coef: 2.900

**CROSS SECTION POINTS - Elevations & Stations in feet:**

| No. | Elev. | Sta.   | No. | Elev. | Sta.   | No. | Elev. | Sta.   |
|-----|-------|--------|-----|-------|--------|-----|-------|--------|
| 1)  | 76.47 | 0.00   | 2)  | 70.86 | 108.00 | 3)  | 68.76 | 214.00 |
| 4)  | 69.28 | 292.00 | 5)  | 69.32 | 298.00 | 6)  | 69.68 | 325.00 |
| 7)  | 70.22 | 369.00 |     |       |        |     |       |        |

**COMPUTED PARAMETERS:**

| WSEL(ft) | Q(cfs) | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) |
|----------|--------|------------|------------|--------|-------|
| 59.40    | 0.2    | 0.08       | 0.04       | 6.0    | 0.2   |
| 59.60    | 3.6    | 0.28       | 0.14       | 21.0   | 2.9   |
| 69.80    | 13.9   | 0.48       | 0.24       | 36.8   | 8.7   |

**NOTES:**

Weir flows to Basin ESB  
appear minimal.  
∴ Ignore this weir flow.

Project Stead Master  
Project No. 208  
Sheet No.      of       
Calculated by      Date     

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Basin 1-W3, outlet, Section # 5538  
Ditch along westside of RR.

CROSS SECTION PARAMETERS:

FILENAME: aw35538.SEC

No. of Cross Section Points: 7 Bed Slope: 0.02200 Max Elev.: 69.12  
Bank Stations.....Left: 7.0 Right.....: 22.0 Min Elev.: 64.18  
Encroachment Stations..Left:      Right.....: 33.0  
Manning-n Values.....LOB: 0.035 CHANNEL...: 0.030 ROB.....: 0.040

CROSS SECTION POINTS - Elevations & Stations in feet:

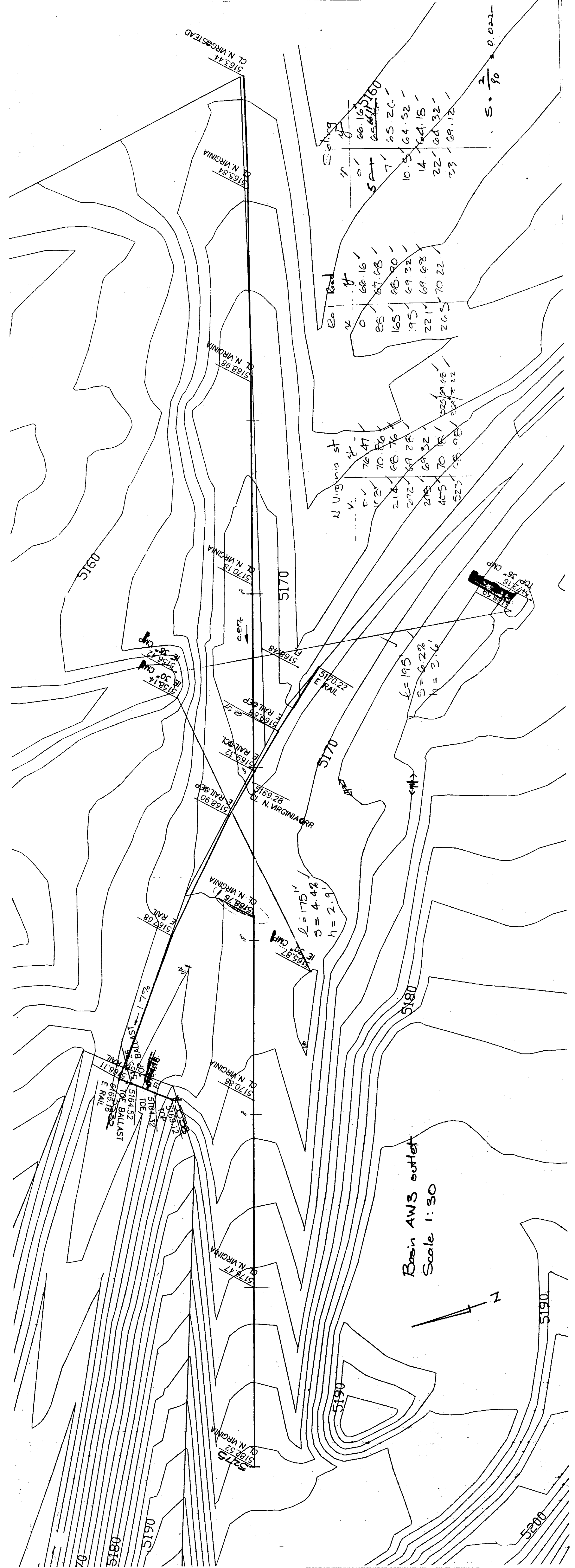
| No. | Elev. | Sta.  | No. | Elev. | Sta.  | No. | Elev. | Sta.  |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| 1)  | 66.16 | 0.00  | 2)  | 66.11 | 5.00  | 3)  | 65.26 | 7.00  |
| 4)  | 64.52 | 10.50 | 5)  | 64.18 | 14.00 | 6)  | 64.32 | 22.00 |
| 7)  | 69.12 | 33.00 |     |       |       |     |       |       |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft) | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|--------|----------|
| 4.50     | 6.8    | 2.6    | 1.00 | 0.030 | 1.0 | 11.7  | 2.6    | 11.8  | 64.50  |          |
| 65.00    | 48.0   | 5.1    | 1.18 | 0.031 | 1.0 | 15.3  | 9.3    | 15.5  | 65.07  |          |
| 65.50    | 123.0  | 6.9    | 1.27 | 0.031 | 1.1 | 18.3  | 17.8   | 18.7  | 65.67  |          |
| 66.00    | 230.4  | 8.4    | 1.35 | 0.031 | 1.1 | 20.6  | 27.5   | 21.2  | 66.11  |          |
| 66.10    | 255.5  | 8.6    | 1.36 | 0.031 | 1.1 | 21.1  | 29.6   | 21.7  | 66.11  |          |
| 66.20    | 251.3  | 7.8    | 1.35 | 0.032 | 1.2 | 26.3  | 32.1   | 27.0  | 66.47  |          |

NOTES:

No overflows to the east to Basin S11





Stantec

Stead Master Plan

260 00210

CP ESB

- 36" <sup>CMP</sup> ~~REP~~, L=220', S=0.036%, I<sub>EW</sub>=5090 ✓
- 36" <sup>CMP</sup> ~~REP~~, L=316', S=0.023%, I<sub>EW</sub>=5091.2 ✓
- Weir flow bottom elevation 5092.5 (to east along US395 ditch)
- Weir flow bottom elevation 5095 (over US395)

| Elevation | Storage Area (ac) | <sup>CMP</sup> 220' REP<br>Q | <sup>CMP</sup> 316' REP<br>Q | Weir<br>Q <sub>FEET</sub> | Weir<br>Q <sub>(US395)</sub> | Total<br>Q |
|-----------|-------------------|------------------------------|------------------------------|---------------------------|------------------------------|------------|
| 5090 ✓    | 0.03 ✓            | 0 ✓                          | 0 ✓                          | 0                         | 0                            | 0 ✓        |
| 5092 ✓    | 0.59 ✓            | 20 ✓                         | 4 ✓                          | 0                         | 0                            | 24 ✓       |
| 5092.5 ✓  | 0.94 ✓            | 28 ✓                         | 10 ✓                         | 0                         | 0                            | 38 ✓       |
| 5094 ✓    | 2.00 ✓            | 55 ✓                         | 33 ✓                         | 14.8 ✓                    | 0                            | 133 128 ✓  |
| 5095 ✓    | 2.80 ✓            | 65 ✓                         | 58 ✓                         | 190.3 ✓                   | 0 ✓                          | 312 299 ✓  |
| 5096 ✓    | 3.60 ✓            | 80 ✓                         | 66 ✓                         | 364.6 ✓                   | 152 ✓                        | 863 819 ✓  |
| <SE>      | <SA>              |                              |                              | ↑<br>DQ                   |                              | <SQ>       |

| Diversion | Rating |      |       |       |       |
|-----------|--------|------|-------|-------|-------|
| DI        | 0 ✓    | 38 ✓ | 128 ✓ | 299 ✓ | 849 ✓ |
| DQ        | 0 ✓    | 0 ✓  | 45 ✓  | 190 ✓ | 565 ✓ |
|           |        |      |       |       | 717 ✓ |

Diversion to basin FEET along 395.

This flow (152 cfs) travels east in median to low point +/sog in US395 northbound lanes @ approx station -397+50, where it discharges into basin ML1 completely. Add 152 cfs to 565 in DQ card.

11/19/99

Designed by:

Checked by:

Project Stead MP  
Project No. 260 00208  
Sheet No. 1 of 1  
Calculated by TM Date 5/1/99

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Weir flow over high point to east  
@ CP ESB

CROSS SECTION PARAMETERS:

FILENAME: Stead1.SEC

No. of Cross Section Points: 6 ~~Bed Slope = 0.00500~~ Max Elev.: 96.00 ✓  
Bank Stations.....Left: 1000.0 Right.....: 1102.0 Min Elev.: 92.50 ✓  
Encroachment Stations..Left:      Right.....:      Weir Coef: 2.650 ✓

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta. No.  | Elev. | Sta. No. | Elev.     | Sta. |         |           |
|-----|---------|-----------|-------|----------|-----------|------|---------|-----------|
| 1)  | 95.00 ✓ | 1000.00 ✓ | 2)    | 94.70 ✓  | 1027.00 ✓ | 3)   | 94.00 ✓ | 1042.00 ✓ |
| 4)  | 92.50 ✓ | 1052.00 ✓ | 5)    | 94.00 ✓  | 1065.00 ✓ | 6)   | 96.00 ✓ | 1102.00 ✓ |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) |
|----------|--------|------------|------------|--------|-------|
| 93.00    | 2.9    | 0.50       | 0.25       | 7.7    | 1.9   |
| 93.50    | 16.3   | 1.00       | 0.50       | 15.3   | 7.7   |
| 94.00    | 44.8   | 1.50       | 0.75       | 23.0   | 17.3  |
| 95.00    | 190.3  | 2.50       | 0.76       | 83.5   | 63.3  |
| 96.00    | 564.6  | 3.50       | 1.53       | 102.0  | 156.1 |

NOTES:

Project Stead MP  
Project No. 260 00208  
Sheet No. 1 of 1  
Calculated by THL Date 5/17/99

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Weir flow over US 395 to Basin SE1  
@ CP ESB

CROSS SECTION PARAMETERS:

FILENAME: Stead2.SEC

No. of Cross Section Points: 3 ~~Bed Slope 0-00500~~ Max Elev.: 96.00  
Bank Stations.....Left: 1000.0 Right....: 1131.0 Min Elev.: 95.00  
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)  | <u>96.00</u> | <u>1000.00</u> | 2)    | <u>95.00</u> | <u>1131.00</u> | 3)   | <u>95.01</u> | <u>1131.01</u> |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs)       | H:max(ft) | H:ave(ft) | TW(ft) | A(sf) |
|----------|--------------|-----------|-----------|--------|-------|
| 95.50    | 26.9         | 0.50      | 0.25      | 65.5   | 16.4  |
| 96.00    | <u>152.0</u> | 1.00      | 0.50      | 131.0  | 65.5  |

NOTES:

PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

May 17, 1999  
STEAD MASTER PLAN  
36" CMP UNDER US395 @ STST 421+00

Approx. invert  $\approx 91.2$

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 3.00 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 2 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0240 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 316.0 ✓  |
| Culvert Slope (feet per foot).....                    | 0.0230 ✓ |

| Elev. | Head (ft) |
|-------|-----------|
| 92    | 0.8 ✓     |
| 92.5  | 1.3 ✓     |
| 94    | 2.8 ✓     |
| 95    | 3.8 ✓     |
| 96    | 4.8 ✓     |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater (ft)<br>Inlet Control | Headwater (ft)<br>Outlet Control | Normal Depth<br>(ft) | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|---------------------------------|----------------------------------|----------------------|------------------------|-------------------------|--------------------------|
| 3.0                | 1.00                    | 0.73                            | -5.47                            | 0.48                 | 0.54                   | 0.48                    | 4.15                     |
| 4.0                | 1.00                    | 0.85                            | -5.41                            | 0.55                 | 0.62                   | 0.55                    | 4.52                     |
| 10.0               | 2.00                    | 1.38                            | -4.98                            | 0.87                 | 1.00                   | 0.87                    | 5.89                     |
| 20.0               | 2.00                    | 2.05                            | -3.90                            | 1.26                 | 1.43                   | 1.26                    | 7.10                     |
| 25.0               | 2.00                    | 2.36                            | -3.17                            | 1.42                 | 1.61                   | 1.42                    | 7.58                     |
| 30.0               | 2.00                    | 2.65                            | -2.29                            | 1.58                 | 1.77                   | 1.58                    | 7.93                     |
| 32.0               | 2.00                    | 2.77                            | -1.91                            | 1.65                 | 1.83                   | 1.65                    | 8.04                     |
| 35.0               | 3.00                    | 2.94                            | -0.75                            | 1.74                 | 1.92                   | 1.74                    | 8.22                     |
| 38.0               | 3.00                    | 3.12                            | -0.12                            | 1.84                 | 2.01                   | 1.84                    | 8.37                     |
| 42.0               | 3.00                    | 3.36                            | 0.80                             | 1.92                 | 2.11                   | 1.92                    | 8.78                     |
| 46.0               | 2.00                    | 3.72                            | 1.42                             | 2.11                 | 2.21                   | 2.11                    | 8.67                     |
| 47.0               | 3.00                    | 3.79                            | 2.08                             | 2.14                 | 2.23                   | 2.14                    | 8.71                     |
| 50.0               | 3.00                    | 3.97                            | 2.92                             | 2.63                 | 2.30                   | 2.63                    | 7.62                     |
| 55.0               | 3.00                    | 4.36                            | 4.42                             | 2.47                 | 2.41                   | 3.00                    | 7.78                     |
| 60.0               | 3.00                    | 4.80                            | 6.08                             | 3.00                 | 2.50                   | 3.00                    | 8.49                     |
| 65.0               | 3.00                    | 5.27                            | 7.87                             | 3.00                 | 2.59                   | 3.00                    | 9.20                     |
| 70.0               | 3.00                    | 5.79                            | 9.81                             | 3.00                 | 2.66                   | 3.00                    | 9.90                     |
| 75.0               | 3.00                    | 6.34                            | 11.90                            | 3.00                 | 2.72                   | 3.00                    | 10.61                    |

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PIPE CULVERT ANALYSIS ✓  
COMPUTATION OF CULVERT PERFORMANCE CURVE

May 17, 1999  
STEAD MASTER PLAN  
36" CMP UNDER US395 @ STAT 418 ✓

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 3.00 ✓   |
| FIWA Chart Number (1,2 or 3).....                     | 2 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0240 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 220.0 ✓  |
| Culvert Slope (feet per foot).....                    | 0.0360 ✓ |

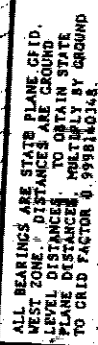
*Approx. Invert = 90.0*

| ELEV. | Head  |
|-------|-------|
| 92    | 2 ✓   |
| 92.5  | 2.5 ✓ |
| 94    | 4 ✓   |
| 95    | 5 ✓   |
| 96    | 6 ✓   |

PROGRAM RESULTS:

| Flow Rate (cfs) | Tailwater Depth (ft) | Headwater Inlet Control (ft) | Headwater Outlet Control (ft) | Normal Depth (ft) | Critical Depth (ft) | Depth at Outlet (ft) | Outlet Velocity (fps) |
|-----------------|----------------------|------------------------------|-------------------------------|-------------------|---------------------|----------------------|-----------------------|
| 10.0            | 2.00                 | 1.38                         | -5.71                         | 0.77              | 1.00                | 0.77                 | 6.92                  |
| 20.0            | 2.00                 | 2.05                         | -4.85                         | 1.11              | 1.43                | 1.11                 | 8.42                  |
| 25.0            | 2.00                 | 2.36                         | -4.27                         | 1.25              | 1.61                | 1.25                 | 8.99                  |
| 30.0            | 2.00                 | 2.65                         | -3.60                         | 1.39              | 1.77                | 1.39                 | 9.40                  |
| 35.0            | 3.00                 | 2.94                         | -2.30                         | 1.52              | 1.92                | 1.52                 | 9.75                  |
| 40.0            | 3.00                 | 3.24                         | -1.49                         | 1.64              | 2.06                | 1.64                 | 10.09                 |
| 45.0            | 3.00                 | 3.64                         | -0.58                         | 1.77              | 2.19                | 1.77                 | 10.34                 |
| 48.0            | 3.00                 | 3.85                         | 0.02                          | 1.85              | 2.26                | 1.85                 | 10.50                 |
| 50.0            | 3.00                 | 3.96                         | 0.44                          | 1.90              | 2.30                | 1.90                 | 10.58                 |
| 55.0            | 3.00                 | 4.36                         | 1.56                          | 2.04              | 2.41                | 2.04                 | 10.77                 |
| 60.0            | 3.00                 | 4.80                         | 2.79                          | 2.18              | 2.50                | 2.18                 | 10.92                 |
| 62.0            | 3.00                 | 4.98                         | 3.31                          | 2.23              | 2.54                | 2.23                 | 10.98                 |
| 65.0            | 3.00                 | 5.27                         | 4.13                          | 2.33              | 2.59                | 2.33                 | 11.05                 |
| 70.0            | 3.00                 | 5.78                         | 5.58                          | 2.53              | 2.66                | 2.53                 | 11.02                 |
| 72.0            | 3.00                 | 6.00                         | 6.19                          | 2.44              | 2.68                | 3.00                 | 10.19                 |

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Stantec

CMP  
36" RGR @ 417+90 EAST 5090 5082

220' long

CMP  
36" RGR @ 421+00 WEST 5091.2 5084

316' long

| EL                | Area(ac)  |              |
|-------------------|-----------|--------------|
| $\phi \approx 90$ | West<br>0 | EAST<br>0.03 |
| 92                | 0.29 =    | 0.30 =       |
| 94                | 0.68 =    | 1.32 =       |
| 96                | 1.23      | 2.37         |
| 98                |           |              |

| Use C = 2.65      |                     |                   |                     |                   |
|-------------------|---------------------|-------------------|---------------------|-------------------|
| $\frac{95}{1000}$ | $\frac{94.7}{1027}$ | $\frac{94}{1042}$ | $\frac{92.5}{1052}$ | $\frac{94}{1065}$ |
| $\frac{96}{1102}$ |                     |                   |                     |                   |
| $\frac{96}{1000}$ | $\frac{95}{1131}$   |                   |                     |                   |

$$90 (0.03)(208)^2 = 1297.9 = 0.03$$

$$92 (0.29)(208)^2 = 12,546.6 = 0.29 \text{ ac} \quad (0.3)(208)^2 = 12,919.2 = 0.30$$

$$94 (0.68)(208)^2 = 29,419.5 = 0.68 \quad (1.33)(208)^2 = 57,541.1 = 1.32$$

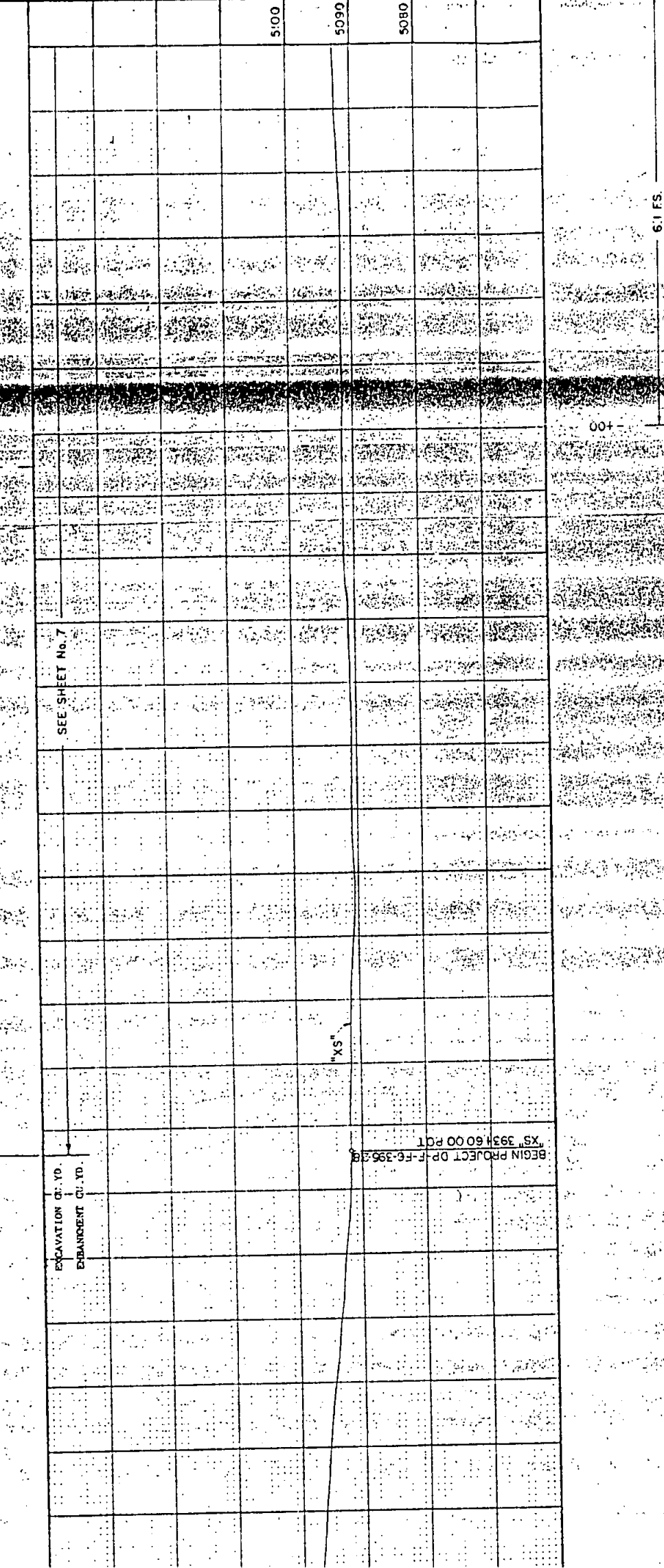
$$96 (1.24)(208)^2 = 53647.4 = 1.23 \quad (2.39)(208)^2 = 103,401.0 = 2.37$$

Designed by:

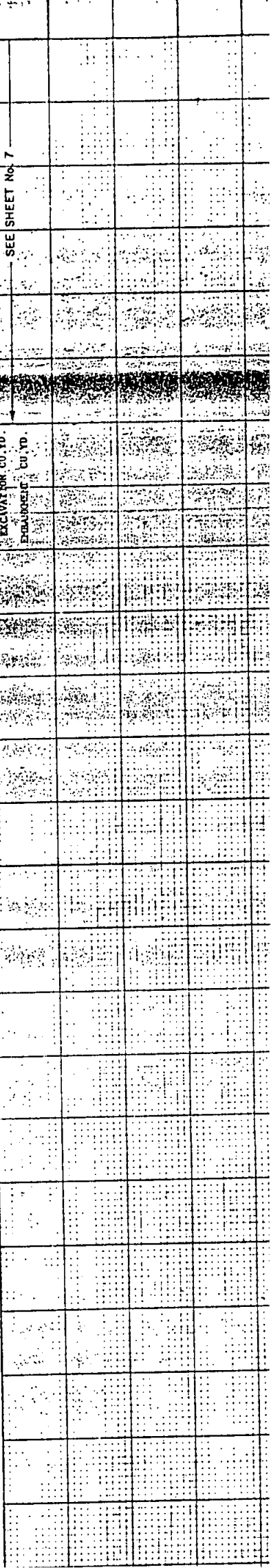
Checked by:

|             |                         |
|-------------|-------------------------|
| SHEET NO.   | 5                       |
| COUNTY      | WASHOE                  |
| PROJECT NO. | DP-F-393-2(8)           |
| DATE        | 10-1-15                 |
| DESIGNER    | 10-1-15 Ditch - 6.18 S. |

10-1-15 Ditch - 6.18 S.



SEE SHEET No. 7



80

10-1-15 Ditch - 6.18 S.

EXCAVATION CU. YD.  
EMBANKMENT CU. YD.

"XS"

BEGIN PROJECT DP-F-393-2(8)  
"XS" 393+60.00 P.O.T.

100

6.1 FS.

EXCAVATION CU. YD.  
EMBANKMENT CU. YD.

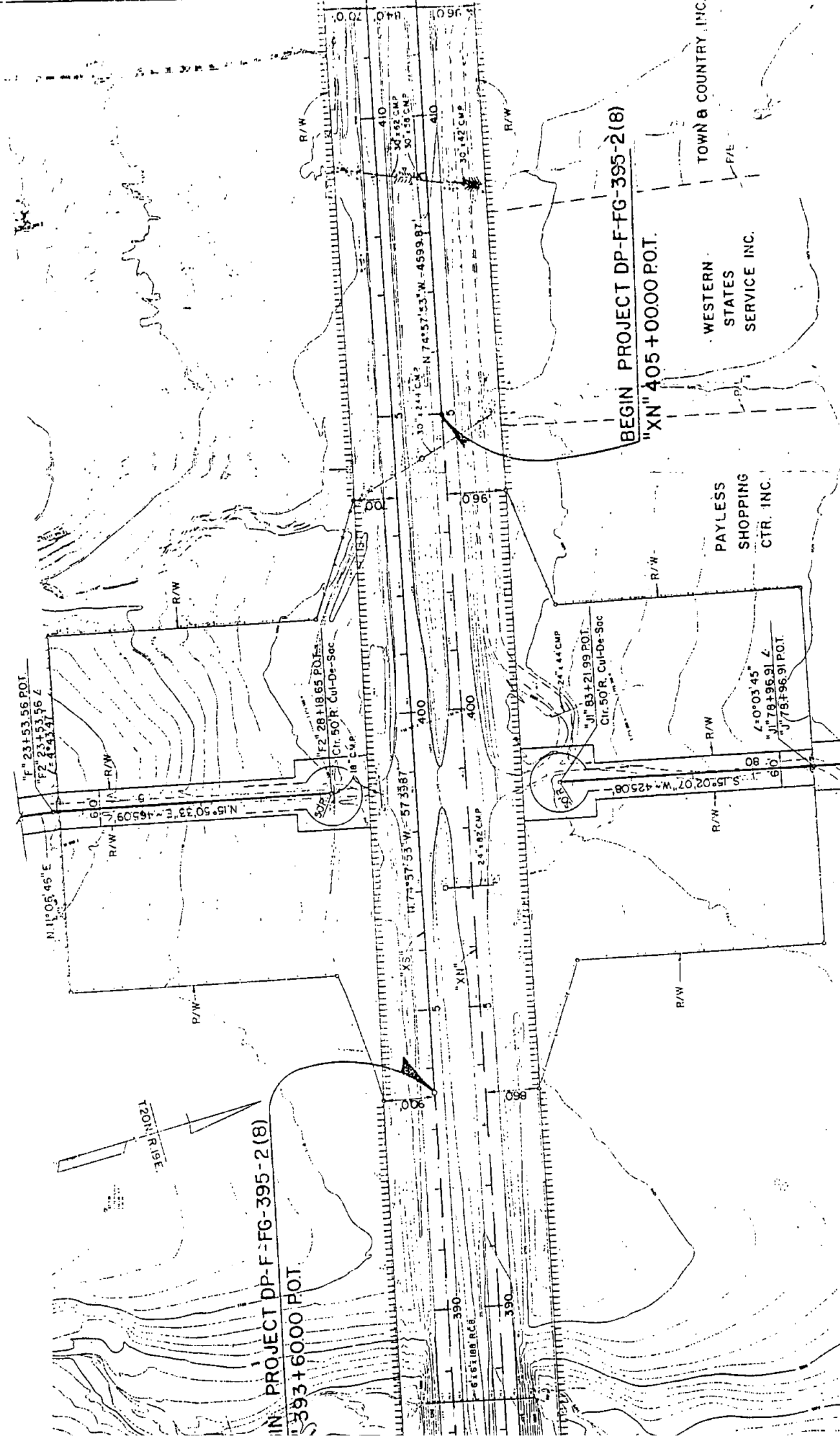
SEE SHEET No. 7

| FED. NO. | STATE  | PROJECT NO.    | COUNTY | SHEET NO. |
|----------|--------|----------------|--------|-----------|
| 9        | NEVADA | DP-FG-395-2(3) | WASHOE | 4         |

EXISTING 13" X 43" CUP 33' LT. REMOVE  
 13" X 30" CUP 138' LT. REMOVE

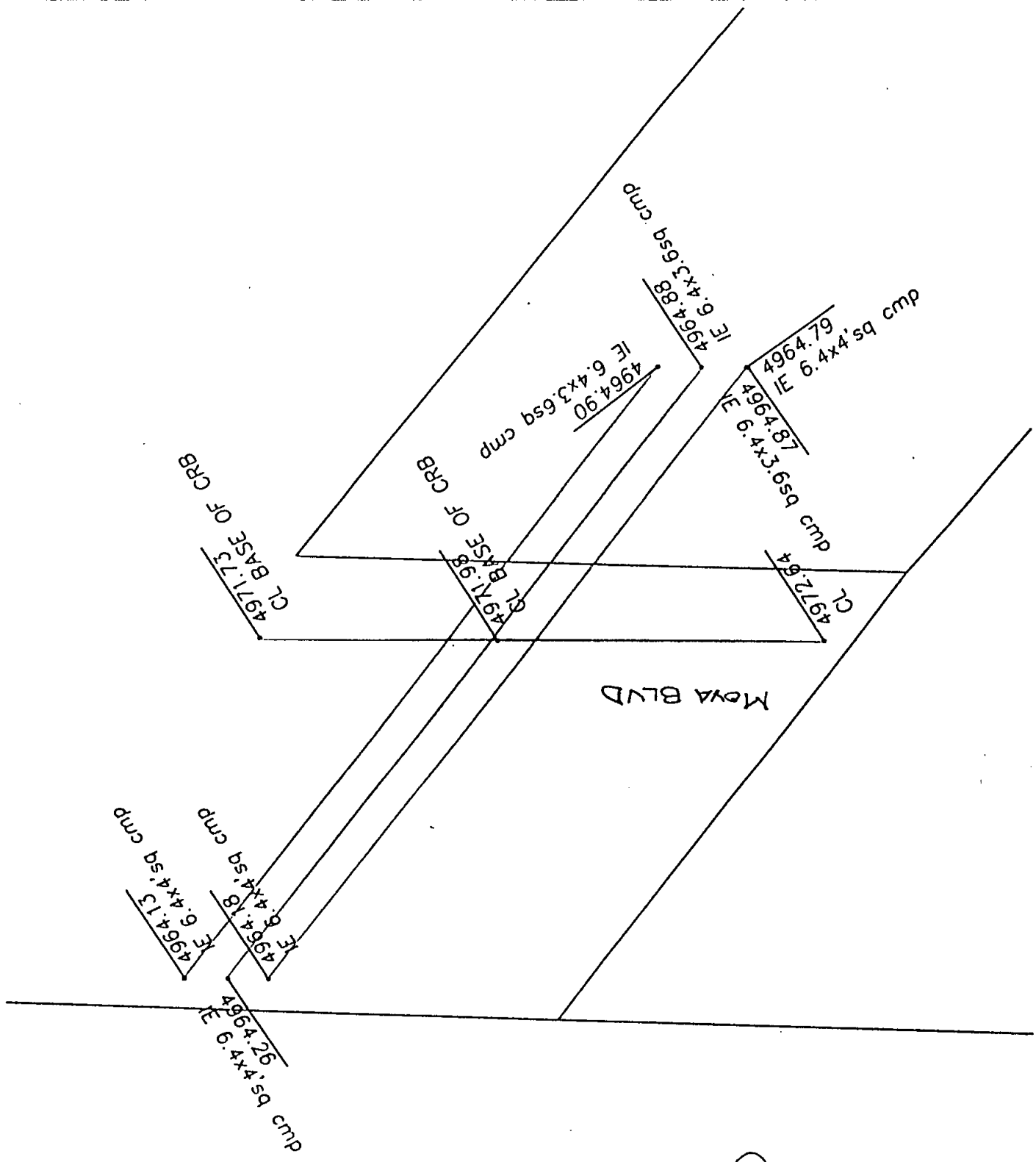
30" X 24" CUP 33' SHOWN WITH 1870' DIAMETER  
 50.5' RT. REMOVE REMOVAL 12' AND EXISTING  
 WITH NEW 30" X 15" CUP 720' X 2535' CUP  
 (NOTE - 5035.0')

30" X 51" CUP 12' 8824' REMOVE REMOVAL 12'  
 AND EXISTING WITH NEW 30" X 18' CUP  
 (NOTE - 5035.0')



IN PROJECT DP-FG-395-2(8)  
 393+6000 P.O.I.

BEGIN PROJECT DP-FG-395-2(8)  
 "XN" 405+0000 P.O.I.



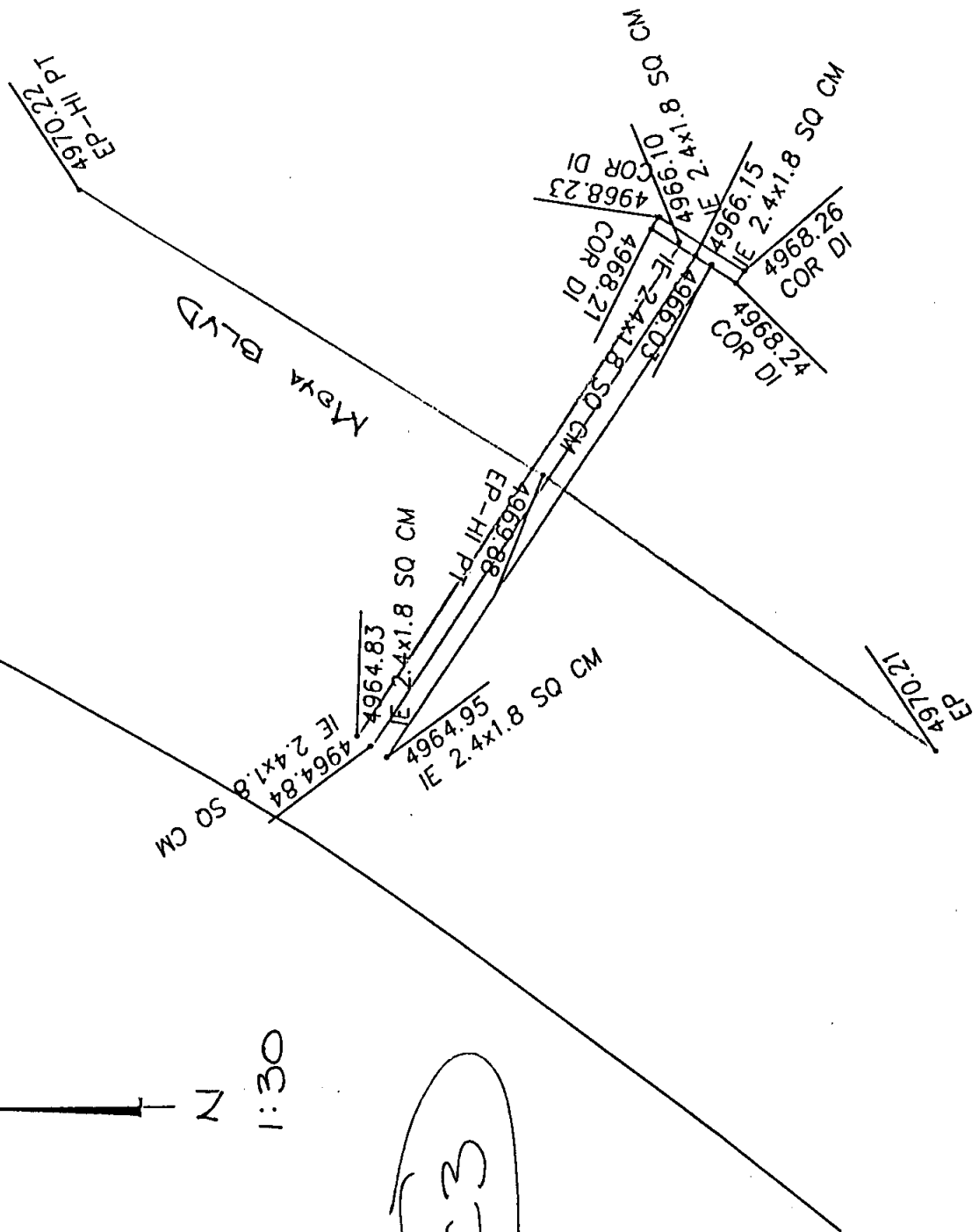
N 1:30

GCC2

GLB

03.11

7



**STANTECH CONSULTING INC.**

Formerly SEA, Incorporated

950 Industrial Way

Sparks, NV 89431-6092

(702) 358-6931

Fax: 358-6954

JOB NO. 2600208

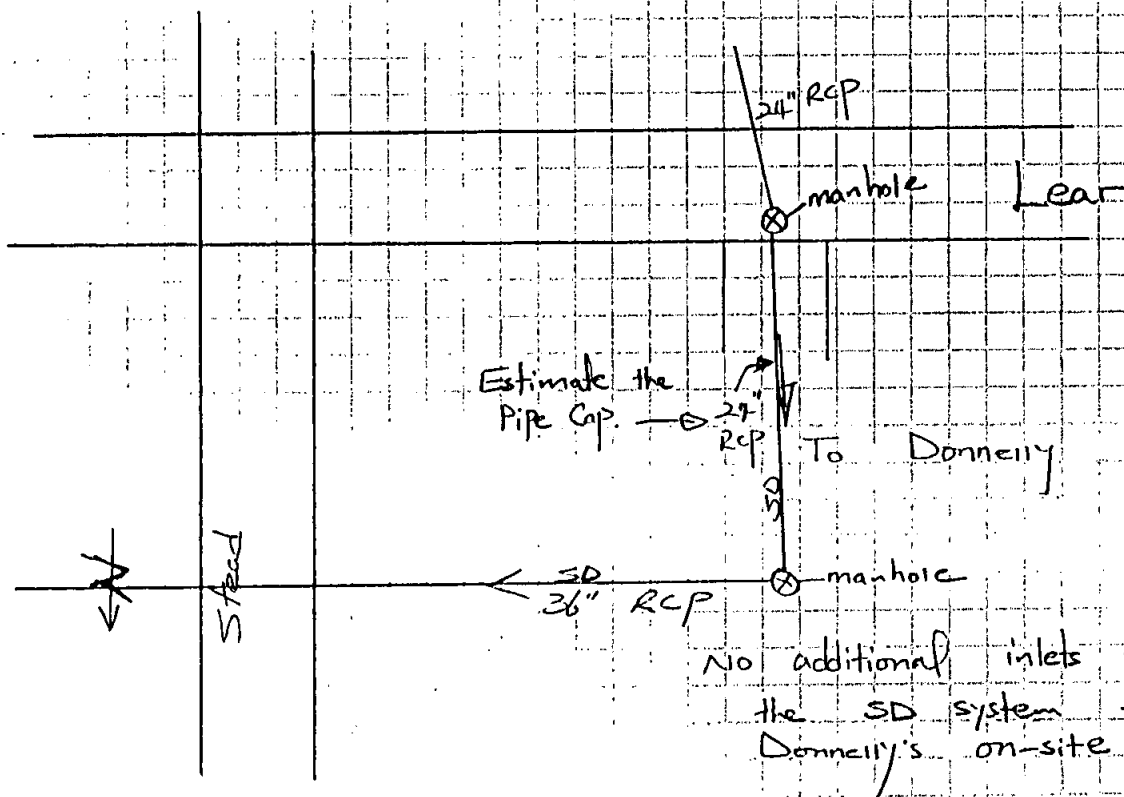
SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT Stead Drainage Master Plan DATE 4/23/99  
SUBJECT Basin "LEA" Diversion DESIGNED \_\_\_\_\_ CHECKED \_\_\_\_\_

Storm Drain Pipe Diversion from Basin "LEA"

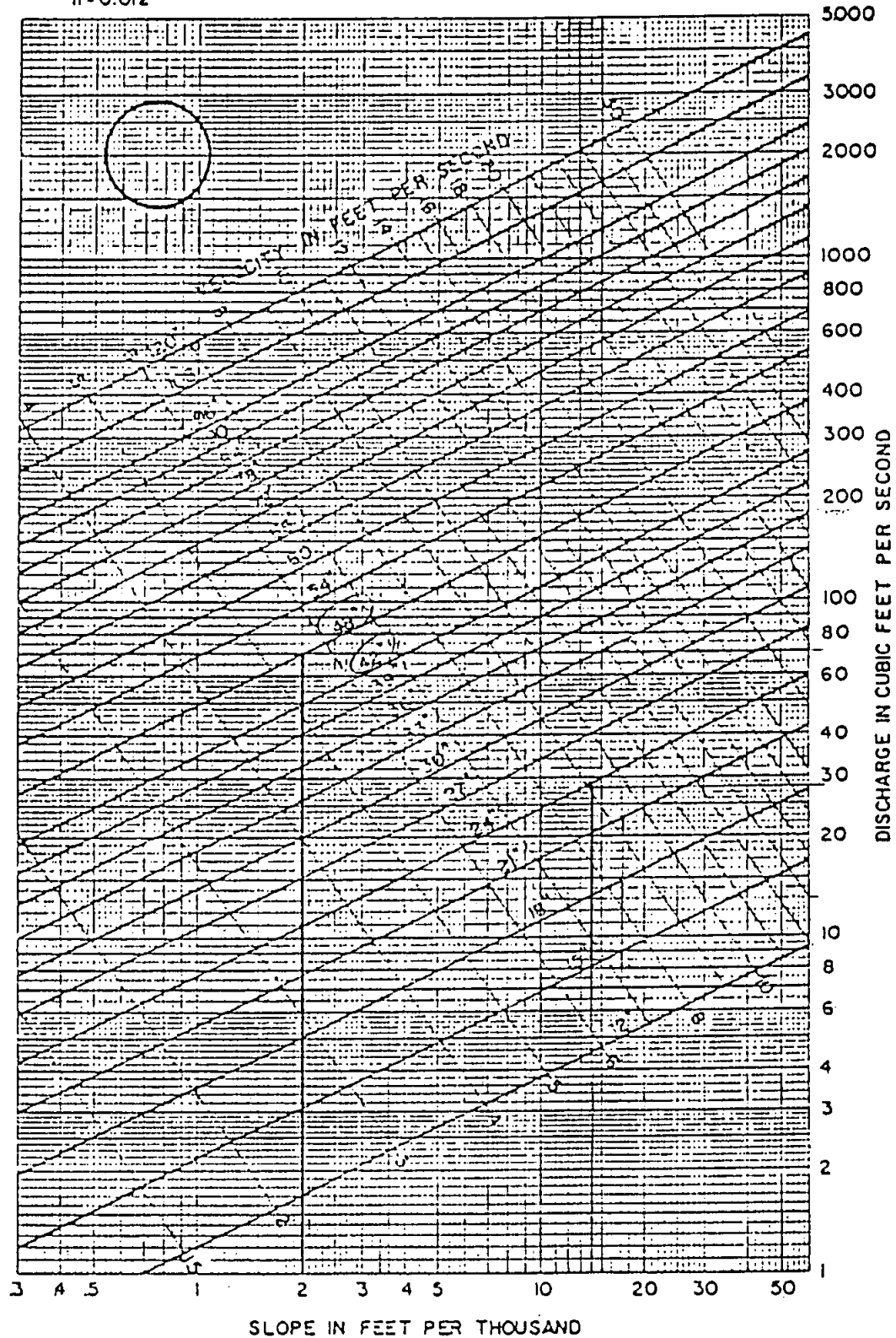
\* assume the flowing full capacity of  
24" RCP = Diversion (maximum)24" RCP @  $S = 0.0037$  %flowing full Capacity  $\approx$  15 cfs

|    |   |    |    |     |     |
|----|---|----|----|-----|-----|
| DI | 0 | 15 | 20 | 100 | 400 |
| DQ | 0 | 15 | 15 | 15  | 15  |



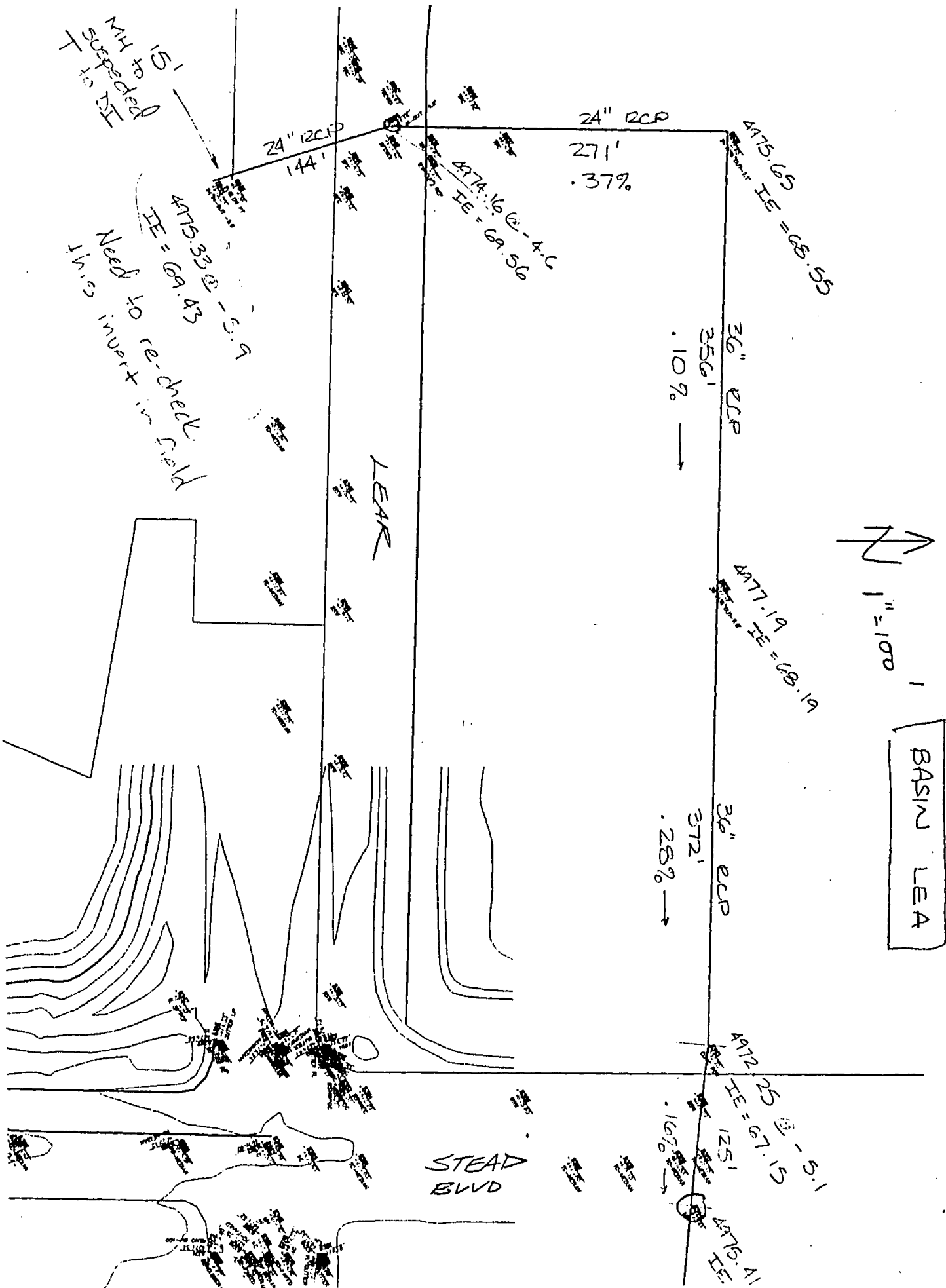


COMPUTED FROM MANNING'S FORMULA  
 $n = 0.012$



DISCHARGE CAPACITY OF CONCRETE PIPE FLOWING FULL

FIGURE 3-51





STANTEC CONSULTING INC.  
950 Industrial Way  
Sparks, Nevada 89431  
Tel: (775) 358-6931 Fax: (775) 358-6954

JOB NO. 6000208

Stantec

SHEET 1 OF 2

PROJECT Steel Master Plan DATE 10/15/99  
SUBJECT Kernite Storm Drain DESIGNED B CHECKED \_\_\_\_\_

From Granite Hills Subdivision #2  
Street Improvement Plans by SEA

SDMH C-12  
(not end)  
4986.63

26.63 - 64.75

24.15

= 0.91%

Learn-Blind  
SDMH C-1  
4964.75

4963.65

Outfall to

old drain ditch

\* 24.15'

370'

0.3%

155'  
190'  
400'  
280'  
260'  
275'  
270'  
150'  
125'  
110'  
200'

100'

165'

165'

30"  
30"  
30"  
36"  
36"  
36"  
36"  
18"  
48"  
48"  
48"

48"

48"

48"

From Granite Hills Subdivision #1  
Street Improvement Plans by SEA  
El Dorado Villas by Resource  
Development Co

Begin old drain  
ditch 4965.63  
(adj according to  
Storm drain IE's  
surveyed)  
4963.37

835'

sheet 12

600'

sheet 13

1435'

65.63 - 63.37 = 0.16%  
14.35

\* Add 230' pipe - length to inlet - use 0.91%  
slope, making IE = 4988.95

MA1



STANTEC CONSULTING INC.  
950 Industrial Way  
Sparks, Nevada 89431  
Tel: (775) 358-6931 Fax: (775) 358-6954

JOB NO. \_\_\_\_\_

**Stantec**

SHEET 2 OF 2

PROJECT

Stead Master Plan

DATE \_\_\_\_\_

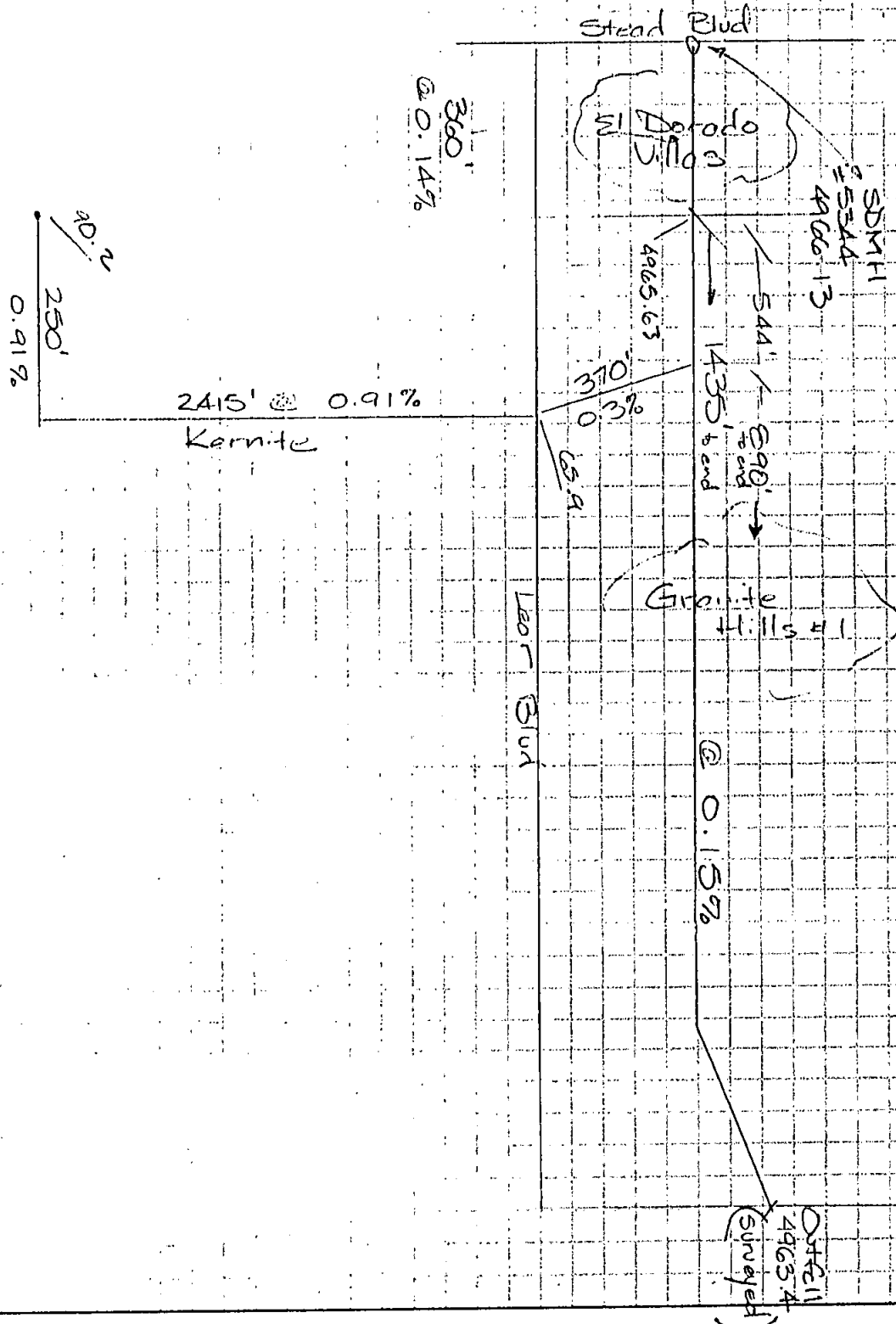
SUBJECT

Sbrm Drain - Main Trunk

DESIGNED \_\_\_\_\_

CHECKED \_\_\_\_\_

Main Trunk line beneath Granite Hills Subdivision  
El Dorado Villas



MA1



# STANTECH CONSULTING INC.

Formerly SEA, Incorporated

950 Industrial Way  
Sparks, NV 89431-6092

(702) 358-6931

Fax: 358-6954

JOB NO. 26000208

SHEET OF

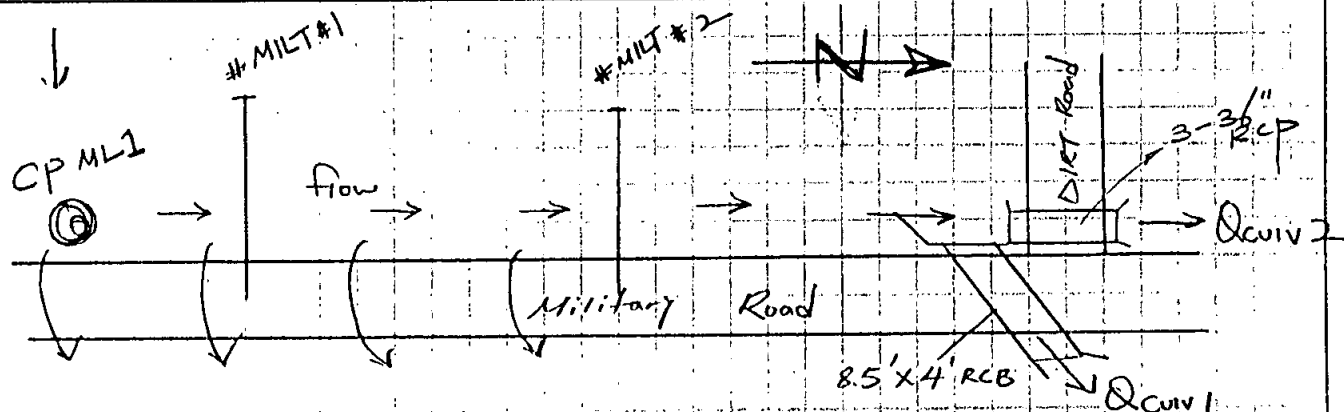
PROJECT STEAD MASTER Plan

DATE 4/30/99

SUBJECT CP MLI

DESIGNED

CHECKED



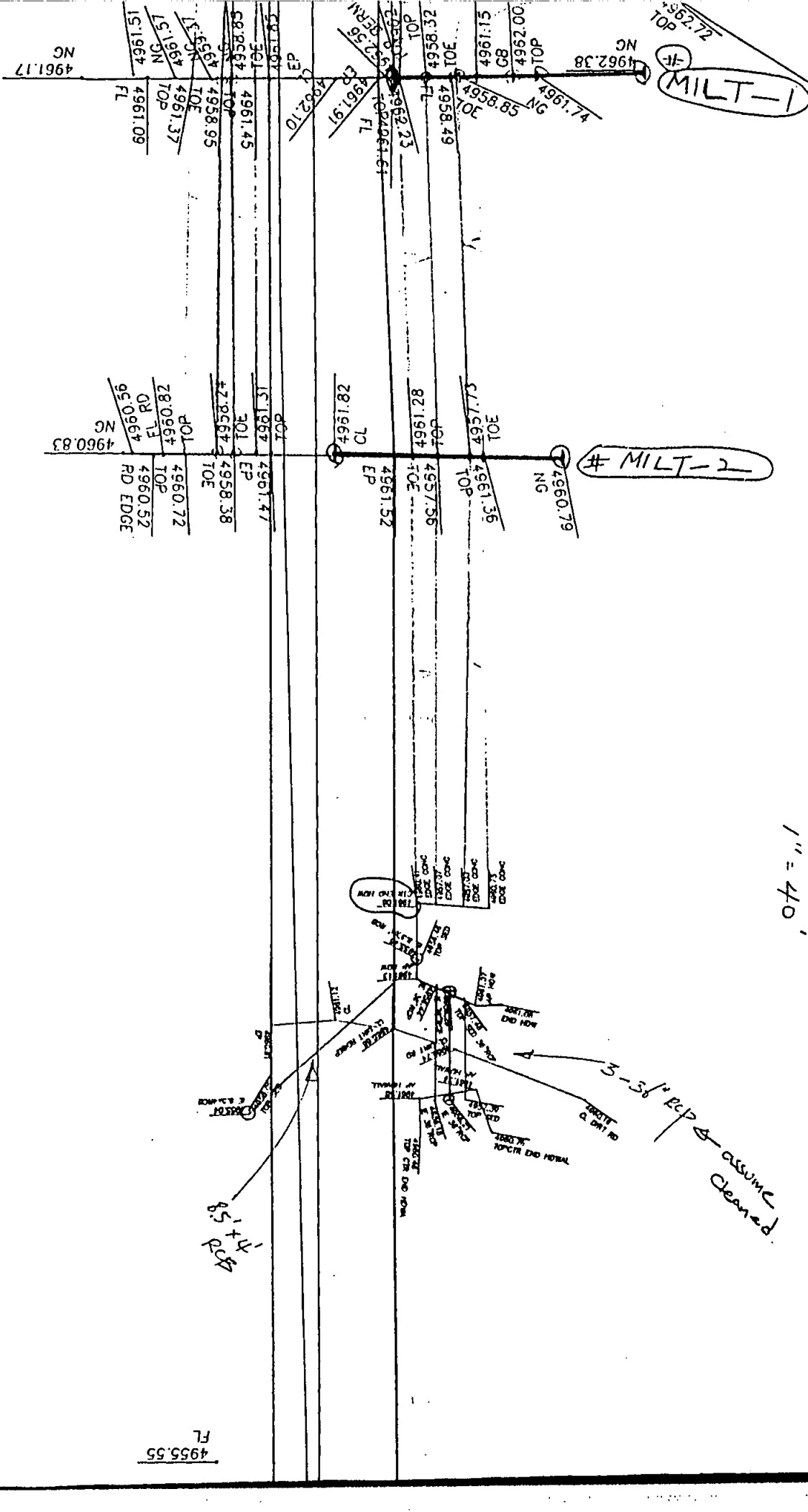
X-section Capacity MILT # 1  $\Rightarrow$  400 cfs +/-  
MILT # 2  $\Rightarrow$  340 cfs +/-  
i. assume 400 cfs will remain in the Ditch, i.  
DI 0 300 400 10.00  
DQ 0 0 0 6.00  
overflow to the east (weir flow over military Road)

## Cuvert Ratings

| Elev. | Qcuv 1<br>8.5' x 4' RCB | Qcuv 2<br>3-36" RCP | Q total |
|-------|-------------------------|---------------------|---------|
| 55.45 | 0 (1.00)                | 0                   | 0       |
| 57.06 | 50 (1.61)               | 12 (0.8)            | 62      |
| 58.04 | 100 (2.59)              | 45 (1.78)           | 145     |
| 58.88 | 150 (3.43)              | 87 (2.62)           | 237     |
| 59.63 | 200 (4.18)              | 123 (3.37)          | 323     |
| 61.06 | 270 (5.61)              | 180 (4.80)          | 450     |

↑  
DQ

DI 0 62 145 237 323 450  
DQ 0 50 100 150 200 270  
to the east thru 8.5' x 4' RCB



Project stead Master Plan  
 Project No. 26000108  
 Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
 Calculated by JS Date \_\_\_\_\_

## UNIFORM FLOW COMPUTATIONS

## LOCATION/DESCRIPTION:

Military Road Ditch Cross-section # MILT-1  
Ditch along westside of the Road near CP MLI

## CROSS SECTION PARAMETERS:

FILENAME: MILT-1.SEC

No. of Cross Section Points: 9 Bed Slope: 0.00600 Max Elev.: 4962.56  
 Bank Stations.....Left: 1038.0 Right.....: 1072.0 Min Elev.: 4958.32  
 Encroachment Stations..Left: \_\_\_\_\_ Right.....: \_\_\_\_\_  
 Manning-n Values.....LOB: 0.045 CHANNEL...: 0.035 ROB.....: 0.020

## CROSS SECTION POINTS - Elevations &amp; Stations in feet:

| No. | Elev.   | Sta.    | No. | Elev.   | Sta.    | No. | Elev.   | Sta.    |
|-----|---------|---------|-----|---------|---------|-----|---------|---------|
| 1)  | 4962.38 | 1000.00 | 2)  | 4961.74 | 1031.00 | 3)  | 4962.00 | 1038.00 |
| 4)  | 4961.15 | 1049.00 | 5)  | 4958.85 | 1054.00 | 6)  | 4958.49 | 1057.00 |
| 7)  | 4958.32 | 1064.00 | 8)  | 4962.23 | 1072.00 | 9)  | 4962.56 | 1073.00 |

## COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | nc  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 4960.00  | 71.3   | 3.7    | 0.58 | 0.035 | 1.0 | 15.9  | 19.5   | 16.6  | 4959.56 |          |
| 4961.00  | 180.2  | 4.8    | 0.62 | 0.035 | 1.0 | 20.2  | 37.5   | 21.3  | 4960.38 |          |
| 4962.00  | 245.1  | 3.7    | 0.60 | 0.035 | 1.1 | 53.1  | 66.2   | 54.5  | 4960.76 |          |
| 4962.56  | 398.1  | 3.9    | 0.64 | 0.037 | 1.3 | 73.0  | 103.2  | 74.5  | 4961.57 |          |
| 4963.00  | 612.8  | 4.5    | 0.67 | 0.038 | 1.3 | 73.0  | 135.3  | 74.5  | 4962.49 |          |
| 4964.00  | 1230.6 | 5.9    | 0.68 | 0.039 | 1.2 | 73.0  | 208.3  | 74.5  | 4963.41 |          |

## NOTES:

Ditch Capacity  $\approx$  400 cfs +/-

Project Stead Master Plan  
Project No. 2600208  
Sheet No.        of         
Calculated by YS Date       

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Military Road Ditch Cross-section # MILT-2  
Ditch along westside of the road, near CP MLI

CROSS SECTION PARAMETERS:

FILENAME: MILT-2.SEC

No. of Cross Section Points: 7 Bed Slope: 0.00600 Max Elev.: 4961.02  
Bank Stations.....Left: 1023.0 Right.....: 1044.0 Min Elev.: 4957.56  
Encroachment Stations..Left: 1000.0 Right.....: 1067.0  
Manning-n Values.....LOB: 0.045 CHANNEL...: 0.035 ROB.....: 0.020

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta.    | No. | Elev.   | Sta.    | No. | Elev.   | Sta.    |
|-----|---------|---------|-----|---------|---------|-----|---------|---------|
| 1)  | 4960.79 | 1000.00 | 2)  | 4961.36 | 1023.00 | 3)  | 4957.73 | 1027.00 |
| 4)  | 4957.56 | 1037.00 | 5)  | 4961.28 | 1044.00 | 6)  | 4961.52 | 1049.00 |
| 7)  | 4961.02 | 1067.00 |     |         |         |     |         |         |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | nc  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 4960.00  | 151.1  | 4.7    | 0.61 | 0.035 | 1.0 | 17.1  | 32.0   | 18.6  | 4959.37 |          |
| 4961.00  | 237.7  | 4.6    | 0.62 | 0.035 | 1.0 | 28.6  | 51.5   | 30.7  | 4959.92 |          |
| 4961.82  | 336.7  | 3.8    | 0.66 | 0.036 | 1.3 | 67.0  | 89.6   | 69.3  | 4960.46 |          |
| 4962.00  | 418.7  | 4.1    | 0.68 | 0.036 | 1.3 | 67.0  | 101.6  | 69.3  | 4960.82 |          |
| 4963.00  | 994.7  | 5.9    | 0.71 | 0.035 | 1.2 | 67.0  | 168.6  | 69.3  | 4962.60 |          |
| 4964.00  | 1753.7 | 7.4    | 0.75 | 0.035 | 1.2 | 67.0  | 235.6  | 69.3  | 4963.41 |          |

NOTES:

DITCH CAPACITY  $\approx$  340 cfs +/-



PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

April 30, 1999

3 - 36" RCP UNDER DIRT ROAD - T INTERSECTION W/ MILITARY

@ INLET OF 8.5' X 4' RCB NEAR CP ML1

INLET ELEV = 56.26', AVAIL HEAD = 4.8' To T. O. HW.

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Diameter (feet).....                          | 3.00   |
| FHWA Chart Number (1,2 or 3).....                     | 1      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 32.0   |
| Culvert Slope (feet per foot).....                    | 0.0020 |

PROGRAM RESULTS:

| Flow Rate (cfs) | Tailwater Depth (ft) | Inlet Headwater (ft) | Outlet Depth (ft) | Normal Depth (ft) | Critical Depth (ft) | Outlet Velocity (fps) |
|-----------------|----------------------|----------------------|-------------------|-------------------|---------------------|-----------------------|
| 20.0            | 1.00                 | 2.07                 | 2.37              | 1.80              | 1.43                | 1.43                  |
| 40.0            | 2.00                 | 3.30                 | 3.33              | 3.00              | 2.06                | 2.06                  |
| 60.0            | 2.00                 | 4.88                 | 4.62              | 3.00              | 2.50                | 3.00                  |
| 80.0            | 3.00                 | 7.11                 | 6.38              | 3.00              | 2.77                | 3.00                  |
| 100.0           | 3.00                 | 9.98                 | 8.31              | 3.00              | 2.90                | 3.00                  |

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Assume inlet control

BOX CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

April 30, 1999

8.5' X 4' RCB UNDER MILITARY ROAD

NEAR CP ML1

INVERT ELEV= 55.45', AVAIL. HEAD = 5.6' TO T.O.HW.

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Span (Width of Opening) (feet).....           | 8.50   |
| Culvert Rise (Height of Opening) (feet).....          | 4.00   |
| FHWA Chart Number (8,9,10,11,12 or 13).....           | 8      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 66.0   |
| Culvert Slope (feet per foot).....                    | 0.0062 |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater (ft)<br>Inlet Control | Normal Depth<br>Outlet Control | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Velocity at Outlet<br>(fps) |
|--------------------|-------------------------|---------------------------------|--------------------------------|------------------------|-------------------------|-----------------------------|
| 50.0               | 1.00                    | 1.61                            | 2.16                           | 0.83                   | 1.02                    | 5.74                        |
| 100.0              | 1.00                    | 2.59                            | 2.63                           | 1.31                   | 1.63                    | 7.24                        |
| 150.0              | 2.00                    | 3.43                            | 3.17                           | 1.71                   | 2.13                    | 10.29                       |
| 200.0              | 2.00                    | 4.18                            | 3.80                           | 2.09                   | 2.58                    | 11.26                       |
| 250.0              | 3.00                    | 5.16                            | 4.53                           | 2.44                   | 2.99                    | 12.05                       |
| 300.0              | 3.00                    | 6.24                            | 5.35                           | 2.78                   | 3.38                    | 12.71                       |

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*Assume  
Inlet  
Control*



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Sparks, NV 89431-6092

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Fax: 358-6954

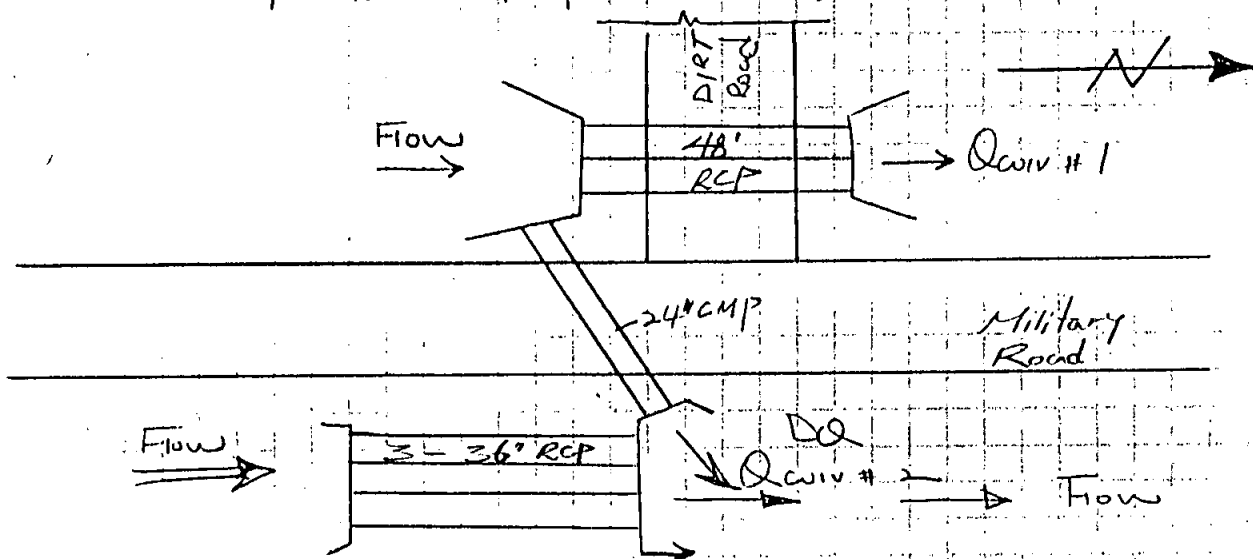
JOB NO. 2600203

SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT Stead Master Plan DATE 5/3/99

SUBJECT Diversion Rating "ML1" DESIGNED \_\_\_\_\_ CHECKED \_\_\_\_\_

Military Road, approximately halfway between CP ML1 & CP ML3



Convent Ratings

| EICV  | I.E. = 47.7'        |       | I.E. = 50.0'        |     | Q <sub>total</sub> |
|-------|---------------------|-------|---------------------|-----|--------------------|
|       | (2 - 48" RCP)       |       | (1 - 24" CMP)       |     |                    |
|       | Q <sub>civ #1</sub> |       | Q <sub>civ #2</sub> |     |                    |
| 47.7' | 0                   |       | 0                   |     | 0                  |
| 50.0  | 60                  | (2.3) | 0                   |     | 60                 |
| 52.0  | 160                 | (4.3) | 13                  | (2) | 173                |
| 53.0  | 203                 | (5.3) | 20                  | (3) | 223                |

|    |   |    |     |     |        |
|----|---|----|-----|-----|--------|
| DI | 0 | 60 | 173 | 223 |        |
| DQ | 0 | 0  | 13  | 20  | to ML2 |

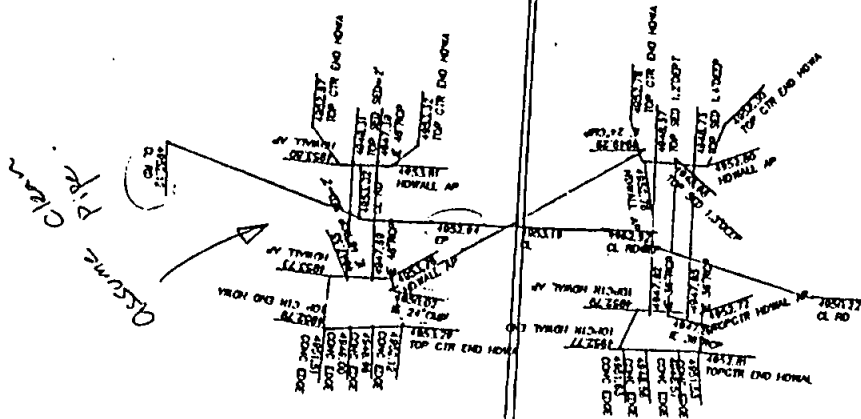
Capacity of 3 - 36" RCP

1" = 40'

4947.97  
 FL

4951.81  
 CL

4947.72  
 FL



MATCH LINE

4949.39  
 FL

4951.32  
 FL

4954.98  
 FL

FL

Project Z60m208  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by YS Date 5/3/89

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Stead - Ditch cross-section #1 MILT-3  
Ditch along westside of Military Road between CP MT1 & CP MT3

CROSS SECTION PARAMETERS:

FILENAME: milt-3.SEC

No. of Cross Section Points: 6 Bed Slope: 0.00360 Max Elev.: 4956.07  
Bank Stations.....Left: 1020.0 Right.....: 1040.0 Min Elev.: 4953.03  
Encroachment Stations..Left: \_\_\_\_\_ Right.....: \_\_\_\_\_  
Manning-n Values.....LOB: 0.045 CHANNEL...: 0.035 ROB.....: 0.020

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta.    | No. | Elev.   | Sta.    | No. | Elev.   | Sta.    |
|-----|---------|---------|-----|---------|---------|-----|---------|---------|
| 1)  | 4955.70 | 1000.00 | 2)  | 4954.88 | 1020.00 | 3)  | 4953.18 | 1025.50 |
| 4)  | 4953.03 | 1032.00 | 5)  | 4955.97 | 1040.00 | 6)  | 4956.07 | 1044.50 |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 4955.00  | 62.8   | 2.7    | 0.45 | 0.035 | 1.0 | 20.3  | 23.1   | 20.9  | 4954.28 |          |
| 4956.00  | 159.6  | 2.9    | 0.49 | 0.038 | 1.3 | 41.3  | 55.9   | 42.1  | 4955.08 |          |
| 4956.07  | 165.7  | 2.8    | 0.49 | 0.038 | 1.3 | 44.5  | 58.9   | 45.3  | 4955.13 |          |
| 4956.50  | 263.8  | 3.4    | 0.50 | 0.038 | 1.2 | 44.5  | 78.0   | 45.3  | 4955.76 |          |
| 4957.00  | 399.6  | 4.0    | 0.51 | 0.038 | 1.2 | 44.5  | 100.3  | 45.3  | 4956.22 |          |
| 4957.50  | 557.0  | 4.5    | 0.52 | 0.038 | 1.2 | 44.5  | 122.5  | 45.3  | 4956.60 |          |

NOTES:

Ditch Capacity = 166 cfs +/-

PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

May 3, 1999

2 - 48" RCP UNDER THE DIRT ROAD ✓

IE= 4947.7 ✓

APPROXIMATE AVAILABLE HEAD = 5.3 FOOT TO THE ROAD LOW PT ✓

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 4.00 ✓   |
| FWHA Chart Number (1,2 or 3).....                     | 1 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 25.0 ✓   |
| Culvert Slope (feet per foot).....                    | 0.0120 ✓ |

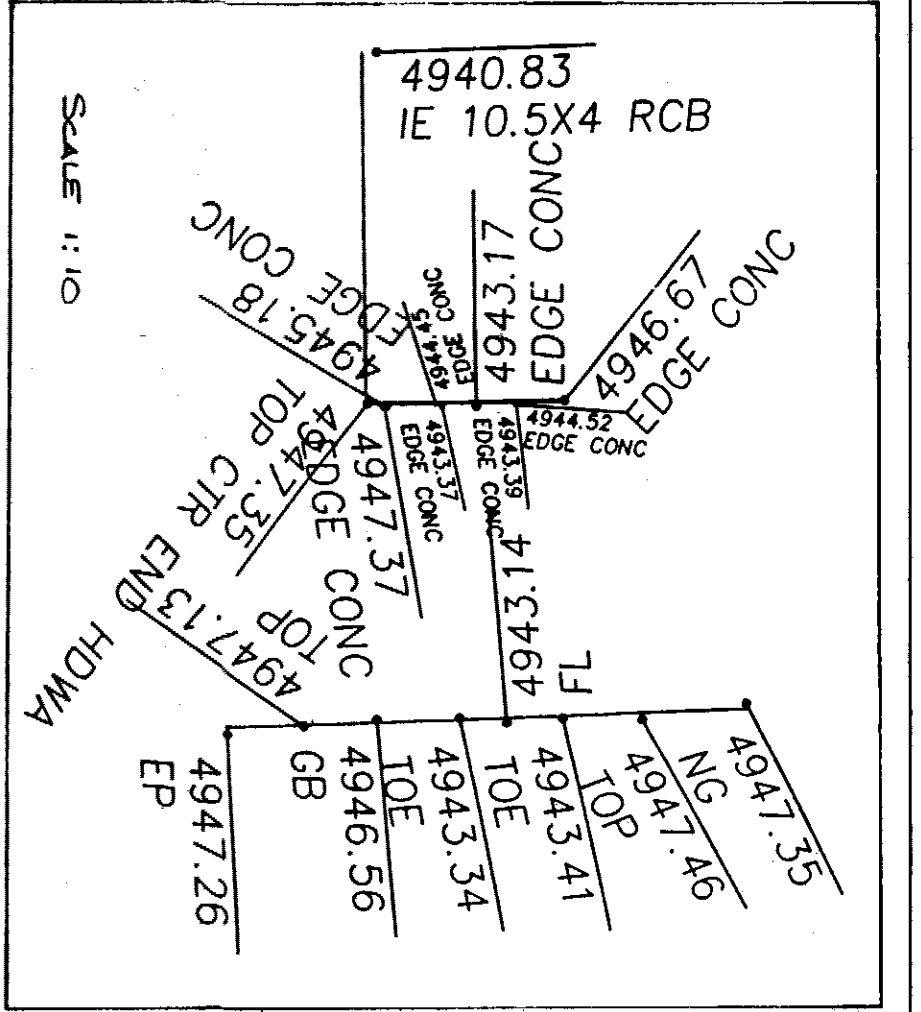
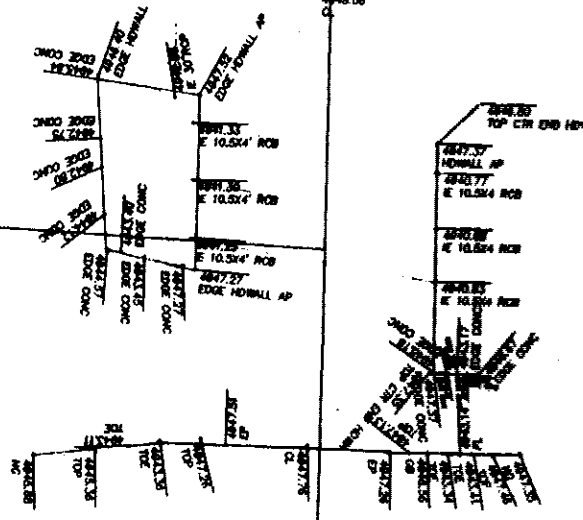
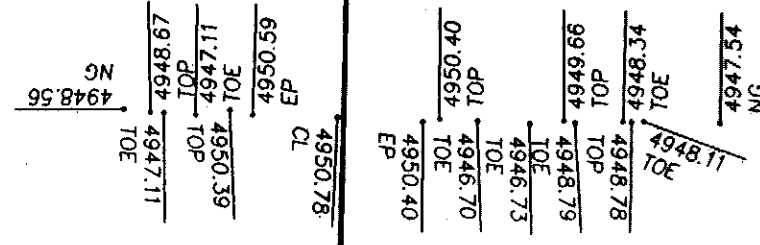
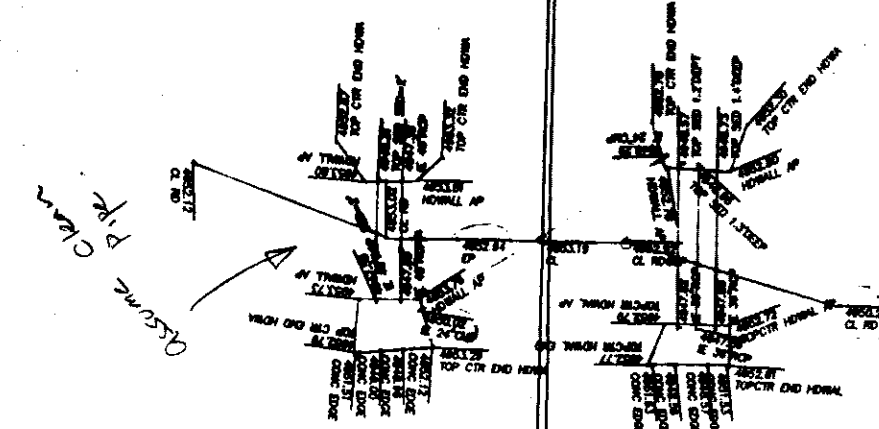
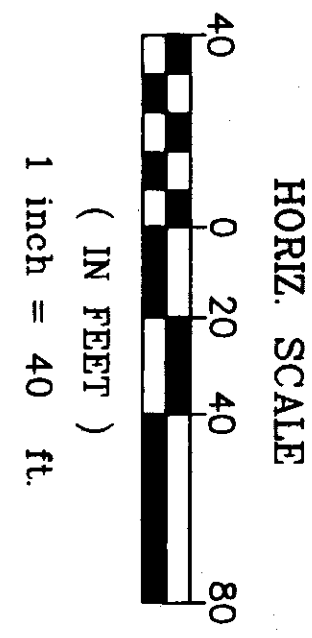
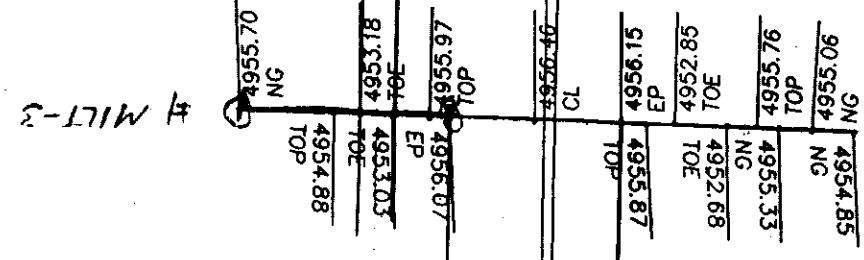
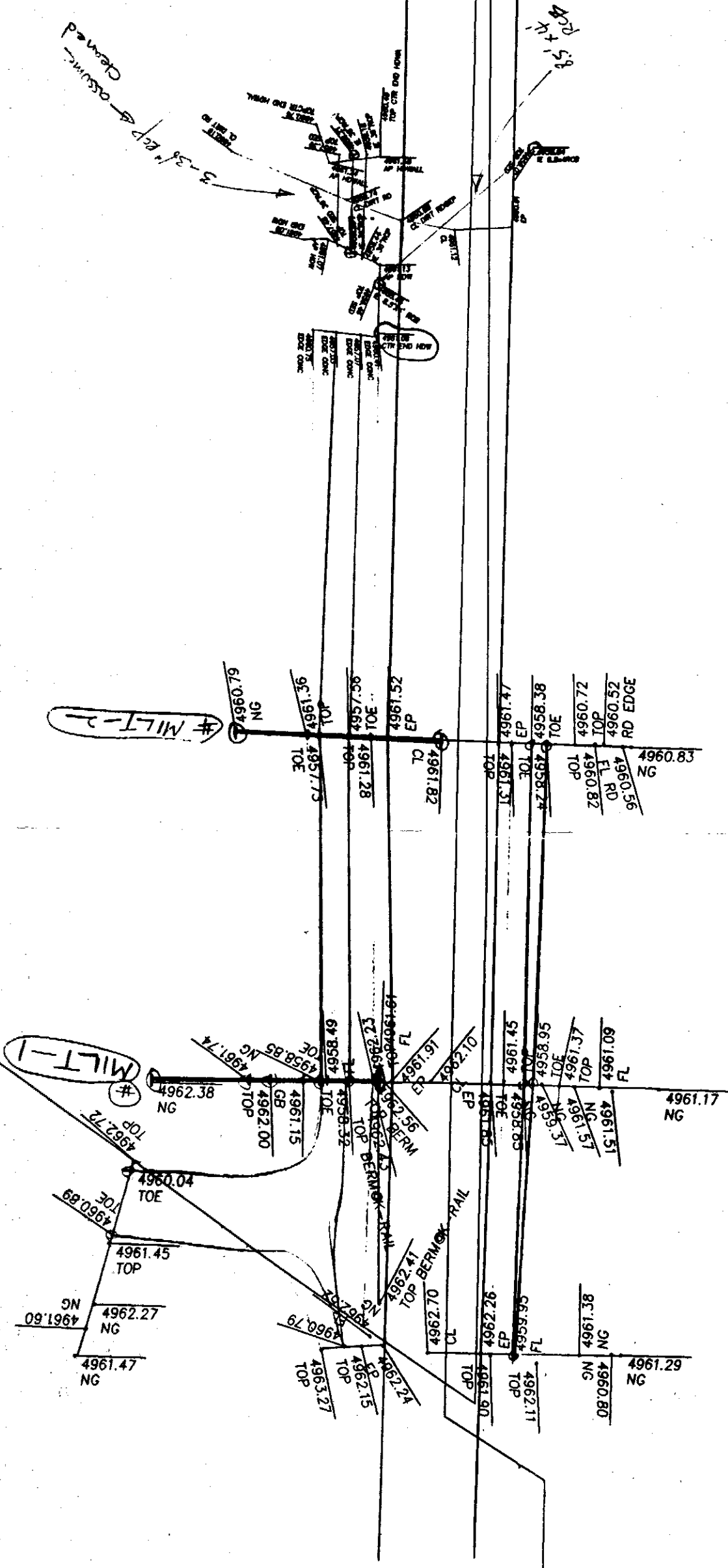
PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater (ft)<br>Inlet Control | Normal Depth<br>Outlet Control | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|---------------------------------|--------------------------------|------------------------|-------------------------|--------------------------|
| 30.0               | 1.00                    | <u>2.29</u>                     | 2.66                           | 1.18                   | 1.62                    | 6.26                     |
| 40.0               | 1.00                    | 2.72                            | 2.90                           | 1.44                   | 1.89                    | 6.86                     |
| 50.0               | 1.00                    | 3.12                            | 3.16                           | 1.55                   | 2.12                    | 7.39                     |
| 60.0               | 1.00                    | 3.52                            | 3.44                           | 1.71                   | 2.33                    | 11.68                    |
| 70.0               | 2.00                    | 3.92                            | 3.75                           | 1.87                   | 2.53                    | 12.16                    |
| 80.0               | 2.00                    | <u>4.32</u>                     | 4.08                           | 2.02                   | 2.71                    | 12.56                    |
| 90.0               | 3.00                    | <u>4.79</u>                     | 4.43                           | 2.17                   | 2.88                    | 12.93                    |
| 100.0              | 3.00                    | <u>5.22</u>                     | 4.81                           | 2.31                   | 3.03                    | 13.27                    |
| 110.0              | 3.00                    | <u>5.73</u>                     | 5.22                           | 2.46                   | 3.17                    | 13.55                    |
| 120.0              | 3.00                    | 6.31                            | 5.65                           | 2.62                   | 3.30                    | 13.79                    |
| 130.0              | 3.00                    | 6.94                            | 6.10                           | 2.77                   | 3.41                    | 14.00                    |
| 140.0              | 3.00                    | 7.62                            | 6.58                           | 2.97                   | 3.51                    | 14.00                    |
| 150.0              | 3.00                    | 8.35                            | 7.09                           | 3.06                   | 3.60                    | 14.53                    |

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Milton Road  
& dammed  
ML1, ML2,  
ML3





PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

May 3, 1999  
24" CMP UNDER MILITARY ROAD  
IE = 4950.02' APPROX. AVAIL. HEAD = 3' to top of road.

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 2.00 ✓   |
| FIWA Chart Number (1,2 or 3).....                     | 2 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0240 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 61.0 ✓   |
| Culvert Slope (feet per foot).....                    | 0.0120 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth<br>(ft) | Headwater<br>Inlet Control<br>Depth<br>(ft) | Headwater<br>Outlet Control<br>Depth<br>(ft) | Normal Depth<br>(ft) | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|----------------------------|---------------------------------------------|----------------------------------------------|----------------------|------------------------|-------------------------|--------------------------|
| 10.0               | 1.00                       | 1.67                                        | 1.47                                         | 1.29                 | 1.13                   | 1.29                    | 4.68                     |
| 20.0               | 1.00                       | 2.92                                        | 3.63                                         | 2.00                 | 1.61                   | 1.61                    | 7.40                     |
| 30.0               | 1.00                       | 4.84                                        | 6.96                                         | 2.00                 | 1.86                   | 1.86                    | 9.84                     |
| 30.0               | 2.00                       | 4.84                                        | 7.03                                         | 2.00                 | 1.86                   | 2.00                    | 9.55                     |
| 40.0               | 2.00                       | 7.52                                        | 11.51                                        | 2.00                 | 1.95                   | 2.00                    | 12.73                    |

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Basin ML2

PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

May 3, 1999

3 - 36" RCP - DITCH ON EASTSIDE OF MILITARY ROAD

APPROX. HALFWAY BETWEEN CP ML1

AND CP ML3

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Diameter (feet).....                          | 3.00   |
| FIWA Chart Number (1,2 or 3).....                     | 1      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 33.0   |
| Culvert Slope (feet per foot).....                    | 0.0150 |

$$NV \approx 4.947.9'$$

$$N_{avail} \approx 3.6' \pm$$

PROGRAM RESULTS:

| Flow Rate (cfs) | Tailwater Depth (ft) | Headwater (ft) | Normal Depth (ft) | Critical Depth (ft) | Depth at Outlet (ft) | Outlet Velocity (fps) |
|-----------------|----------------------|----------------|-------------------|---------------------|----------------------|-----------------------|
| 20.0            | 1.00                 | 2.07           | 1.94              | 1.01                | 1.43                 | 1.01                  |
| 30.0            | 1.00                 | 2.69           | 2.38              | 1.26                | 1.77                 | 1.26                  |
| 40.0            | 1.00                 | 3.30           | 2.90              | 1.48                | 2.06                 | 1.48                  |
| 50.0            | 2.00                 | 4.00           | 3.51              | 1.69                | 2.30                 | 1.69                  |
| 45.0            | 2.00                 | 3.70           | 3.19              | 1.59                | 2.19                 | 1.59                  |

3 - 36" RCP

$$45 \times 3 = 135 \text{ cfs}$$

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∴ assume 135 cfs will stay in the roadside ditch along the east-side of Military Road.

Flows in excess of 135 cfs will

Sheet flow east to Lemmon Lake



Stantech  
Consulting

# STANTECH CONSULTING INC.

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Sparks, NV 89431-6092

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Fax: 358-6954

JOB NO. 2600203

SHEET OF

PROJECT Stead Drainage Master Plan

DATE 7/23/99

SUBJECT Moya Detention Basin

DESIGNED JS

CHECKED

100 - Year, 24 - hour Ponding WSEL from  
Silver Lake  $\approx 68.7' \pm$  ✓, NAVD

→ Need to recalculate the culvert discharge Rating

Outlet ①  $\Rightarrow$  36" RCP, I.E. = 65.15' ✓  
T.W. = ( 3.7' ) Outlet I.E. = 64.98' ✓

Outlet ②  $\Rightarrow$  30" RCP, I.E. = 64.95' ✓  
T.W. = ( 4.5' ) Outlet I.E. = 64.19' ✓

Use Tailwater elev  $\approx$  Silver Lake 100-Year  
WSEL  
 $\approx 68.7'$

☆ < 100-Year, 24-hour event only > ☆

| Elev.  | Q <sub>36" RCP</sub> | Q <sub>30" RCP</sub> | Q <sub>Round</sub> | Q <sub>total</sub> |
|--------|----------------------|----------------------|--------------------|--------------------|
| 65 ✓   | 0 ✓                  | 0 ✓                  | 0 ✓                | 0 ✓                |
| 66 ✓   | 0 ✓                  | 0 ✓                  | 0 ✓                | 0 ✓                |
| 68 ✓   | 0 ✓                  | 0 ✓                  | 0 ✓                | 0 ✓                |
| 70 ✓   | 42 ✓                 | 19 ✓                 | 0 ✓                | 61 ✓               |
| 71 ✓   | 56 ✓                 | 25 ✓                 | 77 ✓               | 158 ✓              |
| 71.4 ✓ | 60 ✓                 | 27 ✓                 | 839 ✓              | 926 ✓              |

\* apply for only 100-year  
storm.

PIPE CULVERT ANALYSIS ✓  
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 13, 1999  
Stead Master Plan ✓  
Moya Detention Basin ✓  
Northern Outlet Culvert 36" rcp ✓

Invert = 65.15'

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 3.00 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 1 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 130.0 ✓  |
| Culvert Slope (feet per foot).....                    | 0.0013 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater<br>Inlet Control<br>Depth (ft) | Normal<br>Outlet Control<br>Depth (ft) | Critical<br>Depth (ft) | Depth at<br>Outlet (ft) | Outlet<br>Velocity<br>(fps) |      |
|--------------------|-------------------------|------------------------------------------|----------------------------------------|------------------------|-------------------------|-----------------------------|------|
| 5.0                | 3.70                    | 0.95                                     | 3.55                                   | 0.93                   | 0.70                    | 3.00                        | 0.71 |
| 7.0                | 3.70                    | 1.14                                     | 3.57                                   | 1.11                   | 0.83                    | 3.00                        | 0.99 |
| 10.0               | 3.70                    | 1.38                                     | 3.61                                   | 1.35                   | 1.00                    | 3.00                        | 1.41 |
| 12.0               | 3.70                    | 1.53                                     | 3.64                                   | 1.50                   | 1.10                    | 3.00                        | 1.70 |
| 15.0               | 3.70                    | 1.74                                     | 3.70                                   | 1.71                   | 1.23                    | 3.00                        | 2.12 |
| 18.0               | 3.70                    | 1.94                                     | 3.78                                   | 1.94                   | 1.36                    | 3.00                        | 2.55 |
| 20.0               | 3.70                    | 2.07                                     | 3.83                                   | 2.09                   | 1.43                    | 3.00                        | 2.83 |
| 24.0               | 3.70                    | 2.32                                     | 3.97                                   | 2.45                   | 1.58                    | 3.00                        | 3.40 |
| 28.0               | 3.70                    | 2.57                                     | 4.12                                   | 3.00                   | 1.71                    | 3.00                        | 3.96 |
| 32.0               | 3.70                    | 2.81                                     | 4.31                                   | 3.00                   | 1.83                    | 3.00                        | 4.53 |
| 36.0               | 3.70                    | 3.05                                     | 4.51                                   | 3.00                   | 1.95                    | 3.00                        | 5.09 |
| 40.0               | 3.70                    | 3.30                                     | 4.74                                   | 3.00                   | 2.06                    | 3.00                        | 5.66 |
| 44.0               | 3.70                    | 3.61                                     | 5.00                                   | 3.00                   | 2.16                    | 3.00                        | 6.22 |
| 48.0               | 3.70                    | 3.89                                     | 5.27                                   | 3.00                   | 2.26                    | 3.00                        | 6.79 |
| 52.0               | 3.70                    | 4.16                                     | 5.58                                   | 3.00                   | 2.34                    | 3.00                        | 7.36 |
| 56.0               | 3.70                    | 4.51                                     | 5.90                                   | 3.00                   | 2.43                    | 3.00                        | 7.92 |
| 60.0               | 3.70                    | 4.88                                     | 6.26                                   | 3.00                   | 2.50                    | 3.00                        | 8.49 |
| 64.0               | 3.70                    | 5.27                                     | 6.63                                   | 3.00                   | 2.57                    | 3.00                        | 9.05 |
| 68.0               | 3.70                    | 5.69                                     | 7.03                                   | 3.00                   | 2.63                    | 3.00                        | 9.62 |

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\* apply to only 100-year  
storm

PIPE CULVERT ANALYSIS ✓  
COMPUTATION OF CULVERT PERFORMANCE CURVE ✓

August 13, 1999  
Stead Master Plan ✓  
Moya Detention Basin ✓  
Southern Outlet culvert 30" rcp ✓

Invert  $\approx 64.95'$

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 2.50 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 1 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 450.0 ✓  |
| Culvert Slope (feet per foot).....                    | 0.0017 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater<br>Inlet Control<br>(ft) | Normal Depth<br>Outlet Control<br>(ft) | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |      |
|--------------------|-------------------------|------------------------------------|----------------------------------------|------------------------|-------------------------|--------------------------|------|
| 5.0                | 4.50                    | 1.01                               | 3.83                                   | 0.93                   | 0.74                    | 2.50                     | 1.02 |
| 10.0               | 4.50                    | 1.50                               | 4.10                                   | 1.38                   | 1.06                    | 2.50                     | 2.04 |
| 14.0               | 4.50                    | 1.83                               | 4.45                                   | 1.73                   | 1.26                    | 2.50                     | 2.85 |
| 18.0               | 4.50                    | 2.16                               | 4.91                                   | 2.24                   | 1.44                    | 2.50                     | 3.67 |
| 22.0               | 4.50                    | 2.48                               | 5.49                                   | 2.50                   | 1.59                    | 2.50                     | 4.48 |
| 26.0               | 4.50                    | 2.80                               | 6.19                                   | 2.50                   | 1.74                    | 2.50                     | 5.30 |
| 30.0               | 4.50                    | 3.21                               | 7.00                                   | 2.50                   | 1.87                    | 2.50                     | 6.11 |

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# Moya Detention Basin

Northern inlet: 36" RCP IE= 65.15

Southern inlet: 30" RCP IE= 64.95

| Elevation | H <sub>36</sub> | Q <sub>36</sub> | H <sub>30</sub> | Q <sub>30</sub> | Q <sub>road</sub>    | Q <sub>total</sub>   |
|-----------|-----------------|-----------------|-----------------|-----------------|----------------------|----------------------|
| 65.0      | 0.00 ✓          | 0 ✓             | 0.05 ✓          | 0 ✓             | 0 ✓                  | 0 ✓                  |
| 66.0      | 0.85 ✓          | 0 ✓             | 1.05 ✓          | 5 ✓             | 0                    | 5 ✓                  |
| 67.0      | 1.85 ✓          | 8 ✓             | 2.05 ✓          | 15 ✓            | 0                    | 23 ✓                 |
| 68.0      | 2.85 ✓          | 29 ✓            | 3.05 ✓          | 22 ✓            | 0                    | 51 ✓                 |
| 69.0      | 3.85 ✓          | 43 ✓            | 4.05 ✓          | 27 ✓            | 0                    | 70 ✓                 |
| 70.0      | 4.85 ✓          | 55 ✓            | 5.05 ✓          | 31 ✓            | 0 ✓                  | 86 ✓                 |
| 70.8      | 5.65 ✓          | 63 ✓            | 5.85 ✓          | 34 ✓            | 1 ✓                  | 98 ✓                 |
| 70.9      | 5.75 ✓          | 64 ✓            | 5.95 ✓          | 35 ✓            | <del>10</del> 22 ✓   | <del>117</del> 121 ✓ |
| 71.0      | 5.85 ✓          | 65 ✓            | 6.05 ✓          | 35 ✓            | <del>65</del> 77 ✓   | <del>165</del> 177 ✓ |
| 71.1      | 5.95 ✓          | 66 ✓            | 6.15 ✓          | 35 ✓            | <del>150</del> 177 ✓ | <del>254</del> 280 ✓ |
| 71.2      | 6.05 ✓          | 67 ✓            | 6.25 ✓          | 36 ✓            | <del>282</del> 335 ✓ | <del>385</del> 438 ✓ |
| 71.3      | 6.15 ✓          | 68 ✓            | 6.35 ✓          | 36 ✓            | <del>466</del> 552 ✓ | <del>570</del> 656 ✓ |
| 71.4      | 6.25 ✓          | 69 ✓            | 6.45 ✓          | 36 ✓            | <del>707</del> 839 ✓ | <del>842</del> 944 ✓ |

Detention Stage / storage / Q Rating

|           |      |        |        |        |         |         |
|-----------|------|--------|--------|--------|---------|---------|
| Area (Ac) | 0 ✓  | 51.2 ✓ | 59.1 ✓ | 72.6 ✓ | 120.9 ✓ | 140.2 ✓ |
| Elev      | 65 ✓ | 66 ✓   | 68 ✓   | 70 ✓   | 71 ✓    | 71.4 ✓  |
| Q (cfs)   | 0 ✓  | 5 ✓    | 51 ✓   | 86 ✓   | 177 ✓   | 944 ✓   |

Rating O.K. for  
5-year storm.

SOQ needs to be modified for a  
100-year storm.

WEIR FLOW COMPUTATIONS

## Moyn Blvd Profile

FILENAME: moya-cl.SEC

Encroachment Stations..Left:                      Right.....:                      Weir Coef: 2.900

| No. | Elev.  | Sta. | No. | Elev.  | Sta. | No. | Elev.  | Sta. |
|-----|--------|------|-----|--------|------|-----|--------|------|
| 1   | 100.00 | 100  | 2   | 100.00 | 100  | 3   | 100.00 | 100  |
| 4   | 100.00 | 100  | 5   | 100.00 | 100  | 6   | 100.00 | 100  |
| 7   | 100.00 | 100  | 8   | 100.00 | 100  | 9   | 100.00 | 100  |
| 10  | 100.00 | 100  | 11  | 100.00 | 100  | 12  | 100.00 | 100  |
| 13  | 100.00 | 100  | 14  | 100.00 | 100  | 15  | 100.00 | 100  |
| 16  | 100.00 | 100  | 17  | 100.00 | 100  | 18  | 100.00 | 100  |
| 19  | 100.00 | 100  | 20  | 100.00 | 100  | 21  | 100.00 | 100  |
| 22  | 100.00 | 100  | 23  | 100.00 | 100  | 24  | 100.00 | 100  |
| 25  | 100.00 | 100  | 26  | 100.00 | 100  | 27  | 100.00 | 100  |
| 28  | 100.00 | 100  | 29  | 100.00 | 100  | 30  | 100.00 | 100  |
| 31  | 100.00 | 100  | 32  | 100.00 | 100  | 33  | 100.00 | 100  |
| 34  | 100.00 | 100  | 35  | 100.00 | 100  | 36  | 100.00 | 100  |
| 37  | 100.00 | 100  | 38  | 100.00 | 100  | 39  | 100.00 | 100  |
| 40  | 100.00 | 100  | 41  | 100.00 | 100  | 42  | 100.00 | 100  |
| 43  | 100.00 | 100  | 44  | 100.00 | 100  | 45  | 100.00 | 100  |
| 46  | 100.00 | 100  | 47  | 100.00 | 100  | 48  | 100.00 | 100  |
| 49  | 100.00 | 100  | 50  | 100.00 | 100  | 51  | 100.00 | 100  |
| 52  | 100.00 | 100  | 53  | 100.00 | 100  | 54  | 100.00 | 100  |
| 55  | 100.00 | 100  | 56  | 100.00 | 100  | 57  | 100.00 | 100  |
| 58  | 100.00 | 100  | 59  | 100.00 | 100  | 60  | 100.00 | 100  |
| 61  | 100.00 | 100  | 62  | 100.00 | 100  | 63  | 100.00 | 100  |
| 64  | 100.00 | 100  | 65  | 100.00 | 100  | 66  | 100.00 | 100  |
| 67  | 100.00 | 100  | 68  | 100.00 | 100  | 69  | 100.00 | 100  |
| 70  | 100.00 | 100  | 71  | 100.00 | 100  | 72  | 100.00 | 100  |
| 73  | 100.00 | 100  | 74  | 100.00 | 100  | 75  | 100.00 | 100  |
| 76  | 100.00 | 100  | 77  | 100.00 | 100  | 78  | 100.00 | 100  |
| 79  | 100.00 | 100  | 80  | 100.00 | 100  | 81  | 100.00 | 100  |
| 82  | 100.00 | 100  | 83  | 100.00 | 100  | 84  | 100.00 | 100  |
| 85  | 100.00 | 100  | 86  | 100.00 | 100  | 87  | 100.00 | 100  |
| 88  | 100.00 | 100  | 89  | 100.00 | 100  | 90  | 100.00 | 100  |
| 91  | 100.00 | 100  | 92  | 100.00 | 100  | 93  | 100.00 | 100  |
| 94  | 100.00 | 100  | 95  | 100.00 | 100  | 96  | 100.00 | 100  |
| 97  | 100.00 | 100  | 98  | 100.00 | 100  | 99  | 100.00 | 100  |
| 100 | 100.00 | 100  | 101 | 100.00 | 100  | 102 | 100.00 | 100  |
| 103 | 100.00 | 100  | 104 | 100.00 | 100  | 105 | 100.00 | 100  |
| 106 | 100.00 | 100  | 107 | 100.00 | 100  | 108 | 100.00 | 100  |
| 109 | 100.00 | 100  | 110 | 100.00 | 100  | 111 | 100.00 | 100  |
| 112 | 100.00 | 100  | 113 | 100.00 | 100  | 114 | 100.00 | 100  |
| 115 | 100.00 | 100  | 116 | 100.00 | 100  | 117 | 100.00 | 100  |
| 118 | 100.00 | 100  | 119 | 100.00 | 100  | 120 | 100.00 | 100  |
| 121 | 100.00 | 100  | 122 | 100.00 | 100  | 123 | 100.00 | 100  |
| 124 | 100.00 | 100  | 125 | 100.00 | 100  | 126 | 100.00 | 100  |
| 127 | 100.00 | 100  | 128 | 100    |      |     |        |      |

|    |         |           |    |         |           |    |         |           |
|----|---------|-----------|----|---------|-----------|----|---------|-----------|
| 1) | 72.25 ✓ | 570.00 ✓  | 2) | 70.75 ✓ | 970.00 ✓  | 3) | 72.25 ✓ | 1370.00 ✓ |
| 4) | 70.75 ✓ | 1770.00 ✓ | 5) | 72.25 ✓ | 2170.00 ✓ | 6) | 70.75 ✓ | 2570.00 ✓ |
| 7) | 72.65 ✓ | 3070.00 ✓ | 8) | 70.75 ✓ | 3570.00 ✓ | 9) | 72.65 ✓ | 4070.00 ✓ |

[illegible]

|       |       |      |      |        |       |
|-------|-------|------|------|--------|-------|
| 70.90 | 21.5  | 0.15 | 0.08 | 318.4  | 23.9  |
| 71.00 | 77.0  | 0.25 | 0.13 | 530.7  | 66.3  |
| 71.10 | 178.5 | 0.35 | 0.17 | 743.0  | 130.0 |
| 71.20 | 334.5 | 0.45 | 0.22 | 955.3  | 214.9 |
| 71.30 | 552.4 | 0.55 | 0.28 | 1167.6 | 321.1 |
| 71.40 | 838.8 | 0.65 | 0.33 | 1379.8 | 448.4 |

**NOTES:**

PIPE CULVERT ANALYSIS ✓  
COMPUTATION OF CULVERT PERFORMANCE CURVE

May 4, 1999  
Stead Master Plan  
Moya Detention Basin  
Northern outlet culvert 36" RCP

I.E. ≈ 65.15'

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 3.00 ✓   |
| FIWA Chart Number (1,2 or 3).....                     | 1 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 130.0 ✓  |
| Culvert Slope (feet per foot).....                    | 0.0013 ✓ |

Culvert info  
from  
Moya Blvd plan  
dated 8/90  
by SEA

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater Depth<br>(ft) | Inlet Control<br>(ft) | Outlet Control<br>(ft) | Normal Depth<br>(ft) | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|-----------------------|------------------------|----------------------|------------------------|-------------------------|--------------------------|
| 8.0                | 0.80 ✓                  | 1.23                  | 1.83                   | 1.19                 | 0.89                   | 0.89                    | 4.54                     |
| 29.0               | 1.50 ✓                  | 2.63                  | 2.84                   | 3.00                 | 1.74                   | 1.74                    | 6.81                     |
| 43.0               | 1.85 ✓                  | 3.50                  | 3.80                   | 3.00                 | 2.14                   | 2.14                    | 7.99                     |
| 44.0               | 1.85 ✓                  | 3.61                  | 3.88                   | 3.00                 | 2.16                   | 2.16                    | 8.07                     |
| 55.0               | 2.05 ✓                  | 4.42                  | 4.82                   | 3.00                 | 2.41                   | 2.41                    | 9.05                     |
| 63.0               | 2.20 ✓                  | 5.17                  | 5.61                   | 3.00                 | 2.55                   | 2.55                    | 9.83                     |
| 64.0               | 2.20 ✓                  | 5.27                  | 5.72                   | 3.00                 | 2.57                   | 2.57                    | 9.93                     |
| 65.0               | 2.20 ✓                  | 5.38                  | 5.82                   | 3.00                 | 2.59                   | 2.59                    | 10.03                    |
| 66.0               | 2.25 ✓                  | 5.48                  | 5.93                   | 3.00                 | 2.60                   | 2.60                    | 10.14                    |
| 67.0               | 2.25 ✓                  | 5.59                  | 6.04                   | 3.00                 | 2.62                   | 2.62                    | 10.25                    |
| 68.0               | 2.30 ✓                  | 5.69                  | 6.15                   | 3.00                 | 2.63                   | 2.63                    | 10.35                    |
| 69.0               | 2.30 ✓                  | 5.80                  | 6.26                   | 3.00                 | 2.64                   | 2.64                    | 10.46                    |

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Tailwater  
Depth from  
Trap channel Rating

TRAPEZOIDAL CHANNEL ANALYSIS  
RATING CURVE COMPUTATION

May 4, 1999  
Stead Master Plan  
Moya Detention Basin  
Outlet channel tailwater

$$IE = 64.95'$$

PROGRAM INPUT DATA:

| DESCRIPTION                                              | VALUE  |
|----------------------------------------------------------|--------|
| Channel Bottom Slope (feet per foot).....                | 0.0017 |
| Manning's Roughness Coefficient (n-value).....           | 0.0300 |
| Channel Side Slope - Left Side (horizontal/vertical).... | 3.00   |
| Channel Side Slope - Right Side (horizontal/vertical)... | 3.00   |
| Channel Bottom Width (feet).....                         | 5.0    |

channel info  
from SEA's  
Moya End Plan

PROGRAM RESULTS:

| Depth<br>(ft) | Flow Rate<br>(cfs) | Velocity<br>(fps) | Froude<br>Number | Velocity<br>Head(ft) | Energy<br>Head(ft) | Flow Area<br>(sq ft) | Top Width<br>(ft) |
|---------------|--------------------|-------------------|------------------|----------------------|--------------------|----------------------|-------------------|
| 0.8           | 8.5                | 1.43              | 0.325            | 0.032                | 0.832              | 5.9                  | 9.8               |
| 1.0           | 13.0               | 1.62              | 0.335            | 0.041                | 1.041              | 8.0                  | 11.0              |
| 1.5           | 28.8               | 2.02              | 0.353            | 0.063                | 1.563              | 14.2                 | 14.0              |
| 1.6           | 32.8               | 2.09              | 0.356            | 0.068                | 1.668              | 15.7                 | 14.6              |
| 1.7           | 37.1               | 2.16              | 0.359            | 0.073                | 1.773              | 17.2                 | 15.2              |
| 1.8           | 41.8               | 2.23              | 0.361            | 0.077                | 1.877              | 18.7                 | 15.8              |
| 1.9           | 46.7               | 2.30              | 0.364            | 0.082                | 1.982              | 20.3                 | 16.4              |
| 2.0           | 52.0               | 2.37              | 0.366            | 0.087                | 2.087              | 22.0                 | 17.0              |
| 2.1           | 57.7               | 2.43              | 0.369            | 0.092                | 2.192              | 23.7                 | 17.6              |
| 2.2           | 63.6               | 2.49              | 0.371            | 0.097                | 2.297              | 25.5                 | 18.2              |
| 2.3           | 70.0               | 2.56              | 0.373            | 0.101                | 2.401              | 27.4                 | 18.8              |
| 2.4           | 76.6               | 2.62              | 0.375            | 0.106                | 2.506              | 29.3                 | 19.4              |
| 2.5           | 83.7               | 2.68              | 0.378            | 0.111                | 2.611              | 31.3                 | 20.0              |
| 2.6           | 91.1               | 2.74              | 0.380            | 0.116                | 2.716              | 33.3                 | 20.6              |

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.3 (c) 1986  
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(713) 440-3787. A manual with equations & flow chart is available.

Approx tailwater depths for 36"  
DCP northern outlet culvert  
rating.



PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

May 4, 1999  
Stead Master Plan  
Moya Detention Basin  
Southern outlet culvert

30" RCP ✓

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 2.50 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 1 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 450.0 ✓  |
| Culvert Slope (feet per foot).....                    | 0.0017 ✓ |

Current info  
from SEA's  
Moya Blvd Plan  
dated 8/90.

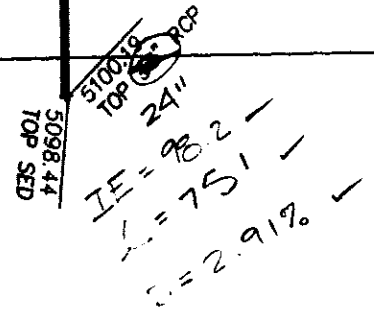
PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater<br>Inlet Control<br>Depth (ft) | Normal<br>Outlet Control<br>Depth (ft) | Critical<br>Depth (ft) | Depth at<br>Outlet<br>(ft) | Outlet<br>Velocity<br>(fps) |
|--------------------|-------------------------|------------------------------------------|----------------------------------------|------------------------|----------------------------|-----------------------------|
| 5.0                | 0.00                    | 1.01                                     | 0.94                                   | 0.93                   | 0.93                       | 3.00                        |
| 15.0               | 0.00                    | 1.92                                     | 1.95                                   | 1.83                   | 1.31                       | 5.78                        |
| 22.0               | 0.00                    | 2.48                                     | 3.04                                   | 2.50                   | 1.59                       | 6.66                        |
| 27.0               | 0.00                    | 2.89                                     | 4.01                                   | 2.50                   | 1.77                       | 7.26                        |
| 31.0               | 0.00                    | 3.27                                     | 4.92                                   | 2.50                   | 1.90                       | 7.76                        |
| 34.0               | 0.00                    | 3.58                                     | 5.67                                   | 2.50                   | 1.98                       | 8.15                        |
| 35.0               | 0.00                    | 3.70                                     | 5.93                                   | 2.50                   | 2.01                       | 8.28                        |
| 36.0               | 0.00                    | 3.82                                     | 6.20                                   | 2.50                   | 2.03                       | 8.41                        |
| 37.0               | 0.00                    | 3.94                                     | 6.48                                   | 2.50                   | 2.06                       | 8.55                        |

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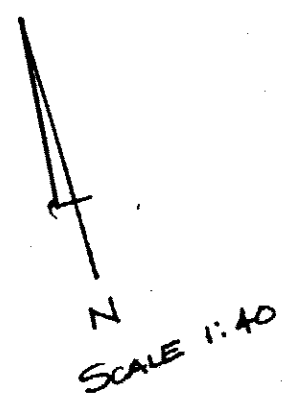
uses the depth @ outlet.

"CR" line 0 + 00  
0 to 1 + 00 - 4.6.75  
1 to 7 + 00 - 6.9.75



Red Rock

|         |       |
|---------|-------|
| 100.35✓ | 1000✓ |
| 100.96✓ | 1050✓ |
| 101.04✓ | 1058✓ |
| 101.41✓ | 1063✓ |



Intersection N. Virginia  
 & Red Rock Road

Stead Basin PA4  
(2) 24" CMP IE= 28.00

| Elevation | Q <sub>culv</sub> * | Q <sub>ditch</sub> | Q <sub>CL</sub> | Q <sub>total</sub> |
|-----------|---------------------|--------------------|-----------------|--------------------|
| 35.0 ✓    | 56 ✓                | 0 ✓                | 0 ✓             | 56 ✓               |
| 36.4      | <del>60</del> 62    | 65 ✓               | 0 ✓             | 125 127 ✓          |
| 36.5      | <del>60</del> 62    | 77 ✓               | 0 ✓             | 137 139 ✓          |
| 36.6      | <del>60</del> 62    | 90 ✓               | 2 ✓             | 152 154 ✓          |
| 36.7      | <del>62</del> 63    | 103 ✓              | 4 6 ✓           | 169 172 ✓          |
| 36.8      | <del>62</del> 64    | 118 ✓              | 8 11 ✓          | 189 193 ✓          |
| 36.9      | <del>62</del> 64    | 133 ✓              | 16 20 ✓         | 211 217 ✓          |

\* Ball pipe  
2-24" CMP

↑  
DQ

|    |    |     |      |      |      |      |      |      |
|----|----|-----|------|------|------|------|------|------|
| DI | 0' | 56' | 127' | 139' | 154' | 172' | 193' | 217' |
| DQ | 0' | 0'  | 65'  | 77'  | 90'  | 103' | 118' | 133' |

Diversion  
to  
Basin AW3

PIPE CULVERT ANALYSIS ✓  
COMPUTATION OF CULVERT PERFORMANCE CURVE

May 10, 1999  
2 -24" cnp beneath N. Virginia ✓  
capacity rating ✓

Basin PA4

App. INV = 28.0'

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 2.00 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 2 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 3 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0240 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.80 ✓   |
| Culvert Length (feet).....                            | 99.0 ✓   |
| Culvert Slope (feet per foot).....                    | 0.0260 ✓ |

PROGRAM RESULTS:

| Flow Rate (cfs) | Tailwater Depth (ft) | Headwater Inlet Control (ft) | Headwater Outlet Control (ft) | Normal Depth (ft) | Critical Depth (ft) | Depth at Outlet (ft) | Outlet Velocity (fps) |
|-----------------|----------------------|------------------------------|-------------------------------|-------------------|---------------------|----------------------|-----------------------|
| 25.0            | 2.00                 | 4.58                         | 5.29                          | 2.00              | 1.76                | 2.00                 | 7.96                  |
| 26.0            | 2.00                 | 4.87                         | 5.77                          | 2.00              | 1.79                | 2.00                 | 8.28                  |
| 27.0            | 2.00                 | 5.16                         | 6.27                          | 2.00              | 1.81                | 2.00                 | 8.59                  |
| 28.0            | 2.00                 | 5.47                         | 6.79                          | 2.00              | 1.83                | 2.00                 | 8.91                  |
| 29.0            | 2.00                 | 5.79                         | 7.32                          | 2.00              | 1.85                | 2.00                 | 9.23                  |
| 30.0            | 2.00                 | 6.12                         | 7.88                          | 2.00              | 1.86                | 2.00                 | 9.55                  |
| 31.0            | 2.00                 | 6.46                         | 8.45                          | 2.00              | 1.88                | 2.00                 | 9.87                  |
| 32.0            | 2.00                 | 6.82                         | 9.04                          | 2.00              | 1.89                | 2.00                 | 10.19                 |
| 33.0            | 2.00                 | 7.18                         | 9.65                          | 2.00              | 1.90                | 2.00                 | 10.50                 |
| 34.0            | 2.00                 | 7.56                         | 10.28                         | 2.00              | 1.91                | 2.00                 | 10.82                 |

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Project \_\_\_\_\_  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

PA4 just east of dual 24" CMP's  
beneath N Virginia

CROSS SECTION PARAMETERS:

FILENAME: PA45556.SEC

No. of Cross Section Points: 8 ~~Bed Slope 0-01250~~ Max Elev.: 38.87  
Bank Stations.....Left: 21.0 Right.....: 45.0 Min Elev.: 35.01  
Encroachment Stations..Left: 34.0 Right.....: 76.0 Weir Coef: 2.650 ✓

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta.    | No. | Elev.   | Sta.    | No. | Elev.   | Sta.    |
|-----|---------|---------|-----|---------|---------|-----|---------|---------|
| 1)  | 37.07 ✓ | 0.00 ✓  | 2)  | 34.60 ✓ | 5.50 ✓  | 3)  | 35.89 ✓ | 21.00 ✓ |
| 4)  | 36.40 ✓ | 34.00 ✓ | 5)  | 36.12 ✓ | 45.00 ✓ | 6)  | 35.01 ✓ | 62.50 ✓ |
| 7)  | 35.15 ✓ | 68.00 ✓ | 8)  | 30.87 ✓ | 76.00 ✓ |     |         |         |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H:max(ft) | H:ave(ft) | TW(ft) | A(sf) | $h_{weir}$ |
|----------|--------|-----------|-----------|--------|-------|------------|
| 36.40    | 65.2   | 1.39      | 0.68      | 36.7   | 25.1  | 8.4 ✓      |
| 36.50    | 76.9   | 1.49      | 0.78      | 36.9   | 28.8  | 8.5 ✓      |
| 36.60    | 89.6   | 1.59      | 0.87      | 37.1   | 32.5  | 8.6 ✓      |
| 36.70    | 103.3  | 1.69      | 0.97      | 37.3   | 36.2  | 8.7 ✓      |
| 36.80    | 117.8  | 1.79      | 1.06      | 37.5   | 39.9  | 8.8 ✓      |
| 36.90    | 133.1  | 1.89      | 1.16      | 37.8   | 43.7  | 8.9 ✓      |

NOTES:

Flow down south roadside  
ditch along N Virginia

Project Stead Master  
Project No. 2-DB  
Sheet No.      of       
Calculated by      Date     

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CP PA4 , Weir flow to PA6  
N. Virginia st E

CROSS SECTION PARAMETERS:

FILENAME: PA45553.SEC

No. of Cross Section Points: 3 ~~Bed Slope = 0.00040~~ Max Elev.: 38.16  
Bank Stations.....Left: 0.0 Right.....: 165.0 Min Elev.: 36.40  
Encroachment Stations..Left: 0.0 Right.....: 165.0 Weir Coef: 3.000 ✓

CROSS SECTION POINTS - Elevations & Stations in feet:

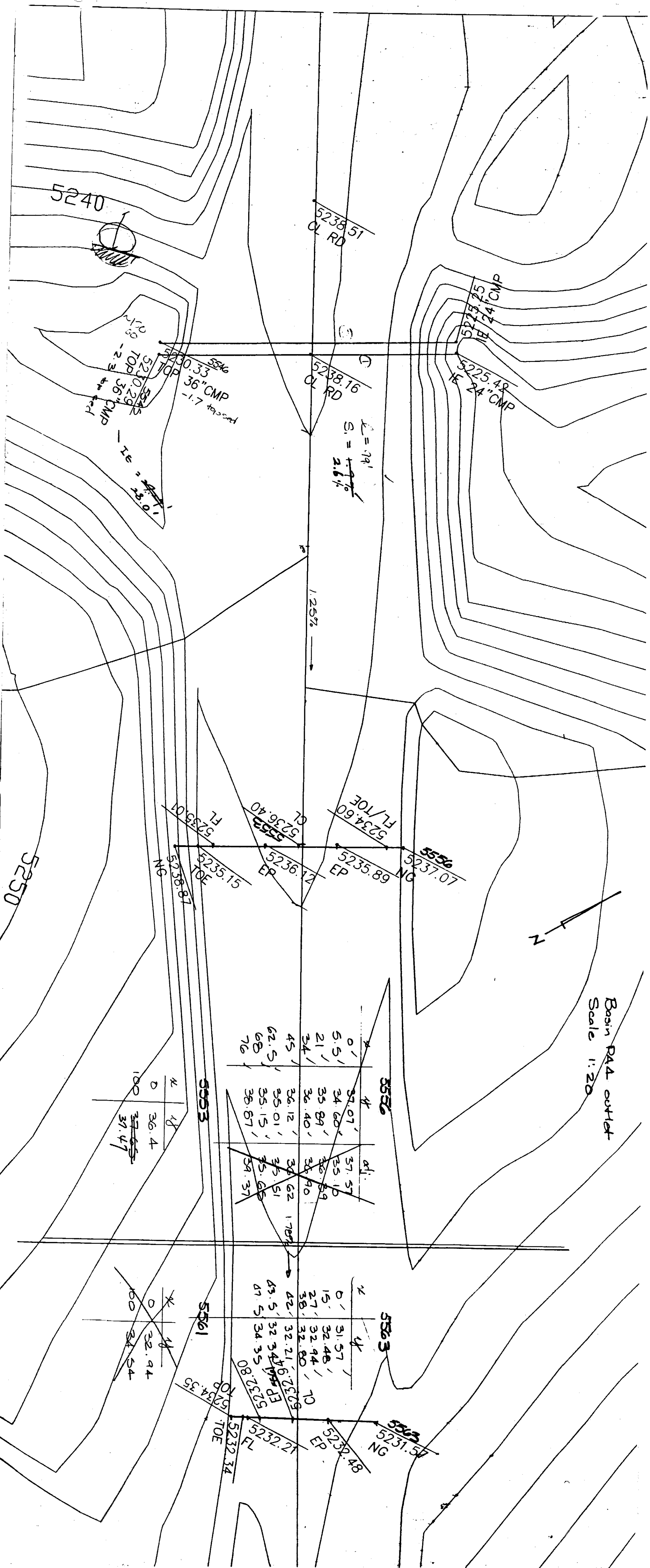
| No. | Elev.   | Sta. No. | Elev. | Sta. No. | Elev.    | Sta. |         |          |
|-----|---------|----------|-------|----------|----------|------|---------|----------|
| 1)  | 36.40 ✓ | 0.00 ✓   | 2)    | 37.47 ✓  | 100.00 ✓ | 3)   | 38.16 ✓ | 165.00 ✓ |

COMPUTED PARAMETERS:

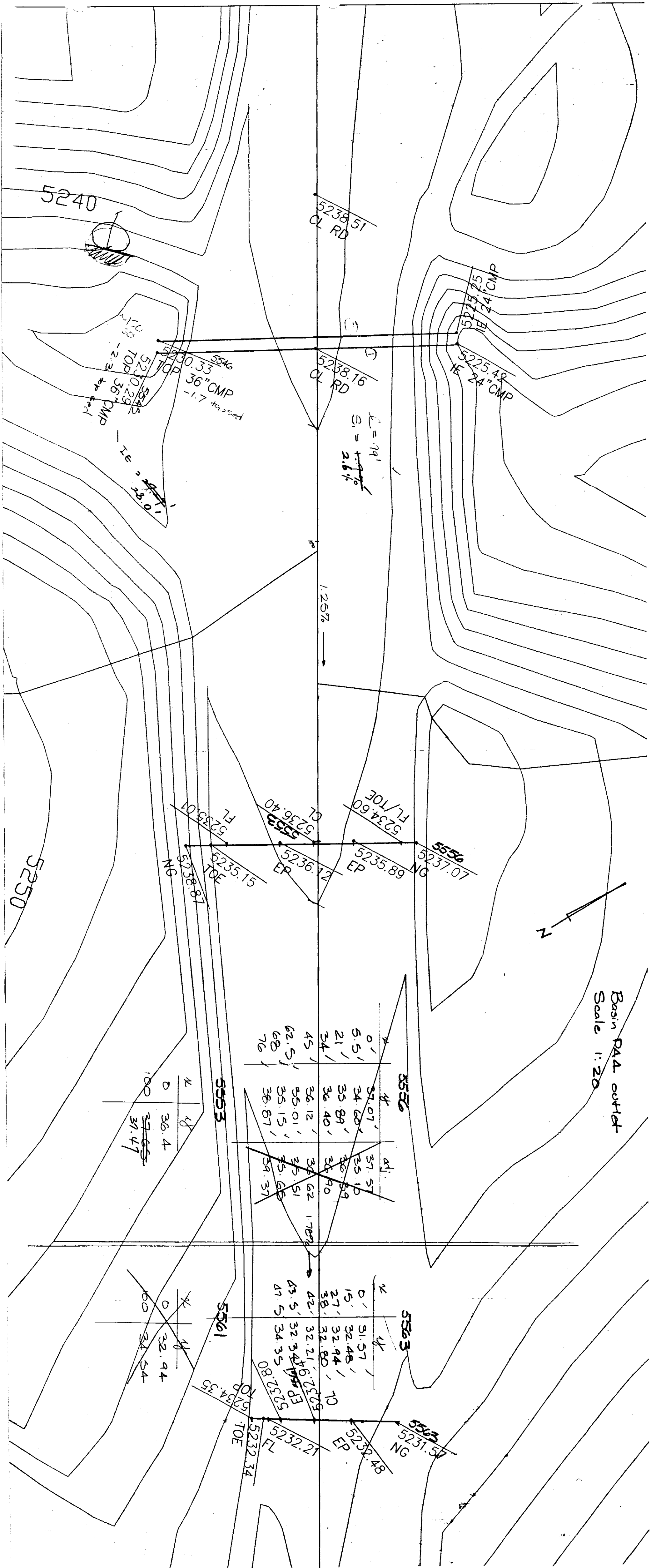
| WSEL(ft) | Q(cfs) | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) |
|----------|--------|------------|------------|--------|-------|
|----------|--------|------------|------------|--------|-------|

|       |      |      |      |      |      |
|-------|------|------|------|------|------|
| 36.50 | 0.4  | 0.10 | 0.05 | 9.3  | 0.5  |
| 36.60 | 2.0  | 0.20 | 0.10 | 18.7 | 1.9  |
| 36.70 | 5.5  | 0.30 | 0.15 | 28.0 | 4.2  |
| 36.80 | 11.3 | 0.40 | 0.20 | 37.4 | 7.5  |
| 36.90 | 19.8 | 0.50 | 0.25 | 46.7 | 11.7 |
| 37.00 | 31.3 | 0.60 | 0.30 | 56.1 | 16.8 |

NOTES:









Stead Basin PA6 ✓  
 36" RCP IE= 91.64 ✓

| Elevation | Q <sub>culv</sub> | Q <sub>road</sub> | Q <sub>total</sub> |
|-----------|-------------------|-------------------|--------------------|
| 95.4      | 52 ✓              | 0                 | 52 ✓               |
| 96.0      | 60 ✓              | 7 ✓               | 67 ✓               |
| 96.7      | 69 ✓              | 47 ✓              | 116 ✓              |
| 97.0      | 72 ✓              | 79 ✓              | 151 ✓              |
| 97.7      | 79 ✓              | 191 ✓             | 270 ✓              |

↑  
 DQ

|    |    |     |     |      |      |      |
|----|----|-----|-----|------|------|------|
| DI | 0' | 52' | 67' | 116' | 151' | 270' |
| DQ | 0' | 0'  | 7'  | 47'  | 79'  | 191' |

↘ Diversion to  
 Basin SRS

PIPE CULVERT ANALYSIS ✓  
COMPUTATION OF CULVERT PERFORMANCE CURVE

May 10, 1999 ✓  
Stead Basin PA6 ✓  
36" RCP beneath 395 ✓  
capacity rating ✓

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 3.00 ✓   |
| FIWA Chart Number (1,2 or 3).....                     | 1 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 3 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.80 ✓   |
| Culvert Length (feet).....                            | 218.0 ✓  |
| Culvert Slope (feet per foot).....                    | 0.0960 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater<br>Inlet Control<br>Depth (ft) | Normal<br>Outlet Control<br>Depth (ft) | Critical<br>Depth (ft) | Depth at<br>Outlet (ft) | Outlet<br>Velocity<br>(fps) |
|--------------------|-------------------------|------------------------------------------|----------------------------------------|------------------------|-------------------------|-----------------------------|
| 52.0               | 2.00                    | 3.77                                     | -15.43                                 | 1.03                   | 2.34                    | 1.03 24.27                  |
| 60.0               | 2.00                    | 4.34                                     | -14.41                                 | 1.10                   | 2.50                    | 1.10 25.41                  |
| 69.0               | 2.00                    | 5.08                                     | -13.12                                 | 1.19                   | 2.64                    | 1.19 26.29                  |
| 72.0               | 2.00                    | 5.35                                     | -12.66                                 | 1.22                   | 2.68                    | 1.22 26.58                  |
| 79.0               | 2.00                    | 6.02                                     | -11.52                                 | 1.29                   | 2.76                    | 1.29 27.25                  |

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Project Steady Master  
Project No. 2-08  
Sheet No.      of       
Calculated by      Date     

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

PA4 @ 30" 12CP beneath 395

CROSS SECTION PARAMETERS:

FILENAME: PA5540.SEC

No. of Cross Section Points: 5 ~~Bed Slope: 0.00010~~ Max Elev.: 97.70  
Bank Stations.....Left: 0.0 Right.....: 47.5 Min Elev.: 95.40  
Encroachment Stations..Left:      Right.....:      Weir Coef: 2.650

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta. No. | Elev. | Sta. No. | Elev.   | Sta. |         |         |
|-----|---------|----------|-------|----------|---------|------|---------|---------|
| 1)  | 97.70 ✓ | 0.00 ✓   | 2)    | 96.69 ✓  | 10.00 ✓ | 3)   | 95.40 ✓ | 23.50 ✓ |
| 4)  | 96.70 ✓ | 40.00 ✓  | 5)    | 97.70 ✓  | 47.50 ✓ |      |         |         |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H:max(ft) | H:ave(ft) | TW(ft) | A(sf) | $h_{m,weir}$ |
|----------|--------|-----------|-----------|--------|-------|--------------|
| 96.00    | 6.8    | 0.60      | 0.30      | 13.9   | 4.2   | 4.26 ✓       |
| 96.70    | 47.3   | 1.30      | 0.65      | 30.1   | 19.6  | 5.06 ✓       |
| 97.00    | 79.2   | 1.60      | 0.83      | 35.3   | 29.4  | 5.36 ✓       |
| 97.70    | 190.8  | 2.30      | 1.23      | 47.5   | 58.4  | 6.06 ✓       |

NOTES:

Basin DAB<sup>6</sup> outlet  
Scale 1:20

| N   | 18    |
|-----|-------|
| 0'  | 96.7' |
| 13' | 95.4' |
| 30' | 96.7' |

97.7

5540

5198.69

NG

5195.40

FL

5196.70

NG

5191.69

IE 36"

PCCP

97.7

98

$h = 3.76'$

5200

Loire = 218'  
Slope ~ 9.6%  
NDOT plans

Steady Basin PE1 ✓  
 24" CMP IE= 95.70 (SE outlet)

| Elevation | Q <sub>culv</sub> | Q <sub>road</sub> | Q <sub>rail</sub> | Q <sub>total</sub> |
|-----------|-------------------|-------------------|-------------------|--------------------|
| 100.5     | 30 ✓              | 0 ✓               | 0 ✓               | 30 ✓               |
| 102.5     | 37 ✓              | 1 ✓               | 0 ✓               | 38 ✓               |
| 103.0     | 39 ✓              | 6 ✓               | 0 ✓               | 45 ✓               |
| 103.5     | 41 ✓              | 20 ✓              | 0 ✓               | 61 ✓               |
| 104.0     | 42 ✓              | 41 ✓              | 36 ✓              | 119 ✓              |
| 104.5     | 44 ✓              | 68 ✓              | 193 ✓             | 305 ✓              |

↑  
DQ

|    |     |      |      |      |      |
|----|-----|------|------|------|------|
| DI | 0 ✓ | 30 ✓ | 38 ✓ | 45 ✓ | 61 ✓ |
| DQ | 0 ✓ | 0 ✓  | 1 ✓  | 6 ✓  | 20 ✓ |

Divert Flows to basin PE2

PE1 ~~PE1~~  
 Detention storage  
 into from  
 Sky Vista  
 Drainage Master  
 Plan

PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

January 11, 1999  
Stead basin PE1B ✓  
24" Railroad culvert (SE) ✓  
Rating capacity ✓

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 2.00 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 2 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0240 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 50.0 ✓   |
| Culvert Slope (feet per foot).....                    | 0.1020 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth<br>(ft) | Headwater<br>Inlet<br>Depth<br>(ft) | Normal<br>Outlet<br>Depth<br>Control<br>(ft) | Critical<br>Depth<br>(ft) | Depth<br>at<br>(ft) | Outlet<br>Velocity<br>(fps) |
|--------------------|----------------------------|-------------------------------------|----------------------------------------------|---------------------------|---------------------|-----------------------------|
| 30.0               | 0.00                       | 4.83                                | 1.94                                         | 1.28                      | 1.86                | 14.11                       |
| 37.0               | 0.00                       | 6.63                                | 4.63                                         | 1.55                      | 1.94                | 14.16                       |
| 39.0               | 0.00                       | 7.21                                | 5.50                                         | 1.64                      | 1.95                | 14.17                       |
| 41.0               | 0.00                       | 7.82                                | 6.41                                         | 1.74                      | 1.96                | 14.14                       |
| 42.0               | 0.00                       | 8.14                                | 6.88                                         | 1.83                      | 1.96                | 13.95                       |
| 44.0               | 0.00                       | 8.80                                | 7.86                                         | 2.00                      | 1.97                | 14.01                       |
| 45.0               | 0.00                       | 9.15                                | 8.37                                         | 2.00                      | 1.97                | 14.32                       |

← 102.5

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Project Stead Master  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Ditch Section / Diversion  
to Easin PE 2

CROSS SECTION PARAMETERS:

FILENAME: PE1ROAD.SEC

.CCP2

No. of Cross Section Points: 7 ~~Bed Slope: 0.00040~~ Max Elev.: 5.79

Bank Stations.....Left: 0.0 Right.....: 17.0 Min Elev.: 2.19

Encroachment Stations..Left: 0.0 Right.....: ✓ Weir Coef: 2.650 ✓

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.  | Sta. No. | Elev. | Sta. No. | Elev.   | Sta. |        |         |
|-----|--------|----------|-------|----------|---------|------|--------|---------|
| 1)  | 3.48 ✓ | 0.00 ✓   | 2)    | 2.78 ✓   | 0.10 ✓  | 3)   | 2.78 ✓ | 3.50 ✓  |
| 4)  | 2.19 ✓ | 6.00 ✓   | 5)    | 3.26 ✓   | 10.00 ✓ | 6)   | 3.81 ✓ | 10.50 ✓ |
| 7)  | 5.79 ✓ | 17.00 ✓  |       |          |         |      |        |         |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) |
|----------|--------|------------|------------|--------|-------|
| 2.50     | 0.5    | 0.31       | 0.15       | 2.5    | 0.4   |
| 3.00     | 5.8    | 0.81       | 0.36       | 9.0    | 3.3   |
| 3.50     | 20.1   | 1.31       | 0.80       | 10.2   | 8.1   |
| 4.00     | 40.9   | 1.81       | 1.21       | 11.1   | 13.4  |
| 4.50     | 67.8   | 2.31       | 1.52       | 12.8   | 19.4  |
| 5.00     | 101.3  | 2.81       | 1.82       | 14.4   | 26.2  |

NOTES:

Project Stead Master  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

R.R. Profile @ CP PE1B

CROSS SECTION PARAMETERS:

FILENAME: PE1RAIL.SEC

No. of Cross Section Points: 4 ~~Bed Slope: 0.00010~~ Max Elev.: 6.17  
Bank Stations.....Left: 0.0 Right....: 400.0 Min Elev.: 3.48  
Encroachment Stations..Left: 0.0 Right....: Weir Coef: 2.800

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.  | Sta. No. | Elev. | Sta. No. | Elev.    | Sta. |        |          |
|-----|--------|----------|-------|----------|----------|------|--------|----------|
| 1)  | 3.48 ✓ | 0.00 ✓   | 2)    | 4.83 ✓   | 221.00 ✓ | 3)   | 5.71 ✓ | 334.50 ✓ |
| 4)  | 6.17 ✓ | 400.00 ✓ |       |          |          |      |        |          |

COMPUTED PARAMETERS:

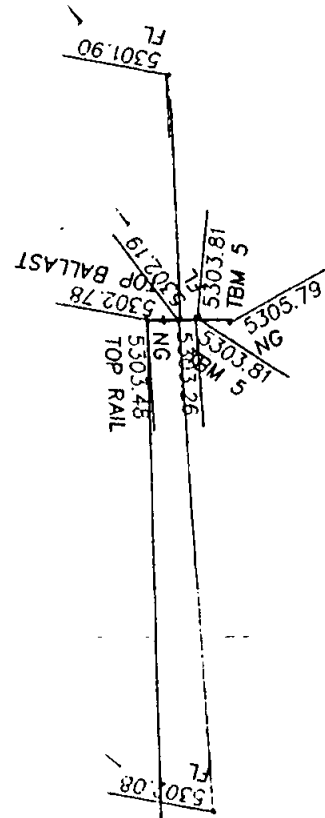
| WSEL(ft) | Q(cfs) | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) |
|----------|--------|------------|------------|--------|-------|
| 3.50     | 0.0    | 0.02       | 0.01       | 3.3    | 0.0   |
| 4.00     | 35.8   | 0.52       | 0.26       | 85.1   | 22.1  |
| 4.50     | 192.7  | 1.02       | 0.51       | 167.0  | 85.2  |
| 5.00     | 521.8  | 1.52       | 0.78       | 242.9  | 188.6 |

NOTES:



Miss  
Feb

SCALE 1:40



530483  
TOP RAIL

5305.71  
TOP RAIL

112750314.  
J. J. J. J. J.

10.7 ✓

0.18%

2

10



950 Industrial Way  
Sparks, NV 89431-6092  
(702) 358-6931  
Fax: 358-6954

SHEET OF

PROJECT Stead Master Plan DATE 5/10/99  
SUBJECT Split Rating @ CP PE2 DESIGNED \_\_\_\_\_ CHECKED \_\_\_\_\_

| Total   | Q Rail | Q Rail split to | PE3 | Q Rail | to ESB2 |
|---------|--------|-----------------|-----|--------|---------|
|         | 0      | 0               |     | 0      |         |
| @ 99.85 | 15     | 7               | ✓   | 8      | ✓       |
|         | 29     | 13              | ✓   | 16     | ✓       |
|         | 48     | 19              | ✓   | 29     | ✓       |
|         | 72     | 27              | ✓   | 45     | ✓       |
|         | 103    | 37              | ✓   | 66     | ✓       |

Total split flow to "PE2" =  $Q_{\text{rail}}$  split to PES  
 $\rightarrow Q_{\text{road}}$

| Elev. | Q <sub>conv.</sub> | Q <sub>road</sub> | Q <sub>weir</sub> | PE3 | Q <sub>weir</sub> | ES02 | Q <sub>total</sub> |
|-------|--------------------|-------------------|-------------------|-----|-------------------|------|--------------------|
| 97.3  | 26                 | 0                 |                   | 0   |                   | 0    | 26                 |
| 98.5  | 30                 | -                 |                   | -   |                   | -    | 30                 |
| 99.0  | 32                 | 7                 |                   | -   |                   | -    | 39                 |
| 99.5  | 34                 | 21                |                   | 7   |                   | 8    | 70                 |
| 99.6  | 34                 | 25                |                   | 13  |                   | 16   | 88                 |
| 99.7  | 34                 | 29                |                   | 19  |                   | 29   | 111                |
| 99.8  | 34                 | 33                |                   | 27  |                   | 45   | 139                |
| 99.9  | 35                 | 37                |                   | 37  |                   | 66   | 175                |

total split  
to PG3

| DI | 0 | 30 | 39 | 70 | 88 | 111 | 139 | 175 |
|----|---|----|----|----|----|-----|-----|-----|
| DQ | 0 | 0  | 7  | 28 | 38 | 48  | 60  | 74  |

split flow to PE3

Stead Basin PE2  
24" CMP IE= 92.72

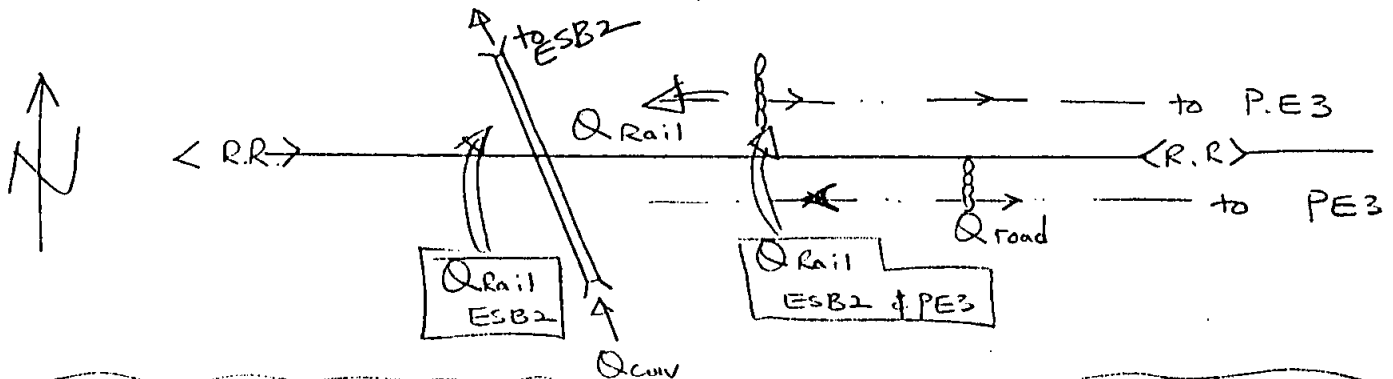
| Elevation | Q <sub>culv</sub> | Q <sub>road</sub> | Q <sub>rail</sub> | Q <sub>total</sub> |
|-----------|-------------------|-------------------|-------------------|--------------------|
| 97.3      | 26 25 ✓           | 0 ✓               | 0 ✓               | 25 26 ✓            |
| 98.5      | 29 30 ✓           | 0 ✓               | 0 ✓               | 29 30 ✓            |
| 99.0      | 31 32 ✓           | 7 ✓               | 0 ✓               | 38 39 ✓            |
| 99.5      | 32 34 ✓           | 21 ✓              | 16 15 ✓           | 69 70 ✓            |
| 99.6      | 33 34 ✓           | 25 ✓              | 30 29 ✓           | 88 ✓               |
| 99.7      | 33 34 ✓           | 29 ✓              | 50 48 ✓           | 112 111 ✓          |
| 99.8      | 33 34 ✓           | 33 ✓              | 76 72 ✓           | 142 139 ✓          |
| 99.9      | 34 35 ✓           | 37 ✓              | 108 103 ✓         | 179 175 ✓          |
| 100.0     | 34 35 ✓           | 41 ✓              | 147 140 ✓         | 222 216 ✓          |

↓  
to  
ESB2

↓  
to  
PE3

↓  
to  
ESB2  
+  
PE3

|                                |     |      |      |      |      |      |      |
|--------------------------------|-----|------|------|------|------|------|------|
| Total Q <sub>Rail</sub>        | 0'  | 15'  | 29'  | 48'  | 72'  | 103' | 140' |
| Rail flow to ESB2 + PE3        | 0   | 15 ✓ | 27 ✓ | 41 ✓ | 57 ✓ | 74 ✓ | 94 ✓ |
| Q <sub>Rail</sub> flow to ESB2 | 0 ✓ | 0 ✓  | 2 ✓  | 7 ✓  | 15 ✓ | 29 ✓ | 46 ✓ |



out of Q<sub>Rail</sub> ESB2 + PE3, Estimate split to Basin PE3

| Elev. | to PE3 | to ESB2 | total |
|-------|--------|---------|-------|
| 97.8  | 5 ✓    | 6 ✓     | 11 ✓  |
| 98.0  | 13 ✓   | 15 ✓    | 28 ✓  |
| 98.2  | 25 ✓   | 27 ✓    | 52 ✓  |
| 98.4  | 40 ✓   | 40 ✓    | 80 ✓  |
| 98.6  | 59 ✓   | 55 ✓    | 114 ✓ |

Project Stand Master  
Project No. 208  
Sheet No.      of       
Calculated by      Date     

**WEIR FLOW COMPUTATIONS**

LOCATION/DESCRIPTION:

@ CP PE2, RR Ditch  
Diversion channel to Basin "PE3"

CROSS SECTION PARAMETERS:

FILENAME: PE2ROAD.SEC

No. of Cross Section Points: 6 Bed-Slope: 0:00300 Max Elev.: 104.15  
Bank Stations.....Left: 0.0 Right.....: 17.0 Min Elev.: 98.29  
Encroachment Stations..Left: 0.0 Right.....: Weir Coef: 2.650

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta.   | No. | Elev.   | Sta.   | No. | Elev.    | Sta.    |
|-----|---------|--------|-----|---------|--------|-----|----------|---------|
| 1)  | 99.16 ✓ | 0.00 ✓ | 2)  | 98.51 ✓ | 0.10 ✓ | 3)  | 98.51 ✓  | 3.00 ✓  |
| 4)  | 98.29 ✓ | 5.50 ✓ | 5)  | 99.28 ✓ | 9.00 ✓ | 6)  | 104.15 ✓ | 17.00 ✓ |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H:max(ft) | H:ave(ft) | TW(ft) | A(sf) | Cover H(ft) |
|----------|--------|-----------|-----------|--------|-------|-------------|
| 99.00    | 7.3    | 0.71      | 0.48      | 8.0    | 3.8   | 6.3 ✓       |
| 99.50    | 21.4   | 1.21      | 0.88      | 9.4    | 8.2   | 6.8 ✓       |
| 99.60    | 24.9   | 1.31      | 0.96      | 9.5    | 9.2   | 6.9 ✓       |
| 99.70    | 28.6   | 1.41      | 1.05      | 9.7    | 10.1  | 7.0 ✓       |
| 99.80    | 32.6   | 1.51      | 1.13      | 9.9    | 11.1  | 7.1 ✓       |
| 99.90    | 36.8   | 1.61      | 1.21      | 10.0   | 12.1  | 7.2 ✓       |
| 100.00   | 41.2   |           |           |        |       | 7.3         |

NOTES:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PIPE CULVERT ANALYSIS ✓  
COMPUTATION OF CULVERT PERFORMANCE CURVE

May 10, 1999  
Stead Basin PE2 ✓  
24" railroad culvert ✓  
capacity rating ✓

Basin PES

Inlet inv = 92.7'

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 2.00 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 2 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 2 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0240 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.80 ✓   |
| Culvert Length (feet).....                            | 44.0 ✓   |
| Culvert Slope (feet per foot).....                    | 0.0740 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater<br>Inlet Control<br>Depth (ft) | Headwater<br>Outlet Control<br>Depth (ft) | Normal<br>Depth (ft) | Critical<br>Depth (ft) | Depth at<br>Outlet (ft) | Outlet<br>Velocity<br>(fps) |
|--------------------|-------------------------|------------------------------------------|-------------------------------------------|----------------------|------------------------|-------------------------|-----------------------------|
| 25.0               | 2.50                    | 4.42                                     | 2.84                                      | 1.29                 | 1.76                   | 1.29                    | 11.66                       |
| 29.0               | 2.50                    | 5.44                                     | 4.08                                      | 1.44                 | 1.85                   | 1.44                    | 11.95                       |
| 30.0               | 2.50                    | 5.71                                     | 4.42                                      | 1.48                 | 1.86                   | 1.48                    | 12.07                       |
| 31.0               | 2.50                    | 6.00                                     | 4.77                                      | 1.53                 | 1.88                   | 1.53                    | 12.06                       |
| 32.0               | 2.50                    | 6.30                                     | 5.13                                      | 1.57                 | 1.89                   | 1.57                    | 12.06                       |
| 33.0               | 2.50                    | 6.60                                     | 5.50                                      | 1.62                 | 1.90                   | 1.62                    | 12.08                       |
| 34.0               | 2.50                    | 6.92                                     | 5.89                                      | 1.68                 | 1.91                   | 1.68                    | 12.10                       |
| 35.0               | 2.50                    | 7.24                                     | 6.28                                      | 1.63                 | 1.92                   | 1.63                    | 12.80                       |
| 36.0               | 2.50                    | 7.57                                     | 6.69                                      | 2.00                 | 1.93                   | 2.00                    | 11.46                       |
| 37.0               | 2.50                    | 7.91                                     | 7.11                                      | 2.00                 | 1.94                   | 2.00                    | 11.78                       |

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(11)  
97.3 (4.6)  
98.5 (5.8)

Project Stead Master  
Project No. 208  
Sheet No.      of       
Calculated by      Date     

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CP PE2, R.R. & Profile

CROSS SECTION PARAMETERS:

FILENAME: PE2RAIL.SEC

No. of Cross Section Points: 4 ~~Bed Slope~~ 0:00010 Max Elev.: 100.05

Bank Stations.....Left: 0.0 Right.....: 170.5 Min Elev.: 99.16

Encroachment Stations..Left: 0.0 Right.....: Weir Coef: 2.650 ✓

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.    | Sta. No. | Elev. | Sta. No. | Elev.   | Sta. |         |         |
|-----|----------|----------|-------|----------|---------|------|---------|---------|
| 1)  | 99.16 ✓  | 0.00 ✓   | 2)    | 99.44 ✓  | 60.00 ✓ | 3)   | 99.53 ✓ | 78.00 ✓ |
| 4)  | 100.05 ✓ | 170.50 ✓ |       |          |         |      |         |         |

COMPUTED PARAMETERS:

WSEL(ft) Q(cfs) H: max(ft) H: ave(ft) TW(ft) A(sf)

|        |       |      |      |       |      |
|--------|-------|------|------|-------|------|
| 99.50  | 15.3  | 0.34 | 0.17 | 72.0  | 12.4 |
| 99.60  | 29.0  | 0.44 | 0.23 | 90.5  | 20.5 |
| 99.70  | 47.9  | 0.54 | 0.28 | 108.2 | 30.4 |
| 99.80  | 72.4  | 0.64 | 0.33 | 126.0 | 42.2 |
| 99.90  | 102.9 | 0.74 | 0.39 | 143.8 | 55.6 |
| 100.00 | 139.8 | 0.84 | 0.44 | 161.6 | 70.9 |

NOTES:

Weir flow over to the north

Project Stead Master  
Project No. 208  
Sheet No.      of       
Calculated by      Date     

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CP PE2 R.R. E Profile  
Encroached Section

CROSS SECTION PARAMETERS:

FILENAME: PE2RAIL.SEC

No. of Cross Section Points: 4 ~~0.00~~ ~~0.0000~~ Max Elev.: 99.44  
Bank Stations.....Left: 0.0 Right....: 170.5 Min Elev.: 99.16  
Encroachment Stations..Left: 0.0 Right....: 60.0 Weir Coef: 2.650 ✓  
CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev. | Sta. No. | Elev. | Sta. No. | Elev. | Sta. |
|-----|-------|----------|-------|----------|-------|------|
|-----|-------|----------|-------|----------|-------|------|

|    |          |          |    |         |         |    |         |         |
|----|----------|----------|----|---------|---------|----|---------|---------|
| 1) | 99.16 ✓  | 0.00 ✓   | 2) | 99.44 ✓ | 60.00 ✓ | 3) | 99.53 ✓ | 78.00 ✓ |
| 4) | 100.05 ✓ | 170.50 ✓ |    |         |         |    |         |         |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) |
|----------|--------|------------|------------|--------|-------|
|----------|--------|------------|------------|--------|-------|

|          |      |      |      |      |      |
|----------|------|------|------|------|------|
| 99.50 ✓  | 15.1 | 0.34 | 0.20 | 60.0 | 12.0 |
| 99.60 ✓  | 26.8 | 0.44 | 0.30 | 60.0 | 18.0 |
| 99.70 ✓  | 40.8 | 0.54 | 0.40 | 60.0 | 24.0 |
| 99.80 ✓  | 56.8 | 0.64 | 0.50 | 60.0 | 30.0 |
| 99.90 ✓  | 74.4 | 0.74 | 0.60 | 60.0 | 36.0 |
| 100.00 ✓ | 93.6 | 0.84 | 0.70 | 60.0 | 42.0 |

NOTES:

Encroached R.R. Weir section  
to estimate Qrail between  
stat 0 and 60.

Project Stead Master  
Project No. 208  
Sheet No.      of       
Calculated by      Date     

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CP PE2

R.R. Ditch, Northside of the track  
flow to "PE3"

CROSS SECTION PARAMETERS:

FILENAME: pe2-dich.SEC

No. of Cross Section Points: 6 Bed Slope: 0.00470 Max Elev.: 5300.78  
Bank Stations.....Left: 1019.0 Right.....: 1038.0 Min Elev.: 5297.37  
Encroachment Stations..Left:      Right.....:       
Manning-n Values.....LOB: 0.040 CHANNEL...: 0.030 ROB.....: 0.035

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta.    | No. | Elev.   | Sta.    | No. | Elev.   | Sta.    |
|-----|---------|---------|-----|---------|---------|-----|---------|---------|
| 1)  | 5300.78 | 1000.00 | (2) | 5297.66 | 1019.00 | 3)  | 5297.67 | 1025.00 |
| 4)  | 5297.37 | 1034.00 | (5) | 5298.50 | 1038.00 | 6)  | 5299.19 | 1040.00 |

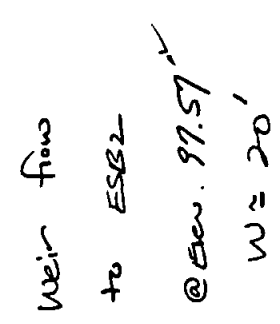
COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | nc  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 5297.80  | 4.5    | 1.2    | 0.46 | 0.030 | 1.0 | 17.4  | 3.7    | 17.4  | 5297.71 |          |
| 5298.00  | 12.9   | 1.8    | 0.51 | 0.031 | 1.0 | 19.3  | 7.4    | 19.4  | 5297.84 |          |
| 5298.20  | 24.9   | 2.2    | 0.54 | 0.031 | 1.1 | 21.2  | 11.4   | 21.4  | 5297.99 |          |
| 5298.40  | 40.2   | 2.5    | 0.56 | 0.031 | 1.1 | 23.2  | 15.9   | 23.4  | 5298.13 |          |
| 5298.60  | 58.8   | 2.8    | 0.58 | 0.031 | 1.1 | 25.0  | 20.7   | 25.3  | 5298.30 |          |
| 5298.80  | 80.7   | 3.1    | 0.59 | 0.032 | 1.1 | 26.8  | 25.9   | 27.1  | 5298.44 |          |

NOTES:



2/ placed in family +  
alone before call +  
admission


$$\text{Slope} = 0.0047\%$$

| Debit    |          | Credit   |
|----------|----------|----------|
| 99.16 ✓  | 1000 ✓   | 99.16 ✓  |
| 99.53 ✓  | 1078 ✓   | 98.51 ✓  |
| 100.05 ✓ | 1170.5 ✓ | 98.51 ✓  |
|          |          | 98.29 ✓  |
|          |          | 1005.5 ✓ |

99.44  
1000  
1000

III = 92.72

7.40%

$$h = 5.57'$$

$g_{c10} \sim 29 \text{ c-fs.}$

7-10-1919

Stead Basin PE3

24" CMP IE= 81.85

| Elevation | Q <sub>culv</sub> | Q <sub>road</sub> | Q <sub>rail</sub> | Q <sub>total</sub> |
|-----------|-------------------|-------------------|-------------------|--------------------|
| 86.4      | 25 ✓              | 0 ✓               | 0 ✓               | 25 ✓               |
| 88.0      | 30 ✓              | 12 ✓              | 0 ✓               | 42 ✓               |
| 88.5      | 31 ✓              | 42 ✓              | 0 ✓               | 73 ✓               |
| 89.0      | 33 ✓              | 95 ✓              | 0 ✓               | 128 ✓              |
| 89.5      | 34 ✓              | 165 ✓             | 831 ✓             | 204 ✓ 230 ✓        |

↑  
DQ

|    |    |     |     |     |      |      |
|----|----|-----|-----|-----|------|------|
| DI | 0' | 25' | 42' | 73' | 128' | 230' |
| DQ | 0' | 0'  | 12' | 42' | 95'  | 165' |

↙ Diversion to  
PE4

PIPE CULVERT ANALYSIS ✓  
COMPUTATION OF CULVERT PERFORMANCE CURVE

January 11, 1999  
Stead basin PE3 ✓  
24" Railroad culvert ✓  
Rating capacity

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 2.00 ✓   |
| FIHWA Chart Number (1,2 or 3).....                    | 2 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 3 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0240 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50     |
| Culvert Length (feet).....                            | 70.0 ✓   |
| Culvert Slope (feet per foot).....                    | 0.0570 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater (ft)<br>Inlet Control | Normal Depth<br>Outlet Control | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|---------------------------------|--------------------------------|------------------------|-------------------------|--------------------------|
| 25.0               | 0.00                    | 4.58                            | 2.26                           | 1.43                   | 1.76                    | 10.40                    |
| 30.0               | 0.00                    | 6.12                            | 4.24                           | 1.72                   | 1.86                    | 10.44                    |
| 31.0               | 0.00                    | 6.46                            | 4.67                           | 1.78                   | 1.88                    | 10.52                    |
| 33.0               | 0.00                    | 7.18                            | 5.58                           | 2.00                   | 1.90                    | 10.50                    |
| 34.0               | 0.00                    | 7.55                            | 6.05                           | 2.00                   | 1.91                    | 10.82                    |
| 35.0               | 0.00                    | 7.94                            | 6.54                           | 2.00                   | 1.92                    | 11.14                    |

=====

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Inlet Control.

Project Stand Master  
Project No. 2.08  
Sheet No.      of       
Calculated by      Date     

**WEIR FLOW COMPUTATIONS**

**LOCATION/DESCRIPTION:**

Ditch Section, South of R.R.  
@ CP PE3

**CROSS SECTION PARAMETERS:**

FILENAME: PE3ROAD.SEC

No. of Cross Section Points: 7 ~~Bed Slope 10.0:12.00~~ Max Elev.: 89.81 ✓  
Bank Stations.....Left: 0.0 Right.....: 33.0 Min Elev.: 86.88 ✓  
Encroachment Stations..Left: 0.0 Right.....: Weir Coef: 2.650 ✓

**CROSS SECTION POINTS - Elevations & Stations in feet:**

| No. | Elev.   | Sta. No. | Elev. | Sta. No. | Elev.   | Sta. |         |         |
|-----|---------|----------|-------|----------|---------|------|---------|---------|
| 1)  | 89.02 ✓ | 0.00 ✓   | 2)    | 88.45 ✓  | 0.10 ✓  | 3)   | 88.45 ✓ | 3.00 ✓  |
| 4)  | 87.86 ✓ | 7.00 ✓   | 5)    | 88.09 ✓  | 18.50 ✓ | 6)   | 86.88 ✓ | 25.00 ✓ |
| 7)  | 89.81 ✓ | 33.00 ✓  |       |          |         |      |         |         |

**COMPUTED PARAMETERS:**

| WSEL(ft) | Q(cfs) | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) |
|----------|--------|------------|------------|--------|-------|
| 88.00    | 11.8   | 1.12       | 0.33       | 17.0   | 5.6   |
| 88.50    | 42.2   | 1.62       | 0.60       | 29.3   | 17.7  |
| 89.00    | 94.9   | 2.12       | 1.06       | 30.8   | 32.8  |
| 89.50    | 164.5  | 2.62       | 1.51       | 32.2   | 48.5  |
| 90.00    | 248.6  | 3.12       | 1.97       | 33.0   | 64.9  |

**NOTES:**

Diversion flow to PE4

Project stead Master  
Project No. 208  
Sheet No.      of       
Calculated by      Date     

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

@ CP PE3

R.R. E profile

CROSS SECTION PARAMETERS:

FILENAME: PE3RAIL.SEC

No. of Cross Section Points: 4 ~~Bed Slope = 0.00010~~ Max Elev.: 90.88 ✓  
Bank Stations.....Left: 0.0 Right.....: 321.0 Min Elev.: 89.02 ✓  
Encroachment Stations..Left: 0.0 Right.....:      Weir Coef: 2.800 ✓

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta. No. | Elev. | Sta. No. | Elev.    | Sta. |         |          |
|-----|---------|----------|-------|----------|----------|------|---------|----------|
| 1)  | 89.02 ✓ | 0.00 ✓   | 2)    | 89.71 ✓  | 119.00 ✓ | 3)   | 90.19 ✓ | 210.00 ✓ |
| 4)  | 90.88 ✓ | 321.00 ✓ |       |          |          |      |         |          |

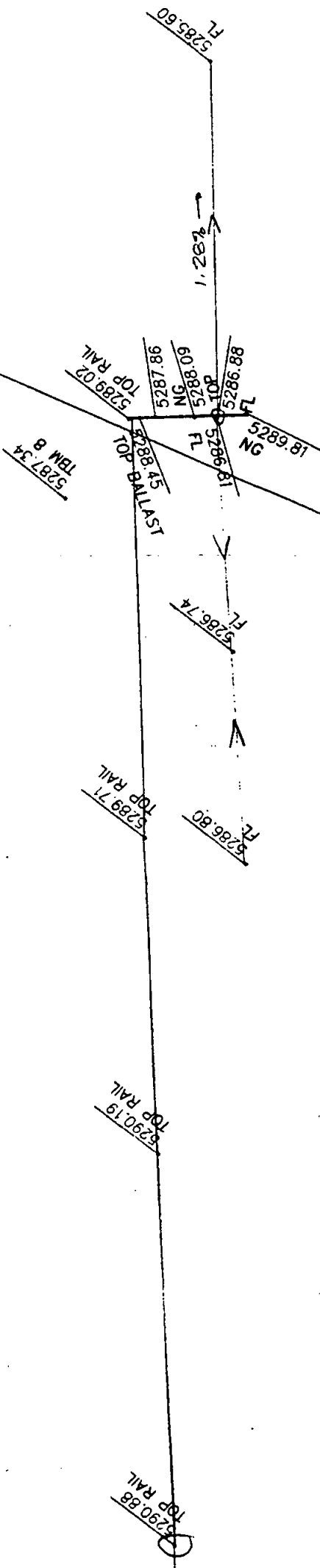
COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) |
|----------|--------|------------|------------|--------|-------|
| 89.50    | 30.8   | 0.48       | 0.24       | 82.8   | 19.9  |
| 90.00    | 184.5  | 0.98       | 0.48       | 174.0  | 83.5  |

NOTES:

Basin PE3 outlet

SCALE 1:40  
N



Sediment  
trapping

| Rail  | Road  |
|-------|-------|
| 89.02 | 89.02 |
| 1000  | 1000  |

Stead Basin PE5  
33" CMP IE= 29.60

| Elevation | Q <sub>culv</sub> | Q <sub>road</sub>   | Q <sub>rail</sub> | Q <sub>total</sub> |
|-----------|-------------------|---------------------|-------------------|--------------------|
| 46.8      | 100✓              | 0✓                  | 0                 | 100✓               |
| 51.5      | 114✓              | 5✓                  | 0                 | 119✓               |
| 52.0      | 115✓              | 31✓                 | 0                 | 146✓               |
| 52.5      | 117✓              | 87✓                 | 0✓                | 204✓               |
| 53.0      | 118✓              | 175✓                | 20✓               | 313✓               |
| 53.5      | 119✓              | 292✓ <sup>117</sup> | 144✓              | 555✓               |
| 54.0      | 121✓              | 440✓                | 425✓              | 986✓               |

18" = 6.9%

↑  
DQ

| DI | 0✓ | 100✓ | 119✓ | 146✓ | 204✓ | 313✓ | 555✓ | 986✓ |
|----|----|------|------|------|------|------|------|------|
| DQ | 0✓ | 0✓   | 5✓   | 31✓  | 87✓  | 175✓ | 292✓ | 440✓ |

Detention @ CP PE5

| Area (A <sub>z</sub> ) | 0'    | 1.46' | 3.22' | 3.3'  | 3.3'  | 3.3'  |  |
|------------------------|-------|-------|-------|-------|-------|-------|--|
| Elev.                  | 29.6' | 40'   | 51.5' | 52.0' | 52.5' | 53.0' |  |
| Q                      | 0'    | 75'   | 119'  | 146'  | 204'  | 313'  |  |

PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

January 13, 1999  
Stead basin PE5 ✓  
33" Railroad culvert ✓  
Rating capacity

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 2.75 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 2 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 3 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0240 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50     |
| Culvert Length (feet).....                            | 85.0 ✓   |
| Culvert Slope (feet per foot).....                    | 0.0494 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater (ft)<br>Inlet Control | Normal Depth<br>Outlet Control | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|---------------------------------|--------------------------------|------------------------|-------------------------|--------------------------|
| 113                |                         | 21.5                            |                                |                        |                         |                          |
| 114.0              | 0.00                    | 21.85                           | 20.50                          | 2.75                   | 2.73                    | 19.19                    |
| 115.0              | 0.00                    | 22.21                           | 20.89                          | 2.75                   | 2.73                    | 19.36                    |
| 117.0              | 0.00                    | 22.94                           | 21.68                          | 2.75                   | 2.73                    | 19.70                    |
| 118.0              | 0.00                    | 23.31                           | 22.07                          | 2.75                   | 2.73                    | 19.87                    |
| 119.0              | 0.00                    | 23.68                           | 22.48                          | 2.75                   | 2.73                    | 20.04                    |
| 121.0              | 0.00                    | 24.43                           | 23.29                          | 2.75                   | 2.73                    | 20.37                    |
| 100.0<br>25        |                         | 17.2                            |                                |                        |                         |                          |

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↓  
Inlet  
Control



Project Stead Master  
Project No. 208  
Sheet No.      of       
Calculated by      Date     

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CP PES, R.R. & Profile

CROSS SECTION PARAMETERS:

FILENAME: PESRAIL.SEC

No. of Cross Section Points: 4 ~~Red Slope~~ 0.00010 Max Elev.: 54.09  
Bank Stations.....Left: 0.0 Right....: 220.0 Min Elev.: 52.55  
Encroachment Stations..Left: 0.0 Right....: Weir Coef: 2.000 ✓

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta.     | No. | Elev.   | Sta.    | No. | Elev.   | Sta.     |
|-----|---------|----------|-----|---------|---------|-----|---------|----------|
| 1)  | 52.55 ✓ | 0.00 ✓   | 2)  | 53.00 ✓ | 58.00 ✓ | 3)  | 53.29 ✓ | 124.00 ✓ |
| 4)  | 54.09 ✓ | 220.00 ✓ |     |         |         |     |         |          |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) |
|----------|--------|------------|------------|--------|-------|
| 53.00    | 19.6   | 0.45       | 0.23       | 58.0   | 13.1  |
| 53.50    | 144.1  | 0.95       | 0.46       | 149.2  | 68.1  |
| 54.00    | 424.8  | 1.45       | 0.75       | 209.2  | 157.7 |

NOTES:

Project Stead Master  
Project No. 2-08  
Sheet No.      of       
Calculated by      Date     

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

@ CP PES , ditch south of R.R.  
Diversion to basin "PE6"

CROSS SECTION PARAMETERS:

FILENAME: PE5ROAD.SEC

No. of Cross Section Points: 8 ~~Bed Slope: 0.00640~~ Max Elev.: 55.43 ✓  
Bank Stations.....Left: 0.0 Right.....: 95.0 Min Elev.: 51.09 ✓  
Encroachment Stations..Left: 0.0 Right.....: Weir Coef: 2.650 ✓

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta.    | No. | Elev.   | Sta.    | No. | Elev.   | Sta.    |
|-----|---------|---------|-----|---------|---------|-----|---------|---------|
| 1)  | 52.55 ✓ | 0.00 ✓  | 2)  | 52.01 ✓ | 0.10 ✓  | 3)  | 52.01 ✓ | 3.50 ✓  |
| 4)  | 51.09 ✓ | 6.00 ✓  | 5)  | 51.28 ✓ | 14.50 ✓ | 6)  | 52.20 ✓ | 38.00 ✓ |
| 7)  | 53.73 ✓ | 61.00 ✓ | 8)  | 55.43 ✓ | 95.00 ✓ |     |         |         |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) |
|----------|--------|------------|------------|--------|-------|
| 51.50    | 5.0    | 0.41       | 0.23       | 15.2   | 3.5   |
| 52.00    | 30.8   | 0.91       | 0.50       | 29.4   | 14.7  |
| 52.50    | 87.4   | 1.41       | 0.79       | 42.5   | 33.8  |
| 53.00    | 174.5  | 1.91       | 1.14       | 50.0   | 56.9  |
| 53.50    | 291.6  | 2.41       | 1.46       | 57.5   | 83.8  |
| 54.00    | 440.0  | 2.91       | 1.73       | 66.4   | 114.6 |

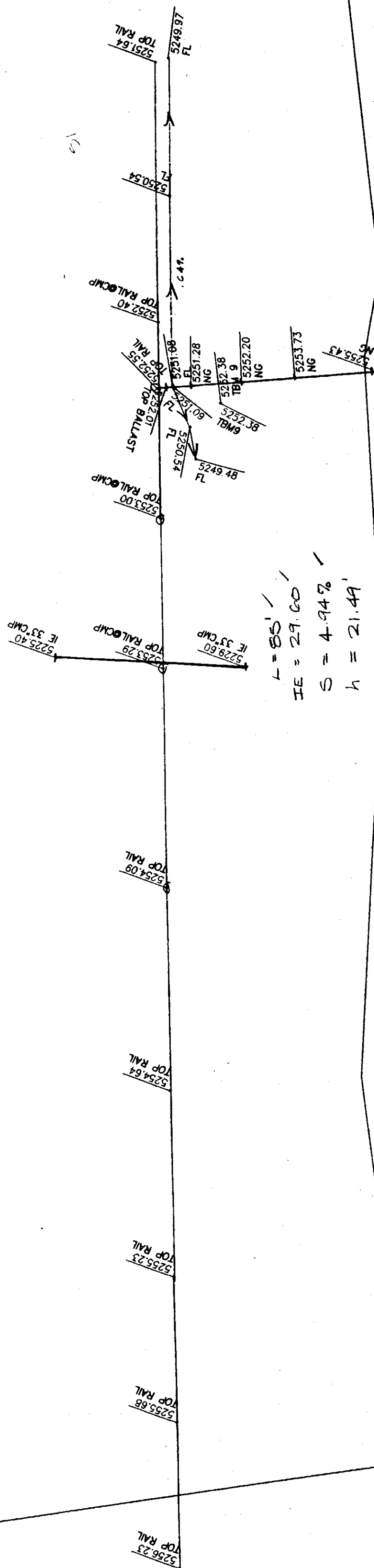
NOTES:

|           |        |
|-----------|--------|
| Basin PE5 | outlet |
|-----------|--------|

## Definition

5240 ✓ 1.46 acres =  
5251 ✓ 3.22 acres =

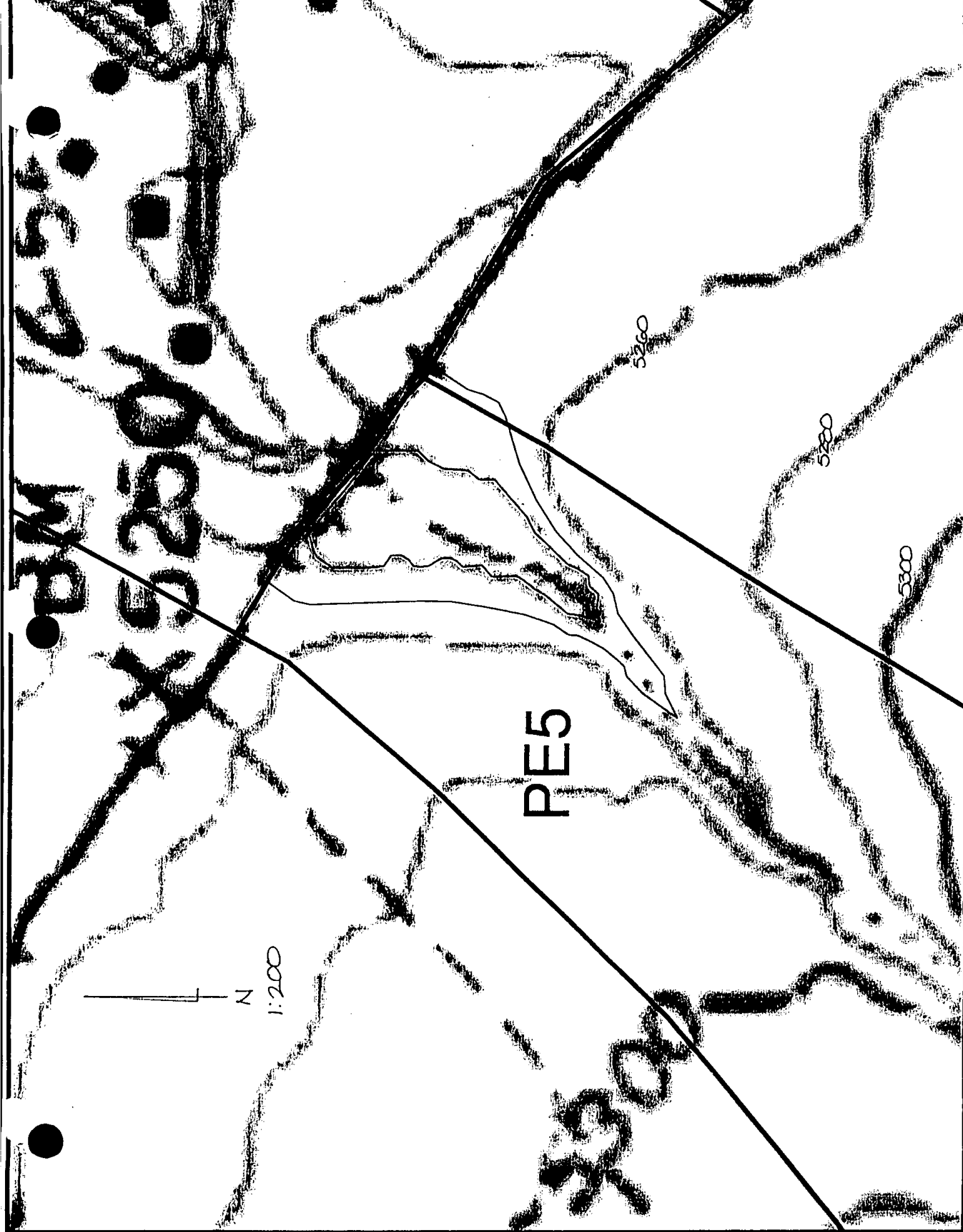
SCALE 1:40


$$\begin{aligned} L &= 85' \\ IE &= 29.60 \\ S &= 4.94\% \\ h &= 21.49' \end{aligned}$$

100 seed - 1  
100 seed - 1

$\gamma_{\text{eff}} \sim 113 \text{ cfs}$

| Rail    | Road    |
|---------|---------|
| 52.55 ✓ | 52.55 ✓ |
| 53.00 ✓ | 52.01 ✓ |
| 53.29 ✓ | 52.01 ✓ |
| 54.09 ✓ | 51.09 ✓ |
|         | 51.28 ✓ |
|         | 52.20 ✓ |
|         | 53.73 ✓ |
|         | 55.43 ✓ |



Stead Basin PE6 ✓  
 24" CMP IE= 22.32 ✓

| Elevation | Q <sub>culv</sub> | Q <sub>road</sub> | Q <sub>rail</sub> ✓ | Q <sub>total</sub> |
|-----------|-------------------|-------------------|---------------------|--------------------|
| 39.4      | 50 49 ✓           | 0 ✓               | 0                   | 50 49 ✓            |
| 40.5      | 51 50 ✓           | 1 ✓               | 0                   | 52 51 ✓            |
| 41.0      | 52 51 ✓           | 12 ✓              | 0                   | 64 63 ✓            |
| 41.5      | 52 51 ✓           | 33 ✓              | 0 ✓                 | 85 84 ✓            |
| 42.0      | 53 52 ✓           | 64 ✓              | 3 ✓                 | 120 119 ✓          |
| 42.5      | 53 52 ✓           | 102 ✓             | 151 ✓               | 306 305 ✓          |

↑  
DQ

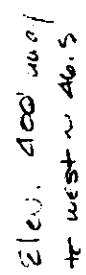
|    |     |      |      |      |      |       |       |
|----|-----|------|------|------|------|-------|-------|
| DI | 0 ✓ | 49 ✓ | 51 ✓ | 63 ✓ | 84 ✓ | 119 ✓ | 305 ✓ |
| DQ | 0 ✓ | 0 ✓  | 1 ✓  | 12 ✓ | 33 ✓ | 64 ✓  | 102 ✓ |

Detention Rating

|                |        |        |        |        |        |        |        |
|----------------|--------|--------|--------|--------|--------|--------|--------|
| Area (Ac.)     | 0 ✓    | 1.56   | 1.56   | 1.56   | 1.56   | 1.56   | 1.56   |
| CULV           | 22.3 ✓ | 39.4 ✓ | 40.5 ✓ | 41.0 ✓ | 41.5 ✓ | 42.0 ✓ | 42.5 ✓ |
| Q <sub>c</sub> | 0 ✓    | 49 ✓   | 51 ✓   | 63 ✓   | 84 ✓   | 119 ✓  | 305 ✓  |

SCALE 1:40

N



No sediment protruding

$q_{adv} \sim 51 \text{ fs}$

Detention ✓  
E240 ✓ 1.56 sec., 21

| Roll  | Read   |
|-------|--------|
| 41.78 | 41.78  |
| 41.93 | 41.24  |
| 42.08 | 41.24  |
| 42.47 | 40.47  |
| 1000  | 1000   |
| 1015  | 1000.1 |
| 1109  | 1002.5 |
| 1224  | 1005   |
|       | 1014   |
|       | 1018   |

PIPE CULVERT ANALYSIS ✓  
COMPUTATION OF CULVERT PERFORMANCE CURVE

May 11, 1999  
Stead Basin PE6 ✓  
24" CMP under Railroad ✓

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 2.00 ✓   |
| FWHA Chart Number (1,2 or 3).....                     | 2 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 3 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0240 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.80 ✓   |
| Culvert Length (feet).....                            | 85.0 ✓   |
| Culvert Slope (feet per foot).....                    | 0.0581 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater (ft)<br>Inlet Control | Normal Depth<br>Outlet Control | Critical Depth<br>(ft) | Depth at<br>(ft) | Outlet Velocity<br>(ft) | Outlet<br>(fps) |
|--------------------|-------------------------|---------------------------------|--------------------------------|------------------------|------------------|-------------------------|-----------------|
| 45.0               | 2.00                    | 12.42                           | 14.19                          | 2.00                   | 1.97             | 2.00                    | 14.32           |
| 46.0               | 2.00                    | 12.93                           | 14.96                          | 2.00                   | 1.97             | 2.00                    | 14.64           |
| 47.0               | 2.00                    | 13.45                           | 15.75                          | 2.00                   | 1.97             | 2.00                    | 14.96           |
| 48.0               | 2.00                    | 13.99                           | 16.56                          | 2.00                   | 1.98             | 2.00                    | 15.28           |
| 49.0               | 2.00                    | 14.53                           | 17.38                          | 2.00                   | 1.98             | 2.00                    | 15.60           |
| 50.0               | 2.00                    | 15.08                           | 18.21 ✓                        | 2.00                   | 1.98             | 2.00                    | 15.92           |
| 51.0               | 2.00                    | 15.65                           | 19.07                          | 2.00                   | 1.98             | 2.00                    | 16.23           |
| 52.0               | 2.00                    | 16.23                           | 19.94                          | 2.00                   | 1.98             | 2.00                    | 16.55           |
| 53.0               | 2.00                    | 16.82                           | 20.83                          | 2.00                   | 1.98             | 2.00                    | 16.87           |
| 54.0               | 2.00                    | 17.42                           | 21.73                          | 2.00                   | 1.99             | 2.00                    | 17.19           |

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Project Stead Master  
Project No. 208  
Sheet No.      of       
Calculated by      Date     

**WEIR FLOW COMPUTATIONS**

CP  
@ PE 6

**LOCATION/DESCRIPTION:**

Ditch section, flow to PE 7

**CROSS SECTION PARAMETERS:**

FILENAME: PE6ROAD.SEC

No. of Cross Section Points: 6 ~~Bed Slope: 1:0.00170~~ Max Elev.: 44.05  
Bank Stations.....Left: 0.0 Right....: 18.0 Min Elev.: 40.38 ✓  
Encroachment Stations..Left: 0.0 Right....: Weir Coef: 2.650 ✓

**CROSS SECTION POINTS - Elevations & Stations in feet:**

| No. | Elev.   | Sta. No. | Elev. | Sta. No. | Elev.   | Sta. |         |         |
|-----|---------|----------|-------|----------|---------|------|---------|---------|
| 1)  | 41.78 ✓ | 0.00 ✓   | 2)    | 41.24 ✓  | 0.10 ✓  | 3)   | 41.24 ✓ | 2.50 ✓  |
| 4)  | 40.47 ✓ | 5.00 ✓   | 5)    | 40.38 ✓  | 14.00 ✓ | 6)   | 44.05 ✓ | 18.00 ✓ |

**COMPUTED. PARAMETERS:**

| WSEL(ft) | Q(cfs) | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) |
|----------|--------|------------|------------|--------|-------|
| 40.50    | 0.5    | 0.12       | 0.07       | 9.2    | 0.7   |
| 41.00    | 11.5   | 0.62       | 0.51       | 11.4   | 5.8   |
| 41.50    | 32.6   | 1.12       | 0.83       | 15.2   | 12.6  |
| 42.00    | 63.5   | 1.62       | 1.29       | 15.8   | 20.3  |
| 42.50    | 102.2  | 2.12       | 1.74       | 16.3   | 28.4  |

18.2' head

**NOTES:**



Project stead Master  
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Calculated by      Date     

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

@ CP DEB  
R.R. Profile (Top Rail)

CROSS SECTION PARAMETERS:

FILENAME: PE6RAIL.SEC

No. of Cross Section Points: 4 ~~Bed Slope = 0.00010~~ Max Elev.: 42.47  
Bank Stations.....Left: 0.0 Right.....: 224.0 Min Elev.: 41.78  
Encroachment Stations..Left: 0.0 Right.....: Weir Coef: 2.800

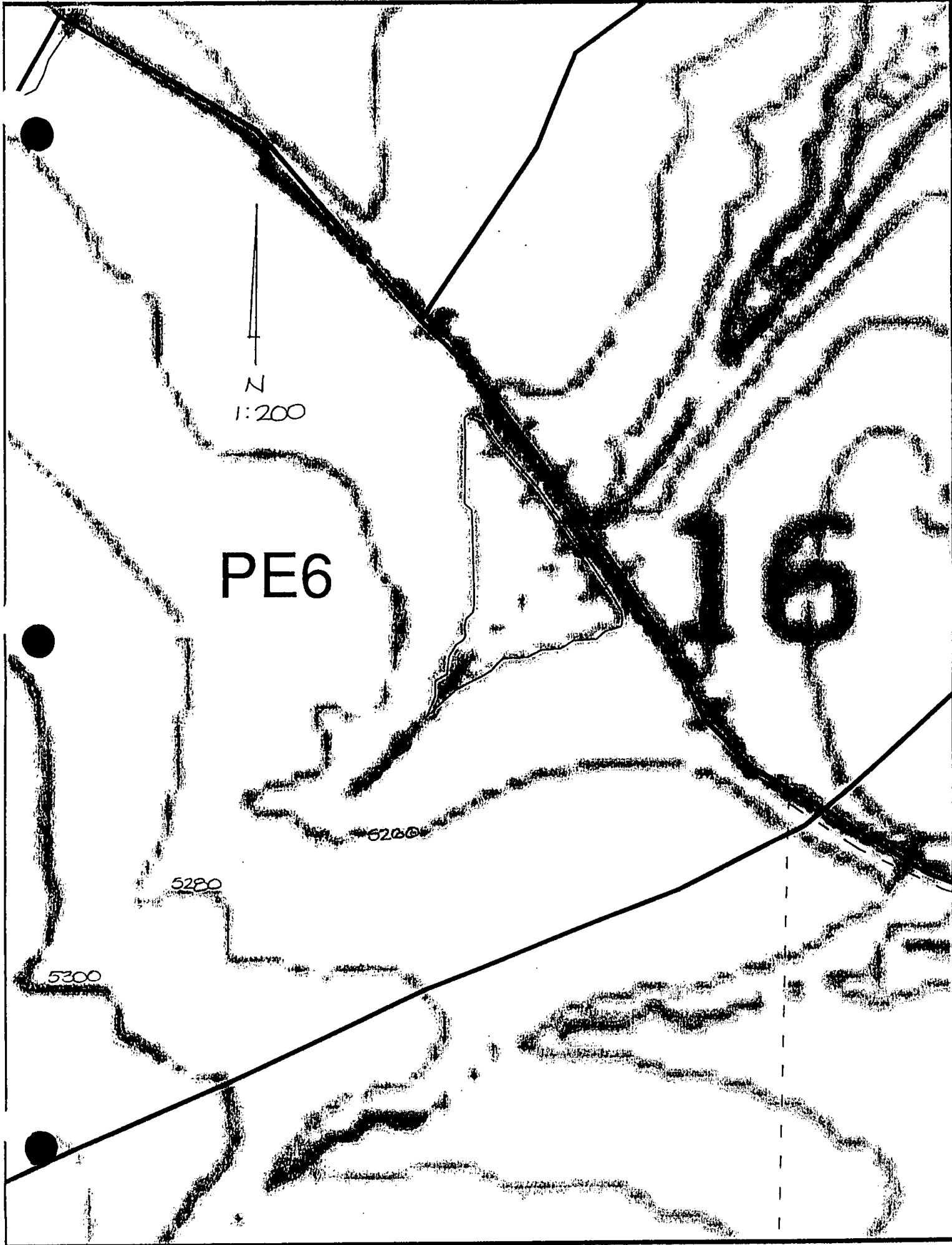
CROSS SECTION POINTS - Elevations & Stations in feet:

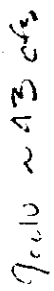
| No. | Elev.   | Sta. No. | Elev. | Sta. No. | Elev.   | Sta. |         |          |
|-----|---------|----------|-------|----------|---------|------|---------|----------|
| 1)  | 41.78 ✓ | 0.00 ✓   | 2)    | 41.93 ✓  | 15.00 ✓ | 3)   | 42.08 ✓ | 109.00 ✓ |
| 4)  | 42.47 ✓ | 224.00 ✓ |       |          |         |      |         |          |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H:max(ft) | H:ave(ft) | TW(ft) | A(sf) |
|----------|--------|-----------|-----------|--------|-------|
| 42.00    | 3.3    | 0.22      | 0.06      | 58.9   | 3.7   |
| 42.50    | 151.4  | 0.72      | 0.37      | 224.0  | 82.1  |
| 43.00    | 513.5  | 1.22      | 0.87      | 224.0  | 194.1 |

NOTES:





5231' 1.48 sec. 2

Protruding  
No sediment

~~SECRET~~ Z

SCALE 1:40

[illegible]

Basin PE7 outlet

Stead Basin PE7 ✓  
24" CMP IE= 17.39 ✓

| Elevation | Q <sub>cult</sub> | Q <sub>road</sub> | Q <sub>rail</sub> | Q <sub>total</sub> |
|-----------|-------------------|-------------------|-------------------|--------------------|
| 29.2      | 40'39" ✓          | 0 ✓               | 0                 | 40'39" ✓           |
| 30.8      | 42'41" ✓          | 0 ✓               | 0                 | 42'41" ✓           |
| 31.0      | 43'42" ✓          | 4 ✓               | 0                 | 47'46" ✓           |
| 31.5      | 44'43" ✓          | 86'31" ✓          | 0                 | 130'74" ✓          |
| 32.0      | 45'43" ✓          | 170'86" ✓         | 0                 | 215'129" ✓         |
| 32.5      | 44' ✓             | 170' ✓            | 0' ✓              | 214' ✓             |
| 33.0      | 45' ✓             | 284' ✓            | 36' ✓             | 365' ✓             |
| 33.5      | 15' ✓             | 426' ✓            | 192' ✓            | 663' ✓             |

|    |    |     |     |     |      |      |      |      |
|----|----|-----|-----|-----|------|------|------|------|
| DI | 0' | 41' | 46' | 74' | 129' | 214' | 365' | 663' |
| DQ | 0' | 0'  | 4'  | 31' | 86'  | 170' | 284' | 426' |

|            |      |      |      |      |     |      |
|------------|------|------|------|------|-----|------|
| Area (Ac.) | 0    | 1.48 | 1.48 | 1.48 | 1.5 | 1.5  |
| Elev.      | 17.4 | 30.8 | 31.0 | 31.5 | 32  | 32.5 |
| Q          | 0    | 41   | 46   | 74   | 129 | 214  |

PIPE CULVERT ANALYSIS ✓  
COMPUTATION OF CULVERT PERFORMANCE CURVE

May 12, 1999  
Stead Basin PE7 ✓  
24" CMP under RR ✓

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 2.00 ✓   |
| FIHWA Chart Number (1,2 or 3).....                    | 2 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 3 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0240 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.80 ✓   |
| Culvert Length (feet).....                            | 70.0 ✓   |
| Culvert Slope (feet per foot).....                    | 0.0204 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater (ft)<br>Inlet Control | Headwater (ft)<br>Outlet Control | Normal Depth<br>(ft) | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|---------------------------------|----------------------------------|----------------------|------------------------|-------------------------|--------------------------|
| 38.0               | 2.00                    | 9.17                            | 11.36                            | 2.00                 | 1.94                   | 2.00                    | 12.10                    |
| 39.0               | 2.00                    | 9.60                            | 11.93 ✓                          | 2.00                 | 1.95                   | 2.00                    | 12.41                    |
| 40.0               | 2.00                    | 10.04                           | 12.52                            | 2.00                 | 1.95                   | 2.00                    | 12.73                    |
| 41.0               | 2.00                    | 10.50                           | 13.12                            | 2.00                 | 1.96                   | 2.00                    | 13.05                    |
| 42.0               | 2.00                    | 10.96                           | 13.74                            | 2.00                 | 1.96                   | 2.00                    | 13.37                    |
| 43.0               | 2.00                    | 11.44                           | 14.38                            | 2.00                 | 1.96                   | 2.00                    | 13.69                    |
| 44.0               | 2.00                    | 11.93                           | 15.03 ✓                          | 2.00                 | 1.97                   | 2.00                    | 14.01                    |
| <u>45.0</u>        | 2.00                    | 12.43                           | 15.69 ✓                          | 2.00                 | 1.97                   | 2.00                    | 14.32                    |

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Project Stead Master  
Project No. 208  
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WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

@ CP PE7

R.R. Profile

CROSS SECTION PARAMETERS:

FILENAME: PE7RAIL.SEC

No. of Cross Section Points: 5 ~~Bed Slope = 0.00040~~ Max Elev.: 34.10  
Bank Stations.....Left: 0.0 Right.....: 214.5 Min Elev.: 32.49  
Encroachment Stations..Left: 0.0 Right.....:      Weir Coef: 2.800 ✓

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta. No. | Elev. | Sta. No. | Elev.    | Sta. |         |          |
|-----|---------|----------|-------|----------|----------|------|---------|----------|
| 1)  | 32.49 ✓ | 0.00 ✓   | 2)    | 33.01 ✓  | 90.00 ✓  | 3)   | 33.31 ✓ | 131.50 ✓ |
| 4)  | 33.71 ✓ | 175.00 ✓ | 5)    | 34.10 ✓  | 214.50 ✓ |      |         |          |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs)      | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) |
|----------|-------------|------------|------------|--------|-------|
| 32.50    | 0.0         | 0.01       | 0.00       | 1.7    | 0.0   |
| 33.00    | <u>36.0</u> | 0.51       | 0.25       | 88.3   | 22.5  |
| 33.50    | 191.7       | 1.01       | 0.55       | 152.2  | 83.6  |
| 34.00    | 491.7       | 1.51       | 0.85       | 204.4  | 172.9 |

NOTES:

Project stead Master  
Project No. 208  
Sheet No.      of       
Calculated by JB Date     

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Ditch @ CP PE7  
flow to "PHI"

CROSS SECTION PARAMETERS:

FILENAME: PE7ROAD.SEC

No. of Cross Section Points: 7 ~~Bed Slope: 0-00000~~ Max Elev.: 34.41 ✓  
Bank Stations.....Left: 0.0 Right.....: 73.0 Min Elev.: 30.75 ✓  
Encroachment Stations..Left: 0.0 Right.....: ✓ Weir Coef: 2.650 ✓

CROSS SECTION POINTS - Elevations & Stations in feet:

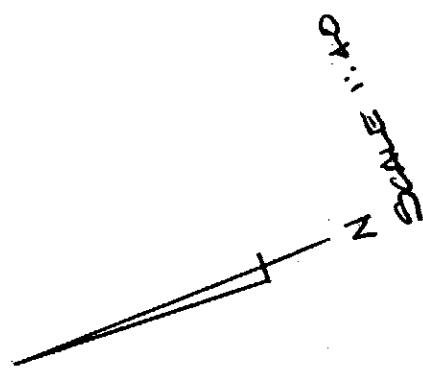
| No. | Elev.   | Sta. No. | Elev. | Sta. No. | Elev.   | Sta. |         |         |
|-----|---------|----------|-------|----------|---------|------|---------|---------|
| 1)  | 32.49 ✓ | 0.00 ✓   | 2)    | 31.82 ✓  | 0.10 ✓  | 3)   | 31.82 ✓ | 3.00 ✓  |
| 4)  | 30.75 ✓ | 6.00 ✓   | 5)    | 30.88 ✓  | 22.00 ✓ | 6)   | 32.06 ✓ | 43.00 ✓ |
| 7)  | 34.41 ✓ | 73.00 ✓  |       |          |         |      |         |         |

COMPUTED PARAMETERS:

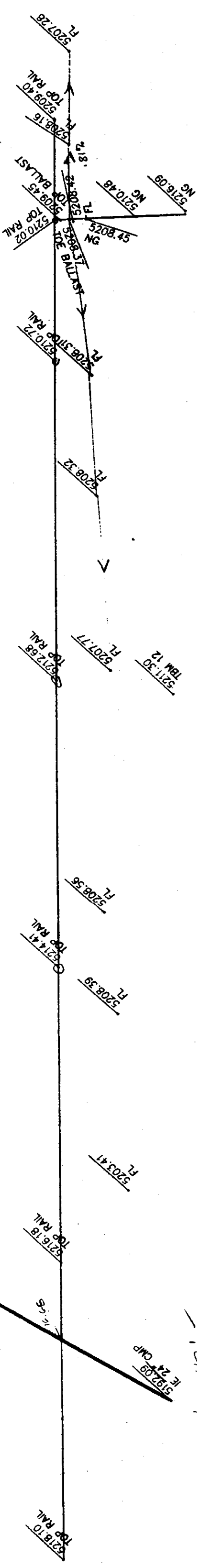
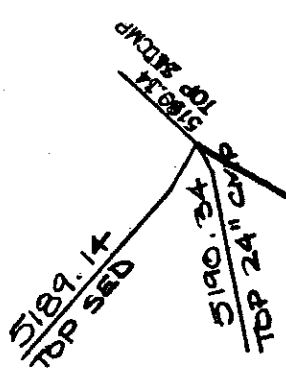
| WSEL(ft) | Q(cfs)  | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) |
|----------|---------|------------|------------|--------|-------|
| 31.00    | 3.6     | 0.25       | 0.17       | 18.8   | 3.2   |
| 31.50    | 31.2    | 0.75       | 0.52       | 29.1   | 15.2  |
| 2.00     | 85.5 ✓  | 1.25       | 0.78       | 41.9   | 32.8  |
| 32.50    | 170.4 ✓ | 1.75       | 1.14       | 48.6   | 55.5  |
| 33.0     | 284 ✓   |            |            |        |       |
| 33.5     | 426 ✓   |            |            |        |       |

NOTES:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



| Rail  |   | Road    |
|-------|---|---------|
| 10.02 | ✓ | 10.02   |
| 10.72 | ✓ | 9.45    |
| 12.68 | ✓ | 9.45    |
| 14.41 | ✓ | 8.42    |
|       |   | 10.08   |
|       |   | 10.13.5 |
|       |   | 10.48   |
|       |   | 16.09   |
|       |   | 1057-   |



$L = 112'$   
 $IE = 92.09'$   
 $S = 4.42\%$   
 $H = 16.28'$

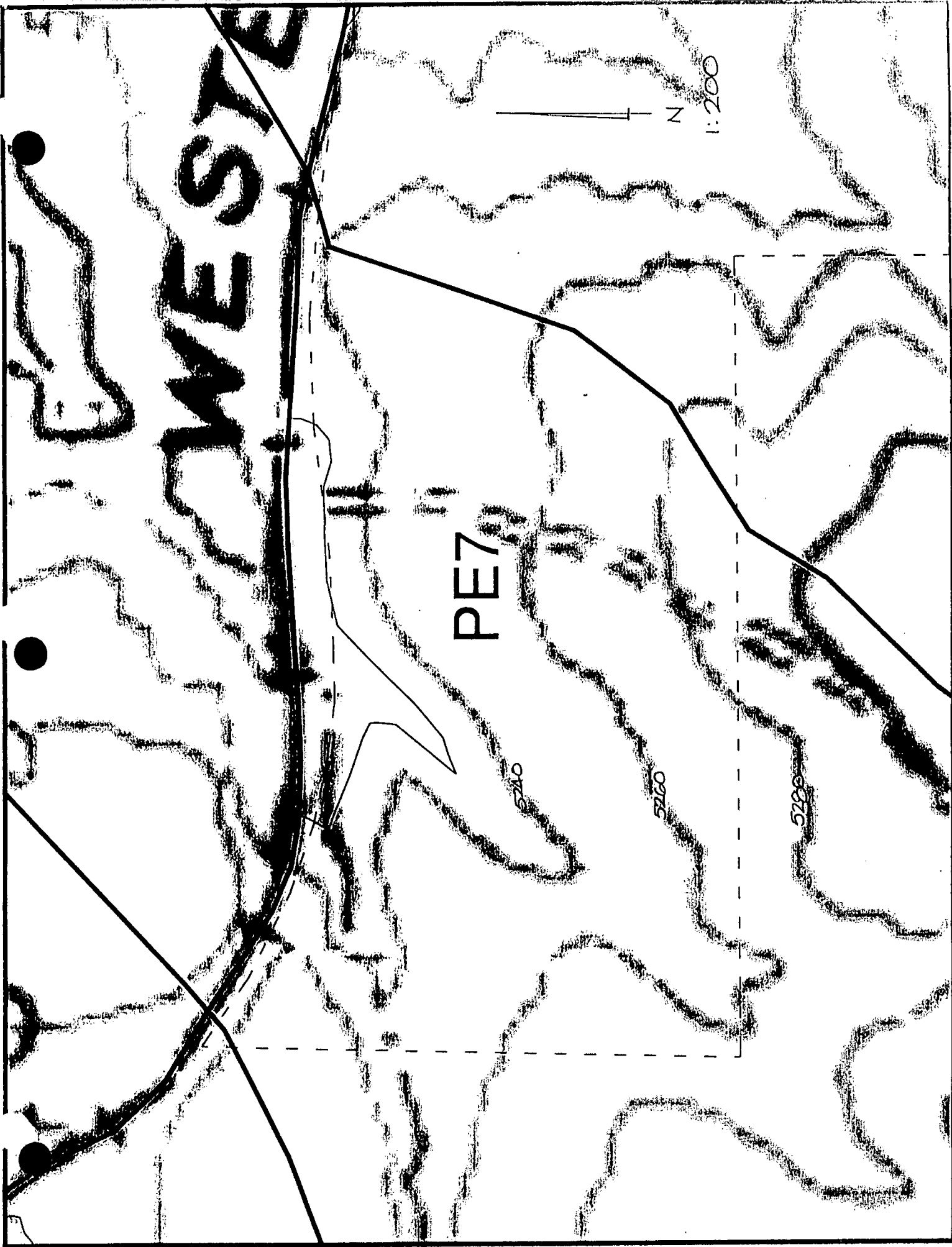
No sediment  
 protruding

gab ~ 44

Detention  
 5200' 0.82 acres  
 5210' 4.30 acres

Basin PH1 outlet





WEST

PE7

5240

5260

5280

1:200

N

Stead Basin PH1 ✓  
24" CMP IE= 92.09 ✓

| Elevation | Q <sub>culv</sub> | Q <sub>road</sub> | Q <sub>rail</sub> | Q <sub>total</sub> |
|-----------|-------------------|-------------------|-------------------|--------------------|
| 5204.8    | 4038 ✓            | 0 ✓               | 0                 | 4038 ✓             |
| 8.5       | 4442 ✓            | 1 ✓               | 0                 | 4543 ✓             |
| 9.0       | 4543 ✓            | 1712 ✓            | 0                 | 6255 ✓             |
| 9.5       | 4543 ✓            | 5140 ✓            | 0                 | 9683 ✓             |
| 10.0      | 4644 ✓            | 10587 ✓           | 0 ✓               | 151131 ✓           |
| 10.5      | 4644 ✓            | 177157 ✓          | 16 ✓              | 239214 ✓           |
| 11.0      | 4745 ✓            | 267240 ✓          | 94 ✓              | 408379 ✓           |

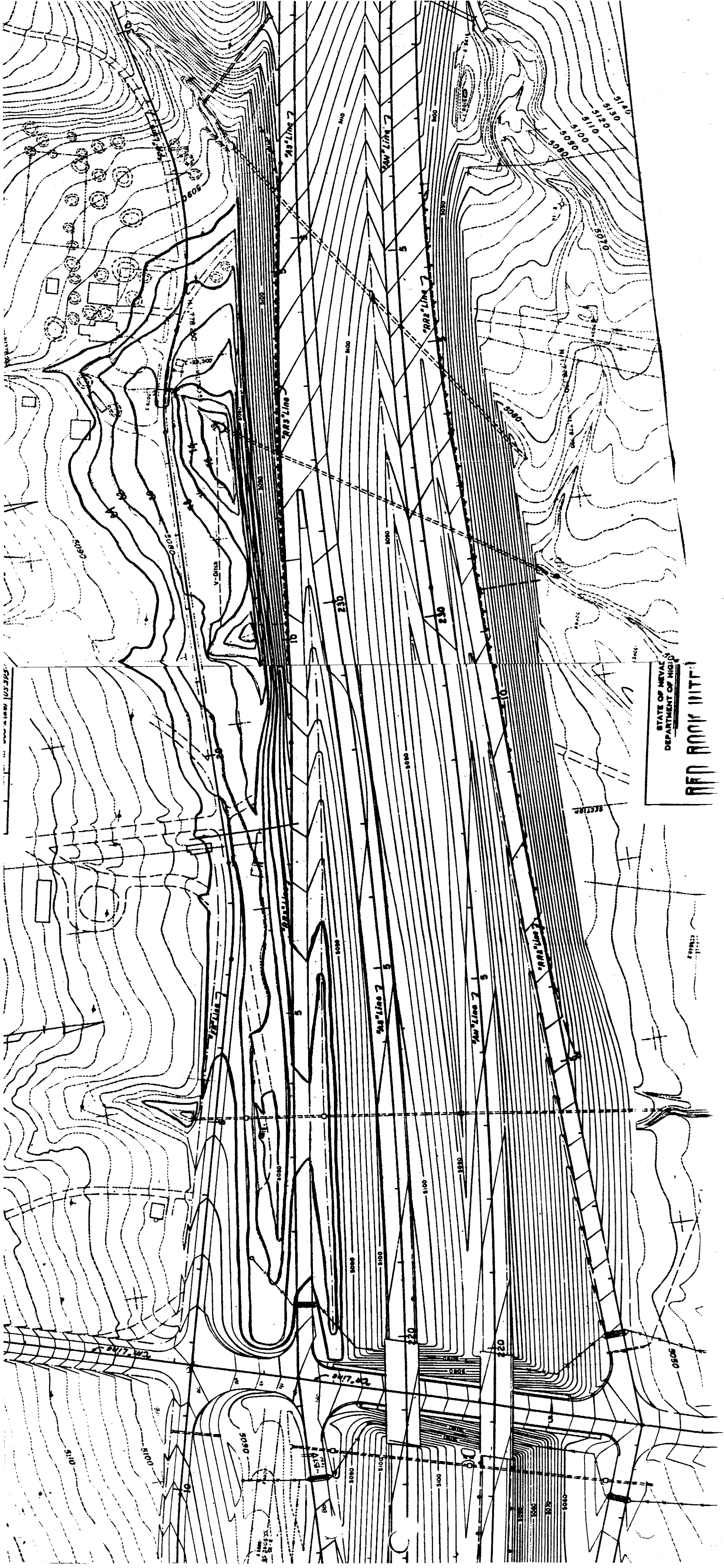
↑ ΔQ

| ΔI | 0' | 38' | 43' | 55' | 83' | 131' | 214' | 379' |
|----|----|-----|-----|-----|-----|------|------|------|
| ΔQ | 0' | 0'  | 1'  | 12' | 40' | 87'  | 154' | 240' |

↙ Diversion to 'RHL'

Detention

| Area (Ac.) | 0'      | 0.82' | 4.3'    | 4.3'    | 4.3'  | 4.3'  |
|------------|---------|-------|---------|---------|-------|-------|
| Elev.      | 5192.1' | 5200' | 5208.5' | 5209.5' | 5210' | 5211' |
| Q          | 0'      | 30'   | 43'     | 83'     | 131'  | 379'  |



STATE OF NEVADA  
DEPARTMENT OF HIGHWAYS  
RED ROCK HILL

PIPE CULVERT ANALYSIS ✓  
COMPUTATION OF CULVERT PERFORMANCE CURVE

May 12, 1999  
Stead Basin PH1 ✓  
24" CMP under RR ✓

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 2.00 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 2 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 3 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0240 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.80 ✓   |
| Culvert Length (feet).....                            | 112.0 ✓  |
| Culvert Slope (feet per foot).....                    | 0.0340 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater<br>Inlet Control<br>Depth (ft) | Headwater<br>Outlet Control<br>Depth (ft) | Normal<br>Depth (ft) | Critical<br>Depth (ft) | Depth at<br>Outlet (ft) | Outlet<br>Velocity<br>(fps) |
|--------------------|-------------------------|------------------------------------------|-------------------------------------------|----------------------|------------------------|-------------------------|-----------------------------|
| 30.0               | 2.00                    | 6.12                                     | 7.42                                      | 2.00                 | 1.86                   | 2.00                    | 9.55                        |
| 32.0               | 2.00                    | 6.82                                     | 8.69                                      | 2.00                 | 1.89                   | 2.00                    | 10.19                       |
| 34.0               | 2.00                    | 7.56                                     | 10.04                                     | 2.00                 | 1.91                   | 2.00                    | 10.82                       |
| 36.0               | 2.00                    | 8.34                                     | 11.47                                     | 2.00                 | 1.93                   | 2.00                    | 11.46                       |
| 38.0               | 2.00                    | 9.17                                     | 12.99                                     | 2.00                 | 1.94                   | 2.00                    | 12.10                       |
| 40.0               | 2.00                    | 10.04                                    | 14.59                                     | 2.00                 | 1.95                   | 2.00                    | 12.73                       |
| 41.0               | 2.00                    | 10.50                                    | 15.42                                     | 2.00                 | 1.96                   | 2.00                    | 13.05                       |
| 42.0               | 2.00                    | 10.96                                    | 16.27                                     | 2.00                 | 1.96                   | 2.00                    | 13.37                       |
| 43.0               | 2.00                    | 11.44                                    | 17.14                                     | 2.00                 | 1.96                   | 2.00                    | 13.69                       |
| 44.0               | 2.00                    | 11.93                                    | 18.03                                     | 2.00                 | 1.97                   | 2.00                    | 14.01                       |
| 45.0               | 2.00                    | 12.43                                    | 18.95                                     | 2.00                 | 1.97                   | 2.00                    | 14.32                       |
| 46.0               | 2.00                    | 12.93                                    | 19.88                                     | 2.00                 | 1.97                   | 2.00                    | 14.64                       |
| 47.0               | 2.00                    | 13.46                                    | 20.83                                     | 2.00                 | 1.97                   | 2.00                    | 14.96                       |
| 48.0               | 2.00                    | 13.99                                    | 21.81                                     | 2.00                 | 1.98                   | 2.00                    | 15.28                       |

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Project stead Master  
Project No. 208  
Sheet No.      of       
Calculated by      Date     

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Ditch section @ CP PH1  
flow to "RHI"

CROSS SECTION PARAMETERS:

FILENAME: PH1ROAD.SEC

No. of Cross Section Points: 8 ~~Bed Slope = 0.00840~~ Max Elev.: 16.09 ✓  
Bank Stations.....Left: 0.0 Right.....: 57.0 Min Elev.: 8.37 ✓  
Encroachment Stations..Left: 0.0 Right.....: Weir Coef: 2.650 ✓

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta.    | No. | Elev.   | Sta.    | No. | Elev.  | Sta.    |
|-----|---------|---------|-----|---------|---------|-----|--------|---------|
| 1)  | 10.02 ✓ | 0.00 ✓  | 2)  | 9.45 ✓  | 0.10 ✓  | 3)  | 9.45 ✓ | 2.00 ✓  |
| 4)  | 8.37 ✓  | 6.00 ✓  | 5)  | 8.42 ✓  | 8.00 ✓  | 6)  | 8.45 ✓ | 13.50 ✓ |
| 7)  | 10.48 ✓ | 35.00 ✓ | 8)  | 16.09 ✓ | 57.00 ✓ |     |        |         |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H:max(ft) | H:ave(ft) | TW(ft) | A(sf) |
|----------|--------|-----------|-----------|--------|-------|
| 8.50     | 0.5    | 0.13      | 0.07      | 8.5    | 0.6   |
| 9.00     | 12.4   | 0.63      | 0.42      | 15.7   | 6.7   |
| 9.50     | 40.2   | 1.13      | 0.67      | 24.5   | 16.4  |
| 10.00    | 87.4   | 1.63      | 1.00      | 29.9   | 30.0  |
| 10.50    | 154.1  | 2.13      | 1.32      | 35.1   | 46.3  |
| 11.00    | 239.7  | 2.63      | 1.74      | 37.0   | 64.3  |

NOTES:

Project < Stead Master >  
Project No. 208  
Sheet No.      of       
Calculated by      Date     

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:  
Stead Master Plan  
@ CP PH1, RR Profile

CROSS SECTION PARAMETERS:                      FILENAME: PH1RAIL.SEC

No. of Cross Section Points: 4 ~~Bed Slope = 0.00016~~ Max Elev.: 14.41 ✓  
Bank Stations.....Left: 0.0 Right.....: 328.0 Min Elev.: 10.02 ✓  
Encroachment Stations..Left: 0.0 Right.....: ✓ Weir Coef: 2.800 ✓

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta.     | No. | Elev.   | Sta.    | No. | Elev.   | Sta.     |
|-----|---------|----------|-----|---------|---------|-----|---------|----------|
| 1)  | 10.02 ✓ | 0.00 ✓   | 2)  | 10.72 ✓ | 62.00 ✓ | 3)  | 12.68 ✓ | 202.00 ✓ |
| 4)  | 14.41 ✓ | 328.00 ✓ |     |         |         |     |         |          |

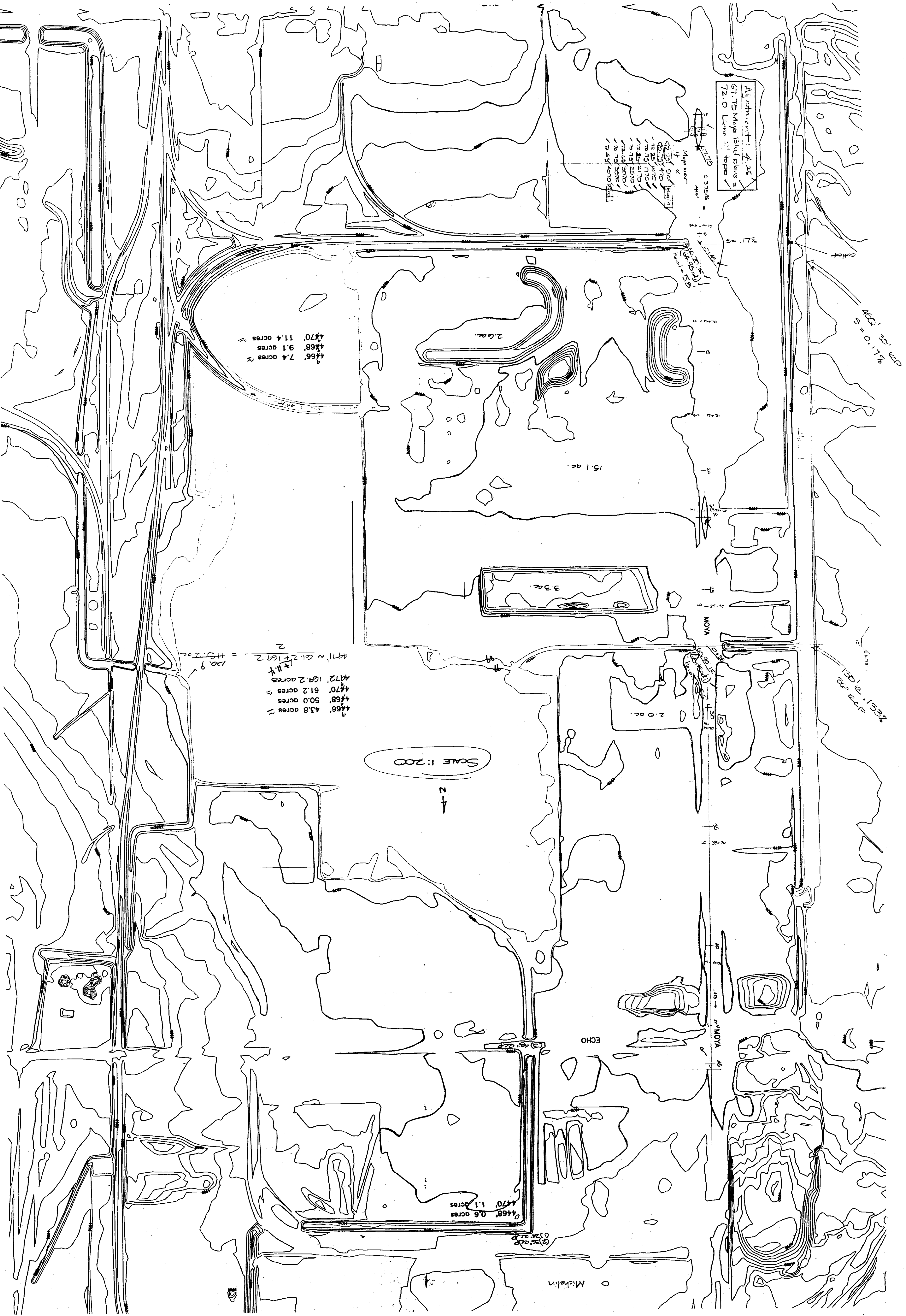
COMPUTED PARAMETERS:

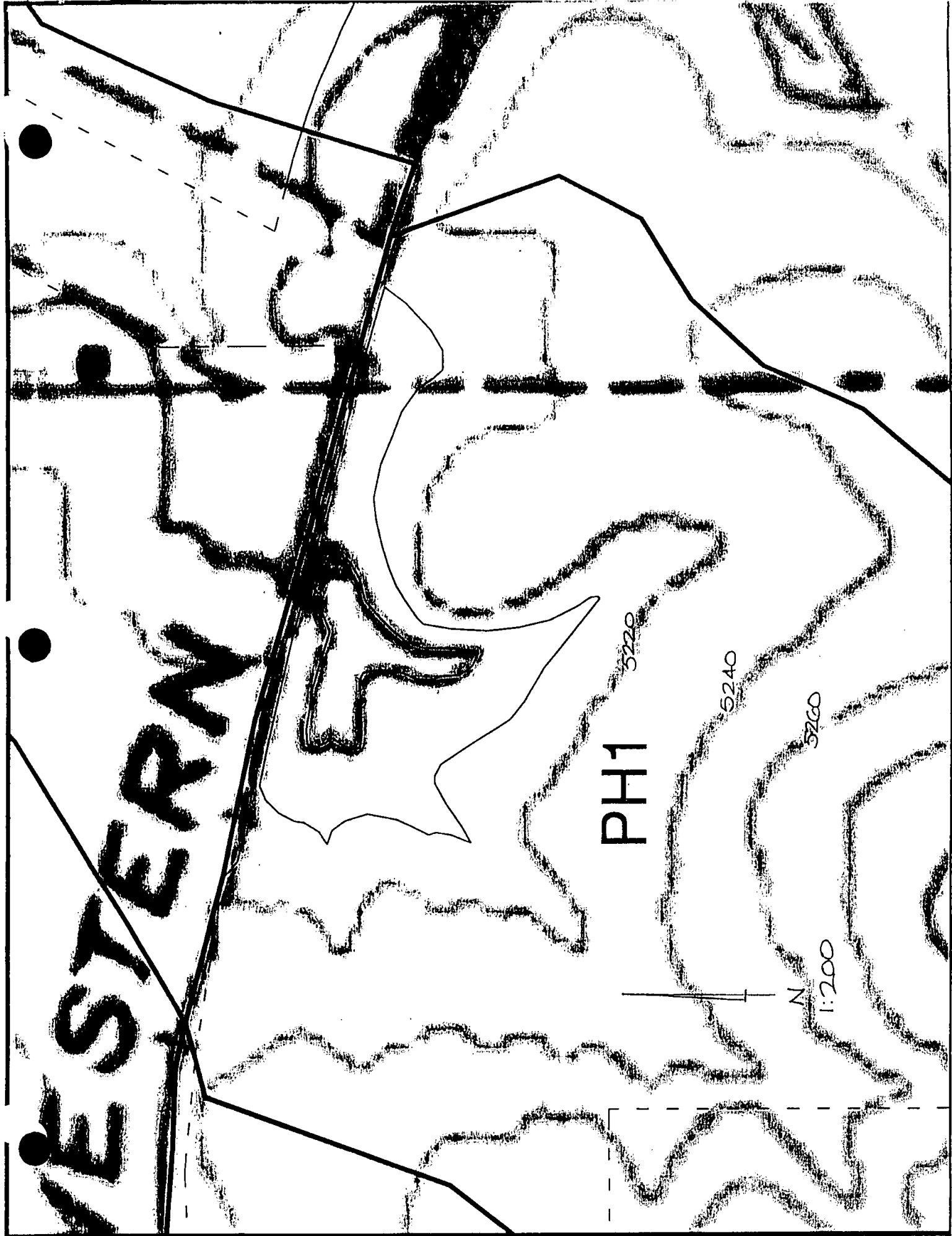
| WSEL(ft) | Q(cfs) | H:max(ft) | H:ave(ft) | TW(ft) | A(sf) |
|----------|--------|-----------|-----------|--------|-------|
| 10.50    | 15.8   | 0.48      | 0.24      | 42.5   | 10.2  |
| 11.00    | 93.5   | 0.98      | 0.51      | 82.0   | 41.9  |
| 11.50    | 254.0  | 1.48      | 0.78      | 117.7  | 91.8  |

NOTES:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_







PH1

5220

5240

5260

N  
1:200

WESTERN





Stantech  
Consulting

# STANTECH CONSULTING INC.

Formerly SEA, Incorporated

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JOB NO. \_\_\_\_\_

SHEET 1 OF \_\_\_\_\_

PROJECT

Stead Master Plan

DATE

5/26/99

SUBJECT

Basin PW 4 Retention Area

DESIGNED

(m)

CHECKED \_\_\_\_\_

| Elev | Areas (ft <sup>2</sup> )                                                  | Area (ac) | Q   | (ft <sup>3</sup> /s) |
|------|---------------------------------------------------------------------------|-----------|-----|----------------------|
| 66.0 | 0                                                                         | 0         | 0   | (0)                  |
| 70.0 | 200 ft <sup>2</sup>                                                       | 0.01      | 50  | (3.1)                |
| 72.0 | 3550 + 500 = 4050 ft <sup>2</sup>                                         | 0.09      | 108 | (5.1)                |
| 74.0 | 7500 + 1500 = 9,000 ft <sup>2</sup>                                       | 0.21      | 150 | (7.1)                |
| 76.0 | 16,250 ft <sup>2</sup>                                                    | 0.37      | 182 | (9.1)                |
| 78.0 | 27,100 ft <sup>2</sup>                                                    | 0.64      | 210 | (11.1)               |
| 80.0 | 57,750 ft <sup>2</sup> + 3400 ft <sup>2</sup> = 61,150 ft <sup>2</sup>    | 1.40      | 234 | (13.1)               |
| 82.0 | 88,100 ft <sup>2</sup> + 18,000 ft <sup>2</sup> = 106,400 ft <sup>2</sup> | 2.44      | 256 | (15.1)               |
| 84.0 | 114,200 ft <sup>2</sup> + 54,700 ft <sup>2</sup> = 168,900                | 3.88      | 277 | (17.1)               |
| 86.0 | 96,350 ft <sup>2</sup> + 140,650 ft <sup>2</sup> = 237,000                | 5.44      | 295 | (19.1)               |
| 87.0 |                                                                           | Δ         | 305 | (20.1)               |

Area from  
NOT  
Rock Interchange  
Contour Grading  
and Drainage  
Control Plan

PIPE CULVERT ANALYSIS ✓  
COMPUTATION OF CULVERT PERFORMANCE CURVE ✓

May 26, 1999 ✓  
48" RCP W/ IMPROVED INLET ✓  
CULVERT PARAMETER FROM NIMBUS REPORT (WSU)  
BASIN PW4 ✓

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 4.00 ✓   |
| FIWA Chart Number (1,2 or 3).....                     | 1 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 2 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.20 ✓   |
| Culvert Length (feet).....                            | 550.0 ✓  |
| Culvert Slope (feet per foot).....                    | 0.0530 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth<br>(ft) | Headwater (ft)<br>Inlet Control | Headwater (ft)<br>Outlet Control | Normal Depth<br>(ft) | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|----------------------------|---------------------------------|----------------------------------|----------------------|------------------------|-------------------------|--------------------------|
| 40.0               | 4.00                       | 2.69                            | -24.54                           | 0.94                 | 1.89                   | 0.94                    | 17.81                    |
| 50.0               | 1.00                       | 3.09                            | -25.13                           | 1.05                 | 2.12                   | 1.05                    | 18.93                    |
| 60.0               | 4.00                       | 3.47                            | -23.77                           | 1.15                 | 2.33                   | 1.15                    | 20.00                    |
| 70.0               | 2.00                       | 3.85                            | -24.01                           | 1.13                 | 2.53                   | 1.13                    | 24.15                    |
| 80.0               | 2.00                       | 4.23                            | -23.34                           | 1.34                 | 2.71                   | 1.34                    | 21.72                    |
| 90.0               | 2.00                       | 4.63                            | -22.61                           | 1.43                 | 2.88                   | 1.43                    | 22.36                    |
| 100.0              | 2.00                       | 4.83                            | -21.80                           | 1.51                 | 3.03                   | 1.51                    | 23.06                    |
| 110.0              | 4.00                       | 5.19                            | -20.52                           | 1.59                 | 3.17                   | 1.59                    | 23.65                    |
| 120.0              | 4.00                       | 5.62                            | -19.63                           | 1.67                 | 3.30                   | 1.67                    | 24.21                    |
| 130.0              | 4.00                       | 6.08                            | -18.68                           | 1.75                 | 3.41                   | 1.75                    | 24.67                    |
| 140.0              | 4.00                       | 6.58                            | -17.64                           | 1.82                 | 3.51                   | 1.82                    | 25.19                    |
| 150.0              | 4.00                       | 7.11                            | -16.53                           | 1.88                 | 3.60                   | 1.88                    | 25.80                    |
| 160.0              | 5.00                       | 7.69                            | -14.34                           | 1.96                 | 3.67                   | 1.96                    | 26.05                    |
| 170.0              | 4.00                       | 8.30                            | -14.08                           | 2.03                 | 3.73                   | 2.03                    | 26.51                    |
| 180.0              | 4.00                       | 8.95                            | -12.74                           | 2.10                 | 3.77                   | 2.10                    | 26.86                    |
| 190.0              | 4.00                       | 9.63                            | -11.32                           | 2.17                 | 3.81                   | 2.17                    | 27.21                    |
| 200.0              | 4.00                       | 10.35                           | -9.83                            | 2.25                 | 3.85                   | 2.25                    | 27.54                    |
| 210.0              | 4.00                       | 11.11                           | -8.26                            | 2.31                 | 3.87                   | 2.31                    | 27.88                    |
| 220.0              | 4.00                       | 11.90                           | -6.61                            | 2.38                 | 3.89                   | 2.38                    | 28.17                    |
| 230.0              | 4.00                       | 12.74                           | -4.89                            | 2.46                 | 3.91                   | 2.46                    | 28.44                    |
| 240.0              | 4.00                       | 13.61                           | -3.09                            | 2.53                 | 3.92                   | 2.53                    | 28.71                    |
| 250.0              | 4.00                       | 14.51                           | -1.21                            | 2.60                 | 3.93                   | 2.60                    | 28.92                    |
| 260.0              | 4.00                       | 15.45                           | 0.74                             | 2.68                 | 3.94                   | 2.68                    | 29.05                    |
| 270.0              | 4.00                       | 16.43                           | 2.77                             | 2.75                 | 3.95                   | 2.75                    | 29.33                    |
| 280.0              | 4.00                       | 17.45                           | 4.88                             | 2.83                 | 3.96                   | 2.83                    | 29.50                    |
| 290.0              | 4.00                       | 18.51                           | 7.07                             | 2.90                 | 3.96                   | 2.90                    | 29.67                    |
| 300.0              | 4.00                       | 19.60                           | 9.33                             | 2.99                 | 3.97                   | 2.99                    | 29.75                    |

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RPT Basin PWS

North Virginia at Red Rock Road ✓  
Centerline elevations

| Elevation | Q <sub>24" CMP</sub> | Q <sub>RedRock</sub> | Q <sub>Virginia</sub> | Q <sub>total</sub> |
|-----------|----------------------|----------------------|-----------------------|--------------------|
| 100.35    | 12-15 ✓              | 0 ✓                  | 0 ✓                   | 12-15 ✓            |
| 100.50    | 14-16 ✓              | 1 ✓                  | 0 ✓                   | 15-17 ✓            |
| 101.00    | 17-21 ✓              | 31-32 ✓              | 12-13                 | 60-66 ✓            |
| 101.40    | 18-24 ✓              | 100-104 ✓            | 40-42                 | 159-170 ✓          |

↑  
DQ

|    |    |     |     |     |      |
|----|----|-----|-----|-----|------|
| DI | 0' | 15' | 17' | 66' | 170' |
| DQ | 0' | 0'  | 1'  | 32' | 104' |

↙ Divert to basin "PW4"

PIPE CULVERT ANALYSIS ✓  
COMPUTATION OF CULVERT PERFORMANCE CURVE

May 12, 1999  
Stead Basin PW5 ✓  
24" rcp under N. Virginia @ FR 10+65 ✓

I.E. = 98.2'

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 2.00 ✓   |
| FIWA Chart Number (1,2 or 3).....                     | 1 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 3 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.80 ✓   |
| Culvert Length (feet).....                            | 75.0 ✓   |
| Culvert Slope (feet per foot).....                    | 0.0291 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater (ft)<br>Inlet Control | Normal Depth<br>Outlet Control | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|---------------------------------|--------------------------------|------------------------|-------------------------|--------------------------|
| 10.0               | 1.00                    | 1.64                            | -0.19                          | 0.69                   | 1.13                    | 0.69                     |
| 11.0               | 2.00                    | 1.74                            | 0.34                           | 0.73                   | 1.19                    | 0.73                     |
| 13.0               | 2.00                    | 1.94                            | 0.54                           | 0.80                   | 1.30                    | 0.80                     |
| 14.0               | 2.00                    | 2.04                            | 0.66                           | 0.83                   | 1.35                    | 0.83                     |
| 15.0               | 2.00                    | 2.13                            | 0.78                           | 0.87                   | 1.40                    | 0.87                     |
| 16.0               | 2.00                    | 2.26                            | 0.92                           | 0.90                   | 1.44                    | 0.90                     |
| 17.0               | 2.00                    | 2.37                            | 1.06                           | 0.93                   | 1.49                    | 0.93                     |
| 18.0               | 2.00                    | 2.42                            | 1.21                           | 0.96                   | 1.53                    | 0.96                     |
| 19.0               | 2.00                    | 2.54                            | 1.37                           | 0.99                   | 1.57                    | 0.99                     |
| 20.0               | 2.00                    | 2.66                            | 1.53                           | 1.02                   | 1.61                    | 1.02                     |
| 21.0               | 2.00                    | 2.80                            | 1.71                           | 1.05                   | 1.64                    | 1.05                     |
| 22.0               | 2.00                    | 2.93                            | 1.89                           | 1.08                   | 1.67                    | 1.08                     |
| 23.0               | 2.00                    | 3.08                            | 2.09                           | 1.11                   | 1.71                    | 1.11                     |
| 24.0 ✓             | 2.00                    | 3.23                            | 2.29                           | 1.14                   | 1.73                    | 1.14                     |
| 25.0               | 2.00                    | 3.39                            | 2.50                           | 1.18                   | 1.76                    | 1.18                     |
| 26.0               | 2.00                    | 3.55                            | 2.72                           | 1.20                   | 1.79                    | 1.20                     |
| 27.0               | 2.00                    | 3.72                            | 2.94                           | 1.23                   | 1.81                    | 1.23                     |

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↑  
Inlet  
Control

Project Stand Master  
Project No. 208  
Sheet No.      of       
Calculated by      Date     

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

N Virginia st @ PWS

CROSS SECTION PARAMETERS:

FILENAME: NVARROCK.SEC

No. of Cross Section Points: 4 Bed-Slope: 0:00010 Max Elev.: 105.19 ✓  
Bank Stations.....Left: 1000.0 Right.....: 1152.0 Min Elev.: 100.35 ✓  
Encroachment Stations..Left: 1000.0 Right.....: Weir Coef: 2.900 ✓

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.    | Sta. No.  | Elev. | Sta. No. | Elev.     | Sta. |          |           |
|-----|----------|-----------|-------|----------|-----------|------|----------|-----------|
| 1)  | 100.35 ✓ | 1000.00 ✓ | 2)    | 101.99 ✓ | 1052.00 ✓ | 3)   | 103.56 ✓ | 1102.00 ✓ |
| 4)  | 105.19 ✓ | 1152.00 ✓ |       |          |           |      |          |           |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) |
|----------|--------|------------|------------|--------|-------|
|----------|--------|------------|------------|--------|-------|

|        |      |      |      |      |      |
|--------|------|------|------|------|------|
| 100.50 | 0.3  | 0.15 | 0.08 | 4.8  | 0.4  |
| 100.80 | 5.0  | 0.45 | 0.23 | 14.3 | 3.2  |
| 101.00 | 12.5 | 0.65 | 0.33 | 20.6 | 6.7  |
| 101.20 | 24.5 | 0.85 | 0.42 | 27.0 | 11.5 |
| 101.40 | 41.6 | 1.05 | 0.53 | 33.3 | 17.5 |

NOTES:

Project Steel Master  
Project No. 203  
Sheet No.      of       
Calculated by      Date     

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Red Rock E Profile

@ CP PW5

CROSS SECTION PARAMETERS:

FILENAME: RROCK@NV.SEC

No. of Cross Section Points: 4 ✓ Bed = 1000.0 Max Elev.: 101.41 ✓  
Bank Stations.....Left: 1000.0 ✓ Right.....: 1068.0 ✓ Min Elev.: 100.35 ✓  
Encroachment Stations..Left: 1000.0 Right.....:      ✓ Weir Coef: 2.900 ✓

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.    | Sta. No.  | Elev. | Sta. No. | Elev.     | Sta. |          |           |
|-----|----------|-----------|-------|----------|-----------|------|----------|-----------|
| 1)  | 100.35 ✓ | 1000.00 ✓ | 2)    | 100.96 ✓ | 1050.00 ✓ | 3)   | 101.04 ✓ | 1058.00 ✓ |
| 4)  | 101.41 ✓ | 1068.00 ✓ |       |          |           |      |          |           |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) |
|----------|--------|------------|------------|--------|-------|
| 100.50   | 0.8    | 0.15       | 0.08       | 12.3   | 0.9   |
| 100.80   | 12.9   | 0.45       | 0.23       | 36.9   | 8.3   |
| 101.00   | 32.4   | 0.65       | 0.32       | 54.0   | 17.3  |
| 101.20   | 63.1   | 0.85       | 0.47       | 62.3   | 29.2  |
| 101.40   | 103.5  | 1.05       | 0.62       | 67.7   | 42.2  |

NOTES:

Stead Basin PW7 ✓  
 48" CMP IE= 16.50 ✓

| Elevation | Q <sub>culv</sub> | Q <sub>road</sub> | Q <sub>rail</sub> | Q <sub>total</sub> |
|-----------|-------------------|-------------------|-------------------|--------------------|
| 22.2      | 100 ✓             | 0                 | 0                 | 100 ✓              |
| 24.5      | 130 ✓             | 0 ✓               | 0                 | 130 ✓              |
| 25.0      | 135 ✓             | 7 ✓               | 0                 | 142 ✓              |
| 25.5      | 140 ✓             | 30 ✓              | 0                 | 170 ✓              |
| 26.0      | 145 ✓             | 71 ✓              | 0 ✓               | 216 ✓              |
| 26.5      | 150 ✓             | 131 ✓             | 1 ✓               | 282 ✓              |

↑  
DQ

|    |    |      |      |      |      |      |      |
|----|----|------|------|------|------|------|------|
| DI | 0' | 100' | 130' | 142' | 170' | 216' | 282' |
| DQ | 0' | 0'   | 0'   | 7'   | 30'  | 71'  | 131' |

↘ Diversion to  
basin "AW1"



PIPE CULVERT ANALYSIS ✓  
COMPUTATION OF CULVERT PERFORMANCE CURVE

May 12, 1999 ✓  
Stead Basin PW7 ✓  
48" CMP under RR ✓

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 4.00 ✓   |
| FIWA Chart Number (1,2 or 3).....                     | 2 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 3 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0240 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.80 ✓   |
| Culvert Length (feet).....                            | 80.0 ✓   |
| Culvert Slope (feet per foot).....                    | 0.1215 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater (ft)<br>Inlet Control | Headwater (ft)<br>Outlet Control | Normal Depth<br>(ft) | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|---------------------------------|----------------------------------|----------------------|------------------------|-------------------------|--------------------------|
| 100.0              | 2.00                    | 5.66                            | -3.12                            | 1.68                 | 3.03                   | 1.68                    | 19.95                    |
| 130.0              | 2.00                    | 8.05                            | -0.80                            | 1.95                 | 3.41                   | 1.95                    | 21.37                    |
| 135.0              | 2.00                    | 8.51                            | -0.37                            | 2.00                 | 3.46                   | 2.00                    | 21.55                    |
| 140.0              | 2.00                    | 8.99                            | 0.08                             | 2.04                 | 3.51                   | 2.04                    | 21.79                    |
| 145.0              | 2.00                    | 9.49                            | 0.54                             | 2.08                 | 3.55                   | 2.08                    | 21.96                    |
| 150.0              | 2.00                    | 10.01                           | 1.02                             | 2.06                 | 3.60                   | 2.06                    | 22.96                    |
| 154.0              | 3.00                    | 10.44                           | 1.41                             | 2.16                 | 3.63                   | 2.16                    | 22.26                    |
| 159.0              | 4.00                    | 10.98                           | 2.08                             | 2.20                 | 3.66                   | 2.20                    | 22.42                    |
| 163.0              | 5.00                    | 11.43                           | 3.47                             | 2.24                 | 3.69                   | 2.24                    | 22.48                    |

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Project Stead Master  
Project No. 208  
Sheet No.      of       
Calculated by      Date     

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

@ CP PW7

Ditch Section flow to "AWI"

CROSS SECTION PARAMETERS:

FILENAME: PW7ROAD.SEC

No. of Cross Section Points: 10 ~~Bed Slope = 0.00010~~ Max Elev.: 28.01 ✓  
Bank Stations.....Left: 0.0 Right.....: 60.0 Min Elev.: 24.41 ✓  
Encroachment Stations..Left: 0.0 Right.....: 60.0 Weir Coef: 2.650 ✓

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta.    | No. | Elev.   | Sta.    | No. | Elev.   | Sta.    |
|-----|---------|---------|-----|---------|---------|-----|---------|---------|
| 1)  | 26.38 ✓ | 0.00 ✓  | 2)  | 25.68 ✓ | 0.10 ✓  | 3)  | 25.68 ✓ | 3.00 ✓  |
| 4)  | 24.41 ✓ | 6.00 ✓  | 5)  | 24.57 ✓ | 10.00 ✓ | 6)  | 25.00 ✓ | 19.00 ✓ |
| 7)  | 25.28 ✓ | 22.00 ✓ | 8)  | 25.85 ✓ | 26.00 ✓ | 9)  | 26.62 ✓ | 37.00 ✓ |
| 10) | 28.01 ✓ | 60.00 ✓ |     |         |         |     |         |         |

COMPUTED PARAMETERS:

| H (ft) | Q(cfs) | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) |
|--------|--------|------------|------------|--------|-------|
| 2.50   | 0.1    | 0.09       | 0.05       | 2.5    | 0.1   |
| 5.00   | 7.2    | 0.59       | 0.30       | 14.4   | 4.4   |
| 25.50  | 30.4   | 1.09       | 0.65       | 20.1   | 13.1  |
| 26.00  | 70.7   | 1.59       | 0.90       | 28.1   | 25.3  |
| 26.50  | 131.4  | 2.09       | 1.16       | 35.3   | 41.1  |

NOTES:

Project Stead Master  
Project No. 203  
Sheet No.      of       
Calculated by      Date     

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

@ CP PWT  
RR Profile

CROSS SECTION PARAMETERS:

FILENAME: PW7RAIL.SEC

No. of Cross Section Points: 5 Bed ~~Slope~~ Slope=0.00040 Max Elev.: 27.94 ✓  
Bank Stations.....Left: 0.0 Right.....: 1215.0 Min Elev.: 26.38 ✓  
Encroachment Stations..Left: 0.0 Right.....:      Weir Coef: 2.000 ✓

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta. No. | Elev. | Sta. No. | Elev.     | Sta. |         |          |
|-----|---------|----------|-------|----------|-----------|------|---------|----------|
| 1)  | 26.38 ✓ | 0.00 ✓   | 2)    | 26.55 ✓  | 19.00 ✓   | 3)   | 27.30 ✓ | 118.00 ✓ |
| 4)  | 27.60 ✓ | 160.00 ✓ | 5)    | 27.94 ✓  | 1215.00 ✓ |      |         |          |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) |
|----------|--------|------------|------------|--------|-------|
| 5.50     | 0.6    | 0.12       | 0.06       | 13.4   | 0.8   |
| 7.00     | 41.0   | 0.62       | 0.30       | 78.4   | 23.5  |
| 15.50    | 186.3  | 1.12       | 0.54       | 146.0  | 79.4  |

NOTES:



PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

Basin RR 1

May 12, 1999  
Stead Basin RR1 ✓  
24" RCP under 395 ✓  
outlet to SS2, IE = 86.9' ✓

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 2.00 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 1 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 3 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.80 ✓   |
| Culvert Length (feet).....                            | 490.0    |
| Culvert Slope (feet per foot).....                    | 0.0600   |

PROGRAM RESULTS:

| Flow Rate (cfs) | Tailwater Depth (ft) | Headwater Inlet Control (ft) | Headwater Outlet Control (ft) | Normal Depth (ft) | Critical Depth (ft) | Depth at Outlet (ft) | Outlet Velocity (fps) |
|-----------------|----------------------|------------------------------|-------------------------------|-------------------|---------------------|----------------------|-----------------------|
| 25.0            | 2.00                 | 3.38                         | -19.68                        | 0.94              | 1.76                | 0.94                 | 17.15                 |
| 26.0            | 2.00                 | 3.55                         | -19.05                        | 0.96              | 1.79                | 0.96                 | 17.36                 |
| 27.0            | 2.00                 | 3.72                         | -18.39                        | 0.99              | 1.81                | 0.99                 | 17.36                 |
| 28.0            | 2.00                 | 3.89                         | -17.72                        | 1.01              | 1.83                | 1.01                 | 17.67                 |
| 29.0            | 3.00                 | 4.08                         | -16.01                        | 1.03              | 1.85                | 1.03                 | 17.80                 |
| 30.0            | 3.00                 | 4.27                         | -15.28                        | 1.05              | 1.86                | 1.05                 | 18.00                 |
| 31.0            | 3.00                 | 4.46                         | -14.53                        | 1.07              | 1.88                | 1.07                 | 18.13                 |
| 32.0            | 3.00                 | 4.67                         | -13.75                        | 1.09              | 1.89                | 1.09                 | 18.24                 |
| 33.0            | 3.00                 | 4.87                         | -12.95                        | 1.11              | 1.90                | 1.11                 | 18.39                 |
| 34.0            | 3.00                 | 5.09                         | -12.12                        | 1.13              | 1.91                | 1.13                 | 18.60                 |

Say  
Culvert Capacity  
≈ 30 cfs +/-

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↑  
Inlet  
Control



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JOB NO. 26000208

**SHEET** \_\_\_\_\_ **OF** \_\_\_\_\_

## PROJECT

Stead Drainage Master

DATE \_\_\_\_\_

4/14/98

**SUBJECT**

split flows (Basin RSD)

**DESIGNED**

**CHECKED**



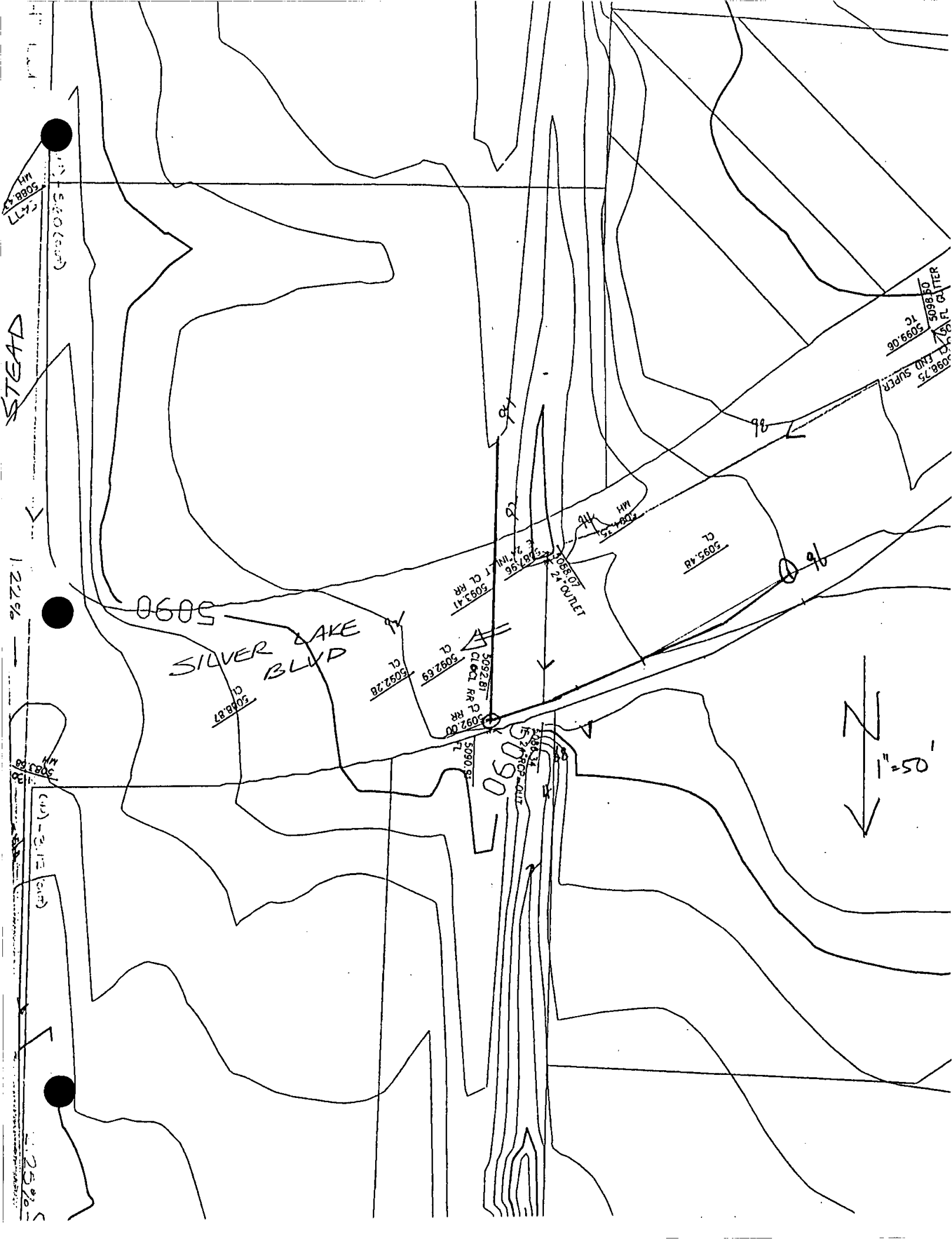
| Flow    | Q <sub>weir</sub> (H) | Q <sub>Rail</sub> | Q <sub>weir</sub> | Q <sub>total</sub> |
|---------|-----------------------|-------------------|-------------------|--------------------|
| 5087.96 | 0                     | 0                 | 0                 | 0                  |
| 92.0    | 26 (4.04)             | 0                 | 0                 | 26                 |
| 92.5    | 28 (1.51)             | 26                | 7                 | 61                 |
| 93.0    | 30 (5.04)             | 166               | 41                | 237                |
| 93.5    | 32 (5.54)             | 469               | 114               | 615                |

DI

0' 26' 61' 237' 615'

to stand  $\triangleleft \triangle \circ$   
Blvd.

|    |    |     |      |      |
|----|----|-----|------|------|
| 0' | 0' | 26' | 166' | 469' |
|----|----|-----|------|------|



5088.47  
5088.47  
5088.47

STEAD

1.22%

0605

SILVER LAKE  
BLVD

5088.87  
CL

5092.28  
CL

5092.69  
CL

5092.87  
CL

5092.00  
CL

5090.87  
CL

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5090.87  
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5081.96  
CL

5081.41  
CL

5081.07  
CL

5095.48  
CL

5098.50  
CL

5098.06  
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PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

April 14, 1999  
24" RCP UNDER SILVER LAKE BLVD ✓  
IE= 87.96' ✓

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 2.00 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 1 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 77.0 ✓   |
| Culvert Slope (feet per foot).....                    | 0.0210 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater (ft)<br>Inlet Control | Headwater (ft)<br>Outlet Control | Normal Depth<br>(ft) | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|---------------------------------|----------------------------------|----------------------|------------------------|-------------------------|--------------------------|
| 5.0                | 1.00                    | 1.11                            | -0.13                            | 0.53                 | 0.79                   | 0.53                    | 7.54                     |
| 10.0               | 1.00                    | 1.69                            | 0.33                             | 0.76                 | 1.13                   | 0.76                    | 9.10                     |
| 15.0               | 2.00                    | 2.26                            | 1.25                             | 0.95                 | 1.40                   | 0.95                    | 10.18                    |
| 20.0               | 3.00                    | 2.95                            | 2.93                             | 1.13                 | 1.61                   | 1.13                    | 10.96                    |
| 25.0               | 2.00                    | 3.86                            | 2.79                             | 1.31                 | 1.76                   | 1.31                    | 11.49                    |
| 30.0               | 2.00                    | 4.97                            | 3.85                             | 1.51                 | 1.86                   | 1.51                    | 11.82                    |
| 35.0               | 2.00                    | 6.28                            | 5.11                             | 1.78                 | 1.92                   | 1.78                    | 11.84                    |
| 40.0               | 2.00                    | 7.79                            | 6.55                             | 2.00                 | 1.95                   | 2.00                    | 12.73                    |
| 45.0               | 2.00                    | 9.51                            | 8.19                             | 2.00                 | 1.97                   | 2.00                    | 14.32                    |

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Project 260002-08  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Silver Lake Blvd split flow  
- Rail Road &

CROSS SECTION PARAMETERS:

FILENAME: SLV-RR1.SEC

No. of Cross Section Points: 4 Bed Slope: 0.02100 Max Elev.: 94.00  
Bank Stations.....Left: 1004.0 Right.....: 1064.0 Min Elev.: 92.00  
Encroachment Stations..Left: \_\_\_\_\_ Right.....: \_\_\_\_\_  
Manning-n Values.....LOB: 0.016 CHANNEL...: 0.016 ROB.....: 0.035

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev. | Sta.    | No. | Elev. | Sta.    | No. | Elev. | Sta.    |
|-----|-------|---------|-----|-------|---------|-----|-------|---------|
| 1)  | 92.00 | 1004.00 | 2)  | 92.81 | 1036.00 | 3)  | 93.41 | 1064.00 |
| 4)  | 94.00 | 1129.00 |     |       |         |     |       |         |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft) | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|--------|----------|
| 92.50    | 26.4   | 5.3    | 1.88 | 0.016 | 1.0 | 19.8  | 4.9    | 19.8  | 92.64  |          |
| 93.00    | 165.5  | 8.3    | 2.10 | 0.016 | 1.0 | 40.9  | 19.9   | 40.9  | 93.34  |          |
| 93.50    | 468.5  | 10.1   | 2.20 | 0.016 | 1.0 | 69.9  | 46.4   | 69.9  | 94.03  |          |
| 94.00    | 832.9  | 8.8    | 2.08 | 0.021 | 1.4 | 125.0 | 95.1   | 125.0 | 94.50  |          |

NOTES:

Project 260002-8  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Silver Lake Blvd split flow  
— Silver Lake

CROSS SECTION PARAMETERS:

FILENAME: slvrlake1.SEC

No. of Cross Section Points: 3 ~~Bed Slope = 0.00500~~ Max Elev.: 96.00 ✓  
Bank Stations.....Left: 1000.0 Right.....: 1147.0 Min Elev.: 92.00 ✓  
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)  | 96.00 | 1000.00  | 2)    | 94.00    | 1076.00 | 3)   | 92.00 | 1147.00 |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H:max(ft) | H:ave(ft) | TW(ft) | A(sf) |
|----------|--------|-----------|-----------|--------|-------|
| 92.50    | 7.3    | 0.50      | 0.25      | 17.8   | 4.4   |
| 93.00    | 41.2   | 1.00      | 0.50      | 35.5   | 17.8  |
| 93.50    | 113.5  | 1.50      | 0.75      | 53.3   | 39.9  |
| 94.00    | 232.9  | 2.00      | 1.00      | 71.0   | 71.0  |

NOTES:

Steady Basin SI1 ✓  
 36" CMP IE= 31.49 ✓

| Elevation | Q <sub>culv</sub> | Q <sub>road</sub> | Q <sub>total</sub> |
|-----------|-------------------|-------------------|--------------------|
| 34.5      | 31 32 ✓           | 0 ✓               | 31 32 ✓            |
| 35.0      | 39 38 ✓           | 4 ✓               | 43 42 ✓            |
| 35.5      | 44 46 ✓           | 19 ✓              | 63 65 ✓            |
| 36.0      | 48 50 ✓           | 48 ✓              | 96 98 ✓            |
| 36.5      | 53 54 ✓           | 95 ✓              | 148 149 ✓          |

↑  
DQ

|    |    |     |     |     |     |      |
|----|----|-----|-----|-----|-----|------|
| ΔI | 0' | 32' | 42' | 65' | 98' | 149' |
| ΔQ | 0' | 32' | 38' | 46' | 50' | 54'  |

↘ Diversion to Basin SI2

PIPE CULVERT ANALYSIS ✓  
COMPUTATION OF CULVERT PERFORMANCE CURVE

May 12, 1999 ✓  
Stead Basin S11 ✓  
36" CMP under Eastbound Offramp ✓

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 3.00 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 2 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 3 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0240 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.80 ✓   |
| Culvert Length (feet).....                            | 80.0 ✓   |
| Culvert Slope (feet per foot).....                    | 0.0130 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater Inlet<br>Depth (ft) | Headwater Outlet<br>Control Depth (ft) | Normal Depth<br>(ft) | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|-------------------------------|----------------------------------------|----------------------|------------------------|-------------------------|--------------------------|
| 30.0               | 2.00                    | 2.90                          | 2.40                                   | 1.91                 | 1.77                   | 1.91                    | 6.32                     |
| 32.0               | 2.00                    | 3.04 ✓                        | 2.57                                   | 1.99                 | 1.83                   | 1.99                    | 6.43                     |
| 34.0               | 2.00                    | 3.18                          | 2.76                                   | 2.08                 | 1.89                   | 2.08                    | 6.51                     |
| 36.0               | 2.00                    | 3.31                          | 2.95                                   | 2.17                 | 1.95                   | 2.17                    | 6.57                     |
| 38.0               | 2.00                    | 3.45 ✓                        | 3.15                                   | 2.26                 | 2.01                   | 2.26                    | 6.65                     |
| 40.0               | 2.00                    | 3.59                          | 3.36                                   | 2.38                 | 2.06                   | 2.38                    | 6.65                     |
| 42.0               | 2.50                    | 3.73                          | 3.58                                   | 2.52                 | 2.11                   | 2.52                    | 6.63                     |
| 44.0               | 2.50                    | 3.92                          | 3.80                                   | 2.67                 | 2.16                   | 2.67                    | 6.62                     |
| 46.0               | 2.50                    | 4.11                          | 4.04                                   | 3.00                 | 2.21                   | 3.00                    | 6.51                     |
| 48.0               | 2.50                    | 4.23                          | 4.28                                   | 3.00                 | 2.26                   | 2.50                    | 7.63                     |
| 50.0               | 2.50                    | 4.39                          | 4.53                                   | 3.00                 | 2.30                   | 2.50                    | 7.94                     |
| 52.0               | 2.50                    | 4.61                          | 4.79                                   | 3.00                 | 2.34                   | 2.50                    | 8.26                     |
| 54.0               | 2.50                    | 4.85                          | 5.06                                   | 3.00                 | 2.39                   | 2.50                    | 8.58                     |
| 56.0               | 2.50                    | 5.09                          | 5.34                                   | 3.00                 | 2.43                   | 2.50                    | 8.90                     |
| 58.0               | 2.50                    | 5.34                          | 5.62                                   | 3.00                 | 2.46                   | 2.50                    | 9.21                     |
| 60.0               | 2.50                    | 5.60                          | 5.92                                   | 3.00                 | 2.50                   | 2.50                    | 9.53                     |

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Project Stead Master  
Project No. 208  
Sheet No.      of       
Calculated by      Date     

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Stead interchange 36" CMP  
@ southbound off-ramp

CROSS SECTION PARAMETERS:

FILENAME: S115523.SEC

No. of Cross Section Points: 5 ~~Bed Slope = 0.0040~~ Max Elev.: 36.62  
Bank Stations.....Left: 0.0 Right....: 30.0 Min Elev.: 34.42  
Encroachment Stations..Left: - Right....: - Weir Coef: 2.650 ✓

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta. No. | Elev. | Sta. No. | Elev.   | Sta. |         |         |
|-----|---------|----------|-------|----------|---------|------|---------|---------|
| 1)  | 36.42 ✓ | 0.00 ✓   | 2)    | 34.62 ✓  | 12.50 ✓ | 3)   | 34.42 ✓ | 14.00 ✓ |
| 4)  | 34.62 ✓ | 15.50 ✓  | 5)    | 36.62 ✓  | 30.00 ✓ |      |         |         |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) | $h_{pipe}$           |
|----------|--------|------------|------------|--------|-------|----------------------|
| 35.00    | 4.0    | 0.58       | 0.29       | 8.4    | 2.5   | 3.5' ✓               |
| 35.50    | 18.7   | 1.08       | 0.54       | 15.5   | 8.4   | 4' ✓                 |
| 36.00    | 48.0   | 1.58       | 0.79       | 22.6   | 18.0  | 4.5' ✓               |
| 36.50    | 95.1   | 2.08       | 1.06       | 29.1   | 31.0  | 5' ✓                 |
| 36.62    | 109.2  | 2.20       | 1.15       | 30.0   | 34.6  | <del>5</del> 5.13' ✓ |

NOTES:

Stead Interchange  
 East ~~Southbound~~ offramp  
 Scale 1:20

5130



5130.44  
 IF 36" CMP

$L = 80'$

$S = 1.3\%$  ✓

$h = 2.93'$  ✓

112

38

35.2

14.4%

34

5134.42

35.2

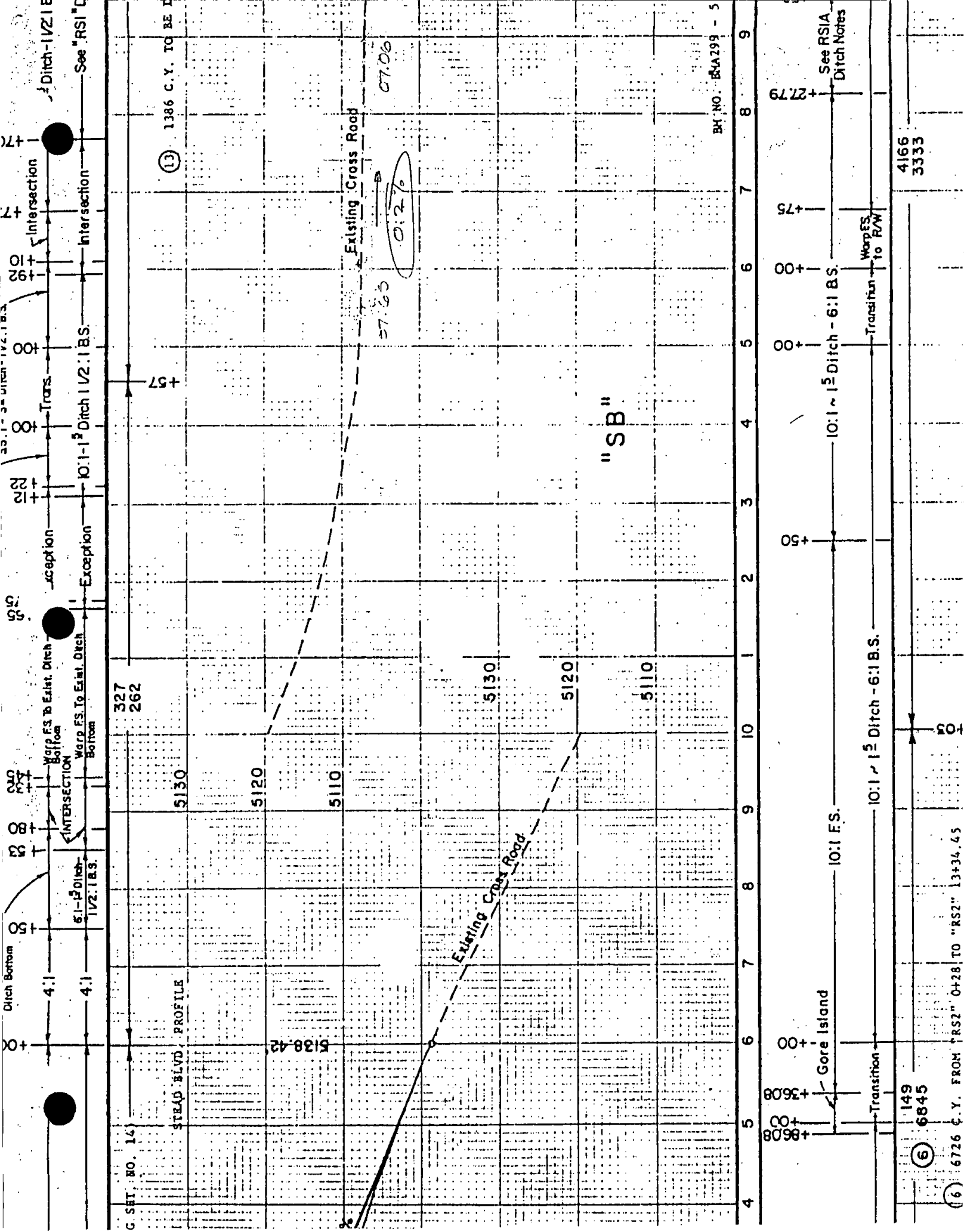
34

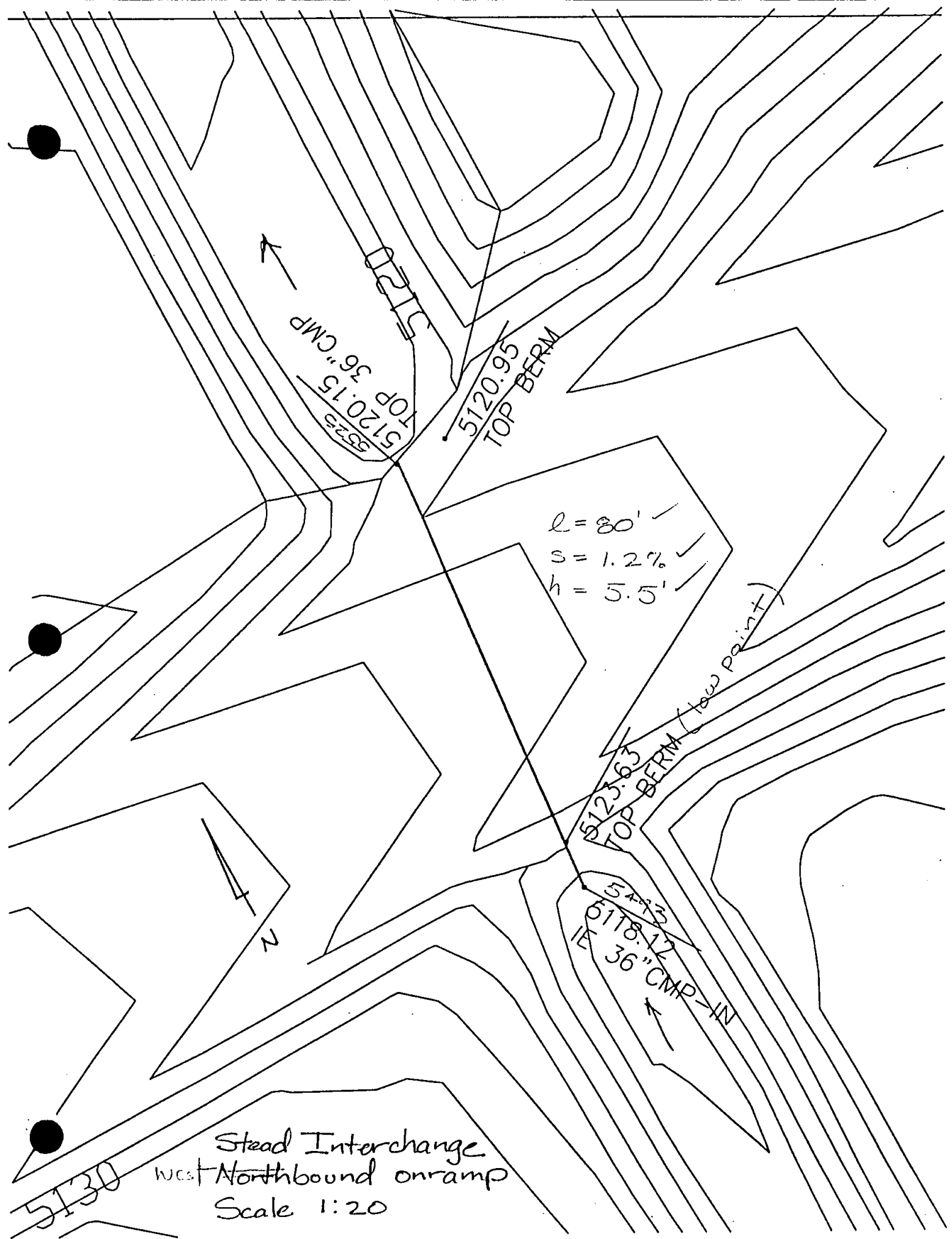
5131.49  
 IF 36" CMP



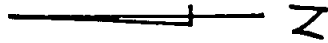
(34.12 ← 33.8)

| ft    | ft    | adj (+0.6) |
|-------|-------|------------|
| 0'    | 35.8' | 36.42 ✓    |
| 12.5' | 34.0' | 34.62 ✓    |
| 14.0' | 33.8' | 34.42 ✓    |
| 15.5' | 34.0' | 34.62 ✓    |
| 30'   | 36.0' | 36.62 ✓    |









Basin SI 1 outlet

|      | +    | +     | + |
|------|------|-------|---|
| 9    | 0    | 10.54 |   |
| 13.9 | 4.9  | 18.47 |   |
| 14.5 | 5.1  | 9.96  |   |
| 15.5 | 6.5  | 9.99  |   |
| 50   | 41   | 10.78 |   |
| 88   | 79   | 10.00 |   |
| 88.9 | 79.9 | 10.04 |   |
| 89.1 | 80.1 | 10.45 |   |
| 945  | 85.5 | 10.56 |   |
| 1025 | 93.5 | 9.24  |   |

Add  
 -9 10.54  
 10.54  
 18.47  
 9.96  
 9.99  
 10.78  
 10.00  
 10.04  
 10.45  
 10.56  
 9.24

→ 2

PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

April 14, 1999  
24" CMP @ CP S11  
INLET FLOW RATING  
INLET = 5107.02, AVAILABLE HEAD = APPROX 3.0 FEET

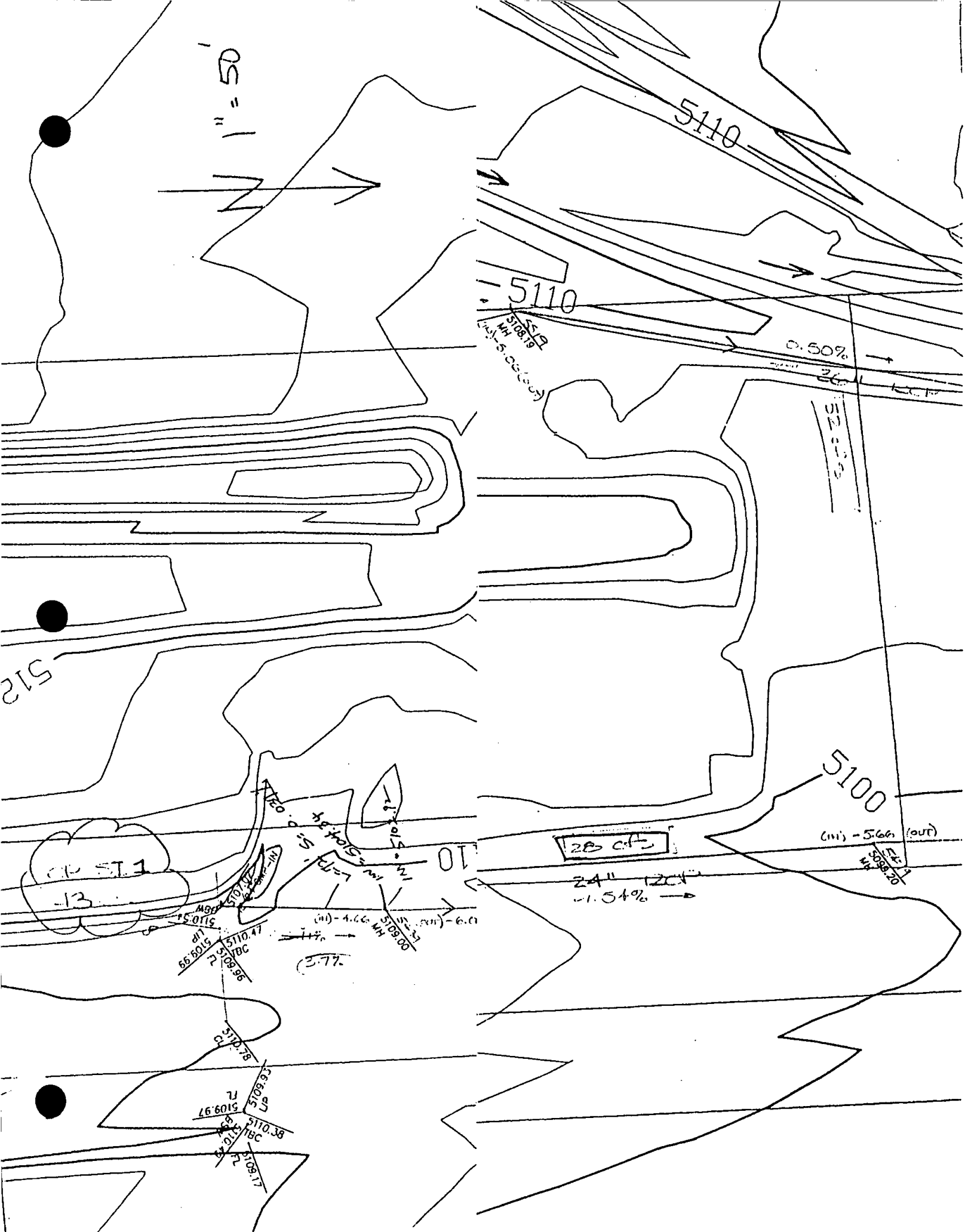
PROGRAM INPUT DATA:

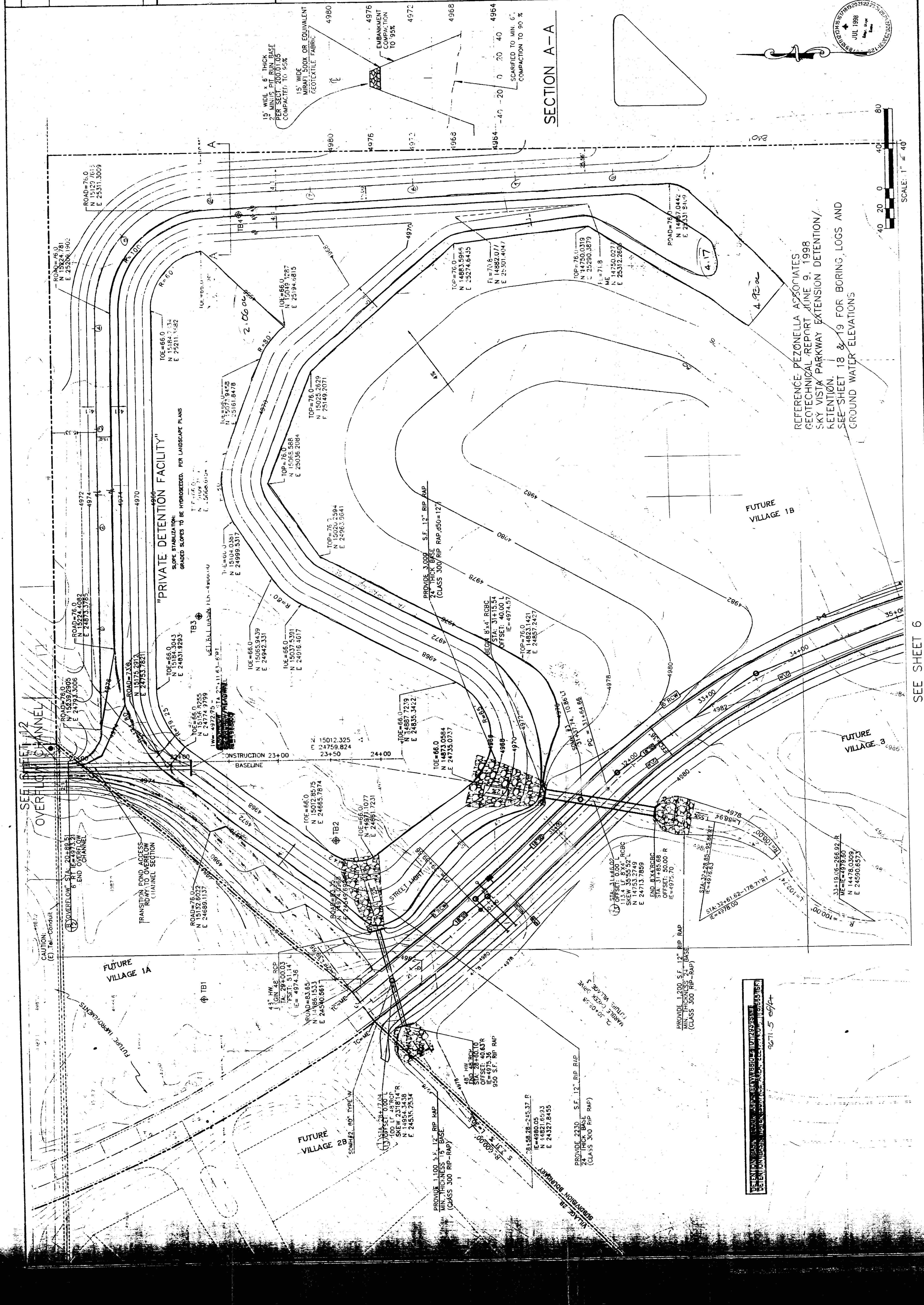
| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 2.00 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 2 -      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 -      |
| Manning's Roughness Coefficient (n-value).....        | 0.0240 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 72.0 ✓   |
| Culvert Slope (feet per foot).....                    | 0.0370 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater (ft)<br>Inlet Control | Headwater (ft)<br>Outlet Control | Normal Depth<br>(ft) | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|---------------------------------|----------------------------------|----------------------|------------------------|-------------------------|--------------------------|
| 5.0                | 1.00                    | 1.10                            | -1.09                            | 0.63                 | 0.79                   | 0.63                    | 5.96                     |
| 10.0               | 2.00                    | 1.67                            | 0.05                             | 0.91                 | 1.13                   | 0.91                    | 7.19                     |
| 15.0               | 2.00                    | 2.21                            | 0.94                             | 1.16                 | 1.40                   | 1.16                    | 7.95                     |
| 20.0               | 2.00                    | 2.91                            | 2.19                             | 1.42                 | 1.61                   | 1.42                    | 8.40                     |
| 21.0               | 2.00                    | 3.07                            | 2.48                             | 1.47                 | 1.64                   | 1.47                    | 8.47                     |
| 22.0               | 2.50                    | 3.24                            | 3.29                             | 1.52                 | 1.67                   | 2.00                    | 7.00                     |
| 23.0               | 2.50                    | 3.41                            | 3.61                             | 1.60                 | 1.71                   | 2.00                    | 7.32                     |
| 24.0               | 2.50                    | 3.59                            | 3.94                             | 1.67                 | 1.73                   | 2.00                    | 7.64                     |
| 25.0               | 2.50                    | 3.78                            | 4.29                             | 1.77                 | 1.76                   | 2.00                    | 7.96                     |

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Stead Master Plan  
Split flow rating at MH 5517 using StormCad

| Q  | 5517a             |                    | 5517b             |                    |
|----|-------------------|--------------------|-------------------|--------------------|
|    | HGL <sub>in</sub> | HGL <sub>out</sub> | HGL <sub>in</sub> | HGL <sub>out</sub> |
| 5  | 5.15              | 4.95               | —                 | —                  |
| 10 | 5.54              | 5.25               | 4.24              | 3.95               |
| 15 | 5.86              | 5.49               | 4.56              | 4.19               |
| 20 | 6.13              | 5.69               | 4.83              | 4.39               |
| 25 | 6.38              | 5.86               | 5.08              | 4.56               |
| 26 | 6.43              | 5.90               | 5.13              | 4.60               |
| 27 | 6.48              | 5.93               | 5.18              | 4.63               |
| 30 | 7.37              | 7.14               | 5.32              | 4.72               |
| 35 |                   |                    | 5.54              | 4.87               |
| 40 |                   |                    | 5.75              | 5.01               |
| 45 |                   |                    | 5.96              | 5.14               |
| 50 |                   |                    | 6.28              | 5.53               |
| 55 |                   |                    | 6.72              | 5.96               |
| 60 |                   |                    | 7.16              | 6.26               |

↑  
P-2  
IE = 4.25

↑  
P-21  
IE = 2.95

|    |   |    |    |    |    |
|----|---|----|----|----|----|
| DI | 0 | 10 | 31 | 45 | 62 |
| DQ | 0 | 10 | 26 | 35 | 45 |

## Analysis Results

### Scenario: Full RR

Title: Stead Master Plan  
 Project Engineer: Stanlec  
 Project Date: 10/13/99  
 Comments: Storm drain system beginning at the 48" Inlet with bar screen, across from O'Brien middle school

#### Inlet Rational Flows

| Label | Inlet Area (acres) | Composite Rational C | Inlet CA (acres) | Carryover CA (acres) | Total Inlet CA (acres) | Time of Concentration (min) | Local Intensity (in/hr) | Local Rational Flow (cfs) | Additional Carryover (cfs) | Total Carryover Flow (cfs) | Total Flow To Inlet (cfs) |
|-------|--------------------|----------------------|------------------|----------------------|------------------------|-----------------------------|-------------------------|---------------------------|----------------------------|----------------------------|---------------------------|
| 48RR  | 0.00               | 0.00                 | 0.00             | 0.00                 | 0.00                   | 0.00                        | 10.00                   | 0.00                      | 0.00                       | 10.00                      | 10.00                     |

#### Inlets

| Label | Bypass Target | Inlet   | Inlet Type         | Total Flow To Inlet (cfs) | Total Intercepted Flow (cfs) | Total Bypassed Flow (cfs) | Capture Efficiency (%) |
|-------|---------------|---------|--------------------|---------------------------|------------------------------|---------------------------|------------------------|
| 48RR  | N/A           | Default | 100% Generic Inlet | 0.00                      | 10.00                        | 0.00                      | 100.0                  |

#### Pipes For Network With Outlet: RRout

| Label | Dn. Pipe | Number of Sections | Section Shape | Section Size | Pipe Length (ft) | Pipe Slope (ft/ft) | Total System Flow (cfs) | Average Velocity (ft/s) | Up Invert (ft) | Dn Invert (ft) | HGL In (ft) | HGL Out (ft) |
|-------|----------|--------------------|---------------|--------------|------------------|--------------------|-------------------------|-------------------------|----------------|----------------|-------------|--------------|
| P-1   | P-2      | 1                  | Circular      | 48 inch      | 29.00            | 0.030000           | 10.00                   | 2.06                    | 5,104.14       | 5,103.27       | 5,105.46    | 5,105.54     |
| P-2   | P-3      | 1                  | Circular      | 36 inch      | 108.00           | 0.005370           | 10.00                   | 4.35                    | 5,104.25       | 5,103.67       | 5,105.25    | 5,104.85     |
| P-3   | P-4      | 1                  | Circular      | 36 inch      | 68.00            | 0.007941           | 10.00                   | 4.35                    | 5,103.67       | 5,103.13       | 5,104.67    | 5,104.31     |
| P-4   | P-5      | 1                  | Circular      | 36 inch      | 267.00           | 0.005019           | 10.00                   | 3.96                    | 5,103.13       | 5,101.79       | 5,104.13    | 5,103.20     |
| P-5   | None     | 1                  | Circular      | 24 inch      | 57.00            | 0.035439           | 10.00                   | 6.27                    | 5,101.79       | 5,099.77       | 5,102.92    | 5,100.69     |

#### Structures For Network With Outlet: RRout

| Label | Hydraulic Grade In (ft) | Hydraulic Grade Out (ft) | Calculated Headloss (ft) | Total System Flow (cfs) | System Flow Time (min) | System Intensity (in/hr) |
|-------|-------------------------|--------------------------|--------------------------|-------------------------|------------------------|--------------------------|
| 48RR  | 5,105.52                | 5,105.46                 | 0.06                     | 10.00                   | 0.00                   | 0.00                     |
| 5517a | 5,105.54                | 5,105.25                 | 0.29                     | 10.00                   | 0.24                   | 0.00                     |
| 5518  | 5,104.85                | 5,104.67                 | 0.18                     | 10.00                   | 0.65                   | 0.00                     |
| 5519  | 5,104.31                | 5,104.13                 | 0.18                     | 10.00                   | 0.91                   | 0.00                     |
| 5520  | 5,103.20                | 5,102.92                 | 0.28                     | 10.00                   | 2.03                   | 0.00                     |
| RRout | 5,100.69                | 5,100.69                 | 0.00                     | 10.00                   | 2.19                   | 0.00                     |



SIERRA SAGE GOLF COURSE

AREA OF GRADING APPROVED BY  
SPECIAL USE PERMIT (CASE NO. 5-98)

CONST. 2 (TEMP) 4' X 2' PREC  
INLETS (TEICHERT, MODEL VK)  
5025.25 GRADE (BOTH GRATES)  
5017.75 IE OUT (BOTH PIPES)

$$\frac{\text{CONST. 38 LF 24" DIA}}{\text{RCP SD PIPE @ S}} = 1.34\%$$

| CONST. SDMH #2          |
|-------------------------|
| 60" DIA TYPE IV SDMH    |
| RIM = 5032.18           |
| 5017.14 IE OUT (48")    |
| 5017.24 IE IN (2 - 24") |

CONST. 96 LF 48" DIA  
RCP SD PIPE @ S = 13.6%

SILVER TERRACE SUB'D  
TRACT #1876  
BLOCK D  
MF-1A

CONST. SDMH #4  
48" DIA TYPE I SDMH W  
NEENAH BEEHIVE GRATE  
5041.7 GRATE  
5003.82 IE

EXIST 05 =  
EXIST 0100 =  
PROPOSED 05 =  
PROPOSED 0100 =

PLACE 8"-12" RIP-RAP  
IN EXIST CHANNEL, MIN 2.0' DEEP

CONST. 8' WIDE BERM  
TOP BERM = 5013.5 MAX

CONST. 31 LF 48" DIA  
RCP SD PIPE @ S = 1.0%  
W/ 150 SF (15' LONG x 10' WIDE)  
8"-12" RIP-RAP AT OUTLET  
5003.68 IE OUT

-PROPOSED GROUND PROFILE

CONST. SDMH #3  
60" DIA TYPE IV SDMH  
RIM = 5014.0  
5004.09 IE OUT  
5003.99 IE IN

LEARNED ESTATES UNIT NO. 3  
TRAC #2528

CONST. 29 LF 24" DIA  
RCP SD PIPE @ S = 2.12%  
CONST. 12' WIDE ACCESS ROAD  
W/ 2 1/2" AGG BASE SURFACE

PARCEL 3  
TRACT #1276A  
APN 30-010-09

AREA OF GRADING APPROVED BY  
SPECIAL USE PERMIT (CASE NO. 5-98)

AREAS GREATER THAN 10' OF FILL

GREATEST CUT IS LESS THAN 20'

## SECTION A

SCALE: H : 1" = 50'  
V : 1" = 50'

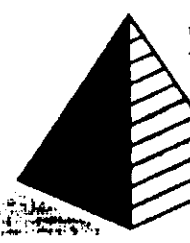
Profile view of the proposed road. The vertical axis represents elevation in feet, ranging from 5010 to 5050. The horizontal axis represents stationing in feet, ranging from 0.00 to 400.00. The profile shows the existing ground profile (dashed line) and the proposed road grade (solid line). The proposed road grade starts at approximately 5045 feet at station 0.00, dips to a minimum of about 5025 feet at station 150.00, and then rises to about 5040 feet at station 400.00. The existing ground profile starts at approximately 5045 feet at station 0.00, dips to a minimum of about 5020 feet at station 150.00, and then rises to about 5040 feet at station 400.00.

## SECTION B

SCALE: H : 1" = 50'  
V : 1" = 5'

SPECIAL USE PERMIT  
FOR  
LEWIS HOMES - SILVER SHORES UNIT #31  
39.06 AC SITE PARTIAL GRADING PLAN

SECTION 6  
T. 20N., R. 19E., M. D. B. & M.  
WASHINGTON COUNTY



**PYRAMID ENGINEERS  
& LAND SURVEYORS**  
 330 CRAMPTON ST.  
RENO, NEVADA 89502  
(702)329-2540  
(702)329-2768 FAX

[illegible]

|                    |
|--------------------|
| SCALE              |
| Horiz. 1"=50'      |
| Vert. -            |
| Designed CNG       |
| Drawn CNG          |
| Dwg. No. 9705SSUP2 |
| Checked RA         |
| Date: FEB 1989     |
| Sheet No. C7       |
| 7 of 7 sheets      |
| JOB NO. 97053      |



# Analysis Results

## Scenario: Full OB

Title: Stead Master Plan  
 Project Engineer: Stantec  
 Project Date: 10/13/99  
 Comments: Storm drain system beginning at the 48" inlet with bar screen, across from O'Brien middle school

### Inlet Rational Flows

| Label | Inlet Area (acres) | Composite Rational C | Inlet CA (acres) | Carryover CA (acres) | Total Inlet CA (acres) | Time of Concentration (min) | Local Intensity (in/hr) | Local Rational Flow (cfs) | Additional Carryover (cfs) | Total Carryover Flow (cfs) | Total Flow To Inlet (cfs) |
|-------|--------------------|----------------------|------------------|----------------------|------------------------|-----------------------------|-------------------------|---------------------------|----------------------------|----------------------------|---------------------------|
| 48OB  | 0.00               | 0.00                 | 0.00             | 0.00                 | 0.00                   | 0.00                        | 10.00                   | 0.00                      | 0.00                       | 10.00                      | 10.00                     |

### Inlets

| Label | Bypass Target | Inlet   | Inlet Type         | Total Flow To Inlet (cfs) | Total Intercepted Flow (cfs) | Total Bypassed Flow (cfs) | Capture Efficiency (%) |
|-------|---------------|---------|--------------------|---------------------------|------------------------------|---------------------------|------------------------|
| 48OB  | N/A           | Default | 100% Generic Inlet | 0.00                      | 10.00                        | 0.00                      | 100.0                  |

### Pipes For Network With Outlet: OBout

| Label | Dn. Pipe | Number of Sections | Section Shape | Section Size | Pipe Length (ft) | Pipe Slope (ft/ft) | Total System Flow (cfs) | Average Velocity (ft/s) | Up Invert (ft) | Dn Invert (ft) | HGL In (ft) | HGL Out (ft) |
|-------|----------|--------------------|---------------|--------------|------------------|--------------------|-------------------------|-------------------------|----------------|----------------|-------------|--------------|
| P-20  | P-21     | 1                  | Circular      | 48 inch      | 29.00            | 0.030000           | 10.00                   | 4.40                    | 5,104.14       | 5,103.27       | 5,105.06    | 5,104.24     |
| P-21  | P-26     | 1                  | Circular      | 36 inch      | 230.00           | 0.019783           | 10.00                   | 3.13                    | 5,102.95       | 5,098.40       | 5,103.95    | 5,103.09     |
| P-23  | P-24     | 1                  | Circular      | 24 inch      | 152.00           | 0.021711           | 10.00                   | 4.70                    | 5,099.86       | 5,096.56       | 5,100.99    | 5,098.06     |
| P-24  | P-25     | 1                  | Circular      | 24 inch      | 373.00           | 0.021689           | 10.00                   | 4.70                    | 5,096.56       | 5,088.47       | 5,097.69    | 5,089.97     |
| P-25  | None     | 1                  | Circular      | 24 inch      | 562.00           | 0.020409           | 10.00                   | 7.26                    | 5,088.47       | 5,077.00       | 5,089.60    | 5,077.76     |
| P-26  | P-23     | 1                  | Circular      | 24 inch      | 84.00            | 0.015357           | 10.00                   | 6.79                    | 5,101.50       | 5,100.21       | 5,102.63    | 5,101.04     |

### Structures For Network With Outlet: OBout

| Label | Hydraulic Grade In (ft) | Hydraulic Grade Out (ft) | Calculated Headloss (ft) | Total System Flow (cfs) | System Flow Time (min) | System Intensity (in/hr) |
|-------|-------------------------|--------------------------|--------------------------|-------------------------|------------------------|--------------------------|
| 48OB  | 5,105.22                | 5,105.06                 | 0.16                     | 10.00                   | 0.00                   | 0.00                     |
| 5480  | 5,089.97                | 5,089.60                 | 0.37                     | 10.00                   | 3.40                   | 0.00                     |
| 5481  | 5,101.22                | 5,100.99                 | 0.23                     | 10.00                   | 1.54                   | 0.00                     |
| 5500b | 5,103.09                | 5,102.63                 | 0.46                     | 10.00                   | 1.33                   | 0.00                     |
| 5517b | 5,104.24                | 5,103.95                 | 0.29                     | 10.00                   | 0.11                   | 0.00                     |
| JNF   | 5,098.06                | 5,097.69                 | 0.37                     | 10.00                   | 2.08                   | 0.00                     |
| OBout | 5,077.76                | 5,077.76                 | 0.00                     | 10.00                   | 4.69                   | 0.00                     |





# STANTECH CONSULTING INC.

Formerly SEA, Incorporated  
950 Industrial Way  
Sparks, NV 89431-6092  
(702) 358-6931  
Fax: 358-6954

JOB NO. 26000208

SHEET \_\_\_\_\_ OF \_\_\_\_\_

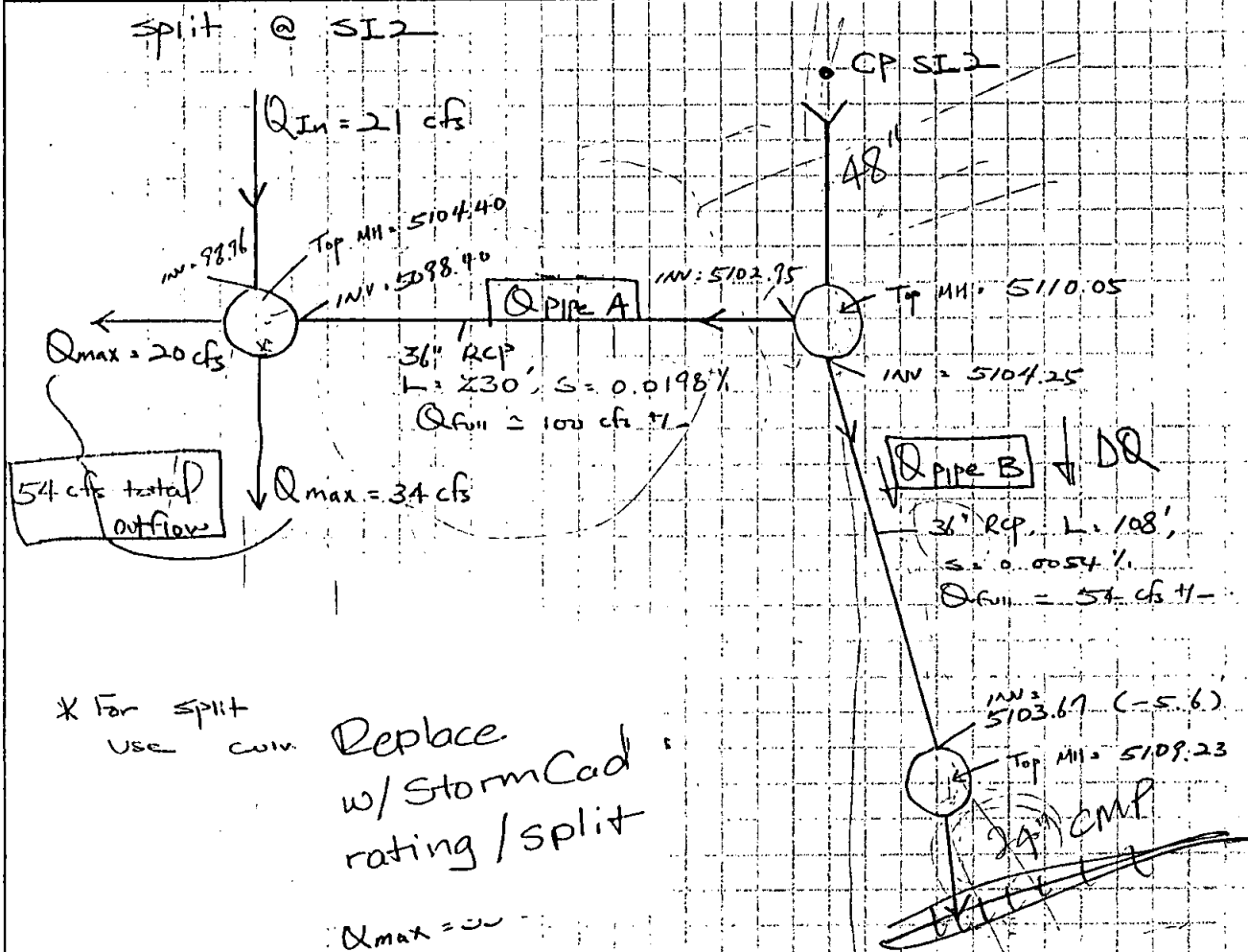
PROJECT STEAD

DATE \_\_\_\_\_

SUBJECT SPLIT (Basin SI2)

DESIGNED \_\_\_\_\_

CHECKED \_\_\_\_\_

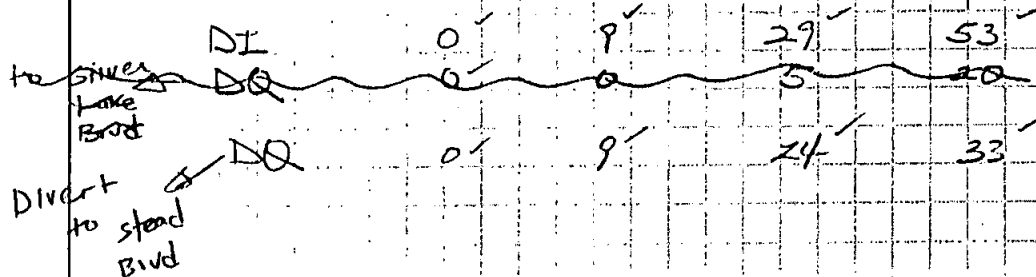


ELCV  
5102.95  
5104.25  
5105.25  
5106.25

Q Pipe A (ft)  
0  
9 (1.3)  
24 (2.3)  
33 (3.3)  
max

DQ  
Q Pipe B (ft)  
0  
0  
5 (1)  
20 (2)

DI  
Q total  
0  
9  
29  
53



PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

April 14, 1999  
36" RCP STORM DRAIN PIPE  
@ OUTLET 6' FROM INVERT TO TOP OF MANHOLE

Diversion from SI2 to SI1

INV = 5102.75

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 3.00 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 1 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 230.0 ✓  |
| Culvert Slope (feet per foot).....                    | 0.0198 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater (ft)<br>Inlet Control | Headwater (ft)<br>Outlet Control | Normal Depth<br>(ft) | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|---------------------------------|----------------------------------|----------------------|------------------------|-------------------------|--------------------------|
| 8.0                | 2.00                    | 1.22                            | -2.49                            | 0.59                 | 0.89                   | 0.59                    | 8.05                     |
| 9.0                | 3.00                    | 1.31                            | -1.47                            | 0.63                 | 0.95                   | 0.63                    | 8.39                     |
| 10.0               | 3.00                    | 1.38                            | -1.46                            | 0.66                 | 1.00                   | 0.66                    | 8.65                     |
| 15.0               | 3.00                    | 1.74                            | -1.33                            | 0.81                 | 1.23                   | 0.81                    | 9.72                     |
| 20.0               | 3.00                    | 2.07                            | -1.16                            | 0.94                 | 1.43                   | 0.94                    | 10.57                    |
| 25.0               | 3.00                    | 2.38                            | -0.94                            | 1.06                 | 1.61                   | 1.06                    | 11.25                    |
| 30.0               | 6.00                    | 2.69                            | 2.33                             | 1.16                 | 1.77                   | 1.16                    | 11.85                    |
| 35.0               | 5.00                    | 2.99                            | 1.65                             | 1.27                 | 1.92                   | 1.27                    | 12.29                    |
| 33 < 40.0<br>max   | 5.00                    | 3.30                            | 2.01                             | 1.37                 | 2.06                   | 1.37                    | 12.76                    |

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PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

April 14, 1999

36" RCP STORM DRAIN AT CP S12

INLET FLOW RATING, Storm Drain to the Channel.

~~INLET = 5107-02, AVAILABLE HEAD = APPROX 3.0 FEET~~

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 3.00 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 1 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 108.0 ✓  |
| Culvert Slope (feet per foot).....                    | 0.0054 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater (ft)<br>Inlet Control | Normal Depth<br>Outlet Control | Critical Depth<br>(ft) | Depth at<br>(ft) | Outlet Velocity<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|---------------------------------|--------------------------------|------------------------|------------------|-------------------------|--------------------------|
| 5.0                | 1.00                    | <u>0.95</u>                     | 1.28                           | 0.65                   | 0.70             | 1.00                    | 2.42                     |
| 10.0               | 1.50                    | 1.38                            | 1.49                           | 0.92                   | 1.00             | 1.50                    | 2.83                     |
| 15.0               | 2.00                    | 1.74                            | 1.69                           | 1.14                   | 1.23             | 1.14                    | 6.10                     |
| 20.0               | 2.00                    | <u>2.07</u>                     | 1.92                           | 1.33                   | 1.43             | 1.33                    | 6.59                     |

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# Sky Vista Detention Basin A

North outlet: 42" RCP IE= 68.00

| Elevation | H <sub>42</sub> | Q <sub>42</sub> | Q <sub>weir1</sub> | Q <sub>weir2</sub> | Q <sub>total</sub> | SA*     |
|-----------|-----------------|-----------------|--------------------|--------------------|--------------------|---------|
| 66.0      | 0.00            | 0               | 0                  | 0                  | 0                  | 2.32 ac |
| 68.0      | 0.00            | 0               | 0                  | 0                  | 0                  |         |
| 69.0      | 1.00            | 6               | 0                  | 0                  | 6                  |         |
| 70.0      | 2.00            | 21              | 0                  | 0                  | 21                 |         |
| 71.0      | 3.00            | 41              | 0                  | 0                  | 41                 |         |
| 72.0      | 4.00            | 62              | 0                  | 0                  | 62                 |         |
| 73.0      | 5.00            | 78              | 0                  | 0                  | 78                 |         |
| 74.0      | 6.00            | 92              | 2                  | 0                  | 94                 | 4.10 ac |
| 75.0      | 7.00            | 104             | 23                 | 0                  | 127                |         |
| 76.0      | 8.00            | 114             | 78                 | 0                  | 192                | 4.9     |
| 76.1      | 8.10            | 115             | 85                 | 88                 | 288                |         |
| 76.2      | 8.20            | 116             | 93                 | 250                | 459                |         |
| 76.3      | 8.30            | 117             | 101                | 460                | 678                | 4.9     |

\* from Sky Vista Parkway Extension  
Detention / Retention Basin plan

|           |      |      |      |      |     |      |      |
|-----------|------|------|------|------|-----|------|------|
| Area (Ac) | 2.32 | 2.77 | 3.21 | 4.10 | 4.9 | 4.9  | 4.9  |
| Elev.     | 66.0 | 68   | 70   | (74) | 76  | 76.1 | 76.3 |
| Q (cfs)   | 0    | 0    | 21   | 94   | 192 | 288  | 678  |
|           |      |      |      |      |     |      |      |

PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

May 5, 1999  
Stead Master Plan ✓  
Sky Vista Detention A ✓  
Outlet culvert rating ✓

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 3.50 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 1 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 787.0 ✓  |
| Culvert Slope (feet per foot).....                    | 0.0117 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater<br>Inlet Control<br>Depth (ft) | Normal<br>Outlet Control<br>Depth (ft) | Critical<br>Depth (ft) | Depth at<br>Outlet (ft) | Outlet<br>Velocity<br>(fps) |
|--------------------|-------------------------|------------------------------------------|----------------------------------------|------------------------|-------------------------|-----------------------------|
| 6.0                | 0.00                    | 1.00                                     | -7.05                                  | 0.56                   | 0.74                    | 6.06                        |
| 21.0               | 0.00                    | 1.98                                     | -6.30                                  | 1.04                   | 1.40                    | 8.76                        |
| 41.0               | 0.00                    | 2.99                                     | -4.74                                  | 1.49                   | 1.99                    | 10.51                       |
| 62.0               | 0.00                    | 4.01                                     | -2.28                                  | 1.89                   | 2.47                    | 11.70                       |
| 78.0               | 0.00                    | 4.96                                     | 0.16                                   | 2.19                   | 2.76                    | 12.30                       |
| 92.0               | 0.00                    | 5.98                                     | 2.70                                   | 2.47                   | 2.97                    | 12.67                       |
| 104.0              | 0.00                    | 7.00                                     | 5.18                                   | 2.74                   | 3.11                    | 12.87                       |
| 114.0              | 0.00                    | 7.93                                     | 7.46                                   | 3.04                   | 3.20                    | 12.84                       |
| 115.0              | 0.00                    | 8.03                                     | 7.70                                   | 3.10                   | 3.21                    | 12.75                       |
| 116.0              | 0.00                    | 8.13                                     | 7.94                                   | 3.16                   | 3.22                    | 12.69                       |
| 117.0              | 0.00                    | 8.23                                     | 8.18                                   | 3.17                   | 3.23                    | 12.76                       |

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use Inlet  
Control.

Project \_\_\_\_\_  
 Project No. \_\_\_\_\_  
 Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
 Calculated by \_\_\_\_\_ Date \_\_\_\_\_

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Sky Vista Detention Basin A  
Out-flow channel @ STA 19+50

CROSS SECTION PARAMETERS:

FILENAME: sv\_dba.SEC

No. of Cross Section Points: 5 ~~Bed Slope = 0.00010~~ Max Elev.: 80.00  
 Bank Stations.....Left: 0.0 Right.....: 32.0 Min Elev.: 73.50  
 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)  | 80.00 ✓ | 0.00 ✓   | 2)    | 75.00 ✓  | 10.00 ✓ | 3)   | 73.50 ✓ | 16.00 ✓ |
| 4)  | 75.00 ✓ | 22.00 ✓  | 5)    | 80.00 ✓  | 32.00 ✓ |      |         |         |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) |
|----------|--------|------------|------------|--------|-------|
| 74.00    | 1.5    | 0.50       | 0.25       | 4.0    | 1.0   |
| 75.00    | 22.9   | 1.50       | 0.75       | 12.0   | 9.0   |
| 76.00    | 78.1   | 2.50       | 1.44       | 16.0   | 23.0  |
| 76.10    | 85.4   | 2.60       | 1.50       | 16.4   | 24.6  |
| 76.20    | 93.1   | 2.70       | 1.56       | 16.8   | 26.3  |
| 76.30    | 101.1  | 2.80       | 1.63       | 17.2   | 28.0  |

} weir 1

NOTES:

Include ~ 1000' weir length along road  
at top of north & east sides of  
deten basin.  $Q = c L H^{3/2}$ ,  $c = 2.8$

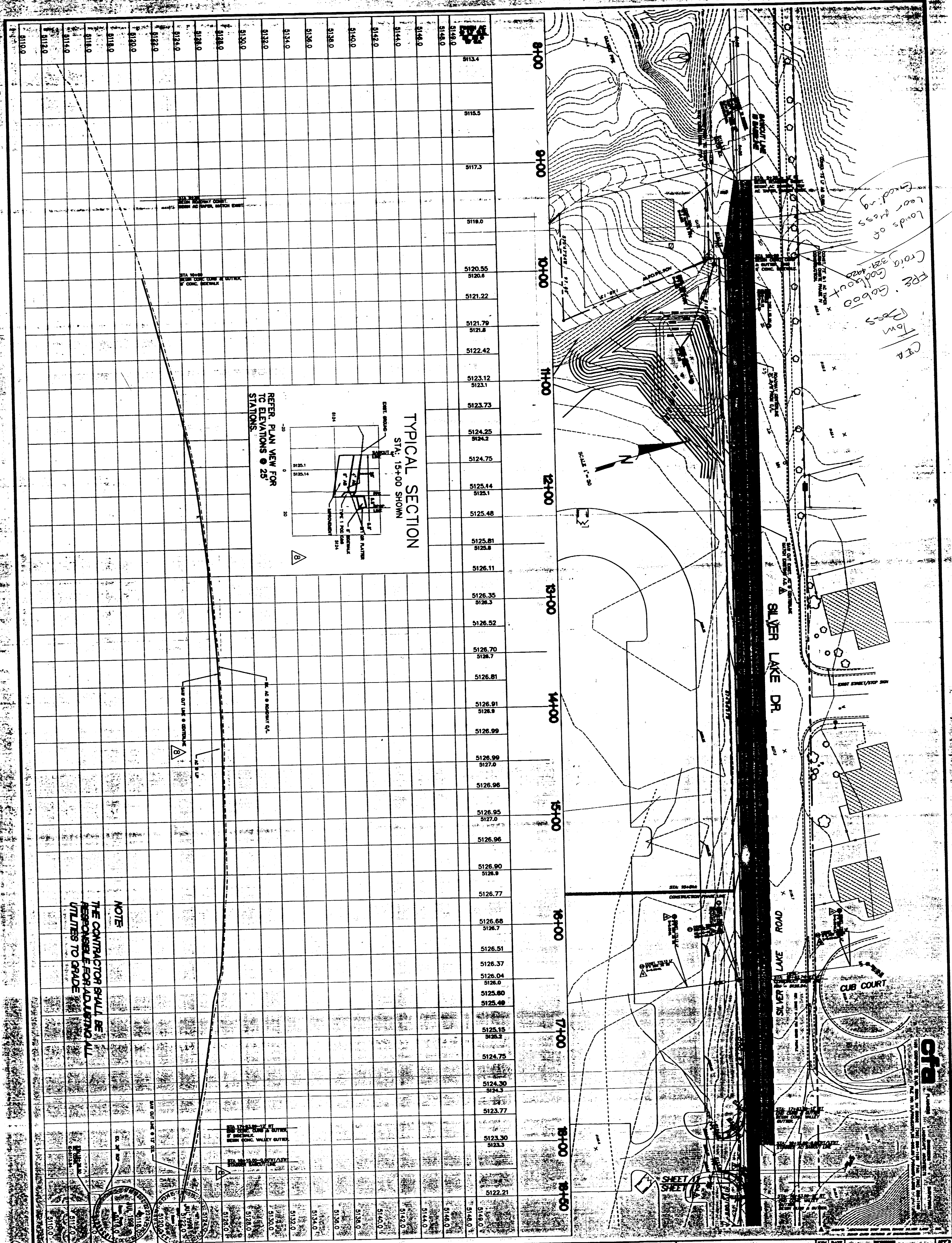
$h = .1$   $Q = 88 \text{ cfs}$  ✓

$h = .2$   $Q = 250 \text{ cfs}$  ✓

$h = .3$   $Q = 460 \text{ cfs}$  ✓

} weir 2





FP2: Gaboon  
Craig Goddard  
Lands of  
Leor Moss  
CRA  
Tom  
Pass

NOTE  
THE CONTRACTOR SHALL BE  
RESPONSIBLE FOR ADJUSTING ALL  
UTILITIES TO GRADE

ofa

Jim Holst  
08/07/08

**SILVER LAKE DRIVE PLAN AND PROFILE**  
FOR  
**SILVER LAKE APARTMENTS**  
PLAN/PROFILE: STA 8+00 ~ 18+50

| NO. | REVISION                | DATE     |
|-----|-------------------------|----------|
| 1   | ISSUED FOR PERMIT       | 08/07/08 |
| 2   | REVISED TO SHOW CHANGES | 08/07/08 |
| 3   | REVISED TO SHOW CHANGES | 08/07/08 |
| 4   | REVISED TO SHOW CHANGES | 08/07/08 |
| 5   | REVISED TO SHOW CHANGES | 08/07/08 |
| 6   | REVISED TO SHOW CHANGES | 08/07/08 |
| 7   | REVISED TO SHOW CHANGES | 08/07/08 |
| 8   | REVISED TO SHOW CHANGES | 08/07/08 |
| 9   | REVISED TO SHOW CHANGES | 08/07/08 |
| 10  | REVISED TO SHOW CHANGES | 08/07/08 |



**PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE**

May 21, 1999  
Basin SLE 30" RCP ✓  
Stand Master Plan

Basin SLE

**PROGRAM INPUT DATA:**

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 2.50 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 1 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 835.0 ✓  |
| Culvert Slope (feet per foot).....                    | 0.0410 ✓ |

**PROGRAM RESULTS:**

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater<br>Inlet Control<br>Depth (ft) | Normal<br>Outlet Control<br>Depth (ft) | Critical<br>Depth (ft) | Depth at<br>Outlet (ft) | Outlet<br>Velocity<br>(fps) |
|--------------------|-------------------------|------------------------------------------|----------------------------------------|------------------------|-------------------------|-----------------------------|
| 30.0               | 0.00                    | 3.21                                     | -26.74                                 | 1.04                   | 1.87                    | 15.54                       |
| 40.0               | 0.00                    | 4.32                                     | -22.48                                 | 1.22                   | 2.13                    | 16.78                       |
| 50.0               | 0.00                    | 5.80                                     | -17.08                                 | 1.40                   | 2.30                    | 17.71                       |
| 51.0               | 0.00                    | 5.97                                     | -16.48                                 | 1.42                   | 2.31                    | 17.71                       |
| 52.0               | 0.00                    | 6.14                                     | -15.86                                 | 1.43                   | 2.32                    | 17.85                       |

← Capacity = 50 cfs

=====

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5.80' avail head @ inlet





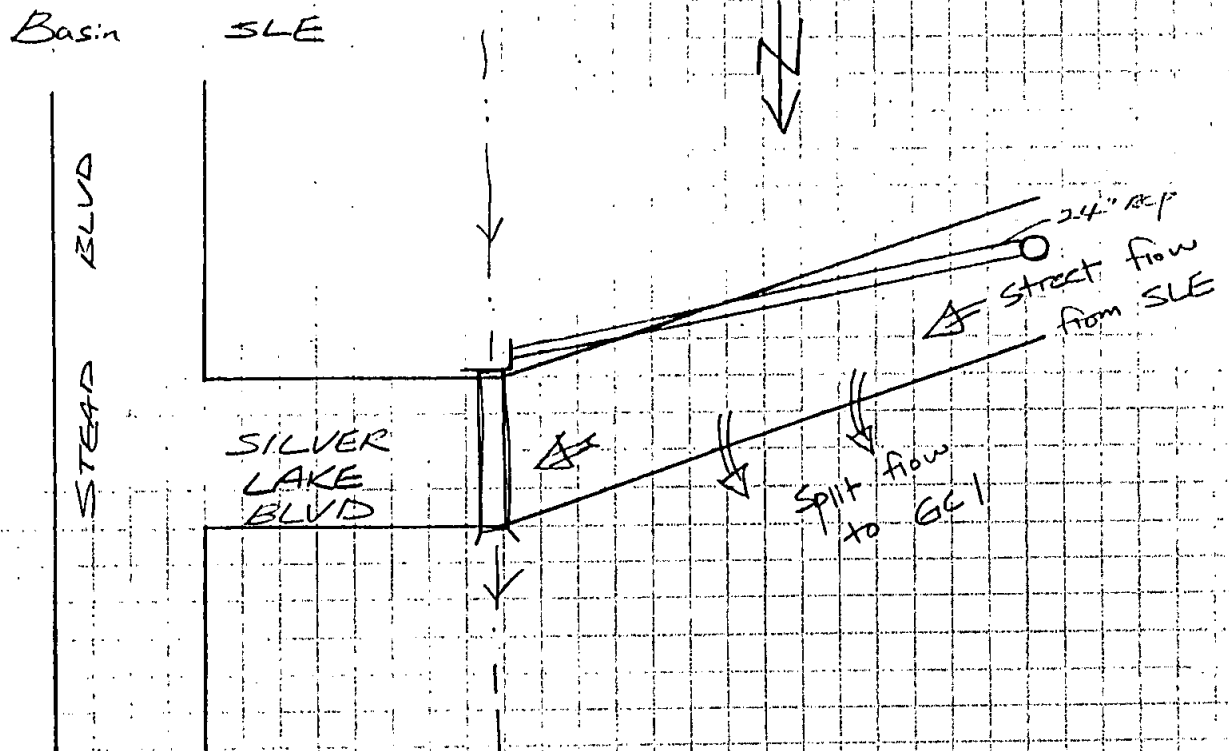
# STANTECH CONSULTING INC.

Formerly SEA, Incorporated  
950 Industrial Way  
Sparks, NV 89431-6092  
(702) 358-6931  
Fax: 358-6954

JOB NO. 26000208

SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT Stead Master Plan DATE \_\_\_\_\_  
SUBJECT Split flow Calculations (SLE) DESIGNED \_\_\_\_\_ CHECKED \_\_\_\_\_

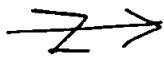


24" RCP Pipe Capacity = assume flowing full Capacity  
= 28 cfs

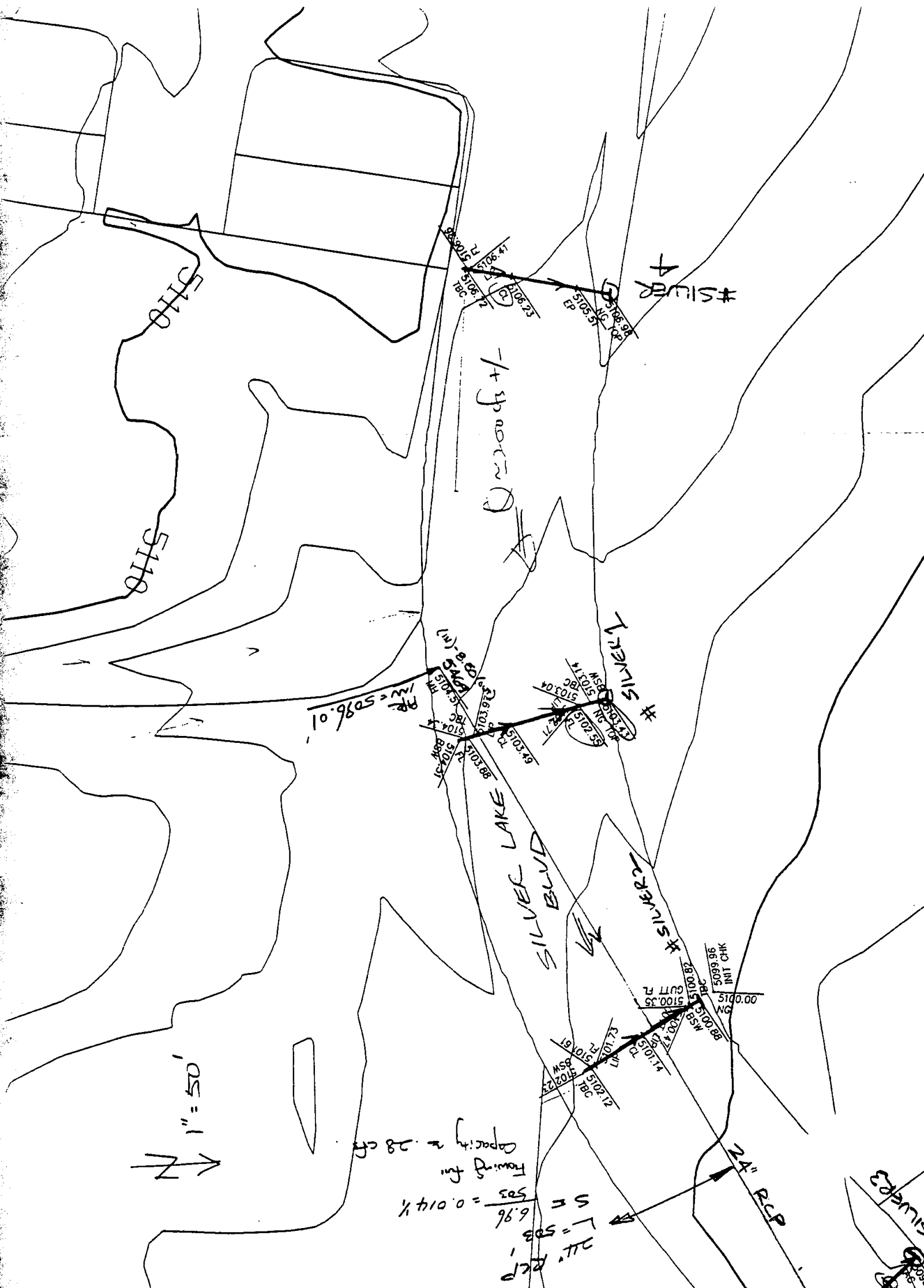
Flows from Basin SLE

assume No street flow will get to the channel @ CP RSD

|    |   |    |     |     |                          |
|----|---|----|-----|-----|--------------------------|
| DI | 0 | 28 | 100 | 300 |                          |
| DQ | 0 | 28 | 28  | 28  | Divert 24" RCP to CP RSD |
| BQ | 0 | 0  | 72  | 272 | Divert to GC1            |

1" = 50'  


Flowing full  
 Capacity = 28 cfs  
 $S = \frac{503}{6.96} = 0.014\%$   
 $L = 503'$   
 24" RCP



Project 2600208  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

SILVER LAKE BLVD

STREET Cross-Section # SILVER4

CROSS SECTION PARAMETERS:

FILENAME: silver4.SEC

No. of Cross Section Points: 6 Bed Slope: 0.01100 Max Elev.: 5106.98  
Bank Stations.....Left: 1015.0 Right.....: 1066.5 Min Elev.: 5105.51  
Encroachment Stations..Left: 1000.0 Right.....: 1066.5  
Manning-n Values.....LOB: 0.035 CHANNEL...: 0.016 ROB.....: 0.035

CROSS SECTION POINTS - Elevations & Stations in feet:

No. Elev. Sta. No. Elev. Sta. No. Elev. Sta.

1) 5106.98 1000.00 2) 5105.51 1015.00 3) 5106.23 1045.00  
4) 5106.41 1064.00 5) 5106.26 1066.00 6) 5106.72 1066.50

COMPUTED PARAMETERS:

WSEL(ft) Q(cfs) V(fps) Fr No. ne ALPHA TW(ft) A(sf) WP(ft) CRWS(ft)

|                |              |            |             |              |            |             |             |             |                |
|----------------|--------------|------------|-------------|--------------|------------|-------------|-------------|-------------|----------------|
| <u>6.00</u>    | <u>18.6</u>  | <u>3.0</u> | <u>1.14</u> | <u>0.020</u> | <u>1.2</u> | <u>25.4</u> | <u>6.2</u>  | <u>25.5</u> | <u>5106.03</u> |
| <u>.20</u>     | <u>46.4</u>  | <u>3.8</u> | <u>1.21</u> | <u>0.020</u> | <u>1.2</u> | <u>35.8</u> | <u>12.4</u> | <u>35.8</u> | <u>5106.28</u> |
| <u>3.40</u>    | <u>85.2</u>  | <u>3.9</u> | <u>1.21</u> | <u>0.020</u> | <u>1.1</u> | <u>59.0</u> | <u>21.6</u> | <u>59.1</u> | <u>5106.45</u> |
| <u>5106.80</u> | <u>289.6</u> | <u>6.2</u> | <u>1.39</u> | <u>0.020</u> | <u>1.2</u> | <u>64.7</u> | <u>46.6</u> | <u>64.9</u> | <u>5107.00</u> |
| <u>5106.98</u> | <u>411.5</u> | <u>7.0</u> | <u>1.44</u> | <u>0.020</u> | <u>1.2</u> | <u>66.5</u> | <u>58.4</u> | <u>66.8</u> | <u>5107.23</u> |

NOTES:

Capacity  $\approx 412$  cfs

O.K.

Project 2600208  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

SILVER LAKE BVD

Street Cross-section # SILVER1

CROSS SECTION PARAMETERS:

FILENAME: SILVER1.SEC

No. of Cross Section Points: 10 Bed Slope: 0.01500 Max Elev.: 5104.51  
Bank Stations.....Left: 1008.0 Right.....: 1070.0 Min Elev.: 5102.55  
Encroachment Stations..Left: Right.....:  
Manning-n Values.....LOB: 0.035 CHANNEL...: 0.016 ROB.....: 0.035

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta. No. | Elev. | Sta. No. | Elev.   | Sta. |         |         |
|-----|---------|----------|-------|----------|---------|------|---------|---------|
| 1)  | 5103.43 | 1000.00  | 2)    | 5103.14  | 1008.00 | 3)   | 5103.04 | 1012.00 |
| 4)  | 5102.55 | 1013.00  | 5)    | 5102.71  | 1015.00 | 6)   | 5103.49 | 1045.00 |
| 7)  | 5103.97 | 1063.00  | 8)    | 5103.88  | 1065.00 | 9)   | 5104.34 | 1066.00 |
| 10) | 5104.51 | 1070.00  |       |          |         |      |         |         |

COMPUTED PARAMETERS:

| (ft)    | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|---------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 5102.80 | 1.3    | 2.3    | 1.34 | 0.016 | 1.0 | 6.0   | 0.6    | 6.0   | 5102.82 |          |
| 5103.00 | 9.3    | 3.6    | 1.50 | 0.016 | 1.0 | 14.1  | 2.6    | 14.2  | 5103.07 |          |
| 5103.20 | 29.0   | 4.4    | 1.57 | 0.016 | 1.0 | 27.5  | 6.7    | 27.6  | 5103.30 |          |
| 5103.43 | 73.8   | 5.0    | 1.58 | 0.018 | 1.1 | 42.7  | 14.7   | 42.8  | 5103.58 |          |
| 5103.60 | 131.1  | 5.8    | 1.60 | 0.019 | 1.1 | 49.1  | 22.5   | 49.3  | 5103.79 |          |
| 5104.00 | 342.0  | 7.5    | 1.67 | 0.019 | 1.1 | 65.3  | 45.3   | 65.4  | 5104.29 |          |

NOTES:

Street Capacity  $\approx$  74 cfs.

Project 26000208  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

SILVER LAKE BLVD

Street Cross-section # SILVER2

CROSS SECTION PARAMETERS:

FILENAME: SILVER2.SEC

No. of Cross Section Points: 8 Bed Slope: 0.01500 Max Elev.: 5102.12  
Bank Stations.....Left: 1000.0 ✓ Right.....: 1057.5 Min Elev.: 5100.35  
Encroachment Stations..Left: Right.....:  
Manning-n Values.....LOD: 0.035 CHANNEL...: 0.016 ✓ ROB.....: 0.035

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.     | Sta.      | No. | Elev.     | Sta.      | No. | Elev.     | Sta.      |
|-----|-----------|-----------|-----|-----------|-----------|-----|-----------|-----------|
| 1)  | 5100.88 ✓ | 1000.00 ✓ | 2)  | 5100.82 ✓ | 1005.00 ✓ | 3)  | 5100.35 ✓ | 1005.50 ✓ |
| 4)  | 5100.47 ✓ | 1007.00 ✓ | 5)  | 5101.14 ✓ | 1030.00 ✓ | 6)  | 5101.73 ✓ | 1055.00 ✓ |
| 7)  | 5101.61 ✓ | 1057.00 ✓ | 8)  | 5102.12 ✓ | 1057.50 ✓ |     |           |           |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | nc  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 5100.70  | 4.4    | 3.1    | 1.44 | 0.016 | 1.0 | 9.8   | 1.4    | 9.9   | 5100.75 |          |
| 5100.80  | 9.6    | 3.8    | 1.51 | 0.016 | 1.0 | 13.3  | 2.6    | 13.5  | 5100.88 |          |
| 5100.88  | 14.2   | 3.7    | 1.50 | 0.016 | 1.0 | 21.1  | 3.9    | 21.3  | 5100.95 |          |
| 5101.00  | 31.1   | 4.7    | 1.60 | 0.016 | 1.0 | 25.2  | 6.7    | 25.4  | 5101.11 |          |
| 5101.40  | 137.6  | 7.0    | 1.77 | 0.016 | 1.0 | 41.0  | 19.8   | 41.2  | 5101.66 |          |
| 5101.60  | 227.8  | 7.9    | 1.83 | 0.016 | 1.0 | 49.5  | 28.8   | 49.7  | 5101.90 |          |

NOTES:

Street Capacity ≈ 14 cfs

Project 26000208  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

SILVER LAKE BLVD

STREET CROSS-SECTION # SILVER 3

CROSS SECTION PARAMETERS:

FILENAME: SILVER3.SEC

No. of Cross Section Points: 6 Bed Slope: 0.02500 Max Elev.: 5099.06  
Bank Stations.....Left: 1017.0 Right.....: 1061.5 Min Elev.: 5098.60  
Encroachment Stations..Left: 1017.0 Right.....:  
Manning-n Values.....LOB: 0.016 CHANNEL...: 0.016 ROB.....: 0.035

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta. No. | Elev. | Sta. No. | Elev.   | Sta. |         |         |
|-----|---------|----------|-------|----------|---------|------|---------|---------|
| 1)  | 5098.02 | 1000.00  | (2)   | 5098.84  | 1017.00 | 3)   | 5098.75 | 1042.00 |
| 4)  | 5098.60 | 1059.00  | 5)    | 5098.60  | 1061.00 | 6)   | 5099.06 | 1061.50 |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 5098.84  | (14.0) | 3.2    | 1.76 | 0.016 | 1.0 | 44.3  | 4.4    | 44.4  | 5098.89 |          |

NOTES:

**STANTECH CONSULTING INC.**

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Sparks, NV 89431-6092

(702) 358-6931

Fax: 358-6954

JOB NO. 80100208

SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT Speed Master PlanDATE 7/22/99SUBJECT SL3A DetentionDESIGNED YS CHECKED \_\_\_\_\_

43, 562

Silver Shores Unit # 31  
Detention Basin Rating

| Elev | Area (ft <sup>2</sup> )  | → | Area (Ac.) |
|------|--------------------------|---|------------|
| 4    | 5657                     |   | 0.13 ✓     |
| 6    | <del>8278</del> / (8293) |   | 0.19 ✓     |
| 8    | 11,160                   |   | 0.26 ✓     |
| 10   | 14,260                   |   | 0.33 ✓     |
| 12   | 17,825                   |   | 0.41 ✓     |
| 14   | 22,475                   |   | 0.52 ✓     |
| 16   | 25,345                   |   | 0.58 ✓     |

Pipe outlet → 24" RCP, L = 72', S = 0.0082%  
I.E. = 3'

Headwall &amp; wingwall

Spillway Elev. = 13.3' L = 137'

&lt; Weir Section &gt;

16  
150014  
103213.3  
104113.3  
117814  
118216  
1204

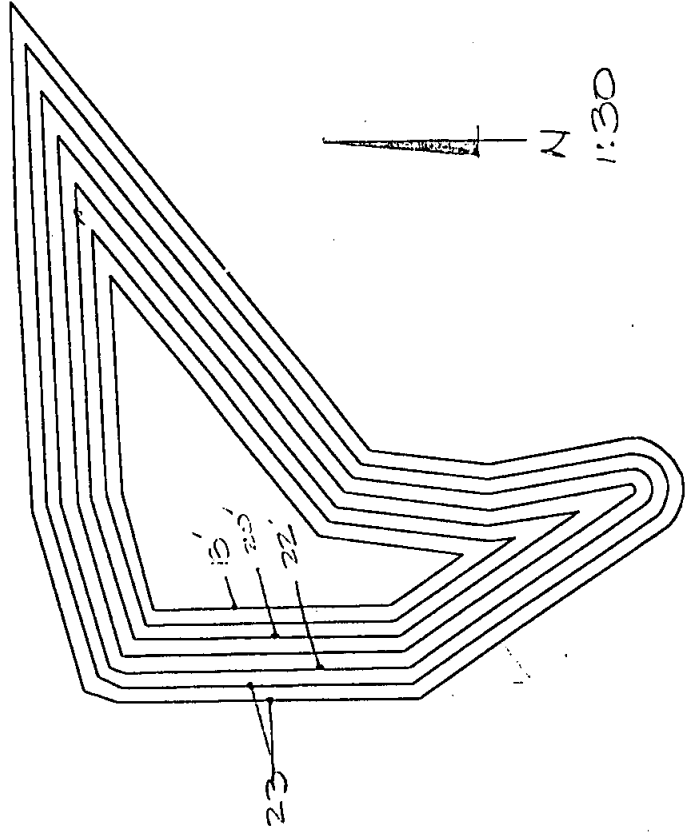
Dirt road C = 2.6

weir from will flow between houses = swale.

little vegetation

Stead basin SS1b  
 Onsite detention basin  
 - from Silver Lake Apts drawing C11  
 by CFA July 1998

Outlet is 10" d. ~~17.50~~  
 w/headwall @ 17.50 ✓  
 Pipe is ~ 53' @ 2.6%  
 Weir @ 23'  
 L = 2125



| Elev | Area, sf     | (Ac.) | Pipe<br>Outflow, CFS | Head<br>(ft) |
|------|--------------|-------|----------------------|--------------|
| 13'  | 1096 (0.025) | ✓     | 1                    | 0.5'         |
| 19   | 1569 (0.036) | ✓     | 2.5                  | 1.5'         |
| 20'  | 2117 (0.049) | ✓     | 4                    | 2.5'         |
| 21   | 2776 (0.064) | ✓     | 4.5                  | 3.5'         |
| 22'  | 3517 (0.081) | ✓     | 5.5                  | 4.5'         |
| 23'  | 4281 (0.098) | ✓     | 6                    | 5.5'         |
| 23.5 | 4281         |       | 6 + 115              |              |

C = 2.6



PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

June 10, 1999  
Stead basin SS1b  
Onsite detention basin  
Outlet rating

PROGRAM INPUT DATA:

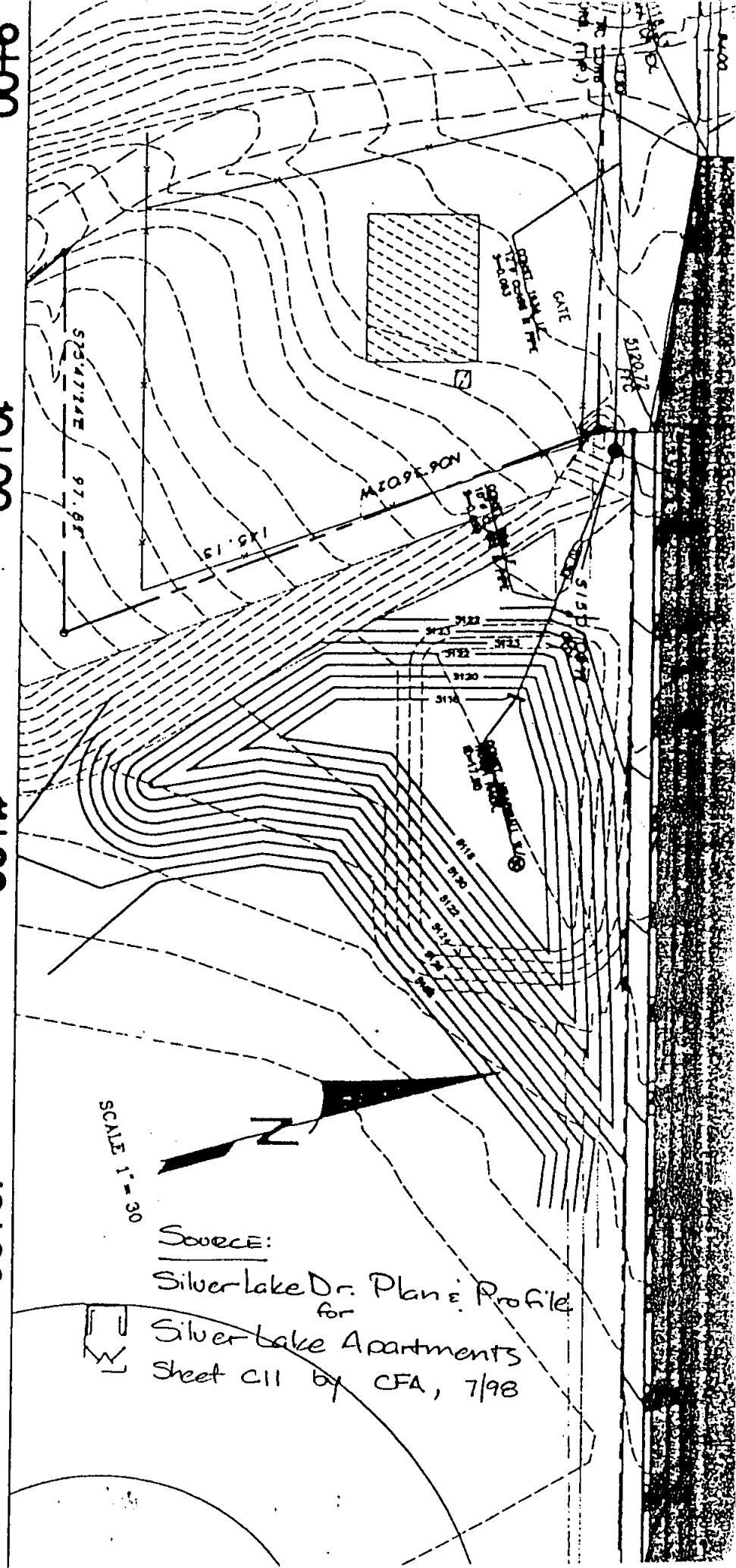
| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 0.83 ✓   |
| FIWA Chart Number (1,2 or 3).....                     | 1 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 53.0 ✓   |
| Culvert Slope (feet per foot).....                    | 0.0260 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth<br>(ft) | Headwater<br>Inlet<br>Depth<br>(ft) | Headwater<br>Outlet<br>Control<br>Depth<br>(ft) | Normal<br>Depth<br>(ft) | Critical<br>Depth<br>(ft) | Depth at<br>Outlet<br>(ft) | Outlet<br>Velocity<br>(fps) |
|--------------------|----------------------------|-------------------------------------|-------------------------------------------------|-------------------------|---------------------------|----------------------------|-----------------------------|
| 1.0                | 0.00                       | 0.66                                | -0.55                                           | 0.30                    | 0.44                      | 0.30                       | 5.58                        |
| 2.0                | 0.00                       | 1.10                                | 0.12                                            | 0.45                    | 0.63                      | 0.45                       | 6.67                        |
| 3.0                | 0.00                       | 1.78                                | 1.14                                            | 0.59                    | 0.75                      | 0.59                       | 7.27                        |
| 4.0                | 0.00                       | 2.73                                | 2.50                                            | 0.83                    | 0.80                      | 0.83                       | 7.39                        |
| 5.0                | 1.00                       | 3.95                                | 4.42                                            | 0.83                    | 0.82                      | 0.83                       | 9.24                        |
| 5.0                | 0.83                       | 3.95                                | 4.25                                            | 0.83                    | 0.82                      | 0.83                       | 9.24                        |
| 5.0                | 0.00                       | 3.95                                | 4.24                                            | 0.83                    | 0.82                      | 0.82                       | 9.27                        |
| 5.5                | 0.83                       | 4.67                                | 5.25                                            | 0.83                    | 0.82                      | 0.83                       | 10.17                       |
| 5.5                | 0.00                       | 4.67                                | 5.25                                            | 0.83                    | 0.82                      | 0.82                       | 10.18                       |
| 6.0                | 0.83                       | 5.45                                | 6.35                                            | 0.83                    | 0.82                      | 0.83                       | 11.09                       |
| 5.8                | 0.83                       | 5.05                                | 5.79                                            | 0.83                    | 0.82                      | 0.83                       | 10.63                       |

PIPE CULVERT ANALYSIS COMPUTER PROGRAM Version 1.7 Copyright (c)1986  
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|       |                   |
|-------|-------------------|
| 9+00  | 5117.3            |
|       | 5119.0            |
| 10+00 | 5120.55<br>5120.6 |
|       | 5121.22           |
|       | 5121.79<br>5121.8 |
|       | 5122.42           |
| 11+00 | 5123.12<br>5123.1 |
|       | 5123.73           |
|       | 5124.25<br>5124.2 |
|       | 5124.75           |
| 12+00 | 5125.14<br>5125.1 |
|       | 5125.48           |
|       | 5125.81<br>5125.8 |
|       | 5126.11           |



Project stead Master  
Project No. 208  
Sheet No.      of       
Calculated by      Date     

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Basin SRS in railroad cut

CROSS SECTION PARAMETERS:

FILENAME: SRS.SEC

No. of Cross Section Points: 8 Bed Slope: 0.02000 Max Elev.: 38.00  
Bank Stations.....Left: 0.0 Right.....: 22.1 Min Elev.: 34.00  
Encroachment Stations..Left:      Right.....:       
Manning-n Values.....LOB: 0.030 CHANNEL...: 0.030 ROB.....: 0.030

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev. | Sta.  | No. | Elev. | Sta.  | No. | Elev. | Sta.  |
|-----|-------|-------|-----|-------|-------|-----|-------|-------|
| 1)  | 38.00 | 0.00  | 2)  | 36.00 | 4.00  | 3)  | 34.00 | 8.00  |
| 4)  | 34.00 | 9.50  | 5)  | 35.00 | 18.50 | 6)  | 36.00 | 19.50 |
| 7)  | 36.00 | 22.00 | 8)  | 36.50 | 22.10 |     |       |       |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | nc  | ALPHA | TW(ft) | A(sf) | WP(ft) | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|--------|----------|
| 5.00     | 32.8   | 4.7    | 1.10 | 0.030 | 1.0 | 12.5  | 7.0    | 12.8  | 35.04  |          |
| 36.00    | 173.2  | 8.2    | 1.25 | 0.030 | 1.0 | 15.5  | 21.0   | 16.4  | 36.27  |          |
| 36.25    | 212.7  | 8.3    | 1.25 | 0.030 | 1.0 | 18.5  | 25.6   | 19.8  | 36.48  |          |
| 36.50    | 274.4  | 9.1    | 1.27 | 0.030 | 1.0 | 19.1  | 30.3   | 20.6  | 36.79  |          |

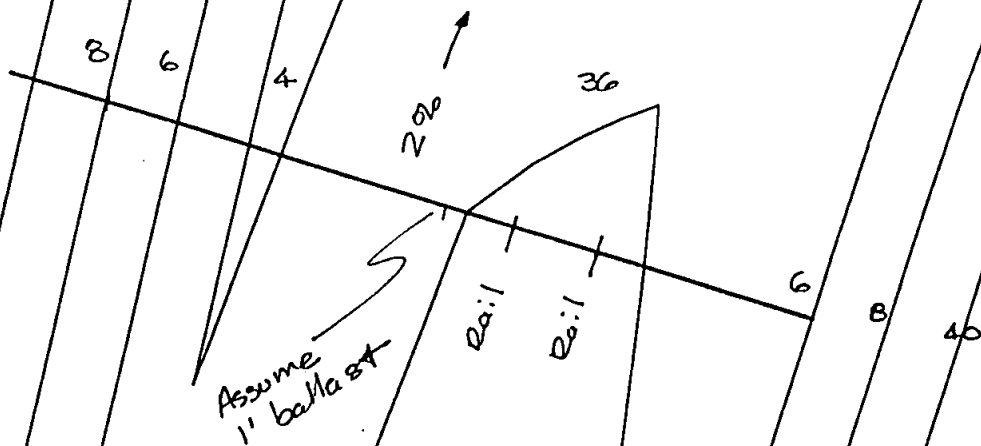
*high velocity*

NOTES:

Capacity check for west-side  
ditch along rail

SRS. SEC  
 $Q_{100} \sim 165 \text{ cfs}$   
 to  $190 \text{ cfs}$

↑  
 N  
 1:10



flow ↑

|       |       |
|-------|-------|
| 38'   | 0'    |
| 36'   | 4'    |
| 34'   | 8'    |
| 34'   | 9.5'  |
| 35'   | 18.5' |
| 36'   | 19.5' |
| 36'   | 22'   |
| 36.5' | 22.1' |

Assumed  
 = O.K.

Project Stead. Master  
Project No. 208  
Sheet No.      of       
Calculated by      Date     

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Basin SRS in railroad cut

CROSS SECTION PARAMETERS:

FILENAME: srsa.SEC

No. of Cross Section Points: 9 Bed Slope: 0.02000 Max Elev.: 26.00  
Bank Stations.....Left: 0.0 -Right.....: 23.6 Min Elev.: 21.40  
Encroachment Stations..Left: Right.....:  
Manning-n Values.....LOB: 0.030 CHANNEL...: 0.030 ROB.....: 0.030

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev. | Sta. No. | Elev. | Sta. No. | Elev. | Sta. |       |       |
|-----|-------|----------|-------|----------|-------|------|-------|-------|
| 1)  | 26.00 | 0.00     | 2)    | 24.00    | 4.00  | 3)   | 22.00 | 8.00  |
| 4)  | 21.40 | 10.00    | 5)    | 22.00    | 12.00 | 6)   | 23.00 | 20.00 |
| 7)  | 24.00 | 21.00    | 8)    | 24.00    | 23.50 | 9)   | 24.50 | 23.60 |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | nc  | ALPHA | TW(ft) | A(sf) | WP(ft) | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|--------|----------|
| 2.00     | 3.7    | 3.1    | 0.98 | 0.030 | 1.0 | 4.0   | 1.2    | 4.2   | 22.00  |          |
| 23.00    | 56.6   | 5.5    | 1.15 | 0.030 | 1.0 | 14.0  | 10.2   | 14.5  | 23.07  |          |
| 24.00    | 227.2  | 8.8    | 1.27 | 0.030 | 1.0 | 17.0  | 25.7   | 18.1  | 24.31  |          |
| 24.50    | 343.1  | 9.6    | 1.29 | 0.030 | 1.0 | 20.6  | 35.7   | 22.3  | 24.83  |          |

*High Velocity*

NOTES:

Capacity check for west-side  
ditch along rail

4  
N  
1:10

SRSa. sec  
Q<sub>100</sub> ~ 190 cfs

32

30

26

24

22

270

Assume  
1' ballast

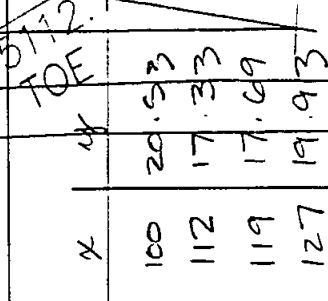
Rail

Rail

24

24

|        |       |
|--------|-------|
| 26'    | 0'    |
| 24'    | 4'    |
| 22'    | 8'    |
| 21.4'  | 10'   |
| 22'    | 12'   |
| (23)   | 20'   |
| 24'    | 21'   |
| (24)   | 23.5' |
| (24.5) | 28.6' |



Stead Master Plan

Split flow rating at MH 5500 using StormCad

| Q  | 5500a             |                    | 5500b             |                    |
|----|-------------------|--------------------|-------------------|--------------------|
|    | HGL <sub>in</sub> | HGL <sub>out</sub> | HGL <sub>in</sub> | HGL <sub>out</sub> |
| 5  |                   |                    | 2.58              | 2.29               |
| 10 | 0.03              | 99.57              | 3.09              | 2.63               |
| 15 | 0.47              | 99.84              | 3.53              | 2.90               |
| 20 | 0.90              | 0.05               | 3.96              | 3.11               |
| 25 | 1.33              | 0.20               | 4.39              | 3.26               |
| 26 | 1.42              | 0.23               | 4.40              | 3.29               |
| 27 | 2.97              | 1.82               | 4.40              | 3.50               |
| 28 | 4.40              | 3.40               | 4.40              | 3.65               |
| 29 | 4.40              | 4.40               | 4.40              | 4.09               |
| 30 | 4.40              | 4.40               | 4.40              | 4.40               |

↑  
P-13  
IE = 98.44

↑  
P-26  
IE = 1.50

|    |   |    |    |    |    |    |
|----|---|----|----|----|----|----|
| DI | 0 | 26 | 32 | 42 | 54 | 60 |
| DQ | 0 | 0  | 5  | 15 | 26 | 30 |



## Analysis Results

### Scenario: Full OB

Title: Stead Master Plan  
 Project Engineer: Slantec  
 Project Date: 10/13/99  
 Comments: Storm drain system beginning at the 48" inlet with bar screen, across from O'Brien middle school

#### Inlet Rational Flows

| Label | Inlet Area (acres) | Composite Rational C | Inlet CA (acres) | Carryover CA (acres) | Total Inlet CA (acres) | Time of Concentration (min) | Local Intensity (in/hr) | Local Rational Flow (cfs) | Additional Carryover (cfs) | Total Carryover Flow (cfs) | Total Flow To Inlet (cfs) |
|-------|--------------------|----------------------|------------------|----------------------|------------------------|-----------------------------|-------------------------|---------------------------|----------------------------|----------------------------|---------------------------|
| 48OB  | 0.00               | 0.00                 | 0.00             | 0.00                 | 0.00                   | 0.00                        | 10.00                   | 0.00                      | 0.00                       | 10.00                      | 10.00                     |

#### Inlets

| Label | Bypass Target | Inlet        | Inlet Type    | Total Flow To Inlet (cfs) | Total Intercepted Flow (cfs) | Total Bypassed Flow (cfs) | Capture Efficiency (%) |
|-------|---------------|--------------|---------------|---------------------------|------------------------------|---------------------------|------------------------|
| 48OB  | N/A           | Default 100% | Generic Inlet | 0.00                      | 10.00                        | 0.00                      | 100.0                  |

#### Pipes For Network With Outlet: OBout

| Label | Dn. Pipe | Number of Sections | Section Shape | Section Size | Pipe Length (ft) | Pipe Slope (ft/ft) | Total System Flow (cfs) | Average Velocity (ft/s) | Up Invert (ft) | Dn Invert (ft) | HGL In (ft) | HGL Out (ft) |
|-------|----------|--------------------|---------------|--------------|------------------|--------------------|-------------------------|-------------------------|----------------|----------------|-------------|--------------|
| P-20  | P-21     | 1                  | Circular      | 48 inch      | 29.00            | 0.030000           | 10.00                   | 4.40                    | 5,104.14       | 5,103.27       | 5,105.06    | 5,104.24     |
| P-21  | P-26     | 1                  | Circular      | 36 inch      | 230.00           | 0.019783           | 10.00                   | 3.13                    | 5,102.95       | 5,098.40       | 5,103.95    | 5,103.09     |
| P-23  | P-24     | 1                  | Circular      | 24 inch      | 152.00           | 0.021711           | 10.00                   | 4.70                    | 5,099.86       | 5,096.56       | 5,100.99    | 5,098.06     |
| P-24  | P-25     | 1                  | Circular      | 24 inch      | 373.00           | 0.021689           | 10.00                   | 4.70                    | 5,096.56       | 5,088.47       | 5,097.69    | 5,089.97     |
| P-25  | None     | 1                  | Circular      | 24 inch      | 562.00           | 0.020409           | 10.00                   | 7.26                    | 5,088.47       | 5,077.00       | 5,089.60    | 5,077.76     |
| P-26  | P-23     | 1                  | Circular      | 24 inch      | 84.00            | 0.015357           | 10.00                   | 6.79                    | 5,101.50       | 5,100.21       | 5,102.63    | 5,101.04     |

#### Structures For Network With Outlet: OBout

| Label | Hydraulic Grade In (ft) | Hydraulic Grade Out (ft) | Calculated Headloss (ft) | Total System Flow (cfs) | System Flow Time (min) | System Intensity (in/hr) |
|-------|-------------------------|--------------------------|--------------------------|-------------------------|------------------------|--------------------------|
| 48OB  | 5,105.22                | 5,105.06                 | 0.16                     | 10.00                   | 0.00                   | 0.00                     |
| 5480  | 5,089.97                | 5,089.60                 | 0.37                     | 10.00                   | 3.40                   | 0.00                     |
| 5481  | 5,101.22                | 5,100.99                 | 0.23                     | 10.00                   | 1.54                   | 0.00                     |
| 5500b | 5,103.09                | 5,102.63                 | 0.46                     | 10.00                   | 1.33                   | 0.00                     |
| 5517b | 5,104.24                | 5,103.95                 | 0.29                     | 10.00                   | 0.11                   | 0.00                     |
| JNF   | 5,098.06                | 5,097.69                 | 0.37                     | 10.00                   | 2.08                   | 0.00                     |
| OBout | 5,077.76                | 5,077.76                 | 0.00                     | 10.00                   | 4.69                   | 0.00                     |

# Analysis Results

## Scenario: Full 24

Title: Stead Master Plan  
 Project Engineer: Stantec  
 Project Date: 10/13/99  
 Comments: Storm drain system beginning at the 24" CMP inlet, 48" inlet with bar screen, across from O'Brien middle school

### Inlet Rational Flows

| Label | Inlet Area (acres) | Composite Rational C | Inlet CA (acres) | Carryover CA (acres) | Total Inlet CA (acres) | Time of Concentration (min) | Local Intensity (in/hr) | Local Rational Flow (cfs) | Additional Carryover (cfs) | Total Carryover Flow (cfs) | Total Flow To Inlet (cfs) |
|-------|--------------------|----------------------|------------------|----------------------|------------------------|-----------------------------|-------------------------|---------------------------|----------------------------|----------------------------|---------------------------|
| 24IN  | 0.00               | 0.00                 | 0.00             | 0.00                 | 0.00                   | 0.00                        | 10.00                   | 0.00                      | 0.00                       | 10.00                      | 10.00                     |

### Inlets

| Label | Bypass Target | Inlet        | Inlet Type    | Total Flow To Inlet (cfs) | Total Intercepted Flow (cfs) | Total Bypassed Flow (cfs) | Capture Efficiency (%) |
|-------|---------------|--------------|---------------|---------------------------|------------------------------|---------------------------|------------------------|
| 24IN  | N/A           | Default 100% | Generic Inlet | 0.00                      | 10.00                        | 0.00                      | 100.0                  |

### Pipes For Network With Outlet: 24OUT

| Label | Dn, Pipe | Number of Sections | Section Shape | Section Size | Pipe Length (ft) | Pipe Slope (ft/ft) | Total System Flow (cfs) | Average Velocity (ft/s) | Up Invert (ft) | Dn Invert (ft) | HGL In (ft) | HGL Out (ft) |
|-------|----------|--------------------|---------------|--------------|------------------|--------------------|-------------------------|-------------------------|----------------|----------------|-------------|--------------|
| P-11  | P-12     | 1                  | Circular      | 24 inch      | 71.00            | 0.037746           | 10.00                   | 6.35                    | 5,107.02       | 5,104.34       | 5,108.15    | 5,105.24     |
| P-12  | P-13     | 1                  | Circular      | 24 inch      | 319.00           | 0.012414           | 10.00                   | 6.51                    | 5,102.92       | 5,098.96       | 5,104.05    | 5,099.84     |
| P-13  | P-14     | 1                  | Circular      | 24 inch      | 317.00           | 0.015457           | 10.00                   | 4.92                    | 5,098.44       | 5,093.54       | 5,099.57    | 5,094.90     |
| P-14  | P-15     | 1                  | Circular      | 24 inch      | 356.00           | 0.017303           | 10.00                   | 4.92                    | 5,093.54       | 5,087.38       | 5,094.67    | 5,088.74     |
| P-15  | P-16     | 1                  | Circular      | 24 inch      | 327.00           | 0.013914           | 10.00                   | 4.92                    | 5,087.38       | 5,082.83       | 5,088.51    | 5,084.19     |
| P-16  | P-17     | 1                  | Circular      | 24 inch      | 290.00           | 0.012241           | 10.00                   | 4.92                    | 5,082.83       | 5,079.28       | 5,083.96    | 5,080.64     |
| P-17  | P-18     | 1                  | Circular      | 24 inch      | 252.00           | 0.022976           | 10.00                   | 7.46                    | 5,079.28       | 5,073.49       | 5,080.41    | 5,074.23     |
| P-18  | None     | 1                  | Circular      | 24 inch      | 68.00            | 0.005147           | 10.00                   | 5.44                    | 5,073.13       | 5,072.78       | 5,074.27    | 5,073.91     |

### Structures For Network With Outlet: 24OUT

| Label | Hydraulic Grade In (ft) | Hydraulic Grade Out (ft) | Calculated Headloss (ft) | Total System Flow (cfs) | System Flow Time (min) | System Intensity (in/hr) |
|-------|-------------------------|--------------------------|--------------------------|-------------------------|------------------------|--------------------------|
| 24IN  | 5,108.38                | 5,108.15                 | 0.23                     | 10.00                   | 0.00                   | 0.00                     |
| 24OU  | 5,073.91                | 5,073.91                 | 0.00                     | 10.00                   | 6.14                   | 0.00                     |
| 5418  | 5,074.49                | 5,074.27                 | 0.23                     | 10.00                   | 5.94                   | 0.00                     |
| 5429  | 5,080.64                | 5,080.41                 | 0.23                     | 10.00                   | 5.37                   | 0.00                     |
| 5477  | 5,084.19                | 5,083.96                 | 0.23                     | 10.00                   | 4.39                   | 0.00                     |
| 5478  | 5,088.74                | 5,088.51                 | 0.23                     | 10.00                   | 3.28                   | 0.00                     |
| 5479  | 5,094.90                | 5,094.67                 | 0.23                     | 10.00                   | 2.08                   | 0.00                     |
| 5500a | 5,100.03                | 5,099.57                 | 0.46                     | 10.00                   | 1.00                   | 0.00                     |
| J-9   | 5,104.28                | 5,104.05                 | 0.23                     | 10.00                   | 0.19                   | 0.00                     |

Title: Stead Master Plan

p:\...6000208\hyddraulics\stormcad\48barscreen.slm

10/14/99 09:20:14 AM

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

ST1

**STANTECH CONSULTING INC.**

Formerly SEA, Incorporated  
950 Industrial Way  
Sparks, NV 89431-6092  
(702) 358-6931  
Fax: 358-6954

JOB NO. 260002-08

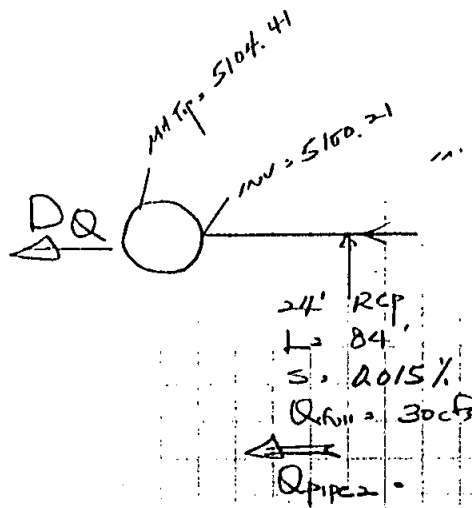
SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT STEADST1DATE 4/14/99SUBJECT Split (Basin SI1)

DESIGNED \_\_\_\_\_

CHECKED \_\_\_\_\_

Storm Drain Split @ Stead Blvd near the school

Replace  
w/ StormCad  
rating/split

24" RCP (Flow From SI1)

36" RCP Flow From SI2  
(Havall = 6')24" RCP  
L = 318', S = 0.015%  
Q\_full = 30 cfs

Q\_pipe1 =

INV = 5093.54

MH, Top = 5099.20

\* For split approximation,  
calculate as culvert.

| Elev.   | Q_pipe1 (H') | Q_pipe2 (H') | Q_total (Cfs)                         |
|---------|--------------|--------------|---------------------------------------|
| 5098.44 | 0            | 0            | 0                                     |
| 5101.50 | 21' (2.6)    | 0 (0)        | 21'                                   |
| 5102.5  | 26' (4.6)    | 5' (1)       | 31'                                   |
| 5103.5  | 30' (5.6)    | 13' (2)      | 43'                                   |
| 5104.4  | 34' (5.96)   | 20' (2.9)    | 54' 5" Q_total @ top of manhole elev. |

Q\_total → DI  
Q\_pipe2 → DQ

↓  
Diverter  
to the  
school

PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

April 14, 1999  
24" RCP STORM DRAIN PIPE  
DIVERSION TO LEMON LAKE STEAD BLVD STORM DRAIN  
NEAR THE SCHOOL  
*INV = 5101.50*

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Diameter (feet).....                          | 2.00   |
| FWWA Chart Number (1,2 or 3).....                     | 1      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 84.0   |
| Culvert Slope (feet per foot).....                    | 0.0150 |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth<br>(ft) | Headwater<br>Inlet Control<br>Depth<br>(ft) | Normal<br>Outlet Control<br>Depth<br>(ft) | Critical<br>Depth<br>(ft) | Normal<br>Depth<br>(ft) | Critical<br>Depth<br>(ft) | Outlet<br>Velocity<br>(fps) |
|--------------------|----------------------------|---------------------------------------------|-------------------------------------------|---------------------------|-------------------------|---------------------------|-----------------------------|
| 5.0                | 1.00                       | 1.11                                        | 0.23                                      | 0.58                      | 0.79                    | 0.58                      | 6.68                        |
| 10.0               | 2.00                       | 1.69                                        | 1.14                                      | 0.83                      | 1.13                    | 0.83                      | 8.11                        |
| 15.0               | 2.00                       | 2.26                                        | 1.64                                      | 1.05                      | 1.40                    | 1.05                      | 9.00                        |
| 20.0               | 2.50                       | 2.95                                        | 2.84                                      | 1.26                      | 1.61                    | 1.26                      | 9.61                        |
| 30.0               | 2.50                       | 4.97                                        | 4.83                                      | 2.00                      | 1.86                    | 2.00                      | 9.55                        |
| 25.0               | 2.50                       | 3.86                                        | 3.74                                      | 1.49                      | 1.76                    | 1.49                      | 9.98                        |

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PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

April 14, 1999  
24" RCP STORM DRAIN PIPE  
STEAD BLVD STORM DRAIN PIPE  
NEAR THE SCHOOL

*INV = 5088.44'*

=====

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Diameter (feet).....                          | 2.00   |
| FWHA Chart Number (1,2 or 3).....                     | 1      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 318.0  |
| Culvert Slope (feet per foot).....                    | 0.0150 |

=====

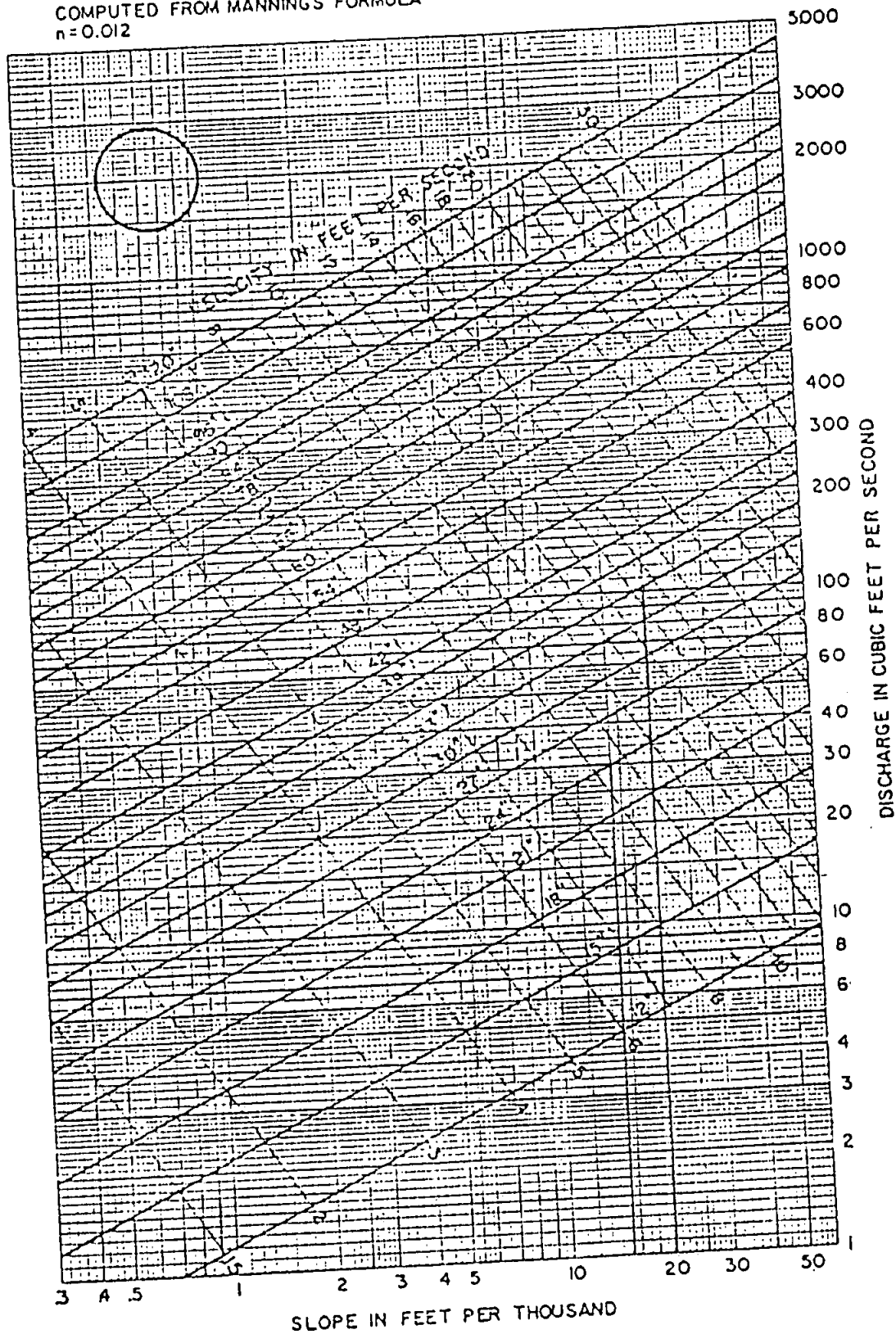
PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater<br>Inlet Control<br>Depth (ft) | Normal<br>Outlet Control<br>Depth (ft) | Critical<br>Depth (ft) | Depth at<br>(ft) | Outlet<br>Depth (ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|------------------------------------------|----------------------------------------|------------------------|------------------|----------------------|--------------------------|
| 5.0                | 1.00                    | 1.11                                     | -3.16                                  | 0.58                   | 0.79             | 0.58                 | 6.68                     |
| 10.0               | 2.00                    | 1.69                                     | -1.92                                  | 0.83                   | 1.13             | 0.83                 | 8.11                     |
| 15.0               | 3.00                    | 2.26                                     | 0.15                                   | 1.05                   | 1.40             | 1.05                 | 9.00                     |
| 20.0               | 3.00                    | 2.95                                     | 1.65                                   | 1.26                   | 1.61             | 1.26                 | 9.61                     |
| 25.0               | 3.00                    | 3.86                                     | 3.57                                   | 1.49                   | 1.76             | 1.49                 | 9.98                     |
| 30.0               | 3.00                    | 4.97                                     | 5.91                                   | 2.00                   | 1.86             | 2.00                 | 9.55                     |
| 35.0               | 3.00                    | 6.28                                     | 8.69                                   | 2.00                   | 1.92             | 2.00                 | 11.14                    |
| 40.0               | 3.00                    | 7.79                                     | 11.89                                  | 2.00                   | 1.95             | 2.00                 | 12.73                    |

=====

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COMPUTED FROM MANNING'S FORMULA  
 $n = 0.012$



DISCHARGE CAPACITY OF CONCRETE PIPE FLOWING FULL

FIGURE 3-51

**STANTECH CONSULTING INC.**

Formerly SEA, Incorporated

950 Industrial Way  
Sparks, NV 89431-6092(702) 358-6931  
Fax: 358-6954

JOB NO.

2000208

SHEET

OF

PROJECT

Stead Drainage Master Plan

DATE

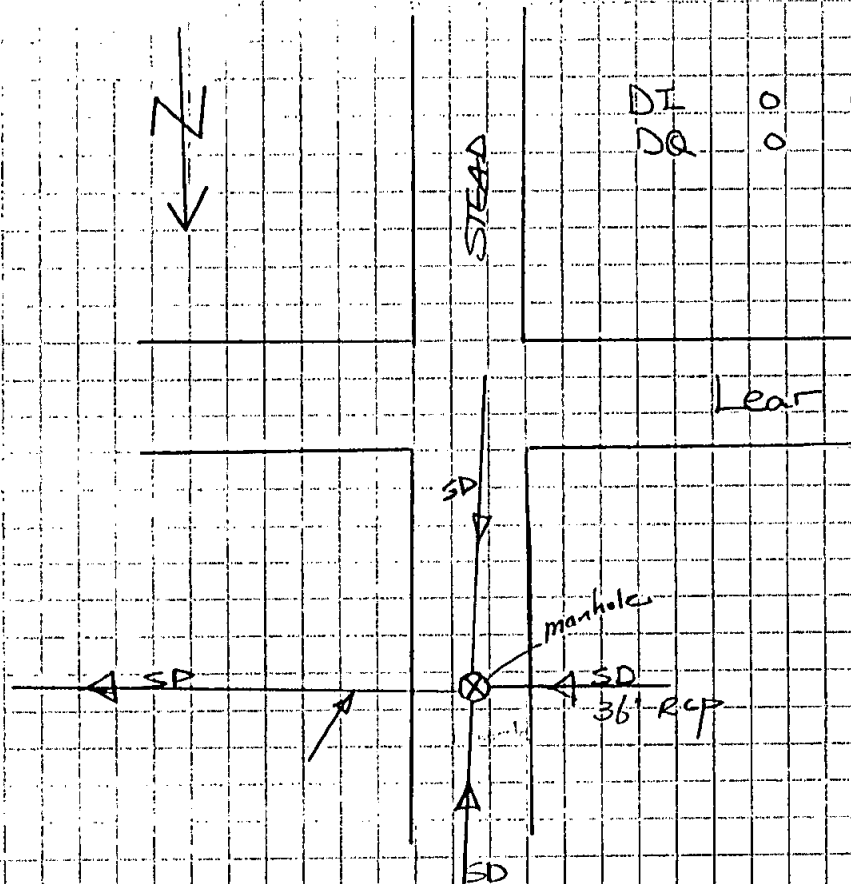
4/29/99

SUBJECT

Basin "ST2"

DESIGNED

CHECKED

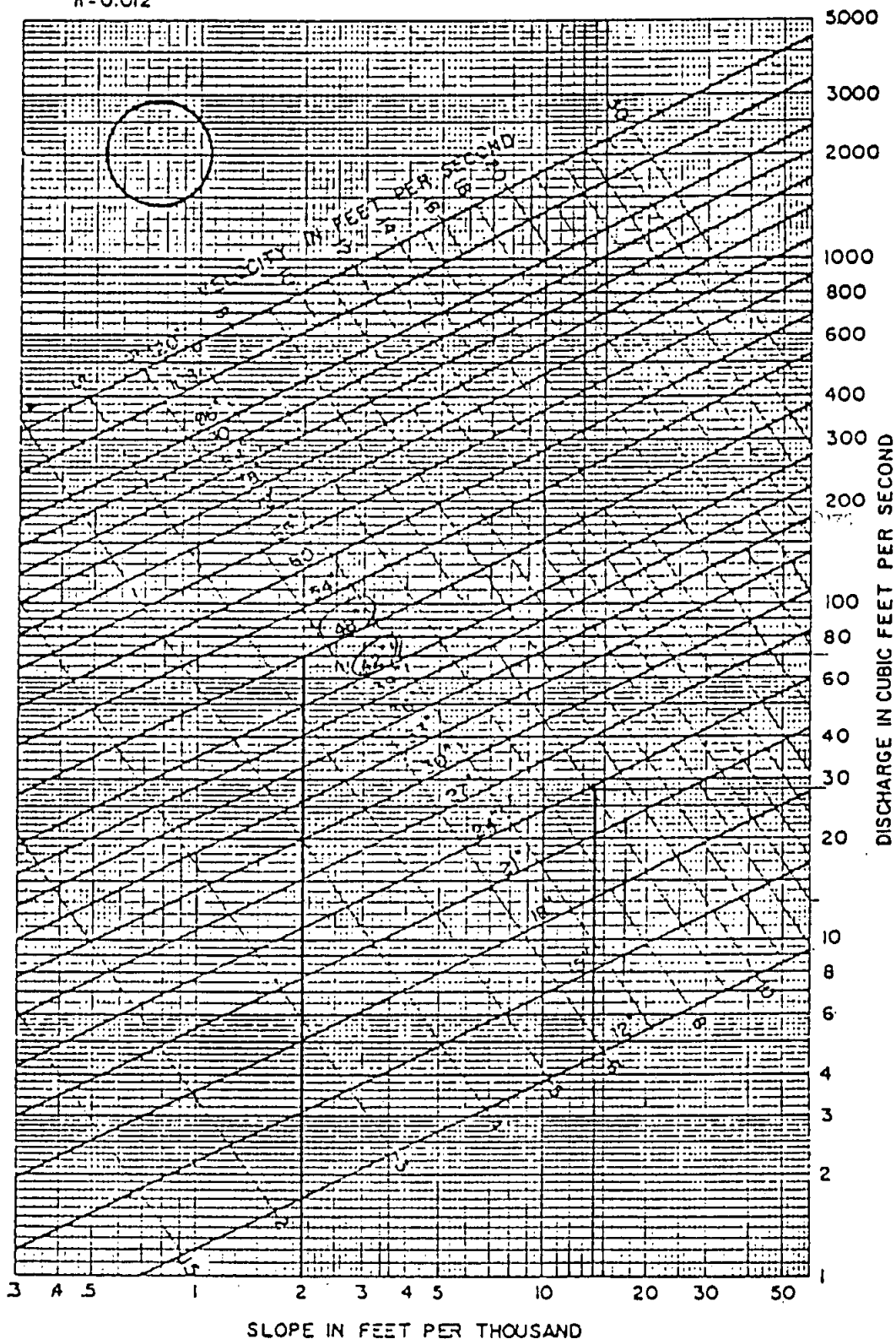
Storm to Drain Lemmon Valley from CP ST2  
"MA1"54" x 36"  $\Rightarrow$  equivalent pipe = 45"  $\pm$ 49" x 33"  $\Rightarrow$  equivalent round pipe = 42"57" x 38"  $\Rightarrow$  " " = 48"

slope = assume approximately 0.2 %

flowing full Capacity of 42" RCP = 50 cfs  
48" " = 70 cfs

Approximate flowing full capacity of  
54" x 36" = 60 cfs  $\Rightarrow$  Divert to Basin "MA1"

COMPUTED FROM MANNING'S FORMULA  
 $n = 0.012$





STEAD

1" = 100'

Basin ST2

25 @ 7.1' 5.1  
HE = 67.15  
125'  
ATB 6.41 @ 8.32  
HE = 69.95

527'  
0.214% →

ATB 12 @ 1.3  
HE = 65.82

234'

65.34  
Calculated Invert

LEAR

2750'

Stead Basin ST2  
18" RCP IE= 92.0  
12" CMP's IE= 90.8

| Elevation | Q <sub>12</sub> * | Q <sub>18</sub> | Q <sub>road</sub> | Q <sub>total</sub> |
|-----------|-------------------|-----------------|-------------------|--------------------|
| 93.0      | 6                 | 3               | 0                 | 9                  |
| 94.0      | 6                 | 9               | 7                 | 22                 |
| 94.1      | 6                 | 9               | 16                | 31                 |
| 94.2      | 6                 | 9               | 29                | 44                 |
| 94.3      | 6                 | 10              | 47                | 63                 |
| 94.4      | 6                 | 10              | 68                | 84                 |
| 94.5      | 6                 | 10              | 94                | 110                |

\* 2 culvert total

Hazelcrest Subdivision  
storm drain diversion

PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

November 16, 1999  
Stead basin ST2  
Culvert rating  
12" CMP

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Diameter (feet).....                          | 1.00   |
| FIWA Chart Number (1,2 or 3).....                     | 2      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0240 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 200.0  |
| Culvert Slope (feet per foot).....                    | 0.0200 |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater<br>Inlet Control<br>Depth (ft) | Normal<br>Outlet Control<br>Depth (ft) | Critical<br>Depth (ft) | Depth at<br>Outlet (ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|------------------------------------------|----------------------------------------|------------------------|-------------------------|--------------------------|
| 1.0                | 1.00                    | 0.59                                     | -2.43                                  | 0.42                   | 0.42                    | 3.21                     |
| 2.0                | 1.00                    | 0.91                                     | -0.71                                  | 0.64                   | 0.60                    | 3.79                     |
| 3.0                | 1.00                    | 1.26                                     | 2.15                                   | 1.00                   | 0.74                    | 1.00                     |
| 4.0                | 1.00                    | 1.67                                     | 6.15                                   | 1.00                   | 0.85                    | 1.00                     |
| 5.0                | 1.00                    | 2.23                                     | 11.29                                  | 1.00                   | 0.92                    | 1.00                     |

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PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

November 16, 1999  
Stead basin ST2  
Culvert rating  
18" RCP

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Diameter (feet).....                          | 1.50   |
| FHWA Chart Number (1,2 or 3).....                     | 1      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 200.0  |
| Culvert Slope (feet per foot).....                    | 0.0200 |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater (ft)<br>Inlet Control | Headwater (ft)<br>Outlet Control | Normal Depth<br>(ft) | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|---------------------------------|----------------------------------|----------------------|------------------------|-------------------------|--------------------------|
| 2.0                | 1.50                    | 0.74                            | -2.40                            | 0.37                 | 0.53                   | 0.37                    | 5.86                     |
| 4.0                | 1.50                    | 1.12                            | -2.09                            | 0.53                 | 0.77                   | 0.53                    | 7.15                     |
| 6.0                | 1.50                    | 1.46                            | -1.58                            | 0.66                 | 0.95                   | 0.66                    | 7.97                     |
| 8.0                | 1.50                    | 1.86                            | -0.87                            | 0.78                 | 1.10                   | 0.78                    | 8.55                     |
| 9.0                | 1.50                    | 2.04                            | -0.44                            | 0.84                 | 1.16                   | 0.84                    | 8.80                     |
| 10.0               | 1.50                    | 2.28                            | 0.05                             | 0.90                 | 1.27                   | 0.90                    | 9.01                     |
| 11.0               | 1.50                    | 2.55                            | 0.58                             | 0.95                 | 1.27                   | 0.95                    | 9.33                     |
| 12.0               | 1.50                    | 2.84                            | 1.17                             | 1.02                 | 1.31                   | 1.02                    | 9.37                     |
| 13.0               | 1.50                    | 3.16                            | 1.81                             | 1.09                 | 1.35                   | 1.09                    | 9.47                     |
| 14.0               | 1.50                    | 3.50                            | 2.49                             | 1.16                 | 1.38                   | 1.16                    | 9.56                     |
| 7.0                | 1.50                    | 1.64                            |                                  |                      |                        |                         |                          |

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Project Stead  
Project No. 26000208  
Sheet No. 1 of 1  
Calculated by CB Date 11/17/99

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Basin STZ

Hazelcrest subdivision

CROSS SECTION PARAMETERS:

FILENAME: hazelcr.SEC

No. of Cross Section Points: 5 Bed Slope: 0.00010 Max Elev.: 94.75  
Bank Stations.....Left: 50.0 Right.....: 80.0 Min Elev.: 93.75  
Encroachment Stations..Left: Right.....: Weir Coef: 2.800

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev. | Sta.  | No. | Elev. | Sta.   | No. | Elev. | Sta.  |
|-----|-------|-------|-----|-------|--------|-----|-------|-------|
| 1)  | 94.75 | 0.00  | 2)  | 93.75 | 50.00  | 3)  | 94.05 | 65.00 |
| 4)  | 93.75 | 80.00 | 5)  | 94.75 | 130.00 |     |       |       |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H: max(ft) | H: ave(ft) | TW(ft) | A(sf) |
|----------|--------|------------|------------|--------|-------|
| 94.00    | 7.0    | 0.25       | 0.13       | 50.0   | 6.2   |
| 94.10    | 16.2   | 0.35       | 0.19       | 65.0   | 12.1  |
| 94.20    | 29.5   | 0.45       | 0.25       | 75.0   | 19.1  |
| 94.30    | 46.8   | 0.55       | 0.32       | 85.0   | 27.1  |
| 94.40    | 68.2   | 0.65       | 0.38       | 95.0   | 36.1  |
| 94.50    | 93.9   | 0.75       | 0.44       | 105.0  | 46.1  |

NOTES:

Weir flow over grade break  
Flow continues west to  
Stead Blvd



STANTEC CONSULTING INC.  
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JOB NO. 26000208

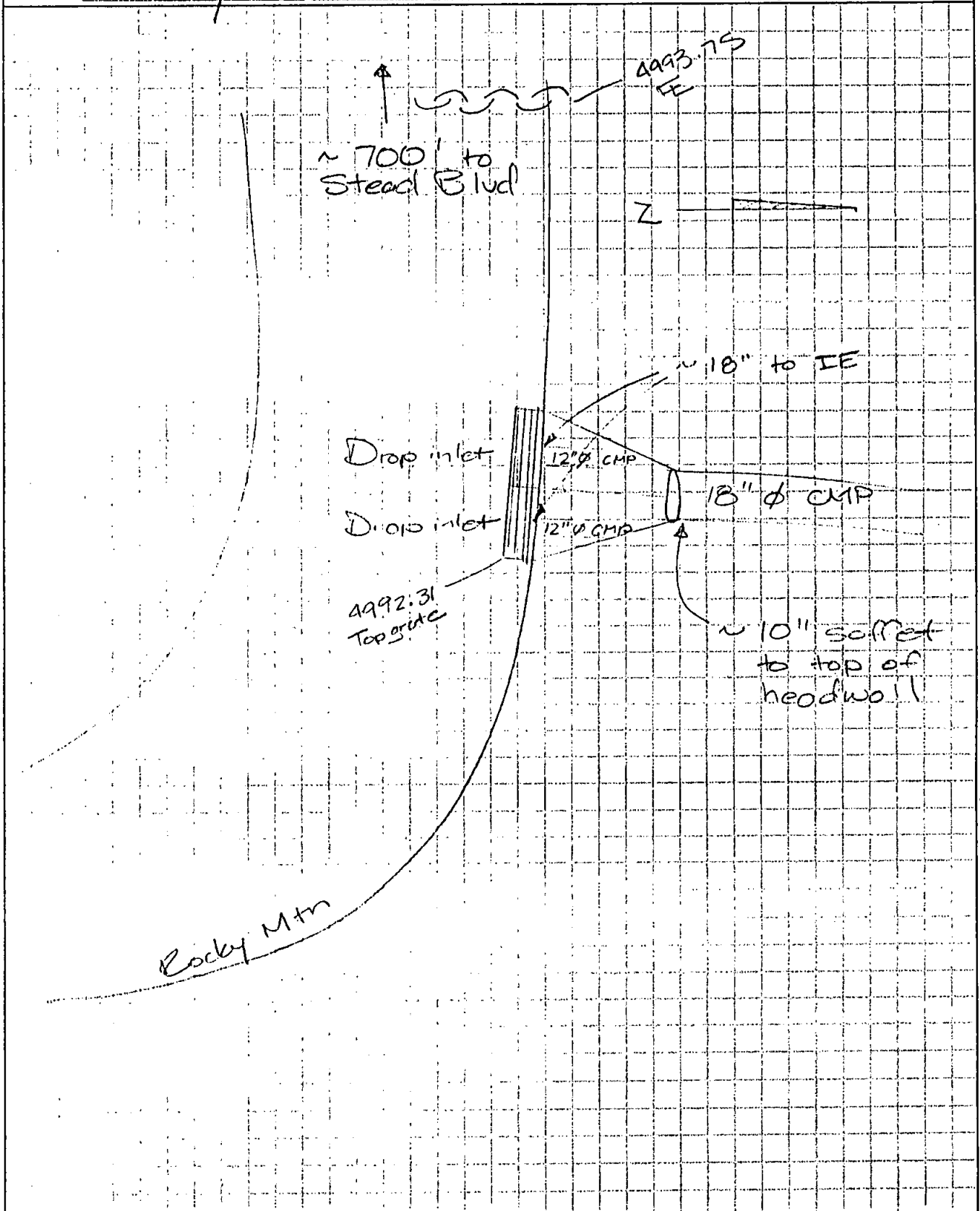
Stantec

SHEET 1 OF 1

PROJECT Stead  
SUBJECT Rocky Mtn DI

DATE 11/3/99

DESIGNED JS CHECKED



Project Steel Master  
Project No. 208  
Sheet No.      of       
Calculated by JB Date     

**WEIR FLOW COMPUTATIONS**

**LOCATION/DESCRIPTION:**

Steel & Leno Blot's, northwest corner  
Basin ST2

**CROSS SECTION PARAMETERS:**

FILENAME: ST2@BSW.SEC

No. of Cross Section Points: 8 ~~Bad Slope: 0.0000~~ Max Elev.: 77.07  
Bank Stations.....Left: 0.0 Right.....: 670.0 Min Elev.: 74.83  
Encroachment Stations..Left:      Right.....: Weir Coef: 2.550 ✓

**CROSS SECTION POINTS - Elevations & Stations in feet:**

| No. | Elev.  | Sta. No. | Elev. | Sta. No. | Elev.   | Sta. |        |         |
|-----|--------|----------|-------|----------|---------|------|--------|---------|
| 1)  | 76.76✓ | 0.00✓    | 2)    | 76.12✓   | 127.00✓ | 3)   | 75.15✓ | 308.00✓ |
| 4)  | 74.83✓ | 365.00✓  | 5)    | 75.01✓   | 385.00✓ | 6)   | 75.07✓ | 403.00✓ |
| 7)  | 75.60✓ | 528.00✓  | 8)    | 77.07✓   | 670.00✓ |      |        |         |

**COMPUTED PARAMETERS:**

| WSEL(ft) | Q(cfs)       | H:max(ft) | H:ave(ft) | TW(ft) | A(sf) |
|----------|--------------|-----------|-----------|--------|-------|
| 75.40    | 86.8         | 0.57      | 0.26      | 219.5  | 58.1  |
| 75.60    | 192.8        | 0.77      | 0.36      | 304.0  | 110.5 |
| 75.80    | 350.9        | 0.97      | 0.49      | 360.6  | 176.9 |
| 76.00    | <u>561.5</u> | 1.17      | 0.61      | 417.2  | 254.7 |
| 76.20    | 827.1        | 1.37      | 0.72      | 474.8  | 343.9 |
| 76.40    | 1150.9       | 1.57      | 0.83      | 533.8  | 444.7 |

**NOTES:**

Weir rating on back sidewalk  
Overflow enters Donnelly channel

Basin ST

Stead & Leor  
BSW Elevations

|     |       |
|-----|-------|
| 0   | 76.76 |
| 127 | 76.12 |
| 308 | 75.15 |
| 365 | 74.83 |
| 385 | 75.01 |
| 403 | 75.07 |
| 528 | 75.60 |
| 610 | 77.07 |

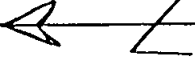
692 (+)  
6+00  
Donnelly  
plains

channel

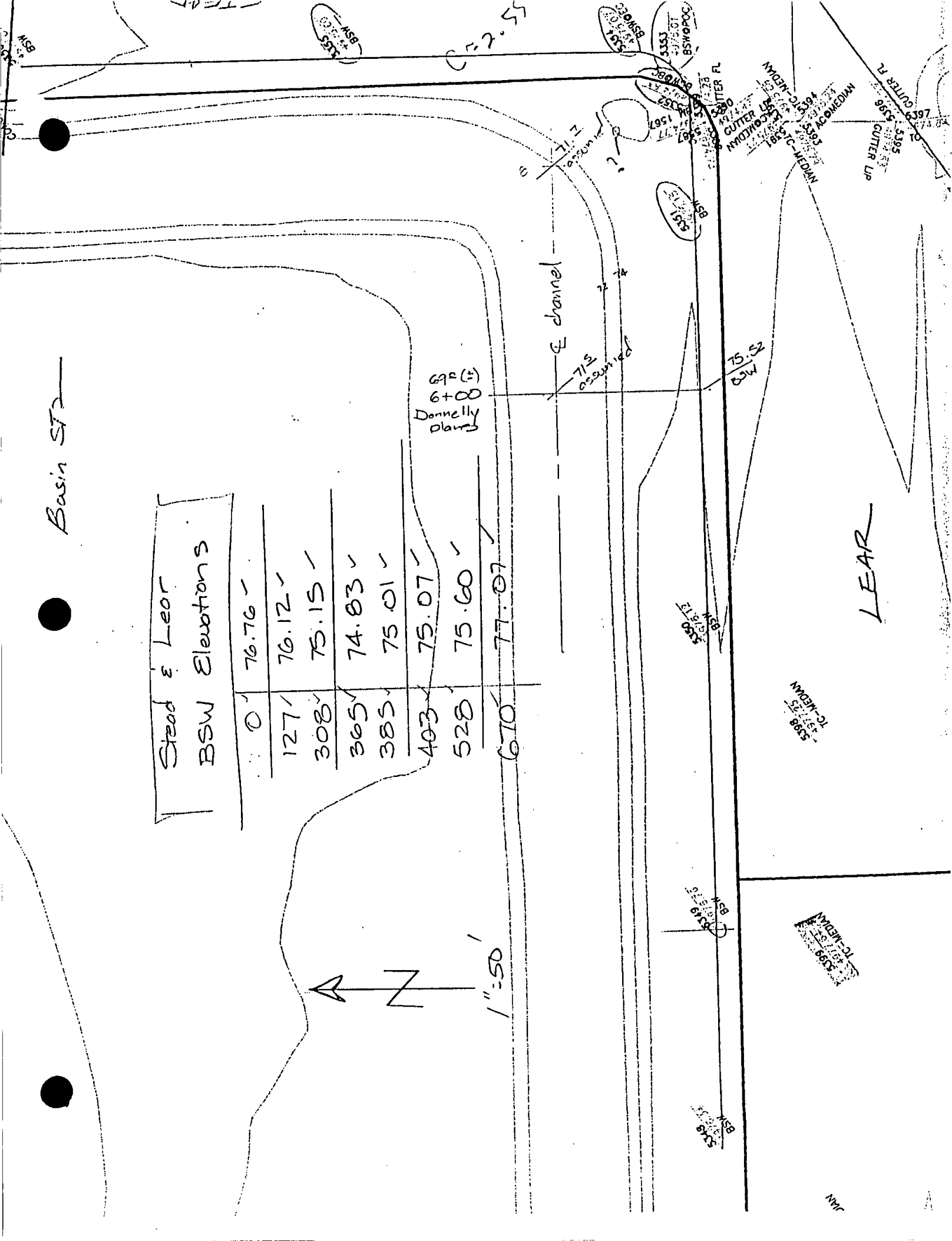
71.7  
71.3  
assumed

75.52  
BSW

LEAR



1"=50'







|                       |          |
|-----------------------|----------|
| <b>Correspondence</b> | <b>1</b> |
|-----------------------|----------|

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|                         |          |
|-------------------------|----------|
| <b>Previous Studies</b> | <b>2</b> |
|-------------------------|----------|

---

|                                                                     |          |
|---------------------------------------------------------------------|----------|
| <b>Existing Conditions Hydrologic<br/>and Hydraulic Backup Data</b> | <b>3</b> |
|---------------------------------------------------------------------|----------|

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|                                                       |          |
|-------------------------------------------------------|----------|
| <b>Proposed Conditions<br/>Hydrologic Backup Data</b> | <b>4</b> |
|-------------------------------------------------------|----------|

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|                                                      |          |
|------------------------------------------------------|----------|
| <b>Proposed Conditions Hydraulic<br/>Backup Data</b> | <b>5</b> |
|------------------------------------------------------|----------|

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|                                      |          |
|--------------------------------------|----------|
| <b>Quantities and Cost Estimates</b> | <b>6</b> |
|--------------------------------------|----------|

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|                    |          |
|--------------------|----------|
| <b>Survey Data</b> | <b>7</b> |
|--------------------|----------|

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|                   |          |
|-------------------|----------|
| <b>References</b> | <b>8</b> |
|-------------------|----------|

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**Bachand, Jim**

**From:** Alverson, Frank  
**Sent:** Monday, November 01, 1999 7:31 AM  
**To:** Bachand, Jim  
**Subject:** FW: Stead Drainage Master Plan

-----Original Message-----

**From:** Albright, Cynthia  
**Sent:** Monday, October 25, 1999 5:16 PM  
**To:** Armstrong, Glen  
**Cc:** Alverson, Frank; Chapman, Curt  
**Subject:** Stead Drainage Master Plan

Glen,

Attached you will please find an excel spreadsheet which details the sources of the density calculations

for the land use coverage I created for the above referenced project. The new cover is called 'lvhbplu'

located in the s:\survey\6300169\gis\covers directory. The aml is lvhbplu.aml under the amls subdirectory.

The land use map has been prepared based on information from the following sources:

Stead District Council Land Use Map dated November 1996;

City of Reno Zoning Map;

Reno-Stead Corridor Joint Plan approved August 1999;

North Valleys Land Use Map, updated October 1999; and

Sky Vista Land Use Plan date May 27, 1999.

This land use coverage is the only one that incorporates the various land use designations for the

entire North Valleys Planning Area under the number of recent jurisdictional approvals.

I have also created a standard city/county land use legend located in

s:\planning\symbology\landuse\_leg.gra

that we should use on ALL maps which identify land use and zoning for both entities.

Any questions, you know where to find me.



Stead Drainage.xls

# AREA PLAN LAND USE CODES

RED INK = ID CODE IN EXLU ITEM IN ASSESSOR. REL LAND TABLE

## LAND USE

## APLU (ITEM IN INFO)

~~Color~~ KENO/SPARKS INCORPORATED AREAS

0

~~ROADS/EASEMENTS~~

3 = 10 Land Use

5

2799

(PARCEL/ID OR P = 99)

8

40+ ACRES RESIDENTIAL

10

9

OPEN SPACE

11

12

13

14

15

16

17

18

20

21

22

30

40

50

60

70

80

81

90

91

98

99

5 LOW DENSITY RURAL

6 MEDIUM DENSITY RURAL

7 HIGH DENSITY RURAL

82 ~~17~~ LOW DENSITY SUBURBAN

83 MEDIUM DENSITY SUBURBAN

84 HIGH DENSITY SUBURBAN

85 LOW DENSITY URBAN

86 MEDIUM DENSITY URBAN

87 HIGH DENSITY URBAN

111 GENERAL COMMERCIAL

113 OFFICE COMMERCIAL

112 TOURIST COMMERCIAL

52 INDUSTRIAL

23 SPECIFIC PLAN AREA

49 PUBLIC/SEMI-PUBLIC FACILITIES

63 PARKS AND RECREATION

65 AGRICULTURE

( ) UNDEVELOPED

INDIAN RESERVATION

75 GENERAL RURAL

16 RURAL RESIDENTIAL

DRY LAKE

UNKNOWN BEHIND

EXLU ITEM IN LAND TABLE  
(ONLY FOR EXISTING LAND USE)

( " " " " " )

( OR 0 )

( PARCEL/ID OR P = 999 )  
TOTAL P. 02

# Stead Master Plan Proposed Conditions Land Use Codes

11/3/99

|         |                                     |            |
|---------|-------------------------------------|------------|
| 0       | 8 'PUBLIC ROADS'                    | "          |
| 10 128  | 'LOW DENSITY RURAL'                 | 'LDR'      |
| 11 130  | 'MEDIUM DENSITY RURAL'              | 'MDR'      |
| 12 117  | 'HIGH DENSITY RURAL / LLR-2.5'      | 'HDR/LLR'  |
| 13 77   | 'LOW DENSITY SUBURBAN / LLR-1'      | 'LDS/LLR'  |
| 14 99   | 'MEDIUM DENSITY SUBURBAN / SFR-15'  | 'MDS/SFR'  |
| 15 82   | 'HIGH DENSITY SUBURBAN / SFR-6'     | 'HDS/SFR'  |
| 16 84   | 'LOW DENSITY URBAN / SFR-4 / MF-14' | 'LDU/SFR'  |
| 17 104  | 'MEDIUM DENSITY URBAN / MF-21'      | 'MDU/MF21' |
| 18 91   | 'HIGH DENSITY URBAN / MF-43'        | 'MDU/MF43' |
| 20 2    | 'GENERAL COMMERCIAL'                | 'GC'       |
| 21 385  | 'NEIGHBORHOOD COMMERCIAL/OFFICE'    | 'NC/O'     |
| 22 391  | 'TOURIST COMMERCIAL'                | 'TC'       |
| 30 13   | 'INDUSTRIAL'                        | 'I'        |
| 40 308  | 'SPECIAL PLAN AREA'                 | 'SPA'      |
| 50 267  | 'PUBLIC AND SEMI-PUBLIC/FACILITIES' | 'PSF'      |
| 60 182  | 'PARKS AND RECREATION'              | 'PR'       |
| 65 141  | 'OPEN SPACE'                        | 'OS'       |
| 90 163  | 'GENERAL RURAL'                     | 'GR'       |
| 91 149  | 'RURAL RESIDENTIAL'                 | 'GRR'      |
| 98 8    | 'DRY LAKE'                          | "          |
| 999 265 | 'WATER BODIES'                      | "          |

16  
5a  
2.5ac  
1.0  
13  
7an/ac  
10 du/ac  
21 du/ac  
42 du/ac

40 ac  
40 ac



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JOB NO. 26000208

Stantec

SHEET 1 OF 1

PROJECT Stead Master Plan DATE 11/10/99  
SUBJECT Curve Number estimates DESIGNED SB CHECKED \_\_\_\_\_

## Public Roads Curve Numbers

### Neighborhood areas:

Use same number as majority or conservative residential unit

### Major arterials / parkways

Use paved + gravel 2 87, 92, 94, 95

### NDOT - Hwy 395

Use paved + gravel 3 + 35% sagebrush

78, 81, 86, 89

59, 59, 71, 77

### Rural areas

Use gravel 76, 85, 89, 91

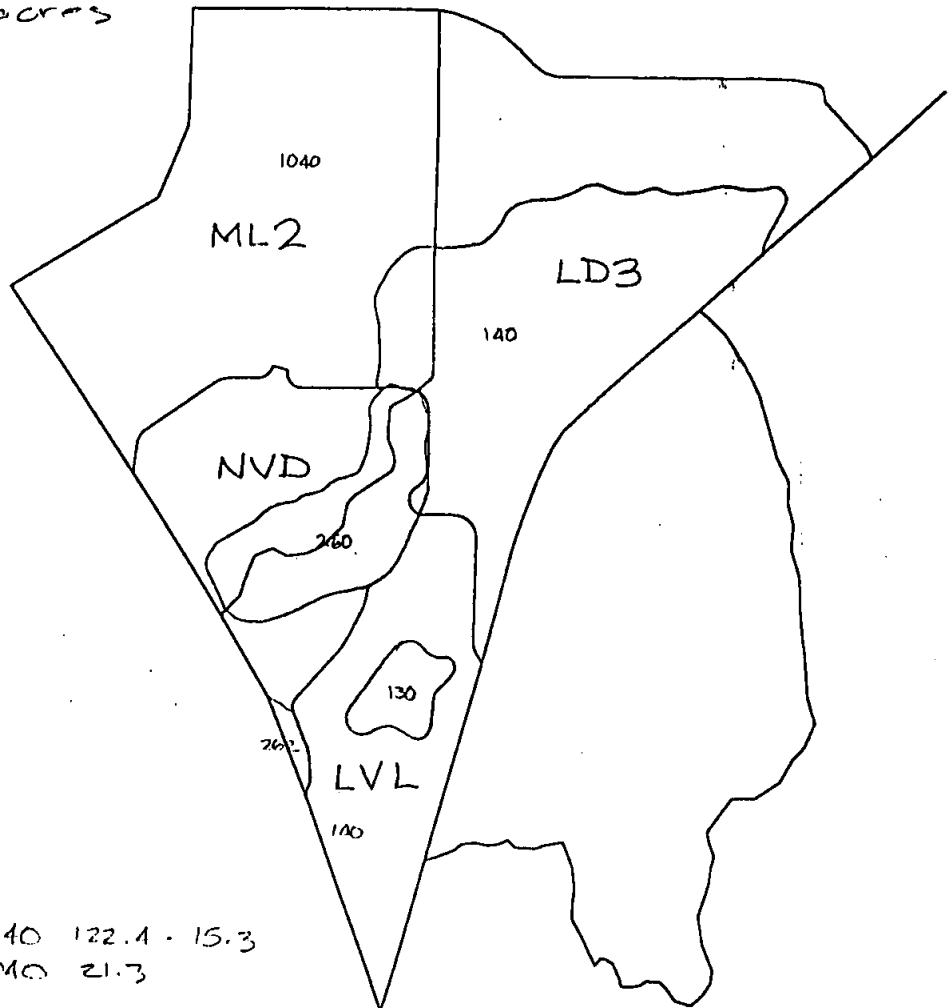
Acres

LD3 322.38 acres  
 LVL 186.83 "  
 ML2 308.28 "  
 NVD 97.19 "

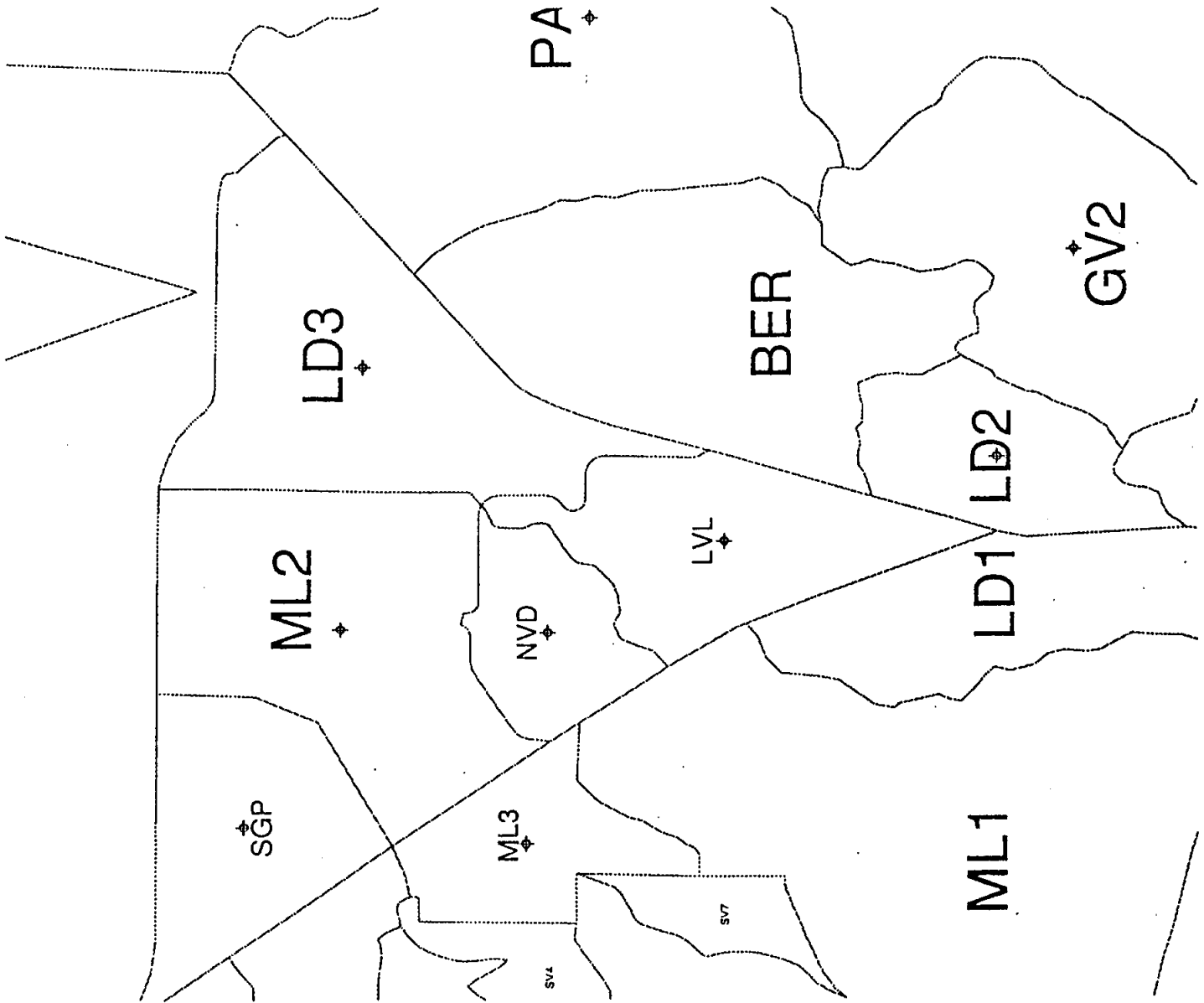
| %A  | %B   | %C   | %D   |
|-----|------|------|------|
| 2.7 | 83.1 | 7.6  | 6.7  |
| 2.9 | 60.6 | 28.8 | 7.7  |
| 0.6 | 78.8 | 9.5  | 11.0 |
| 0.0 | 68.9 | 24.5 | 6.6  |

Test grid  
 91.8 ac

- 914.65 acres



140 122.4 - 15.3  
 1040 21.3



|     | 2/1  | 2/2  | 2/24 |
|-----|------|------|------|
| LD3 | .453 | 1.01 | 1.50 |
| LVL | .455 | 1.01 | 1.52 |
| ML2 | .473 | 1.05 | 1.58 |
| NVD | .467 | 1.04 | 1.56 |



# City of Reno - Stead Master Drainage Study HEC-1 Model Flow Summary

| Location                 | Existing 100-yr            | Proposed 100-yr | Existing 5-year | Proposed 5-yr |
|--------------------------|----------------------------|-----------------|-----------------|---------------|
| CP GR3                   | 960 cfs                    | 1039 cfs        | 175 cfs         | 220 cfs       |
| Moya at Red Rock         | 1249 cfs                   | 1324 cfs        | 226 cfs         | 284 cfs       |
| CP SS3                   | 467 cfs                    | 482 cfs         | 140 cfs         | 148 cfs       |
| SS3 AT 48" RCP           | 219 cfs                    | 229 cfs         | 23 cfs          | 30 cfs        |
| CP SL3B                  | 155 cfs                    | 266 cfs         | 40 cfs          | 56 cfs        |
| CP GC3                   | 234 cfs                    | 422 cfs         | 59 cfs          | 110 cfs       |
| CP AW3                   | 205 cfs                    | 230 cfs         | 28 cfs          | 64 cfs        |
| CP SRS                   | 197 cfs                    | 272 cfs         | 5 cfs           | 51 cfs        |
| Silver Lake Blvd at RR   | 80 cfs                     | 0 cfs           | 35 cfs          | 0 cfs         |
| CP RSD                   | 281 cfs                    | 462 cfs         | 62 cfs          | 148 cfs       |
| CP GC1                   | 463 cfs                    | 937 cfs         | 86 cfs          | 248 cfs       |
| CP GC2 <sup>1</sup>      | 769 cfs                    | 1270 cfs        | 138 cfs         | 307 cfs       |
| CP ST1                   | 270 cfs                    | 105 cfs         | 53 cfs          | 29 cfs        |
| DV ST2                   | 614 cfs                    | 470 cfs         | 109 cfs         | 98 cfs        |
| CP LEA                   | 738 cfs                    | 594 cfs         | 126 cfs         | 118 cfs       |
| Moya Detention basin     | 4970.77 ft                 | 4970.58 ft      | 4966.83 ft      | 4966.95 ft    |
| CP SLK <sup>2</sup>      | 9688 cfs                   | 10276 cfs       | 2397 cfs        | 2579 cfs      |
| Silver Lake <sup>2</sup> | 4964.99 ft                 | 4965.22 ft      | 4960.74 ft      | 4960.91 ft    |
| CP PE4                   | 884 cfs                    | 1062 cfs        | 127 cfs         | 211 cfs       |
| CP ML1                   | 1161 cfs 1066 <sup>3</sup> | 1492 cfs        | 178 cfs         | 336 cfs       |
| CP ML3 (box inlet)       | 899 cfs                    | 1014 cfs        | 258 cfs         | 262 cfs       |
| CP ML3 (box outlet)      | 1038 cfs                   | 1014 cfs        | 377 cfs         | 262 cfs       |
| CP LD2                   | 1418 cfs 1477 <sup>3</sup> | 1795 cfs        | 231 cfs         | 369 cfs       |
| CP LLK                   | 5435 cfs                   | 6514 cfs        | 1062 cfs        | 1542 cfs      |
| Lemmon Lake              | 4914.81 ft                 | 4915.13 ft      | 4913.14 ft      | 4913.35 ft    |

1 Does not include runoff from basin UPR

2 Does not include retention basin modeling

3 Schaaf & Wheeler CLOMR

Silver Lake +254 acre feet  
Lemmon Lake +319 acre feet

| PEAK FLOW | TIME     | MAXIMUM AVERAGE FLOW |       |       |          |
|-----------|----------|----------------------|-------|-------|----------|
|           |          | 6-HR                 | 24-HR | 72-HR | 99.92-HR |
|           | (HR)     |                      |       |       |          |
|           | (CFS)    |                      |       |       |          |
| + 0.      | 0.08     | 0.                   | 0.    | 0.    | 0.       |
|           | (INCHES) | 0.000                | 0.000 | 0.000 | 0.000    |
|           | (AC-FT)  | 0.                   | 0.    | 0.    | 0.       |

| PEAK STORAGE | TIME  | MAXIMUM AVERAGE STORAGE |       |       |          |
|--------------|-------|-------------------------|-------|-------|----------|
|              |       | 6-HR                    | 24-HR | 72-HR | 99.92-HR |
|              | (HR)  |                         |       |       |          |
| + (AC-FT)    |       |                         |       |       |          |
| 6107.        | 99.92 | 6106.                   | 6101. | 6065. | 5238.    |

| PEAK STAGE | TIME  | MAXIMUM AVERAGE STAGE |         |         |          |
|------------|-------|-----------------------|---------|---------|----------|
|            |       | 6-HR                  | 24-HR   | 72-HR   | 99.92-HR |
|            | (HR)  |                       |         |         |          |
| + (FEET)   |       |                       |         |         |          |
| 4964.99    | 99.33 | 4965.00               | 4965.01 | 4964.99 | 4963.80  |

CUMULATIVE AREA = 56.43 SQ MI

EX - 100. OUT

Existing 100-year model

Silver Lake

\*\*\*\*\*

| PEAK FLOW | TIME |          | MAXIMUM AVERAGE FLOW |       |       |          |
|-----------|------|----------|----------------------|-------|-------|----------|
|           |      |          | 6-HR                 | 24-HR | 72-HR | 99.92-HR |
| (CFS)     | (HR) |          |                      |       |       |          |
| 0.        | 0.08 | (CFS)    | 0.                   | 0.    | 0.    | 0.       |
|           |      | (INCHES) | 0.000                | 0.000 | 0.000 | 0.000    |
|           |      | (AC-FT)  | 0.                   | 0.    | 0.    | 0.       |

| PEAK STORAGE | TIME  |  | MAXIMUM AVERAGE STORAGE |       |       |          |
|--------------|-------|--|-------------------------|-------|-------|----------|
|              |       |  | 6-HR                    | 24-HR | 72-HR | 99.92-HR |
| (AC-FT)      | (HR)  |  |                         |       |       |          |
| 6361.        | 99.92 |  | 6360.                   | 6356. | 6321. | 5457.    |

| PEAK STAGE | TIME  |  | MAXIMUM AVERAGE STAGE |         |         |          |
|------------|-------|--|-----------------------|---------|---------|----------|
|            |       |  | 6-HR                  | 24-HR   | 72-HR   | 99.92-HR |
| (FEET)     | (HR)  |  |                       |         |         |          |
| 4965.22    | 98.67 |  | 4965.22               | 4965.26 | 4965.15 | 4963.96  |

CUMULATIVE AREA = 56.43 SQ MI

PR - 100 . OUT

Proposed 100-year model , no retention  
Silver Lake

| PEAK FLOW | TIME     | MAXIMUM AVERAGE FLOW |       |       |          |
|-----------|----------|----------------------|-------|-------|----------|
|           |          | 6-HR                 | 24-HR | 72-HR | 99.92-HR |
|           | (HR)     |                      |       |       |          |
|           | (CFS)    |                      |       |       |          |
| 0.        | 0.08     | 0.                   | 0.    | 0.    | 0.       |
|           | (INCHES) | 0.000                | 0.000 | 0.000 | 0.000    |
|           | (AC-FT)  | 0.                   | 0.    | 0.    | 0.       |

| PEAK STORAGE | TIME  | MAXIMUM AVERAGE STORAGE |       |       |          |
|--------------|-------|-------------------------|-------|-------|----------|
|              |       | 6-HR                    | 24-HR | 72-HR | 99.92-HR |
|              | (HR)  |                         |       |       |          |
| (AC-FT)      |       |                         |       |       |          |
| 6106.        | 99.92 | 6105.                   | 6100. | 6066. | 5236.    |

| PEAK STAGE | TIME  | MAXIMUM AVERAGE STAGE |         |         |          |
|------------|-------|-----------------------|---------|---------|----------|
|            |       | 6-HR                  | 24-HR   | 72-HR   | 99.92-HR |
|            | (HR)  |                       |         |         |          |
| (FEET)     |       |                       |         |         |          |
| 4964.99    | 99.17 | 4965.00               | 4965.01 | 4964.99 | 4963.80  |

CUMULATIVE AREA = 56.43 SQ MI

PR-100. OUT

Proposed 100-year model with retention  
Silver Lake

\*\*\*\*\*

| PEAK FLOW | TIME | MAXIMUM AVERAGE FLOW |       |       |          |
|-----------|------|----------------------|-------|-------|----------|
|           |      | 6-HR                 | 24-HR | 72-HR | 99.92-HR |
| (CFS)     | (HR) |                      |       |       |          |
| 0.        | 0.08 | 0.                   | 0.    | 0.    | 0.       |
| (INCHES)  |      | 0.000                | 0.000 | 0.000 | 0.000    |
| (AC-FT)   |      | 0.                   | 0.    | 0.    | 0.       |

| PEAK STORAGE | TIME  | MAXIMUM AVERAGE STORAGE |       |       |          |
|--------------|-------|-------------------------|-------|-------|----------|
|              |       | 6-HR                    | 24-HR | 72-HR | 99.92-HR |
| (AC-FT)      | (HR)  |                         |       |       |          |
| 4287.        | 99.75 | 4287.                   | 4287. | 4286. | 3930.    |

| PEAK STAGE | TIME  | MAXIMUM AVERAGE STAGE |         |         |          |
|------------|-------|-----------------------|---------|---------|----------|
|            |       | 6-HR                  | 24-HR   | 72-HR   | 99.92-HR |
| (FEET)     | (HR)  |                       |         |         |          |
| 4914.81    | 84.25 | 4914.82               | 4914.77 | 4914.83 | 4914.45  |

CUMULATIVE AREA = 39.99 SQ MI

1

EX - 100. OUT

Existing 100-year model

Lemmon Lake

\*\*\*\*\*

| PEAK FLOW | TIME | MAXIMUM AVERAGE FLOW |       |       |          |
|-----------|------|----------------------|-------|-------|----------|
|           |      | 6-HR                 | 24-HR | 72-HR | 99.92-HR |
| (CFS)     | (HR) |                      |       |       |          |
| 0.        | 0.08 | 0.                   | 0.    | 0.    | 0.       |
| (INCHES)  |      | 0.000                | 0.000 | 0.000 | 0.000    |
| (AC-FT)   |      | 0.                   | 0.    | 0.    | 0.       |

| PEAK STORAGE | TIME  | MAXIMUM AVERAGE STORAGE |       |       |          |
|--------------|-------|-------------------------|-------|-------|----------|
|              |       | 6-HR                    | 24-HR | 72-HR | 99.92-HR |
| (AC-FT)      | (HR)  |                         |       |       |          |
| 4606.        | 99.83 | 4606.                   | 4606. | 4606. | 4202.    |

| PEAK STAGE | TIME  | MAXIMUM AVERAGE STAGE |         |         |          |
|------------|-------|-----------------------|---------|---------|----------|
|            |       | 6-HR                  | 24-HR   | 72-HR   | 99.92-HR |
| (FEET)     | (HR)  |                       |         |         |          |
| 4915.13    | 62.58 | 4915.13               | 4915.14 | 4915.13 | 4914.70  |

CUMULATIVE AREA = 39.98 SQ MI

PR-100. OUT  
Proposed 100-year model  
Lemmon Lake

| PEAK FLOW | TIME | MAXIMUM AVERAGE FLOW |       |       |           |
|-----------|------|----------------------|-------|-------|-----------|
|           |      | 6-HR                 | 24-HR | 72-HR | 192.00-HR |
| (S)       | (HR) |                      |       |       |           |
| 0.        | 0.10 | 0.                   | 0.    | 0.    | 0.        |
| (CFS)     |      |                      |       |       |           |
| (INCHES)  |      | 0.000                | 0.000 | 0.000 | 0.000     |
| (AC-FT)   |      | 0.                   | 0.    | 0.    | 0.        |

| PEAK STORAGE | TIME   | MAXIMUM AVERAGE STORAGE |       |       |           |
|--------------|--------|-------------------------|-------|-------|-----------|
|              |        | 6-HR                    | 24-HR | 72-HR | 192.00-HR |
| (AC-FT)      | (HR)   |                         |       |       |           |
| 6379.        | 192.00 | 6379.                   | 6379. | 6378. | 5901.     |

| PEAK STAGE | TIME   | MAXIMUM AVERAGE STAGE |         |         |           |
|------------|--------|-----------------------|---------|---------|-----------|
|            |        | 6-HR                  | 24-HR   | 72-HR   | 192.00-HR |
| (FEET)     | (HR)   |                       |         |         |           |
| 4965.24    | 168.80 | 4965.23               | 4965.26 | 4965.25 | 4964.47   |

CUMULATIVE AREA = 56.43 SQ MI

Stead Master Plan - Proposed Conditions  
Silver Lake  
8-day hydrograph simulation

+9 ac-ft difference in peak storage compared  
to 4-day hydrograph  
(+0.01 ft peak stage)

Conclusion:

4-day hydrograph values should be  
acceptable.

\*\*\*\*\*

| PEAK FLOW | TIME | MAXIMUM AVERAGE FLOW |       |       |          |
|-----------|------|----------------------|-------|-------|----------|
|           |      | 6-HR                 | 24-HR | 72-HR | 99.92-HR |
| (S)       | (HR) |                      |       |       |          |
| 0.        | 0.08 | 0.                   | 0.    | 0.    | 0.       |
| (CFS)     |      |                      |       |       |          |
| (INCHES)  |      | 0.000                | 0.000 | 0.000 | 0.000    |
| (AC-FT)   |      | 0.                   | 0.    | 0.    | 0.       |

| PEAK STORAGE | TIME      | MAXIMUM AVERAGE STORAGE |       |       |          |
|--------------|-----------|-------------------------|-------|-------|----------|
|              |           | 6-HR                    | 24-HR | 72-HR | 99.92-HR |
| (AC-FT)      | (HR)      |                         |       |       |          |
| 6118.        | 99.92     | 6117.                   | 6112. | 6075. | 5246.    |
| 6128         | 12/7/99 B |                         |       |       |          |

| PEAK STAGE | TIME  | MAXIMUM AVERAGE STAGE |         |         |          |
|------------|-------|-----------------------|---------|---------|----------|
|            |       | 6-HR                  | 24-HR   | 72-HR   | 99.92-HR |
| (FEET)     | (HR)  |                       |         |         |          |
| 4965.00    | 99.33 | 4965.00               | 4965.01 | 4965.00 | 4963.80  |
| .01        |       |                       |         |         |          |

CUMULATIVE AREA = 56.43 SQ MI

Stead Master Plan - Existing Conditions  
Silver Lake  
100-hour hydrograph





**Correspondence** **1**

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**Previous Studies** **2**

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**Existing Conditions Hydrologic  
and Hydraulic Backup Data** **3**

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**Proposed Conditions  
Hydrologic Backup Data** **4**

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**Proposed Conditions Hydraulic  
Backup Data** **5**

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**Quantities and Cost Estimates** **6**

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**Survey Data** **7**

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**References** **8**

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**STANTECH CONSULTING INC.**

Formerly SEA, Incorporated

950 Industrial Way  
Sparks, NV 89431-6092  
(702) 358-6931  
Fax: 358-6954JOB NO. 801 00 208

SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT Proposed Culvert Under Moya Blvd at GC2DATE 3/6/00SUBJECT Golf course Channel

DESIGNED

TH

CHECKED \_\_\_\_\_

3 - 10' x 4'  $\Rightarrow$  1200 cfs N.G.4 - 8' x 4'  $\Rightarrow$  1280 cfs OK 35' x 4'3 - 10' x 5'  $\Rightarrow$  1290 cfs OK 32' x 5'6 - 6' x 4'  $\Rightarrow$  1380 cfs N.G. 41' x 4'

Existing

3 - 6' CMAPs (squeezed)

L =

S =

Grouted rip-rap sides, natural bottom and riprap sides (no grout)

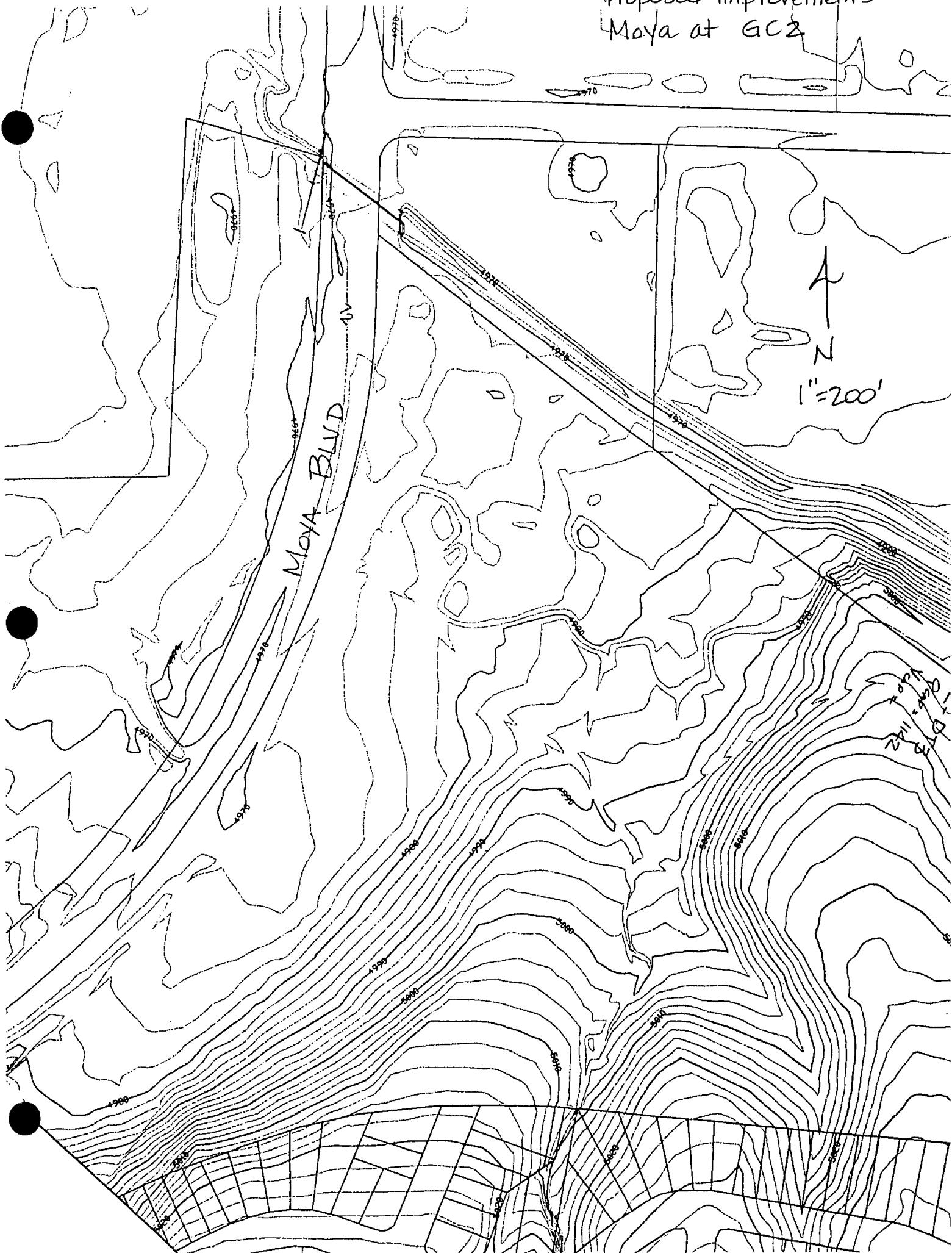
14' bw 4-8' TW

Proposed Improvements  
Moya at GC2

MOYA BLVD

N  
1"=200'

9963.1142  
7407  
2111.1142



BOX CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

March 6, 2000  
Proposed Structure at Moya and Golf Course Channel  
3 - 10' x 5' RCB's  
801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Span (Width of Opening) (feet).....           | 10.00  |
| Culvert Rise (Height of Opening) (feet).....          | 5.00   |
| FHWA Chart Number (8,9,10,11,12 or 13).....           | 10     |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0120 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 165.0  |
| Culvert Slope (feet per foot).....                    | 0.0042 |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater<br>Inlet Control<br>Depth (ft) | Normal<br>Outlet Control<br>Depth (ft) | Critical<br>Depth (ft) | Depth at<br>Outlet (ft) | Outlet<br>Velocity<br>(fps) |
|--------------------|-------------------------|------------------------------------------|----------------------------------------|------------------------|-------------------------|-----------------------------|
| 100.0              | 5.00                    | 2.39                                     | 4.42                                   | 1.25                   | 1.46                    | 5.00                        |
| 200.0              | 5.00                    | 3.80                                     | 4.77                                   | 1.98                   | 2.32                    | 5.00                        |
| 300.0              | 5.00                    | 4.97                                     | 5.34                                   | 2.61                   | 3.03                    | 5.00                        |
| 400.0              | 5.00                    | 6.10                                     | 6.14                                   | 3.19                   | 3.68                    | 5.00                        |
| 410.0              | 5.00                    | 6.28                                     | 6.24                                   | 3.25                   | 3.74                    | 3.25                        |
| 420.0              | 5.00                    | 6.46                                     | 6.33                                   | 3.31                   | 3.80                    | 3.31                        |
| 430.0              | 5.00                    | 6.64                                     | 6.43                                   | 3.36                   | 3.86                    | 3.36                        |
| 440.0              | 5.00                    | 6.82                                     | 6.53                                   | 3.42                   | 3.92                    | 3.42                        |
| 450.0              | 5.00                    | 6.99                                     | 6.63                                   | 3.47                   | 3.98                    | 3.47                        |

*x.3 = 1290 cfs*

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3-6x4' CMAP's

$$L = 165'$$

$$1E_{up} = 4964.9$$

$$|E_{\infty}| = 4964.2$$

## Equivalent Area

$$\approx 18.85 \text{ Hz}$$

$$= \$6.55 \text{ f72-total}$$

$$S = 0.0042$$

$$u = 6.8' - 7'$$

22

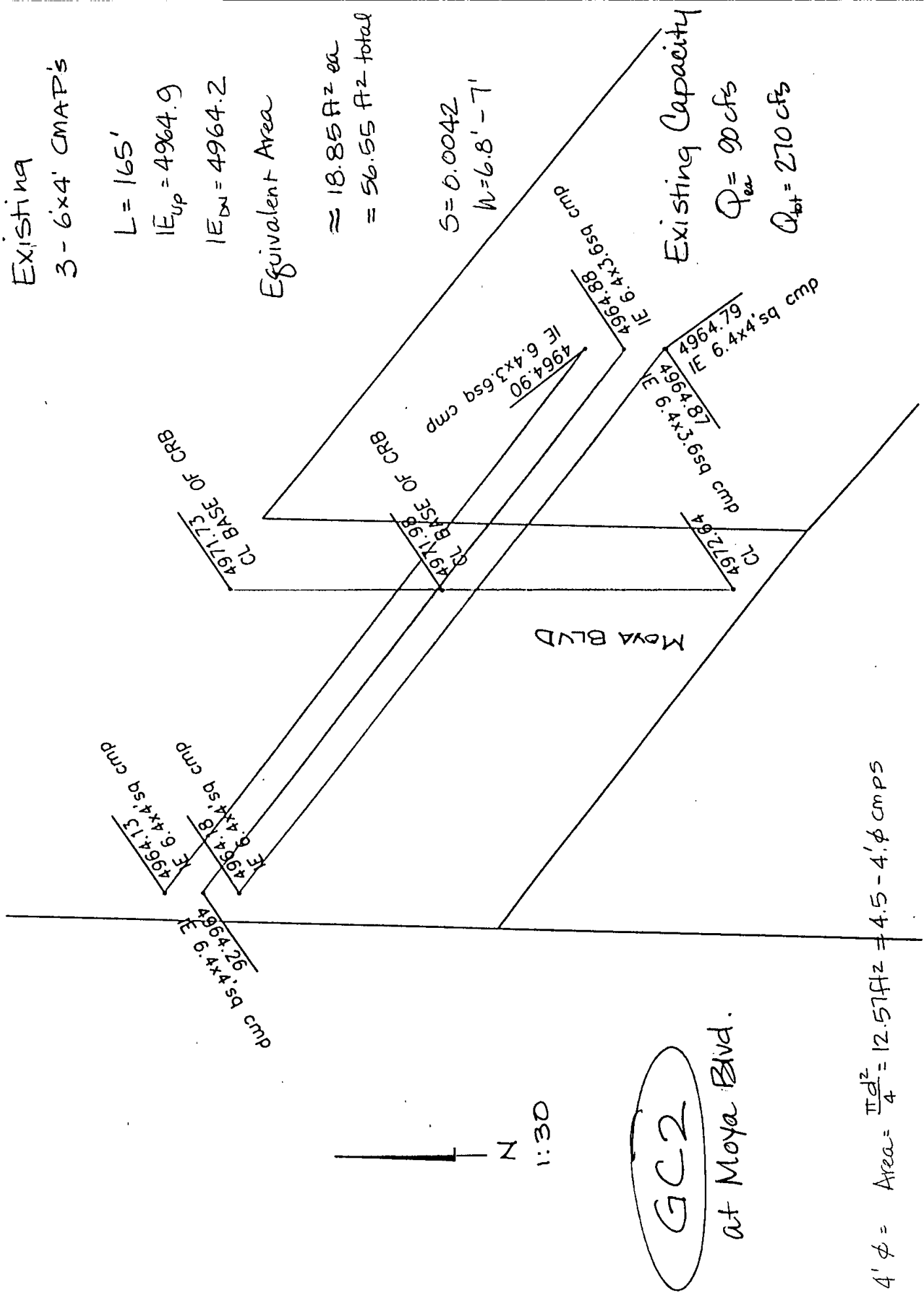
at Moya Blvd.

## Existing Capacity

$$\Phi_{\text{tot}} = 20 \text{ cfs}$$

$$Q_{\text{tot}} = 270 \text{ cfs}$$

$$4' \phi = \text{Area} = \frac{\pi d^2}{4} = 12.57 \text{ Hz} = 4.5 - 4' \phi \text{ cm ps}$$



PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

March 6, 2000  
Existing Structure at Moya and Golf Course Channel  
3-6'x4' CMAP's  
801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Diameter (feet).....                          | 4.00   |
| FHWA Chart Number (1,2 or 3).....                     | 2      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0240 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 165.0  |
| Culvert Slope (feet per foot).....                    | 0.0042 |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater<br>Inlet Control<br>Depth (ft) | Normal<br>Outlet Control<br>Depth (ft) | Critical<br>Depth (ft) | Depth at<br>Depth (ft) | Outlet<br>Depth (ft) | Outlet<br>Velocity<br>(fps) |
|--------------------|-------------------------|------------------------------------------|----------------------------------------|------------------------|------------------------|----------------------|-----------------------------|
| 10.0               | 4.00                    | 1.25                                     | 3.35                                   | 1.21                   | 0.92                   | 4.00                 | 0.80                        |
| 20.0               | 4.00                    | 1.81                                     | 3.47                                   | 1.75                   | 1.32                   | 4.00                 | 1.59                        |
| 30.0               | 4.00                    | 2.28                                     | 3.68                                   | 2.22                   | 1.62                   | 4.00                 | 2.39                        |
| 40.0               | 4.00                    | 2.70                                     | 3.98                                   | 2.69                   | 1.89                   | 4.00                 | 3.18                        |
| 50.0               | 4.00                    | 3.09                                     | 4.35                                   | 3.13                   | 2.12                   | 4.00                 | 3.98                        |
| 60.0               | 4.00                    | 3.48                                     | 4.81                                   | 4.00                   | 2.33                   | 4.00                 | 4.77                        |
| 70.0               | 4.00                    | 3.86                                     | 5.36                                   | 4.00                   | 2.53                   | 4.00                 | 5.57                        |
| 80.0               | 4.00                    | 4.24                                     | 5.99                                   | 4.00                   | 2.71                   | 4.00                 | 6.37                        |
| 90.0               | 4.00                    | 4.70                                     | 6.70                                   | 4.00                   | 2.88                   | 4.00                 | 7.16                        |
| 100.0              | 4.00                    | 5.17                                     | 7.49                                   | 4.00                   | 3.03                   | 4.00                 | 7.96                        |
| 110.0              | 4.00                    | 5.66                                     | 8.37                                   | 4.00                   | 3.17                   | 4.00                 | 8.75                        |

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Worksheet  
Worksheet for Irregular Channel

Moya at GC2

Existing Structure  
Tail water Depth

| Project Description |                             |
|---------------------|-----------------------------|
| Project File        | untitled                    |
| Worksheet           | GC2 at Moya Tailwater Depth |
| Flow Element        | Irregular Channel           |
| Method              | Manning's Formula           |
| Solve For           | Discharge                   |

| Input Data                             |                |               |             |           |
|----------------------------------------|----------------|---------------|-------------|-----------|
| Channel Slope                          | 0.004200       | ft/ft         |             |           |
| Water Surface Elevation                | 68.00          | ft            |             |           |
| Elevation range: 64.00 ft to 70.00 ft. |                |               |             |           |
| Station (ft)                           | Elevation (ft) | Start Station | End Station | Roughness |
| 1000.00                                | 68.00          | 1000.00       | 1180.00     | 0.040     |
| 1090.00                                | 66.00          |               |             |           |
| 1122.00                                | 64.00          |               |             |           |
| 1137.00                                | 64.00          |               |             |           |
| 1148.00                                | 68.00          |               |             |           |
| 1180.00                                | 70.00          |               |             |           |

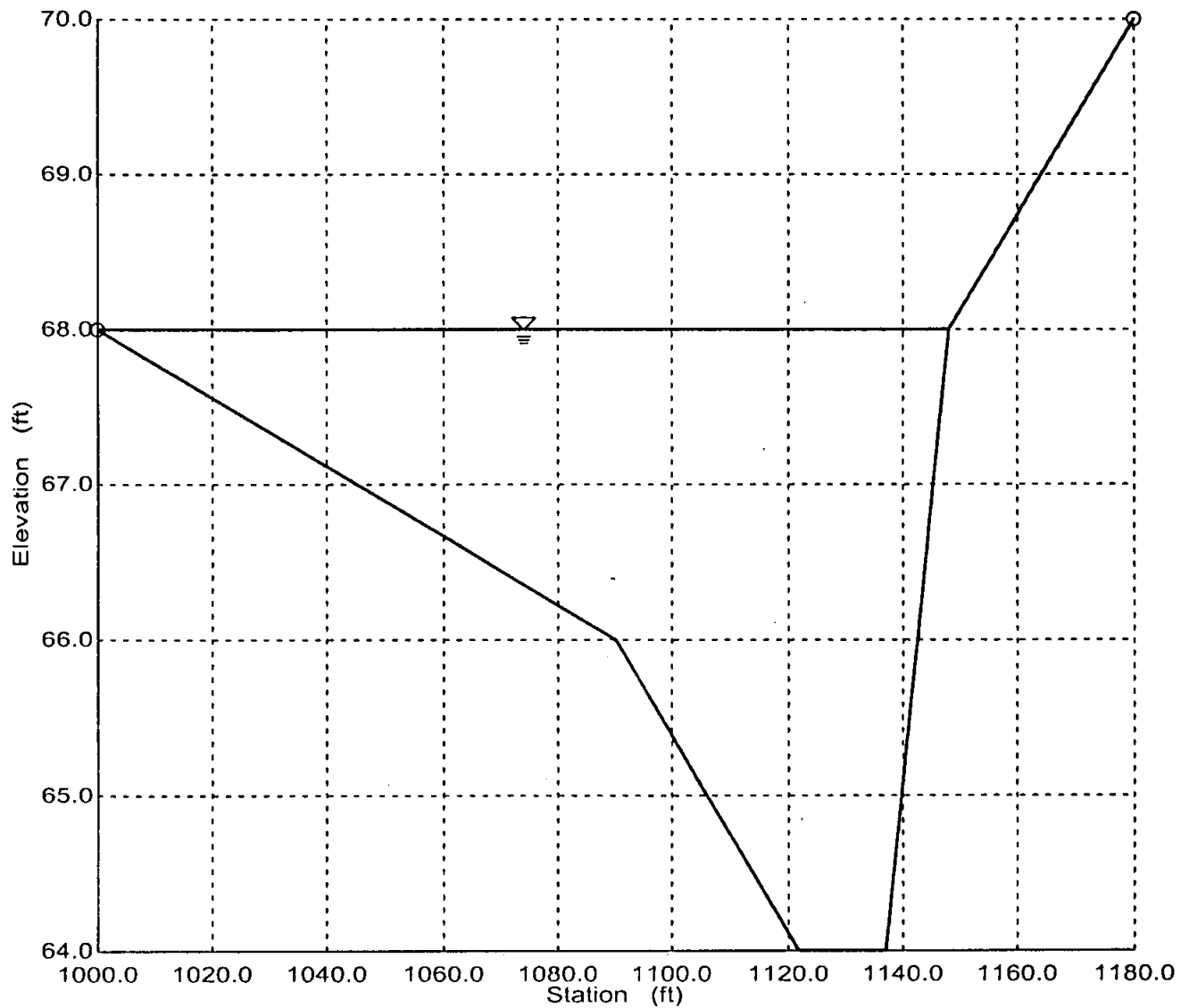
| Results                   |          |                    |
|---------------------------|----------|--------------------|
| Wtd. Mannings Coefficient | 0.040    |                    |
| Discharge                 | 955.15   | ft <sup>3</sup> /s |
| Flow Area                 | 268.00   | ft <sup>2</sup>    |
| Wetted Perimeter          | 148.79   | ft                 |
| Top Width                 | 148.00   | ft                 |
| Depth                     | 4.00     | ft                 |
| Critical Water Elev.      | 66.97    | ft                 |
| Critical Slope            | 0.020880 | ft/ft              |
| Velocity                  | 3.56     | ft/s               |
| Velocity Head             | 0.20     | ft                 |
| Specific Energy           | 68.20    | ft                 |
| Froude Number             | 0.47     |                    |
| Full Flow Capacity        | 3154.31  | ft <sup>3</sup> /s |
| Flow is subcritical.      |          |                    |



**Cross Section**  
**Cross Section for Irregular Channel**

| Project Description |                             |
|---------------------|-----------------------------|
| Project File        | untitled                    |
| Worksheet           | GC2 at Moya Tailwater Depth |
| Flow Element        | Irregular Channel           |
| Method              | Manning's Formula           |
| Solve For           | Discharge                   |

| Section Data              |          |                    |
|---------------------------|----------|--------------------|
| Wtd. Mannings Coefficient | 0.040    |                    |
| Channel Slope             | 0.004200 | ft/ft              |
| Water Surface Elevation   | 68.00    | ft                 |
| Discharge                 | 955.15   | ft <sup>3</sup> /s |



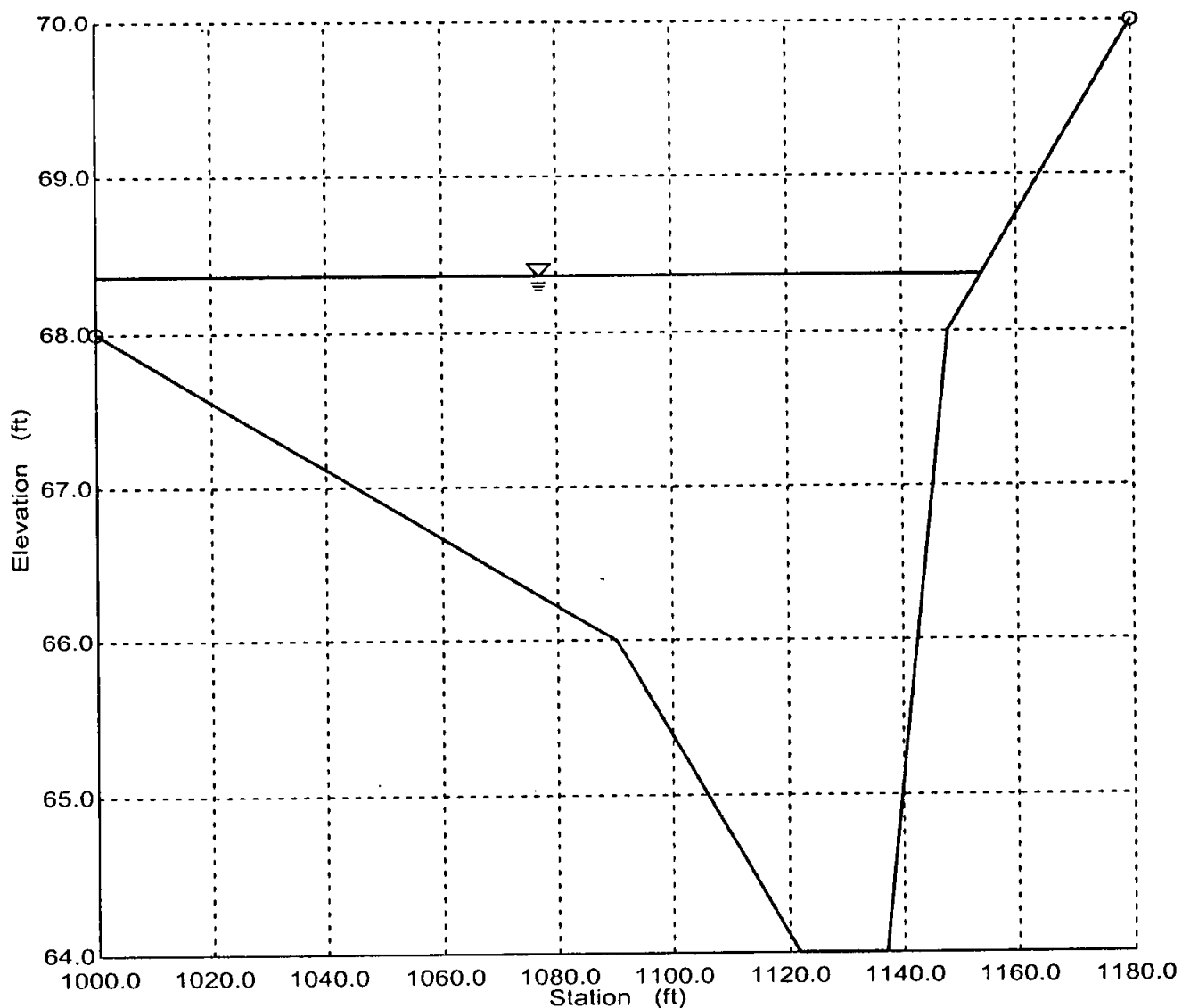
# **Cross Section** **Cross Section for Irregular Channel**

## **Project Description**

|              |                             |
|--------------|-----------------------------|
| Project File | untitled                    |
| Worksheet    | GC2 at Moya Tailwater Depth |
| Flow Element | Irregular Channel           |
| Method       | Manning's Formula           |
| Solve For    | Water Elevation             |

## **Section Data**

|                           |                            |
|---------------------------|----------------------------|
| Wtd. Mannings Coefficient | 0.040                      |
| Channel Slope             | 0.004200 ft/ft             |
| Water Surface Elevation   | 68.37 ft                   |
| Discharge                 | 1270.00 ft <sup>3</sup> /s |



# Worksheet

## Worksheet for Irregular Channel

| Project Description |                             |
|---------------------|-----------------------------|
| Project File        | untitled                    |
| Worksheet           | GC2 at Moya Tailwater Depth |
| Flow Element        | Irregular Channel           |
| Method              | Manning's Formula           |
| Solve For           | Water Elevation             |

| Input Data                             |                |                    |             |           |
|----------------------------------------|----------------|--------------------|-------------|-----------|
| Channel Slope                          | 0.004200 ft/ft |                    |             |           |
| Elevation range: 64.00 ft to 70.00 ft. |                |                    |             |           |
| Station (ft)                           | Elevation (ft) | Start Station      | End Station | Roughness |
| 1000.00                                | 68.00          | 1000.00            | 1180.00     | 0.040     |
| 1090.00                                | 66.00          |                    |             |           |
| 1122.00                                | 64.00          |                    |             |           |
| 1137.00                                | 64.00          |                    |             |           |
| 1148.00                                | 68.00          |                    |             |           |
| 1180.00                                | 70.00          |                    |             |           |
| Discharge                              | 1270.00        | ft <sup>3</sup> /s |             |           |

| Results                                                |          |                    |
|--------------------------------------------------------|----------|--------------------|
| Wtd. Mannings Coefficient                              | 0.040    |                    |
| Water Surface Elevation                                | 68.37    | ft                 |
| Flow Area                                              | 323.22   | ft <sup>2</sup>    |
| Wetted Perimeter                                       | 155.02   | ft                 |
| Top Width                                              | 153.85   | ft                 |
| Depth                                                  | 4.37     | ft                 |
| Critical Water Elev.                                   | 67.33    | ft                 |
| Critical Slope                                         | 0.020305 | ft/ft              |
| Velocity                                               | 3.93     | ft/s               |
| Velocity Head                                          | 0.24     | ft                 |
| Specific Energy                                        | 68.61    | ft                 |
| Froude Number                                          | 0.48     |                    |
| Full Flow Capacity                                     | 3154.31  | ft <sup>3</sup> /s |
| Flow is subcritical.                                   |          |                    |
| Water elevation exceeds lowest end station by 0.37 ft. |          |                    |



STANTEC CONSULTING INC.  
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Sparks, Nevada 89431  
Tel: (775) 358-6931 Fax: (775) 358-6954

Stantec

GC-13  
JOB NO. 80100208

SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT Golf Course Channel - Near Moya

DATE 3/8/00

SUBJECT \_\_\_\_\_

DESIGNED TML

CHECKED \_\_\_\_\_

### Existing Conditions

$$Q_{E100} = 769 \text{ cfs}$$

Existing Channel Capacity  $\approx 1142 \text{ cfs}$

" " Velocity  $\approx 7.3 \text{ fps}$

Currently has grouted rip-rap sides and natural bottom w/veg.

No evidence of bottom scour

Ex 6' bw

### Proposed Conditions

$$Q_{P100} = 1270 \text{ cfs}, \text{ which exceeds existing capacity by } 10\%$$

propose widening of channel

Existing max depth = 5.5'

Propose 25' bw, 58" TW, 5.5' deep

Wsel 4.5'

$$V = 7.5$$

TRAPEZOIDAL CHANNEL ANALYSIS  
RATING CURVE COMPUTATION

March 14, 2000  
Golf Course Channel Improvements  
Proposed 25'bw, 3:1ss, riprap lined channel at Section B  
801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                              | VALUE  |
|----------------------------------------------------------|--------|
| Channel Bottom Slope (feet per foot).....                | 0.0065 |
| Manning's Roughness Coefficient (n-value).....           | 0.0350 |
| Channel Side Slope - Left Side (horizontal/vertical).... | 3.00   |
| Channel Side Slope - Right Side (horizontal/vertical)... | 3.00   |
| Channel Bottom Width (feet).....                         | 25.0   |

PROGRAM RESULTS:

| Depth<br>(ft) | Flow Rate<br>(cfs) | Velocity<br>(fps) | Froude Number | Velocity Head(ft) | Energy Head(ft) | Flow Area<br>(sq ft) | Top Width<br>(ft) |
|---------------|--------------------|-------------------|---------------|-------------------|-----------------|----------------------|-------------------|
| 1.0           | 88.9               | 3.18              | 0.589         | 0.157             | 1.157           | 28.0                 | 31.0              |
| 2.0           | 296.0              | 4.77              | 0.650         | 0.354             | 2.354           | 62.0                 | 37.0              |
| 3.0           | 611.8              | 6.00              | 0.686         | 0.559             | 3.559           | 102.0                | 43.0              |
| 4.0           | 1040.3             | 7.03              | 0.713         | 0.767             | 4.767           | 148.0                | 49.0              |
| 4.1           | 1089.5             | 7.12              | 0.715         | 0.788             | 4.888           | 152.9                | 49.6              |
| 4.2           | 1140.0             | 7.22              | 0.717         | 0.809             | 5.009           | 157.9                | 50.2              |
| 4.3           | 1191.7             | 7.31              | 0.719         | 0.830             | 5.130           | 163.0                | 50.8              |
| 4.2           | 1140.0             | 7.22              | 0.717         | 0.809             | 5.009           | 157.9                | 50.2              |
| 4.5           | 1298.7             | 7.50              | 0.724         | 0.873             | 5.373           | 173.2                | 52.0              |
| 4.6           | 1354.0             | 7.59              | 0.726         | 0.894             | 5.494           | 178.5                | 52.6              |
| 4.7           | 1410.6             | 7.68              | 0.728         | 0.915             | 5.615           | 183.8                | 53.2              |
| 4.8           | 1468.4             | 7.76              | 0.730         | 0.936             | 5.736           | 189.1                | 53.8              |
| 4.9           | 1527.5             | 7.85              | 0.732         | 0.957             | 5.857           | 194.5                | 54.4              |
| 5.0           | 1587.8             | 7.94              | 0.734         | 0.979             | 5.979           | 200.0                | 55.0              |
| 5.5           | 1908.5             | 8.36              | 0.743         | 1.086             | 6.586           | 228.2                | 58.0              |

*Q=1270 cfs*

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.3 (c) 1986  
Dodson & Associates, Inc., 5629 FM 1960 W., #314, Houston, TX 77069  
(713) 440-3787. A manual with equations & flow chart is available.

Project Stead Master  
Project No. 80100208  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by HS Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Railroad Ditch Section #1 GC2-DT3  
Drainage Basin GC2

CROSS SECTION PARAMETERS:

FILENAME: gc2-dt3.SEC

No. of Cross Section Points: 9 Bed Slope: 0.00660 Max Elev.: 80.00  
Bank Stations.....Left: 1000.0 Right.....: 1068.0 Min Elev.: 72.70  
Encroachment Stations..Left: Right.....:  
Manning-n Values.....LOB: 0.045 CHANNEL...: 0.035 ROB.....: 0.045

CROSS SECTION POINTS - Elevations & Stations in feet:

No. Elev. Sta. No. Elev. Sta. No. Elev. Sta.

|    |       |         |    |       |         |    |       |         |
|----|-------|---------|----|-------|---------|----|-------|---------|
| 1) | 80.00 | 1000.00 | 2) | 78.00 | 1019.00 | 3) | 76.00 | 1025.00 |
| 4) | 74.00 | 1031.00 | 5) | 72.70 | 1039.00 | 6) | 72.70 | 1045.00 |
| 7) | 74.00 | 1051.00 | 8) | 76.00 | 1060.00 | 9) | 78.00 | 1068.00 |

6' bw

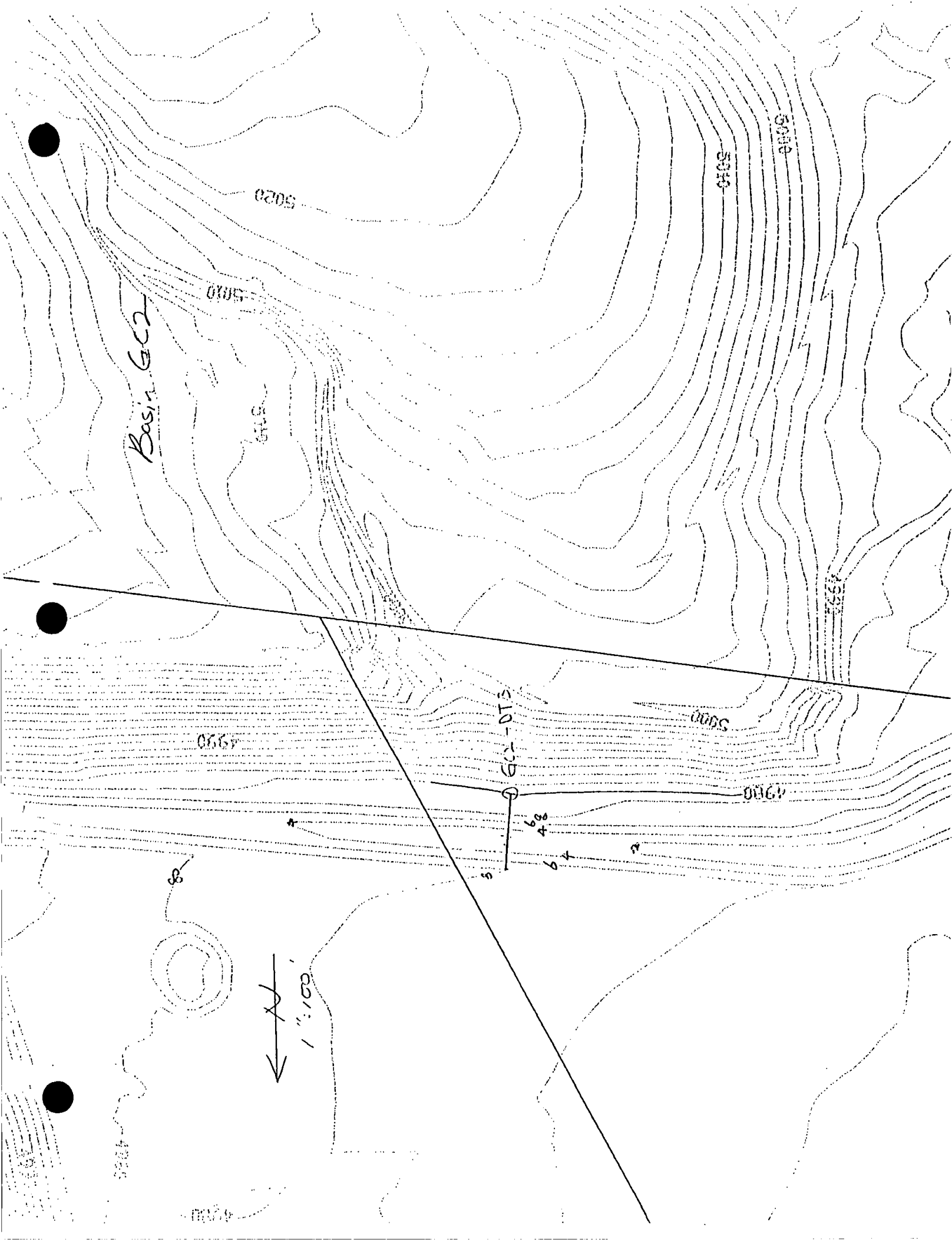
COMPUTED PARAMETERS:

SEL(ft) Q(cfs) V(fps) Fr No. ne ALPHA TW(ft) A(sf) WP(ft) CRWS(ft)

|       |        |     |      |       |     |      |       |      |       |
|-------|--------|-----|------|-------|-----|------|-------|------|-------|
| 73.00 | 3.1    | 1.4 | 0.48 | 0.035 | 1.0 | 9.2  | 2.3   | 9.3  | 72.89 |
| 74.00 | 51.7   | 3.1 | 0.59 | 0.035 | 1.0 | 20.0 | 16.9  | 20.2 | 73.69 |
| 75.00 | 179.7  | 4.4 | 0.64 | 0.035 | 1.0 | 27.5 | 40.7  | 28.0 | 74.55 |
| 76.00 | 394.9  | 5.5 | 0.68 | 0.035 | 1.0 | 35.0 | 71.9  | 35.8 | 75.43 |
| 77.00 | 713.2  | 6.5 | 0.70 | 0.035 | 1.0 | 42.0 | 110.4 | 43.1 | 76.33 |
| 78.00 | 1142.2 | 7.3 | 0.72 | 0.035 | 1.0 | 49.0 | 155.9 | 50.4 | 77.25 |

NOTES:

Channel Capacity Check "  
465 cfs < Q<sub>100</sub> < 770 cfs



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Fax: 358-6954

JOB NO. \_\_\_\_\_

SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT \_\_\_\_\_

DATE \_\_\_\_\_

SUBJECT \_\_\_\_\_

DESIGNED \_\_\_\_\_

CHECKED \_\_\_\_\_

## Tumbling Flow Energy Dissipator

$$Q \approx 1000 \text{ cfs}$$

$$q = Q/W = 1270/30 = 42.3$$

$$y_c = (q^2/g)^{1/3} = 3.82'$$

$$V_c = 11.1 \text{ fps}$$

Ideal  
Inlet

$$V_i = \sqrt[3]{g y_c} - 5 = 6.08 \text{ fps}$$

baffle height

$$0.8 \text{ to } 0.9 y_c = 3.05' \text{ to } 3.4'$$

3.25

Chute Training walls

$$3 \times 3.25 = 9.75' \text{ meas. normal to floor}$$

$$q = Q/W = 1270/40 = 31.75$$

$$y_c = (q^2/g)^{1/3} = 3.15$$

$$V_c = 10.1 \text{ fps}$$

$$\text{Ideal } V_i = \sqrt[3]{g y_c} - 5 = 5.07 \text{ fps}$$

baffle height

$$0.8 \text{ to } 0.9 y_c = 0.8 y_c = 2.52' \text{ existing baffle height}$$

wall height

$$3 \times 2.5 = 7.5'$$



**Stantec**

## PROJECT

DATE 4/6/00

**SUBJECT**

**DESIGNED**

**CHECKED**

$$Q = 1270$$

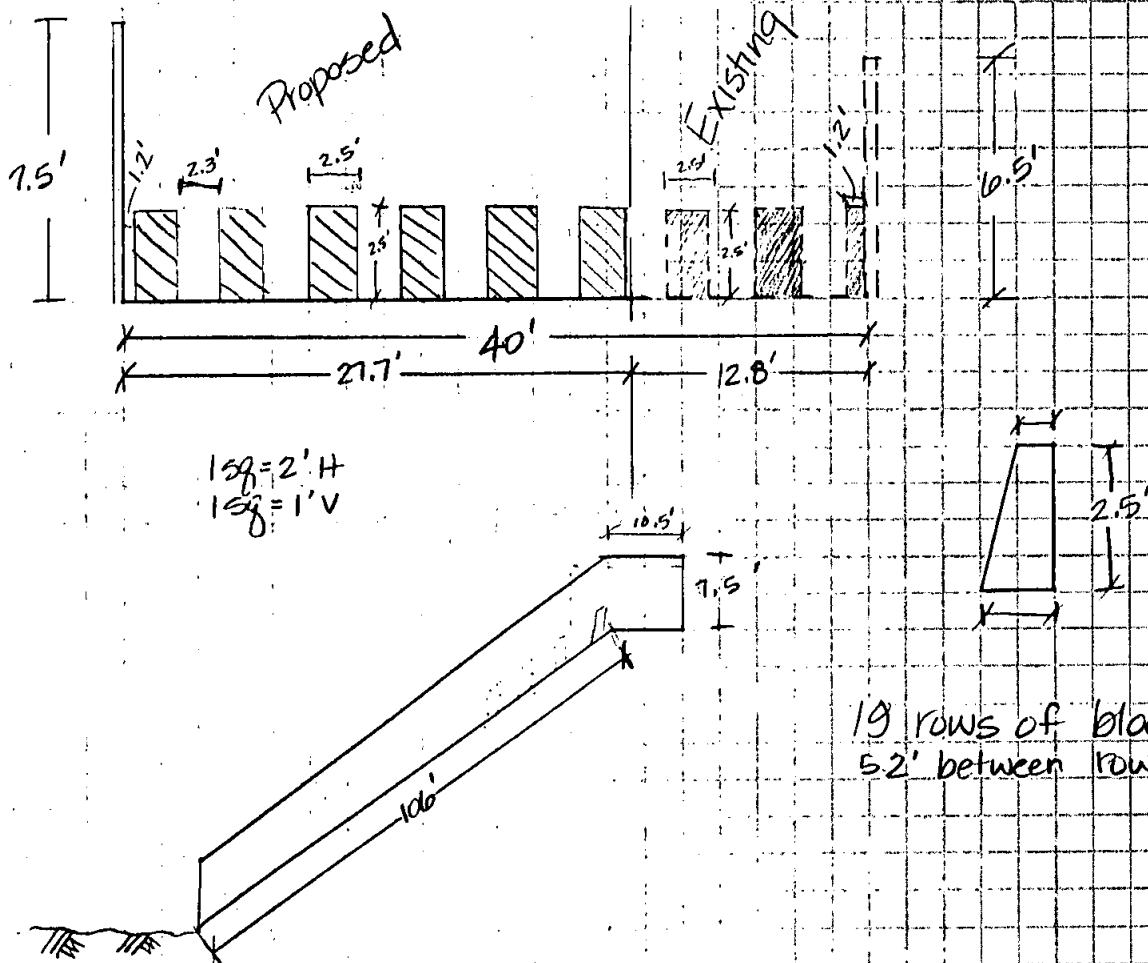
$W = 40'$  ( $14 - 1.2' = 12.8'$  existing)

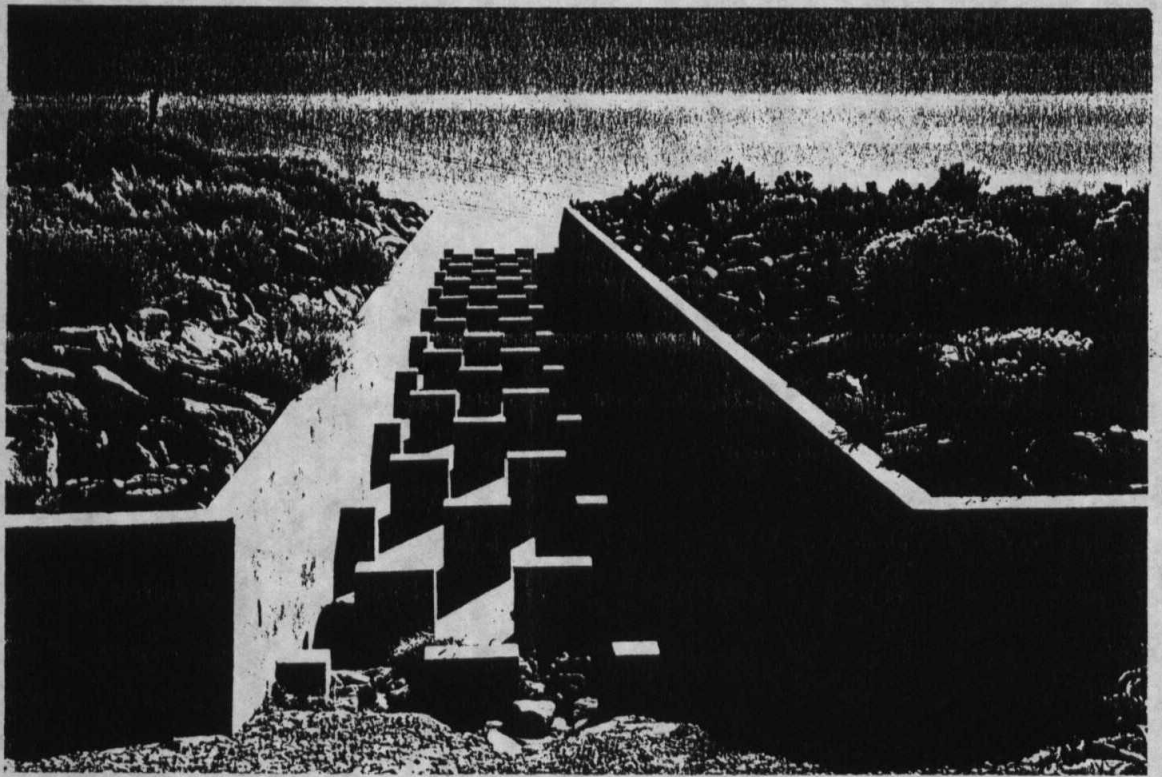
baffle height = 2.5'

Chute training wall 7.5' high

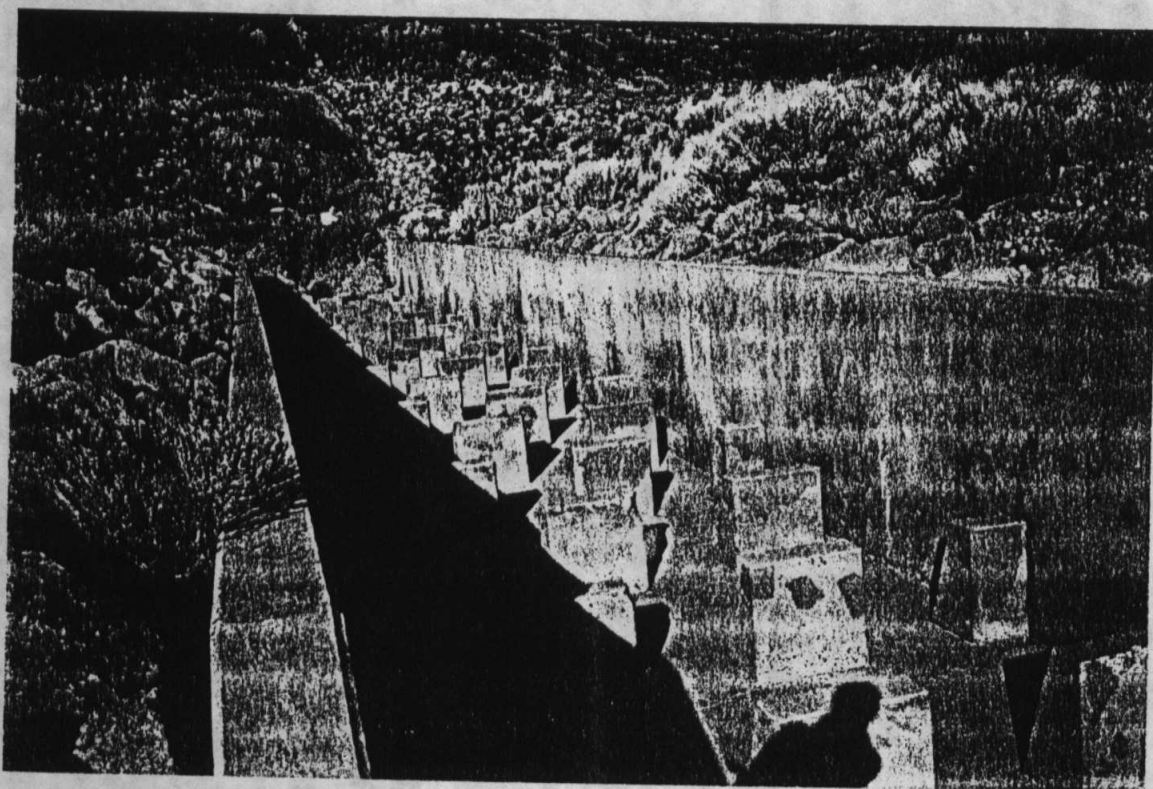
Wing wall (US and DS) 18.5' wide

Remove 1 wall and us/OS wing walls.





Looking upstream



Looking downstream



**Stantech**  
Consulting

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(702) 358-6931

Fax: 358-6954

JOB NO. 80100208

SHEET 1 OF

PROJECT

DATE

SUBJECT

DESIGNED TM

CHECKED

## Tumbling Flow Energy Dissipator

14 foot wide Concrete Channel

Manning's  $n = 0.013$

$Q_{max} = 1270$

$S = 35\%$  which is less than 2:1

$Q = AV$

$$q = Q/W = 1270/14' = 90.7 \text{ cfs/ft}$$

$$y_c = (q^2/g)^{1/3} = 6.3'$$

$$V_c = 14.4 \text{ fps}$$

$$\text{Ideal } V_i = \sqrt{2gh} - 5 = 9.29$$

baffle height should be 0.8 to 0.9  $D_c$

$$0.8 D_c = 2.5$$

$$D_c = 3.125' \text{ to}$$

$$0.9 D_c = 2.5$$

$$D_c = 2.78'$$

therefore  $f_{design} \approx 30$  and

$$Q = 420 \text{ cfs}$$

The chute training walls should be  
3x height of baffle piers meas.  
normal to the floor

$$\text{baffle piers} = 2.5'$$

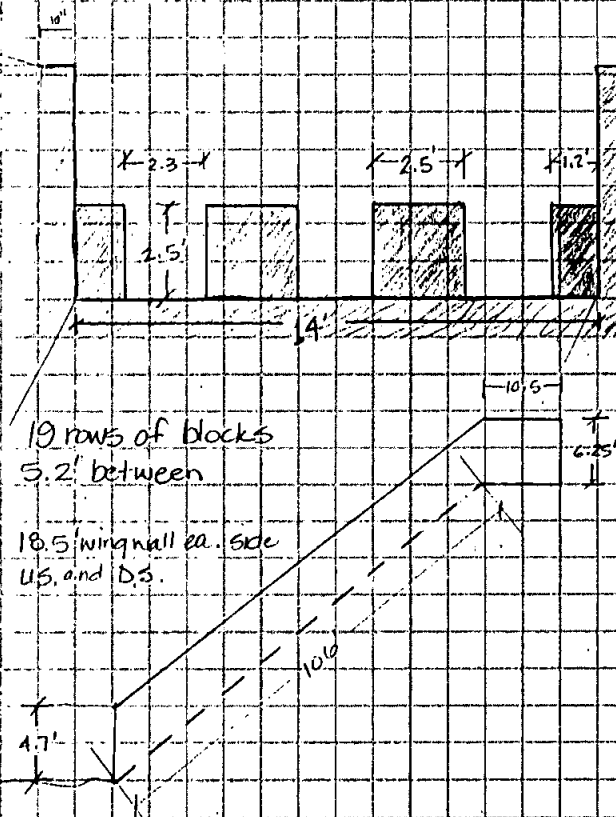
$$\times 3$$

$$\text{wall height} = 7.5'$$

wall height is  
only  $= 6.25'$

Entrance velocity should not  
exceed 5 ft/s

Baffle height from chart at  $f=30$   
is 2.5'



Entrance velocity

from XSN GC2-DTZA

GC2-USBK

$$V_i = 8.6 \text{ fps}$$

Project \_\_\_\_\_  
 Project No. \_\_\_\_\_  
 Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
 Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CROSS SECTION PARAMETERS:

FILENAME: gc2-dt2a.SEC

No. of Cross Section Points: 9 Bed Slope: 0.01000 Max Elev.: 5020.00  
 Bank Stations.....Left: 1000.0 Right.....: 1113.0 Min Elev.: 5010.30  
 Encroachment Stations..Left: Right.....:  
 Manning-n Values.....LOB: 0.035 CHANNEL...: 0.030 ROB.....: 0.035

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta.    | No. | Elev.   | Sta.    | No. | Elev.   | Sta.    |
|-----|---------|---------|-----|---------|---------|-----|---------|---------|
| 1)  | 5020.00 | 1000.00 | 2)  | 5018.00 | 1050.00 | 3)  | 5012.00 | 1070.00 |
| 4)  | 5010.30 | 1073.00 | 5)  | 5010.30 | 1084.00 | 6)  | 5012.00 | 1087.00 |
| 7)  | 5016.00 | 1099.00 | 8)  | 5018.00 | 1107.00 | 9)  | 5018.20 | 1113.00 |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 5012.00  | 142.6  | 6.0    | 0.89 | 0.030 | 1.0 | 17.0  | 23.8   | 17.9  | 5011.88 |          |
| 5013.00  | 321.3  | 7.3    | 0.94 | 0.030 | 1.0 | 23.3  | 44.0   | 24.5  | 5012.89 |          |
| 5014.00  | 601.1  | 8.5    | 0.98 | 0.030 | 1.0 | 29.7  | 70.5   | 31.2  | 5013.93 |          |
| 5015.00  | 999.8  | 9.7    | 1.01 | 0.030 | 1.0 | 36.0  | 103.3  | 37.8  | 5015.04 |          |
| 5016.00  | 1533.7 | 10.8   | 1.03 | 0.030 | 1.0 | 42.3  | 142.5  | 44.5  | 5016.12 |          |
| 5017.00  | 2200.8 | 11.7   | 1.06 | 0.030 | 1.0 | 49.7  | 188.5  | 52.1  | 5017.19 |          |

NOTES:

|          | $Q_s$ | $C_{r100}$ | $V_s$ | $V_{100}$ | $D_{100}$ |
|----------|-------|------------|-------|-----------|-----------|
| Existing | 138   | 769        |       |           |           |
| Proposed | 307   | 1270       |       | 10.26     | 0.51      |

Project \_\_\_\_\_  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CROSS SECTION PARAMETERS:

FILENAME: gc2-usbr.SEC

No. of Cross Section Points: 4 Bed Slope: 0.01000 Max Elev.: 5016.30  
Bank Stations.....Left: 1000.0 Right.....: 1014.1 Min Elev.: 5010.00  
Encroachment Stations..Left: Right.....:  
Manning-n Values.....LOB: 0.013 CHANNEL...: 0.013 ROB.....: 0.013

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta.    | No. | Elev.   | Sta.    | No. | Elev.   | Sta.    |
|-----|---------|---------|-----|---------|---------|-----|---------|---------|
| 1)  | 5016.30 | 1000.00 | 2)  | 5010.00 | 1000.10 | 3)  | 5010.00 | 1014.00 |
| 4)  | 5016.30 | 1014.10 |     |         |         |     |         |         |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 5012.00  | 427.8  | 15.4   | 1.92 | 0.013 | 1.0 | 14.0  | 27.9   | 17.9  | 5013.11 |          |
| 5013.00  | 785.0  | 18.8   | 1.91 | 0.013 | 1.0 | 14.0  | 41.8   | 19.9  | 5014.65 |          |
| 5014.00  | 1191.8 | 21.3   | 1.88 | 0.013 | 1.0 | 14.0  | 55.9   | 21.9  | 5016.13 |          |
| 5015.00  | 1633.9 | 23.4   | 1.85 | 0.013 | 1.0 | 14.1  | 69.9   | 23.9  | 5017.56 |          |
| 5016.00  | 2102.5 | 25.0   | 1.81 | 0.013 | 1.0 | 14.1  | 84.0   | 25.9  | 5018.93 |          |
| 5017.00  | 2682.0 | 27.3   | 1.83 | 0.013 | 1.0 | 14.1  | 98.1   | 26.5  | 5020.49 |          |

NOTES:

Project \_\_\_\_\_  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CROSS SECTION PARAMETERS:

FILENAME: gc2-usbr.SEC

No. of Cross Section Points: 4 Bed Slope: 0.00500 Max Elev.: 5016.30  
Bank Stations.....Left: 1000.0 Right.....: 1014.1 Min Elev.: 5010.00  
Encroachment Stations..Left: Right.....:  
Manning-n Values.....LOB: 0.013 CHANNEL...: 0.013 ROB.....: 0.013

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta.    | No. | Elev.   | Sta.    | No. | Elev.   | Sta.    |
|-----|---------|---------|-----|---------|---------|-----|---------|---------|
| 1)  | 5016.30 | 1000.00 | 2)  | 5010.00 | 1000.10 | 3)  | 5010.00 | 1014.00 |
| 4)  | 5016.30 | 1014.10 |     |         |         |     |         |         |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 5011.00  | 102.9  | 7.4    | 1.30 | 0.013 | 1.0 | 13.9  | 13.9   | 15.9  | 5011.21 |          |
| 5012.00  | 302.5  | 10.9   | 1.35 | 0.013 | 1.0 | 14.0  | 27.9   | 17.9  | 5012.47 |          |
| 5013.00  | 555.1  | 13.3   | 1.35 | 0.013 | 1.0 | 14.0  | 41.8   | 19.9  | 5013.69 |          |
| 5014.00  | 842.7  | 15.1   | 1.33 | 0.013 | 1.0 | 14.0  | 55.9   | 21.9  | 5014.85 |          |
| 5015.00  | 1155.3 | 16.5   | 1.31 | 0.013 | 1.0 | 14.1  | 69.9   | 23.9  | 5016.01 |          |
| 5016.00  | 1486.7 | 17.7   | 1.28 | 0.013 | 1.0 | 14.1  | 84.0   | 25.9  | 5017.09 |          |

NOTES:





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Stantec

GC-D  
JOB NO. 801 00208

SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT Proposed Golf Course Channel - Near JCP DATE 3/6/00  
SUBJECT \_\_\_\_\_ DESIGNED TNO CHECKED \_\_\_\_\_

### Existing Conditions

$$Q_{E100} = 463 \text{ cfs}$$

Existing Channel Capacity varies between <sup>approx</sup> 190 and 500 cfs  
Existing velocities range from 5 to 8.5 fps

### Proposed Conditions

$$Q_{P100} = 937 \text{ at GC1 and } 1270 \text{ at GC2}$$

Majority of flow from GC2 will enter channel further downstream, therefore

$$\text{use } Q_{100} = 950 - 1000 \text{ cfs}$$

L = 2100'  
S = 0.012  
10' bw  
3:1 ss  
5' deep  
40' TW  
Fr = 0.84  
V = 8.5 fps  
Rip-rap lined

ROW issues  
RR issues  
Cut/Fill  
Fr =

TRAPEZOIDAL CHANNEL ANALYSIS  
RATING CURVE COMPUTATION

March 14, 2000  
Golf Course Channel Improvements  
Proposed 36'bw, 60'tw, riprap lined channel at Section D  
801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                              | VALUE  |
|----------------------------------------------------------|--------|
| Channel Bottom Slope (feet per foot).....                | 0.0120 |
| Manning's Roughness Coefficient (n-value).....           | 0.0400 |
| Channel Side Slope - Left Side (horizontal/vertical).... | 3.00   |
| Channel Side Slope - Right Side (horizontal/vertical)... | 3.00   |
| Channel Bottom Width (feet).....                         | 36.0   |

PROGRAM RESULTS:

| Depth<br>(ft) | Flow Rate<br>(cfs) | Velocity<br>(fps) | Froude<br>Number | Velocity<br>Head(ft) | Energy<br>Head(ft) | Flow Area<br>(sq ft) | Top Width<br>(ft) |
|---------------|--------------------|-------------------|------------------|----------------------|--------------------|----------------------|-------------------|
| 1.0           | 150.3              | 3.85              | 0.705            | 0.231                | 1.231              | 39.0                 | 42.0              |
| 1.5           | 299.8              | 4.94              | 0.749            | 0.378                | 1.878              | 60.7                 | 45.0              |
| 2.0           | 492.0              | 5.86              | 0.780            | 0.533                | 2.533              | 84.0                 | 48.0              |
| 2.5           | 725.5              | 6.67              | 0.805            | 0.691                | 3.191              | 108.7                | 51.0              |
| 3.0           | 1000.0             | 7.41              | 0.826            | 0.852                | 3.852              | 135.0                | 54.0              |
| 3.5           | 1315.6             | 8.08              | 0.843            | 1.015                | 4.515              | 162.7                | 57.0              |
| 4.0           | 1672.7             | 8.71              | 0.858            | 1.179                | 5.179              | 192.0                | 60.0              |

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.3 (c) 1986  
Dodson & Associates, Inc., 5629 FM 1960 W., #314, Houston, TX 77069  
(713) 440-3787. A manual with equations & flow chart is available.

Project Stead Master  
 Project No. 80100208  
 Sheet No.        of         
 Calculated by JS Date       

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Railroad Ditch Section # GC2 - DT1  
Drainage Basin GC2

CROSS SECTION PARAMETERS:

FILENAME: gc2-dt1.SEC

No. of Cross Section Points: 6 Bed Slope: 0.00790 Max Elev.: 22.00  
 Bank Stations.....Left: 1000.0 Right.....: 1030.0 Min Elev.: 18.00  
 Encroachment Stations..Left:        Right.....:         
 Manning-n Values.....LOB: 0.050 CHANNEL...: 0.035 ROB.....: 0.050  
 CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev. | Sta. No. | Elev. | Sta. No. | Elev.   | Sta. |       |         |
|-----|-------|----------|-------|----------|---------|------|-------|---------|
| 1)  | 22.00 | 1000.00  | 2)    | 20.00    | 1003.00 | 3)   | 18.00 | 1006.00 |
| 4)  | 18.00 | 1015.00  | 5)    | 20.00    | 1022.00 | 6)   | 20.50 | 1030.00 |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft) | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|--------|----------|
| 19.00    | 37.3   | 3.2    | 0.63 | 0.035 | 1.0 | 14.0  | 11.5   | 14.4  | 18.76  |          |
| 20.00    | 132.7  | 4.7    | 0.69 | 0.035 | 1.0 | 19.0  | 28.0   | 19.9  | 19.62  |          |
| 20.50    | 185.5  | 4.7    | 0.69 | 0.035 | 1.0 | 27.8  | 39.7   | 28.8  | 19.96  |          |
| 21.00    | 301.2  | 5.6    | 0.72 | 0.035 | 1.0 | 28.5  | 53.8   | 29.7  | 20.62  |          |
| 22.00    | 597.4  | 7.2    | 0.76 | 0.035 | 1.0 | 30.0  | 83.0   | 31.5  | 21.52  |          |

During a 100-year event, flows will overtop the rail to Jc penny Area.

NOTES:

$Q_{100} = 465 \text{ cfs} +$   
 Channel Capacity @ Top of Rail  $\approx 185 \text{ cfs}$

Project Stead Master  
Project No. 80100208  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by JS Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Railroad Ditch Section # GC2 - DT2  
Drainage Basin GC2

CROSS SECTION PARAMETERS:

FILENAME: gc2-dt2.SEC

No. of Cross Section Points: 11 Bed Slope: 0.00890 Max Elev.: 22.00 ✓  
Bank Stations.....Left: 1049.0 ✓ Right.....: 1120.0 Min Elev.: 12.40 ✓  
Encroachment Stations..Left: Right.....:  
Manning-n Values.....LOB: 0.045 CHANNEL...: 0.035 ROB.....: 0.045

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta.      | No. | Elev.   | Sta.      | No. | Elev.   | Sta.      |
|-----|---------|-----------|-----|---------|-----------|-----|---------|-----------|
| 1)  | 22.00 ✓ | 1000.00 ✓ | 2)  | 20.00 ✓ | 1049.00 ✓ | 3)  | 18.00 ✓ | 1055.00 ✓ |
| 4)  | 16.00 ✓ | 1061.00 ✓ | 5)  | 14.00 ✓ | 1069.00 ✓ | 6)  | 12.40 ✓ | 1076.00 ✓ |
| 7)  | 12.40 ✓ | 1082.00 ✓ | 8)  | 14.00 ✓ | 1089.00 ✓ | 9)  | 16.00 ✓ | 1096.00 ✓ |
| 10) | 18.00 ✓ | 1101.00 ✓ | 11) | 19.80 ✓ | 1120.00 ✓ |     |         |           |

COMPUTED PARAMETERS:

| L(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft) | CRWS(ft) |
|-------|--------|--------|------|-------|-----|-------|--------|-------|--------|----------|
| 14.00 | 84.5   | 4.1    | 0.70 | 0.035 | 1.0 | 20.0  | 20.8   | 20.4  | 13.73  |          |
| 15.00 | 242.5  | 5.4    | 0.75 | 0.035 | 1.0 | 27.5  | 44.6   | 28.1  | 14.66  |          |
| 16.00 | 499.8  | 6.6    | 0.79 | 0.035 | 1.0 | 35.0  | 75.8   | 35.9  | 15.61  |          |
| 17.00 | 886.3  | 7.8    | 0.82 | 0.035 | 1.0 | 40.5  | 113.6  | 41.7  | 16.60  |          |
| 18.00 | 1390.5 | 8.9    | 0.85 | 0.035 | 1.0 | 46.0  | 156.8  | 47.6  | 17.58  |          |
| 19.00 | 1903.8 | 9.1    | 0.85 | 0.035 | 1.0 | 59.6  | 209.6  | 61.4  | 18.49  |          |

NOTES:

Capacity Check  
465 cfs  $Q_{10/10} < 770$  cfs

## Drainage Master Plan for Stead, Nevada

Golf Course Channel Improvements  
CP AW3, CP RSD, CP GC1, CP GC2

### PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

| ITEM NO. | QUANTITY | UNIT | DESCRIPTION                          | UNIT COST   | TOTAL COST   |
|----------|----------|------|--------------------------------------|-------------|--------------|
| 1        | 1550     | SY   | REMOVE EXISTING PAVEMENT             | \$5.00      | \$7,750.00   |
| 2        | 2        | EA   | NDOT TYPE 11 DROP INLET              | \$5,000.00  | \$10,000.00  |
| 3        | 1        | LS   | UTILITY RELOCATION                   | LS          | \$10,000.00  |
| 4        | 1550     | SY   | 6 INCH PLANTMIX BITUMINOUS PAVEMENT  | \$10.00     | \$15,500.00  |
| 5        | 1550     | SY   | 6 INCH TYPE 2 CLASS B AGGREGATE BASE | \$4.00      | \$6,200.00   |
| 6        | 250      | LF   | CURB AND GUTTER                      | \$8.00      | \$2,000.00   |
| 7        | 500      | LF   | 4 INCH SOLID YELLOW LINE             | \$2.20      | \$1,100.00   |
| 8        | 500      | LF   | 4 INCH SOLID WHITE LINE              | \$2.20      | \$1,100.00   |
| 9        | 34000    | CY   | EXCAVATION AND EMBANKMENT            | \$5.00      | \$170,000.00 |
| 10       | 28500    | SY   | RIPRAP, CLASS 300 W/FILT. FAB.       | \$35.00     | \$997,500.00 |
| 11       | 1180     | SY   | GROUTED RIPRAP DROP STRUCTURES       | \$85.00     | \$100,300.00 |
| 12       | 4230     | CY   | GROUTED RIPRAP FOR CHANNEL           | \$70.00     | \$296,100.00 |
| 13       | 2500     | CY   | BERM W/ COMPACTION                   | \$6.50      | \$16,250.00  |
| 14       | 80       | LF   | SINGLE 12' X 6' RCB                  | \$800.00    | \$64,000.00  |
| 15       | 2        | EA   | HEADWALL/WINGWALL FOR 12'X6' RCB     | \$16,000.00 | \$32,000.00  |
| 16       | 165      | LF   | TRIPLE 10'X5' RCB                    | \$1,200.00  | \$198,000.00 |
| 17       | 2        | EA   | HEADWALL/WINWALL FOR 3-10'X5' RCB    | \$28,000.00 | \$56,000.00  |
| 18       | 1        | LS   | TUMBLING ENERGY DISSIPATOR ADDITION  | LS          | \$122,500.00 |
| 19       | 1        | LS   | PLUG AND ABANDON 36" RCP             | LS          | \$1,200.00   |
| 20       | 1        | LS   | TRAFFIC CONTROL                      | LS          | \$100,000.00 |
| 21       |          |      |                                      |             | \$0.00       |
| 22       |          |      |                                      |             | \$0.00       |
| 23       |          |      |                                      |             | \$0.00       |
| 24       |          |      |                                      |             | \$0.00       |

SUBTOTAL \$2,207,500  
CONTINGENCY (15%) \$331,125  
TOTAL CONSTRUCTION COST \$2,538,625

RIGHT-OF-WAY/EASEMENT (550,225 SF) \$550,225

DESIGN SERVICES  
ENGINEERING DESIGN (6%) \$152,500  
HYDROLOGY (WA. CO. REQUIREMENTS) \$25,000  
SURVEYING (TOPOGRAPHIC + LEGALS) \$18,000  
GEOTECHNICAL \$25,000  
TOTAL DESIGN SERVICES \$220,500

CONSTRUCTION SERVICES  
SURVEYING STAKEOUT \$55,500  
QUALITY CONTROL \$230,000  
CONSTRUCTION ADMINISTRATION \$21,000  
TOTAL CONSTRUCTION SERVICES \$306,500

TOTAL PROJECT COST \$3,615,850

BY TMM

|                                           | A                      | B         | C           | D          | E          | F                                            |
|-------------------------------------------|------------------------|-----------|-------------|------------|------------|----------------------------------------------|
| Ex ± EM                                   | 2249cy                 | 1762cy    |             | 14933cy    | 14585cy    |                                              |
| Pavement                                  | 1136sy                 |           |             |            |            | 3911sy                                       |
| Curb & gutter                             | 150LF                  |           |             |            |            | 100 LF                                       |
| Rip Rap class 300                         | 2615y                  |           |             | 12,833 sy  | 13,800 sy  | 1850SY                                       |
| ROW                                       | 3100SF                 | 34,600 SF | 3600 SF     | 178,500 SF | 163,925 SF | 166,500 SF                                   |
| Rip Rap grouted<br>Class 150              |                        | 4229sy    |             |            |            |                                              |
| Tumbling Energy<br>Dissipator             |                        |           | 50,000 L.S. |            |            |                                              |
| Berm                                      |                        |           |             | 2489 cy    |            |                                              |
| NDOT Drop Intake (2)                      |                        |           |             |            |            | NDOT TYPE II<br>D's                          |
| Box Culvert under Silver<br>Lake<br>12x6' |                        |           |             |            |            | 1- 12'x6' RCB<br>w/ headwall<br>1500 LF @ 2' |
| Rip Rap grouted<br>drop structures        |                        |           |             |            | 977 sy     | 200 sy                                       |
| Box Culvert under Moya<br>3-10x5 RCB's    | 165 LF w/<br>Headwalls |           |             |            |            |                                              |
|                                           |                        |           |             |            |            |                                              |
|                                           |                        |           |             |            |            |                                              |
|                                           |                        |           |             |            |            |                                              |
|                                           |                        |           |             |            |            |                                              |
|                                           |                        |           |             |            |            |                                              |
|                                           |                        |           |             |            |            |                                              |
| Total length > 10,200' ≈ 2 mi             |                        |           |             |            |            |                                              |



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JOB NO. \_\_\_\_\_

Stantec

SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT Golf Course Channel Improvements

DATE \_\_\_\_\_

SUBJECT \_\_\_\_\_

DESIGNED (M)

CHECKED \_\_\_\_\_

### Section A

Propose 3-10x5 RCB's, L=165'

Pavement = 1136 SF ROW = 3100 SF

Ex:EM = 2249 CY

RipRap = 175 CY of 1'φ

### Section B

Propose 25' bw, 58 TW, 5.5' deep, wsel depth = 4.5', L = 1730'  
S = 0.0%

Ex:EM = 1762 CY ROW = 34,600 SF

RipRap = 2114 CY 0.75'φ

### Section C

Propose new drop structure 2-3 times larger (wider)  
Acquire ROW

ROW =

### Section D

Propose 36' bw, 60' tw, 4' deep, wsel = 3', L = 2100'  
Acquire ROW, also berm along rail to 4' high

Ex:EM = 14933 CY

RipRap = 8556 CY 1'φ

ROW = 178,500 SF

FILL BERM = 248 CY

### Section E

Propose 1200', 15' bw, 48' tw, at S = 1.125% riprap lined  
designed channel w/ cut back slopes and uniform shape  
add drop structures 3-3'

Ex:EM = 4800 CY

RipRap = 2667 CY

ROW = 64,500 SF

Propose 1525', 15' bw, 42' tw, at S = 1.05% riprap lined  
designed channel w/ cut back slopes and uniform shape  
add 2-3' drop structures

Ex:EM = 9785 CY ROW = 99125 SF

RipRap = 4326 CY

### Section F



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JOB NO. 801 00208

**Stantec**

SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT Golf Course Channel

DATE 3/7/00

SUBJECT \_\_\_\_\_

DESIGNED (TNU)

CHECKED \_\_\_\_\_

Existing

- From top of Drop structure to RR

grouted and non-grouted Rip Rap

- From RR to Silver Lake Blvd

natural Channel

- at bend -  $1\frac{1}{2}:1$  ss LOB 27' ROB 3', RR drop off to JCP

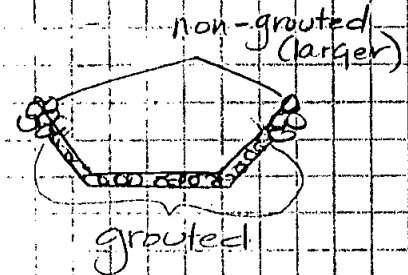
- bend - 5' cut LOB-  $1\frac{1}{2}:1$  High ROB- 5' vert then Slope to Rail

- Along Channel Varying 15-20' head cut Sides

- 7.5' bw ss-almost vert LOB 8' high

- 24" RCP under Silver Lake Blvd along Golf Course Channel

- 24" RCP from Silver Shores Subdivision





Jepenny Site

1" = 100'  
Basin GC2

# GC2 - DT1

20  
10  
5

6

5030

5010

5040

8424680

5020

5020

Project \_\_\_\_\_  
 Project No. \_\_\_\_\_  
 Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
 Calculated by \_\_\_\_\_ Date \_\_\_\_\_

## UNIFORM FLOW COMPUTATIONS

## LOCATION/DESCRIPTION:

## CROSS SECTION PARAMETERS:

FILENAME: GC1-DT42.SEC

No. of Cross Section Points: 7 Bed Slope: 0.01600 Max Elev.: 5040.00  
 Bank Stations.....Left: 1000.0 Right.....: 1115.0 Min Elev.: 5035.70  
 Encroachment Stations..Left: Right.....:  
 Manning-n Values.....LOB: 0.045 CHANNEL...: 0.030 ROB.....: 0.030

## CROSS SECTION POINTS - Elevations &amp; Stations in feet:

| No. | Elev.   | Sta.    | No. | Elev.   | Sta.    | No. | Elev.   | Sta.    |
|-----|---------|---------|-----|---------|---------|-----|---------|---------|
| 1)  | 5040.00 | 1000.00 | 2)  | 5038.00 | 1090.00 | 3)  | 5036.00 | 1095.00 |
| 4)  | 5035.70 | 1097.50 | 5)  | 5036.00 | 1100.00 | 6)  | 5038.00 | 1107.00 |
| 7)  | 5040.00 | 1115.00 |     |         |         |     |         |         |

## COMPUTED PARAMETERS:

| SEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|---------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 5036.00 | 1.3    | 1.8    | 0.80 | 0.030 | 1.0 | 5.0   | 0.7    | 5.0   | 5035.98 |          |
| 5037.00 | 46.0   | 5.3    | 1.04 | 0.030 | 1.0 | 11.0  | 8.7    | 11.4  | 5037.04 |          |
| 5038.00 | 168.5  | 7.4    | 1.13 | 0.030 | 1.0 | 17.0  | 22.7   | 17.7  | 5038.32 |          |
| 5039.00 | 392.1  | 6.1    | 1.09 | 0.030 | 1.0 | 66.0  | 64.2   | 66.8  | 5039.09 |          |
| 5039.50 | 703.1  | 6.8    | 1.12 | 0.030 | 1.0 | 90.5  | 103.4  | 91.4  | 5039.63 |          |
| 5040.00 | 1175.2 | 7.6    | 1.15 | 0.030 | 1.0 | 115.0 | 154.7  | 116.0 | 5040.14 |          |

## NOTES:

GC-D

Project \_\_\_\_\_  
 Project No. \_\_\_\_\_  
 Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
 Calculated by \_\_\_\_\_ Date \_\_\_\_\_

## UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CROSS SECTION PARAMETERS:

FILENAME: GC1-DT48.SEC

No. of Cross Section Points: 6 Bed Slope: 0.01600 Max Elev.: 5038.00  
 Bank Stations.....Left: 1000.0 Right.....: 1042.0 Min Elev.: 5030.00  
 Encroachment Stations..Left: Right.....:  
 Manning-n Values.....LOB: 0.030 CHANNEL...: 0.030 ROB.....: 0.030

CROSS SECTION POINTS - Elevations &amp; Stations in feet:

| No. | Elev.   | Sta. No. | Elev. | Sta. No. | Elev.   | Sta. |         |         |
|-----|---------|----------|-------|----------|---------|------|---------|---------|
| 1)  | 5038.00 | 1000.00  | 2)    | 5036.00  | 1012.00 | 3)   | 5030.00 | 1022.00 |
| 4)  | 5030.00 | 1024.00  | 5)    | 5032.00  | 1030.00 | 6)   | 5034.00 | 1042.00 |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 1.00     | 19.5   | 4.5    | 0.98 | 0.030 | 1.0 | 6.7   | 4.3    | 7.1   | 5030.99 |          |
| 5032.00  | 88.6   | 6.6    | 1.08 | 0.030 | 1.0 | 11.3  | 13.3   | 12.2  | 5032.09 |          |
| 5033.00  | 224.3  | 7.9    | 1.13 | 0.030 | 1.0 | 19.0  | 28.5   | 20.2  | 5033.18 |          |
| 5034.00  | 478.8  | 9.3    | 1.18 | 0.030 | 1.0 | 26.7  | 51.3   | 28.3  | 5034.26 |          |

NOTES:

Project Stand Master  
 Project No. 80100208  
 Sheet No.        of         
 Calculated by YS Date       

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Railroad Ditch Section # GCI-DT5  
Drainage Basin GCI

CROSS SECTION PARAMETERS:

FILENAME: GCI-DT5.SEC

No. of Cross Section Points: 8 Bed Slope: 0.01670 Max Elev.: 34.00  
 Bank Stations.....Left: 1000.0 Right....: 1037.0 Min Elev.: 26.00  
 Encroachment Stations..Left:        Right....:         
 Manning-n Values.....LOB: 0.050 CHANNEL...: 0.035 ROB.....: 0.050

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev. | Sta.    | No. | Elev. | Sta.    | No. | Elev. | Sta.    |
|-----|-------|---------|-----|-------|---------|-----|-------|---------|
| 1)  | 34.00 | 1000.00 | 2)  | 32.00 | 1003.00 | 3)  | 30.00 | 1007.00 |
| 4)  | 28.00 | 1010.00 | 5)  | 26.00 | 1013.00 | 6)  | 28.00 | 1019.00 |
| 7)  | 30.00 | 1031.00 | 8)  | 30.20 | 1037.00 |     |       |         |

COMPUTED PARAMETERS:

| SEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft) | CRWS(ft) |
|---------|--------|--------|------|-------|-----|-------|--------|-------|--------|----------|
| 27.00   | 7.3    | 3.2    | 0.81 | 0.035 | 1.0 | 4.5   | 2.3    | 5.0   | 26.92  |          |
| 28.00   | 46.2   | 5.1    | 0.91 | 0.035 | 1.0 | 9.0   | 9.0    | 9.9   | 27.92  |          |
| 29.00   | 136.3  | 6.3    | 0.96 | 0.035 | 1.0 | 16.5  | 21.8   | 17.8  | 28.96  |          |
| 30.00   | 319.7  | 7.6    | 1.01 | 0.035 | 1.0 | 24.0  | 42.0   | 25.7  | 30.06  |          |
| 30.20   | 337.4  | 7.1    | 1.00 | 0.035 | 1.0 | 30.4  | 47.4   | 32.2  | 30.20  |          |
| 31.00   | 658.3  | 9.1    | 1.07 | 0.035 | 1.0 | 32.0  | 72.4   | 33.9  | 31.10  |          |

Velocity

NOTES:

$Q_{100} \approx 465$  cfs

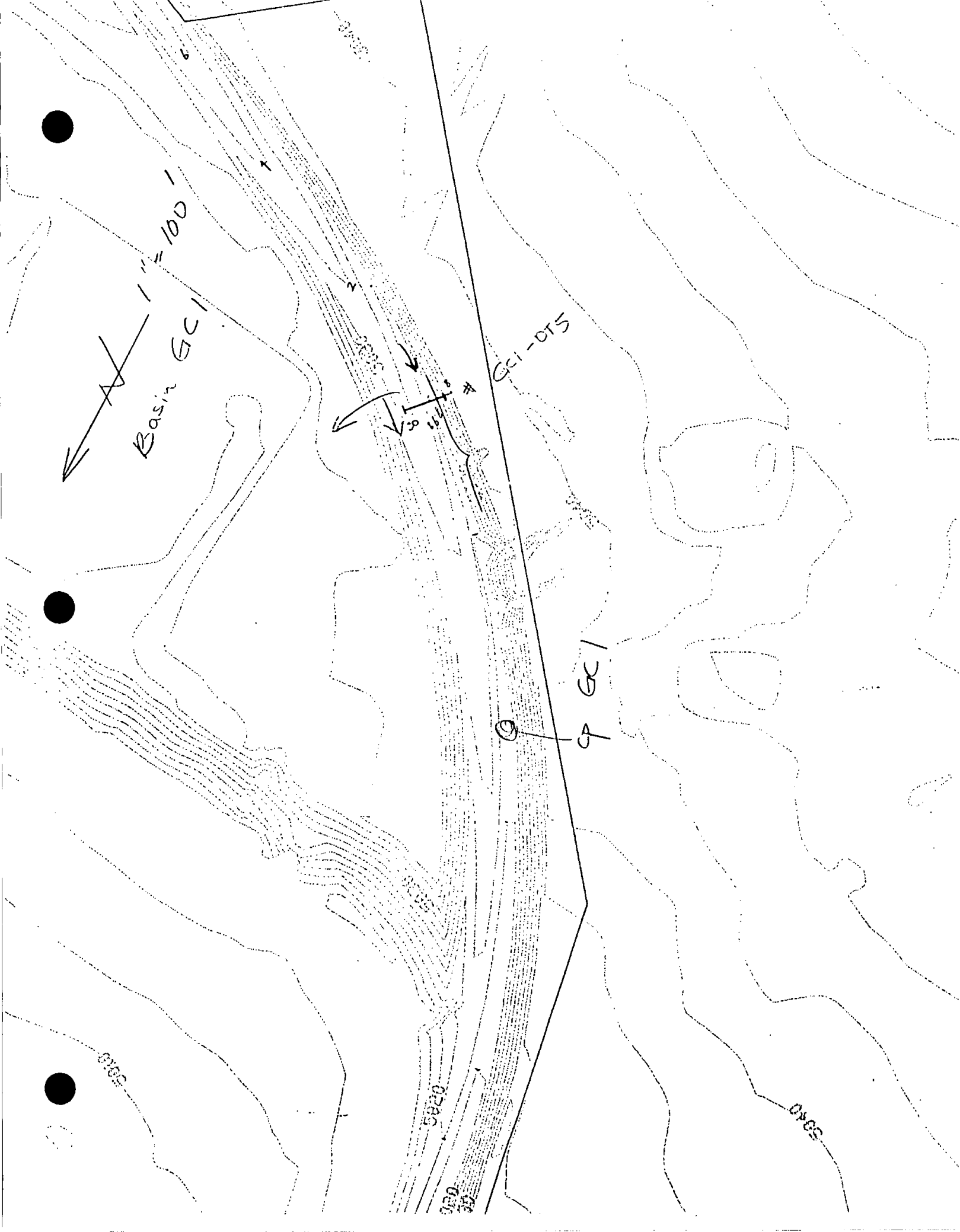
Channel Capacity  $\approx 337$  cfs @ Rail top.

During a 100-year event, flows will overtop the rail to Jc penney Area.

1" = 100'  
Basin GC1

GC1-DTS

GC1





STANTEC CONSULTING INC.  
950 Industrial Way  
Sparks, Nevada 89431  
Tel: (775) 358-6931 Fax: (775) 358-6954

Stantec

60-E  
JOB NO. \_\_\_\_\_

SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT Golf Course Channel

DATE \_\_\_\_\_

SUBJECT \_\_\_\_\_

DESIGNED \_\_\_\_\_

CHECKED \_\_\_\_\_

### Existing Conditions

$$Q_{E100} = 463 \text{ cfs}$$

Existing Channel Capacity  $\approx 950$  to  $1500$  cfs

Floodplain is wide and extends beyond channel bank

Velocities vary around 5 fps

### Proposed Conditions

$$Q_{P100} = 937 \text{ cfs} \quad \therefore \text{Channel}$$

Channel has sufficient capacity  
May require Channel Lining

May want to channelize, ie no floodplain flow

$L =$

$$S = 0.025$$

Slope is steep, may want to Flatten & add drop structures  
or concrete line Channel

Channel has experienced severe head cutting in this  
reach.

May want to provide drop structures with flatter slopes  
and Channel Lining

From Silver Lake Blvd 1200' ds. 15' bw, 3:1 ss,  $S = 0.0125$ , 3-3' drop struct.

TRAPEZOIDAL CHANNEL ANALYSIS  
RATING CURVE COMPUTATION

March 14, 2000

Golf Course Channel Improvements

Proposed 15'bw, riprap lined channel at upper Section B

801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                              | VALUE  |
|----------------------------------------------------------|--------|
| Channel Bottom Slope (feet per foot).....                | 0.0112 |
| Manning's Roughness Coefficient (n-value).....           | 0.0400 |
| Channel Side Slope - Left Side (horizontal/vertical).... | 3.00   |
| Channel Side Slope - Right Side (horizontal/vertical)... | 3.00   |
| Channel Bottom Width (feet).....                         | 15.0   |

PROGRAM RESULTS:

| Depth<br>(ft) | Flow Rate<br>(cfs) | Velocity<br>(fps) | Froude Number | Velocity Head(ft) | Energy Head(ft) | Flow Area<br>(sq ft) | Top Width<br>(ft) |
|---------------|--------------------|-------------------|---------------|-------------------|-----------------|----------------------|-------------------|
| 1.0           | 63.3               | 3.52              | 0.670         | 0.192             | 1.192           | 18.0                 | 21.0              |
| 2.0           | 218.7              | 5.21              | 0.736         | 0.421             | 2.421           | 42.0                 | 27.0              |
| 3.0           | 468.1              | 6.50              | 0.776         | 0.656             | 3.656           | 72.0                 | 33.0              |
| 4.0           | 821.1              | 7.60              | 0.805         | 0.898             | 4.898           | 108.0                | 39.0              |
| 4.1           | 862.5              | 7.71              | 0.808         | 0.922             | 5.022           | 111.9                | 39.6              |
| 4.2           | 905.0              | 7.81              | 0.810         | 0.946             | 5.146           | 115.9                | 40.2              |
| 4.3           | 948.7              | 7.91              | 0.813         | 0.971             | 5.271           | 120.0                | 40.8              |
| 4.5           | 1039.7             | 8.11              | 0.818         | 1.020             | 5.520           | 128.2                | 42.0              |
| 5.0           | 1288.1             | 8.59              | 0.829         | 1.145             | 6.145           | 150.0                | 45.0              |
| 5.5           | 1567.7             | 9.05              | 0.839         | 1.271             | 6.771           | 173.2                | 48.0              |

$Q = 468$ ,  $D = 3'$

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.3 (c) 1986  
Dodson & Associates, Inc., 5629 FM 1960 W., #314, Houston, TX 77069  
(713) 440-3787. A manual with equations & flow chart is available.

TRAPEZOIDAL CHANNEL ANALYSIS  
RATING CURVE COMPUTATION

March 14, 2000  
Golf Course Channel Improvements  
Proposed 15'bw, riprap lined channel at middle Section B  
801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                              | VALUE  |
|----------------------------------------------------------|--------|
| Channel Bottom Slope (feet per foot).....                | 0.0105 |
| Manning's Roughness Coefficient (n-value).....           | 0.0400 |
| Channel Side Slope - Left Side (horizontal/vertical).... | 3.00   |
| Channel Side Slope - Right Side (horizontal/vertical)... | 3.00   |
| Channel Bottom Width (feet).....                         | 15.0   |

PROGRAM RESULTS:

| Depth<br>(ft) | Flow Rate<br>(cfs) | Velocity<br>(fps) | Froude<br>Number | Velocity<br>Head(ft) | Energy<br>Head(ft) | Flow Area<br>(sq ft) | Top Width<br>(ft) |
|---------------|--------------------|-------------------|------------------|----------------------|--------------------|----------------------|-------------------|
| 1.0           | 61.2               | 3.40              | 0.647            | 0.180                | 1.180              | 18.0                 | 21.0              |
| 2.0           | 211.3              | 5.03              | 0.711            | 0.393                | 2.393              | 42.0                 | 27.0              |
| 3.0           | 452.2              | 6.28              | 0.749            | 0.613                | 3.613              | 72.0                 | 33.0              |
| 4.0           | 793.2              | 7.34              | 0.778            | 0.838                | 4.838              | 108.0                | 39.0              |
| 4.1           | 833.2              | 7.44              | 0.780            | 0.861                | 4.961              | 111.9                | 39.6              |
| 4.2           | 874.3              | 7.54              | 0.783            | 0.883                | 5.083              | 115.9                | 40.2              |
| 4.3           | 916.6              | 7.64              | 0.785            | 0.906                | 5.206              | 120.0                | 40.8              |
| 4.4           | 959.9              | 7.74              | 0.788            | 0.929                | 5.329              | 124.1                | 41.4              |
| 4.5           | 1004.4             | 7.83              | 0.790            | 0.952                | 5.452              | 128.2                | 42.0              |
| 5.0           | 1244.4             | 8.30              | 0.801            | 1.069                | 6.069              | 150.0                | 45.0              |
| 5.5           | 1514.5             | 8.74              | 0.811            | 1.187                | 6.687              | 173.2                | 48.0              |

*Q=937 cfs, D=435*

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.3 (c) 1986  
Dodson & Associates, Inc., 5629 FM 1960 W., #314, Houston, TX 77069  
(713) 440-3787. A manual with equations & flow chart is available.



Project Stead Master  
Project No. 80100208  
Sheet No.      of       
Calculated by YS Date     

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Railroad Ditch Section # GCI-DT1

Drainage Basin GCI

CROSS SECTION PARAMETERS:

FILENAME: GCI-DT1.SEC

No. of Cross Section Points: 8 Bed Slope: 0.01740 Max Elev.: 88.00 ✓  
Bank Stations.....Left: 1000.0 Right.....: 1037.0 Min Elev.: 80.30 ✓  
Encroachment Stations..Left:      Right.....:       
Manning-n Values.....LOB: 0.045 CHANNEL...: 0.035 ROB.....: 0.045

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.        | Sta. No.       | Elev. | Sta. No.     | Elev.          | Sta. |              |                |
|-----|--------------|----------------|-------|--------------|----------------|------|--------------|----------------|
| 1)  | <u>84.80</u> | <u>1000.00</u> | 2)    | <u>84.00</u> | <u>1004.00</u> | 3)   | <u>82.00</u> | <u>1010.00</u> |
| 4)  | <u>80.30</u> | <u>1013.00</u> | 5)    | <u>82.00</u> | <u>1018.00</u> | 6)   | <u>84.00</u> | <u>1022.00</u> |
| 7)  | <u>86.00</u> | <u>1027.00</u> | 8)    | <u>88.00</u> | <u>1037.00</u> |      |              |                |

COMPUTED PARAMETERS:

| IEL(ft)      | Q(cfs)       | V(fps)     | Fr          | No.          | ne         | ALPHA       | TW(ft)      | A(sf)       | WP(ft)       | CRWS(ft) |
|--------------|--------------|------------|-------------|--------------|------------|-------------|-------------|-------------|--------------|----------|
| <u>82.00</u> | <u>32.2</u>  | <u>4.7</u> | <u>0.91</u> | <u>0.035</u> | <u>1.0</u> | <u>8.0</u>  | <u>6.8</u>  | <u>8.7</u>  | <u>81.94</u> |          |
| <u>83.00</u> | <u>110.9</u> | <u>6.4</u> | <u>0.98</u> | <u>0.035</u> | <u>1.0</u> | <u>13.0</u> | <u>17.3</u> | <u>14.1</u> | <u>82.98</u> |          |
| <u>84.00</u> | <u>259.6</u> | <u>7.9</u> | <u>1.03</u> | <u>0.035</u> | <u>1.0</u> | <u>18.0</u> | <u>32.8</u> | <u>19.5</u> | <u>84.05</u> |          |
| <u>84.80</u> | <u>429.9</u> | <u>8.7</u> | <u>1.06</u> | <u>0.035</u> | <u>1.0</u> | <u>24.0</u> | <u>49.6</u> | <u>25.8</u> | <u>84.89</u> |          |

↑  
High Velocity.

NOTES:

Channel Capacity Check

80 < Q<sub>des</sub> < 464

Project Stead Master  
 Project No. 80/00208  
 Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
 Calculated by ys Date \_\_\_\_\_

## UNIFORM FLOW COMPUTATIONS

## LOCATION/DESCRIPTION:

Railroad Ditch Section #1 GC1-DT2  
Drainage Basin GC1

## CROSS SECTION PARAMETERS:

FILENAME: GC1-DT2.SEC

No. of Cross Section Points: 8 Bed Slope: 0.01350 Max Elev.: 70.00  
 Bank Stations.....Left: 1251.0 Right.....: 1299.0 Min Elev.: 62.60  
 Encroachment Stations..Left: \_\_\_\_\_ Right.....: \_\_\_\_\_  
 Manning-n Values.....LOB: 0.045 CHANNEL...: 0.035 ROB.....: 0.045

## CROSS SECTION POINTS - Elevations &amp; Stations in feet:

| No. | Elev. | Sta. No. | Elev. | Sta. No. | Elev.   | Sta. |       |         |
|-----|-------|----------|-------|----------|---------|------|-------|---------|
| 1)  | 68.00 | 1000.00  | 2)    | 66.00    | 1140.00 | (3)  | 64.00 | 1251.00 |
| 4)  | 62.60 | 1269.00  | 5)    | 64.00    | 1279.00 | 6)   | 66.00 | 1286.00 |
| 7)  | 68.00 | 1291.00  | 8)    | 70.00    | 1299.00 |      |       |         |

## COMPUTED PARAMETERS:

| TEL(ft) | Q(cfs)      | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft) | CRWS(ft) |
|---------|-------------|--------|------|-------|-----|-------|--------|-------|--------|----------|
| 63.50   | 23.4        | 2.9    | 0.76 | 0.035 | 1.0 | 18.0  | 8.1    | 18.1  | 63.40  |          |
| 64.00   | <u>76.0</u> | 3.9    | 0.82 | 0.035 | 1.0 | 28.0  | 19.6   | 28.2  | 63.89  |          |
| 64.50   | 153.0       | 3.7    | 0.86 | 0.037 | 1.2 | 57.5  | 41.0   | 57.7  | 64.33  |          |
| 65.00   | 316.2       | 4.1    | 0.92 | 0.039 | 1.4 | 87.0  | 77.1   | 87.3  | 64.90  |          |
| 65.50   | 586.3       | 4.6    | 0.95 | 0.040 | 1.5 | 116.5 | 128.0  | 116.9 | 65.44  |          |
| 66.00   | 984.8       | 5.1    | 0.96 | 0.041 | 1.5 | 146.0 | 193.6  | 146.4 | 65.96  |          |

## NOTES:

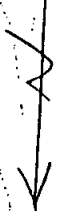
$$80 < Q_{100} < 464$$

Channel Capacity Check.

Low flow channel capacity  $\approx 76$  cfs +/-

Steady State

1"=100'



Pipe outlet

864

60

Basin GC1

H  
GC1-CT2

GC1-DT3

6505

Project Stand Master  
 Project No. 80100208  
 Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
 Calculated by Js Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Railroad Ditch Section # GCI-DT3

Drainage Basin GCI

CROSS SECTION PARAMETERS:

FILENAME: gc1-dt3.SEC

No. of Cross Section Points: 14 Bed Slope: 0.01800 Max Elev.: 58.00  
 Bank Stations.....Left: 1107.0 Right.....: 1130.0 Min Elev.: 53.00  
 Encroachment Stations..Left: \_\_\_\_\_ Right.....: \_\_\_\_\_  
 Manning-n Values.....LOB: 0.050 CHANNEL...: 0.035 ROB.....: 0.050

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev. | Sta.    | No. | Elev. | Sta.    | No. | Elev. | Sta.    |
|-----|-------|---------|-----|-------|---------|-----|-------|---------|
| 1)  | 58.00 | 1000.00 | 2)  | 56.00 | 1011.00 | 3)  | 54.50 | 1095.00 |
| 4)  | 55.20 | 1107.00 | 5)  | 54.00 | 1115.00 | 6)  | 53.10 | 1122.00 |
| 7)  | 54.00 | 1130.00 | 8)  | 53.20 | 1170.00 | 9)  | 53.70 | 1210.00 |
| 10) | 53.50 | 1235.00 | 11) | 53.00 | 1240.00 | 12) | 54.00 | 1245.00 |
| 13) | 56.00 | 1252.00 | 14) | 58.00 | 1260.00 |     |       |         |

COMPUTED PARAMETERS:

| EL(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft) | CRWS(ft) |
|--------|--------|--------|------|-------|-----|-------|--------|-------|--------|----------|
| 54.00  | 151.4  | 2.5    | 0.65 | 0.048 | 1.0 | 130.0 | 61.0   | 130.2 | 53.88  |          |
| 54.50  | 503.5  | 4.0    | 0.73 | 0.048 | 1.0 | 135.1 | 127.3  | 135.4 | 54.32  |          |
| 55.00  | 934.2  | 4.6    | 0.77 | 0.048 | 1.1 | 176.7 | 205.2  | 177.2 | 54.73  |          |

NOTES:

Capacity check

$Q_{100} < 465$  cfs

Minimal Capacity in the low flow channel.

Project Stead Master  
Project No. 80100208  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by JS Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Railroad Ditch Section # GCI-DT4  
Drainage Basin GC 1

CROSS SECTION PARAMETERS:

FILENAME: gc1-dt4.SEC

No. of Cross Section Points: 8 Bed Slope: 0.01300 Max Elev.: 42.00  
Bank Stations.....Left: 1160.0 Right.....: 1212.0 Min Elev.: 38.40  
Encroachment Stations..Left: \_\_\_\_\_ Right.....: \_\_\_\_\_  
Manning-n Values.....LOB: 0.050 CHANNEL...: 0.035 ROB.....: 0.050

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev. | Sta.    | No. | Elev. | Sta.    | No. | Elev. | Sta.    |
|-----|-------|---------|-----|-------|---------|-----|-------|---------|
| 1)  | 42.00 | 1000.00 | 2)  | 40.00 | 1120.00 | 3)  | 40.00 | 1148.00 |
| 4)  | 40.70 | 1160.00 | 5)  | 40.00 | 1171.00 | 6)  | 38.40 | 1180.00 |
| 7)  | 40.00 | 1200.00 | 8)  | 42.00 | 1212.00 |     |       |         |

COMPUTED PARAMETERS:

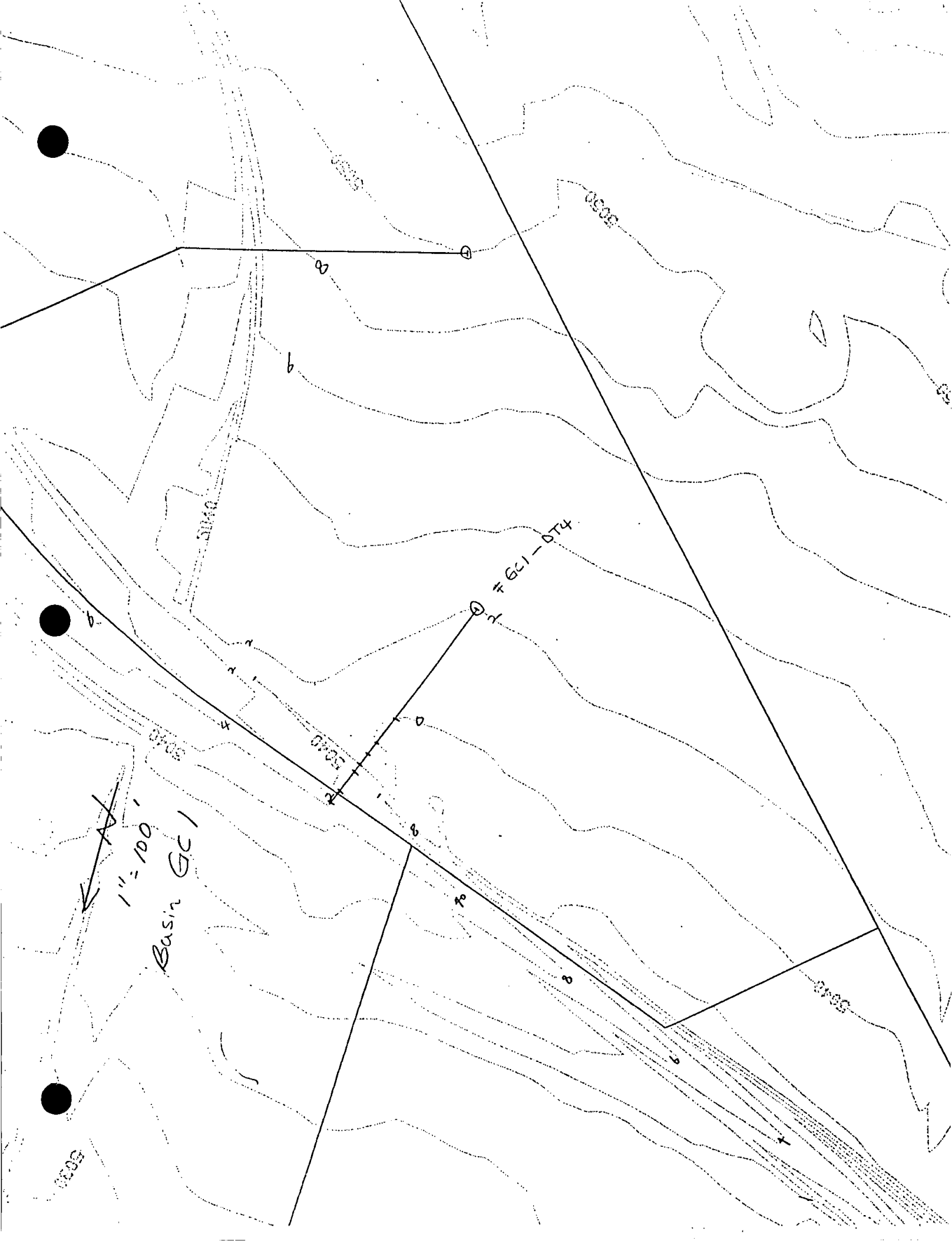
| SEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft) | CRWS(ft) |
|---------|--------|--------|------|-------|-----|-------|--------|-------|--------|----------|
| 40.00   | 96.3   | 4.2    | 0.82 | 0.035 | 1.0 | 29.0  | 23.2   | 29.2  | 39.87  |          |
| 40.70   | 275.5  | 3.2    | 0.81 | 0.042 | 1.5 | 126.2 | 87.3   | 126.5 | 40.58  |          |
| 41.00   | 461.8  | 3.6    | 0.82 | 0.043 | 1.5 | 146.0 | 128.1  | 146.3 | 40.88  |          |
| 42.00   | 1483.4 | 4.8    | 0.85 | 0.045 | 1.4 | 212.0 | 307.1  | 212.4 | 41.83  |          |

NOTES:

Capacity Check

$Q_{1000} \leq 464 \text{ cfs}$

No railroad  
overlapping



GC-F

Project Stead Master  
 Project No. 26m002-08  
 Sheet No.      of       
 Calculated by JS Date     

## UNIFORM FLOW COMPUTATIONS

## LOCATION/DESCRIPTION:

Railroad Ditch Section # RSD-DT1  
Drainage Basin # RSD

## CROSS SECTION PARAMETERS:

FILENAME: RSD-DT1.SEC

No. of Cross Section Points: 8 Bed Slope: 0.01630 Max Elev.: 98.00  
 Bank Stations.....Left: 1000.0 Right....: 1061.0 Min Elev.: 91.70  
 Encroachment Stations..Left:      Right....:       
 Manning-n Values.....LOB: 0.045 CHANNEL...: 0.035 ROB.....: 0.045

## CROSS SECTION POINTS - Elevations &amp; Stations in feet:

| No. | Elev. | Sta.    | No. | Elev. | Sta.    | No. | Elev. | Sta.    |
|-----|-------|---------|-----|-------|---------|-----|-------|---------|
| 1)  | 98.00 | 1000.00 | 2)  | 96.00 | 1012.00 | 3)  | 94.00 | 1022.00 |
| 4)  | 92.00 | 1034.00 | 5)  | 91.70 | 1037.00 | 6)  | 92.00 | 1039.00 |
| 7)  | 94.00 | 1047.00 | 8)  | 96.00 | 1061.00 |     |       |         |

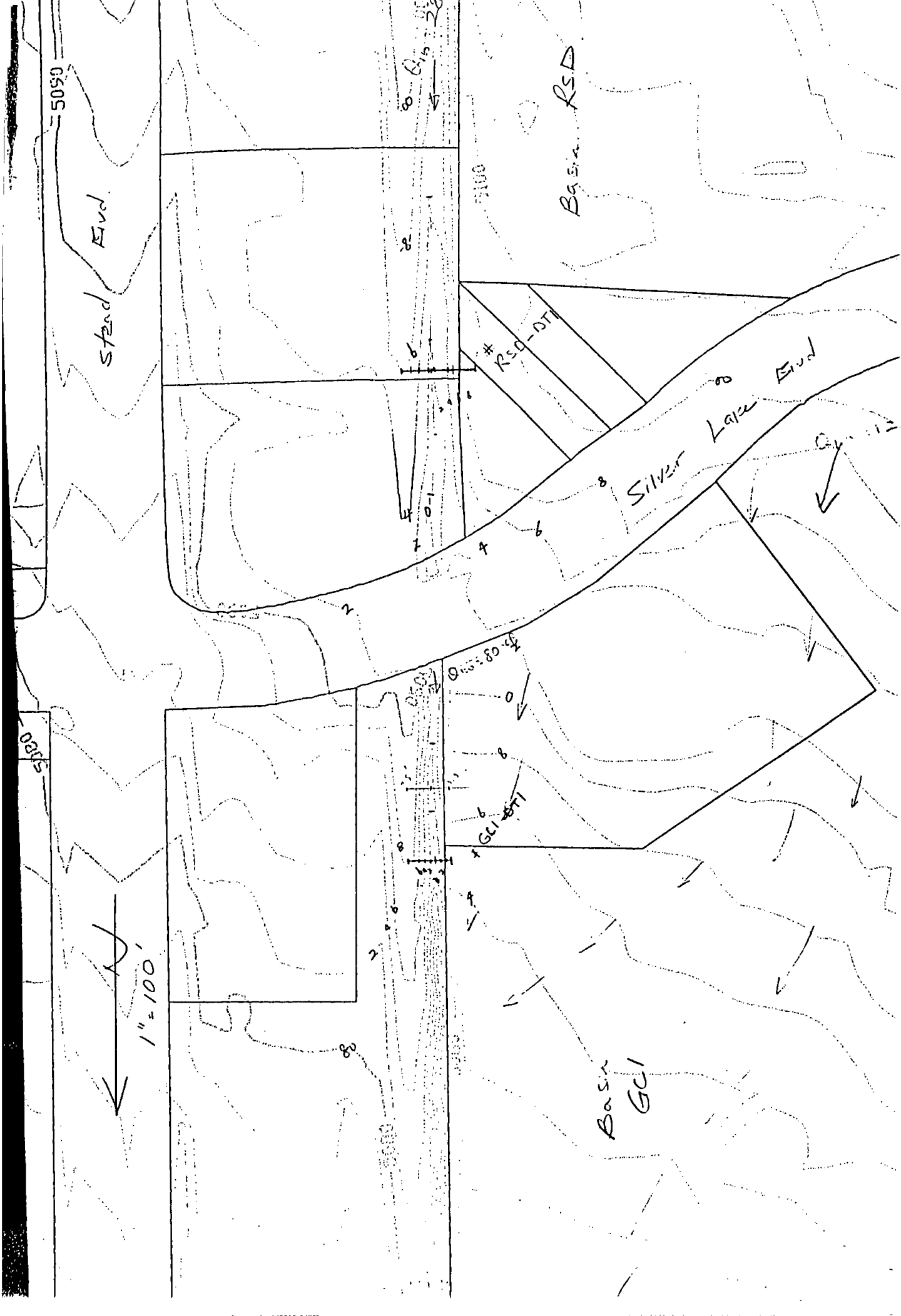
## COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft) | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|--------|----------|
| 92.00    | 1.1    | 1.5    | 0.69 | 0.035 | 1.0 | 5.0   | 0.8    | 5.0   | 91.96  |          |
| 93.00    | 46.2   | 4.3    | 0.89 | 0.035 | 1.0 | 15.0  | 10.8   | 15.2  | 92.94  |          |
| 94.00    | 189.1  | 6.1    | 0.98 | 0.035 | 1.0 | 25.0  | 30.8   | 25.4  | 93.98  |          |
| 95.00    | 465.8  | 7.5    | 1.03 | 0.035 | 1.0 | 37.0  | 61.8   | 37.6  | 95.04  |          |
| 96.00    | 932.3  | 8.9    | 1.07 | 0.035 | 1.0 | 49.0  | 104.8  | 49.8  | 96.11  |          |
| 94.42    | 285.0  | 6.7    | 1.00 | 0.035 | 1.0 | 30.0  | 42.3   | 30.6  | 94.42  |          |

Velocity

## NOTES:

$Q_{100} = 285 \text{ cfs} \pm$   
- Channel capacity check.  
- Ignore the backwater from the Pipe  
current under Silver Lake Blvd.  
Proposed  
 $Q_{100} = 462 \text{ cfs}$  WSEL = 95,  $V = 7.5 \text{ fps}$







*Formerly SEA, Incorporated*

**950 Industrial Way  
Sparks, NV 89431-6092  
(702) 358-6931  
Fax: 358-6954**

JOB NO. 00208

SHEET 1 OF 1

## PROJECT

## Stead Master Plan

DATE \_\_\_\_\_

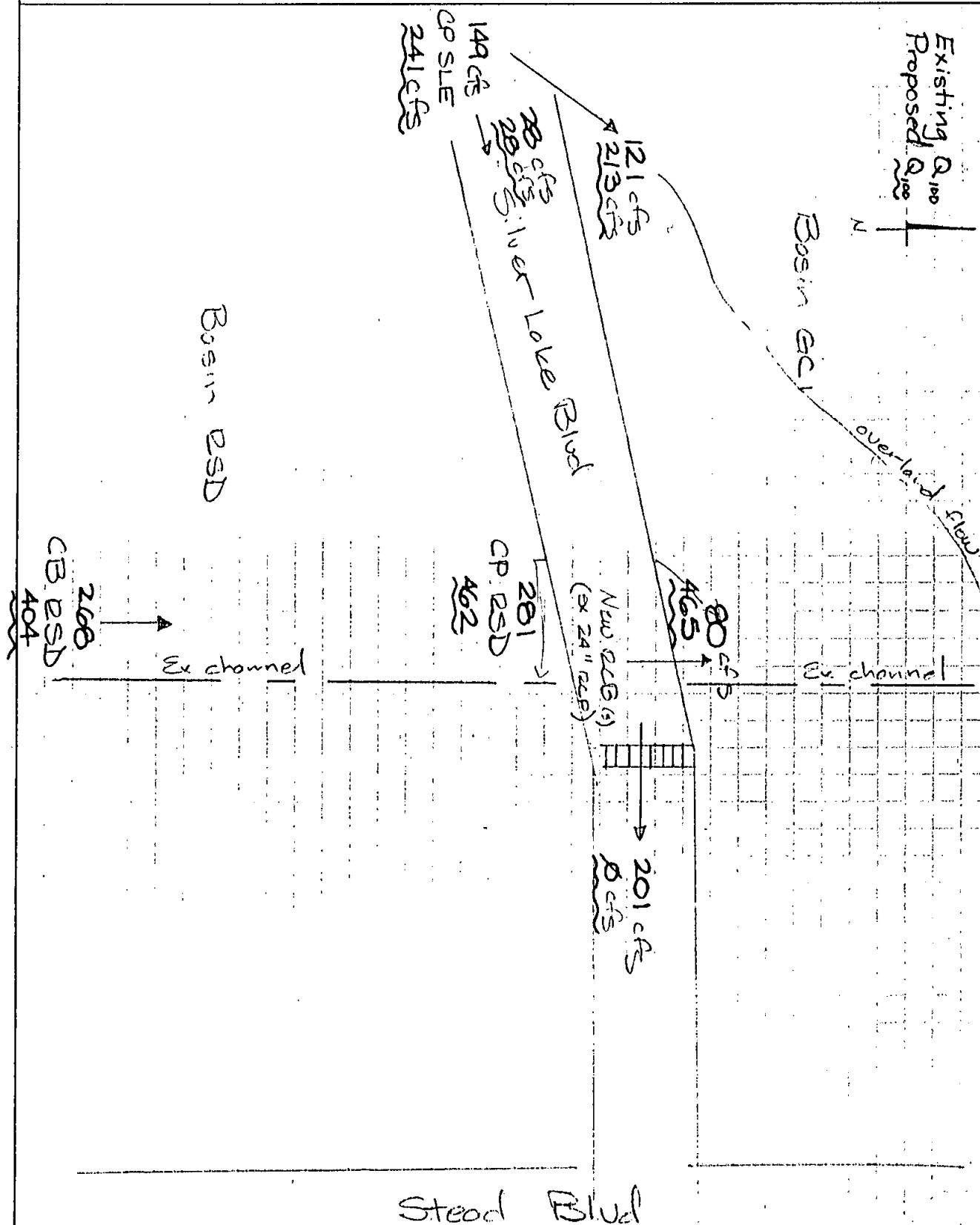
1/19/00

**SUBJECT**

Silver Lake Blvd @ Rail

DESIGNED

**CHECKED**





**Stantech**  
Consulting

# STANTECH CONSULTING INC.

Formerly SEA, Incorporated

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(702) 358-6931  
Fax: 358-6954

JOB NO. 26000208

SHEET \_\_\_\_\_ OF \_\_\_\_\_

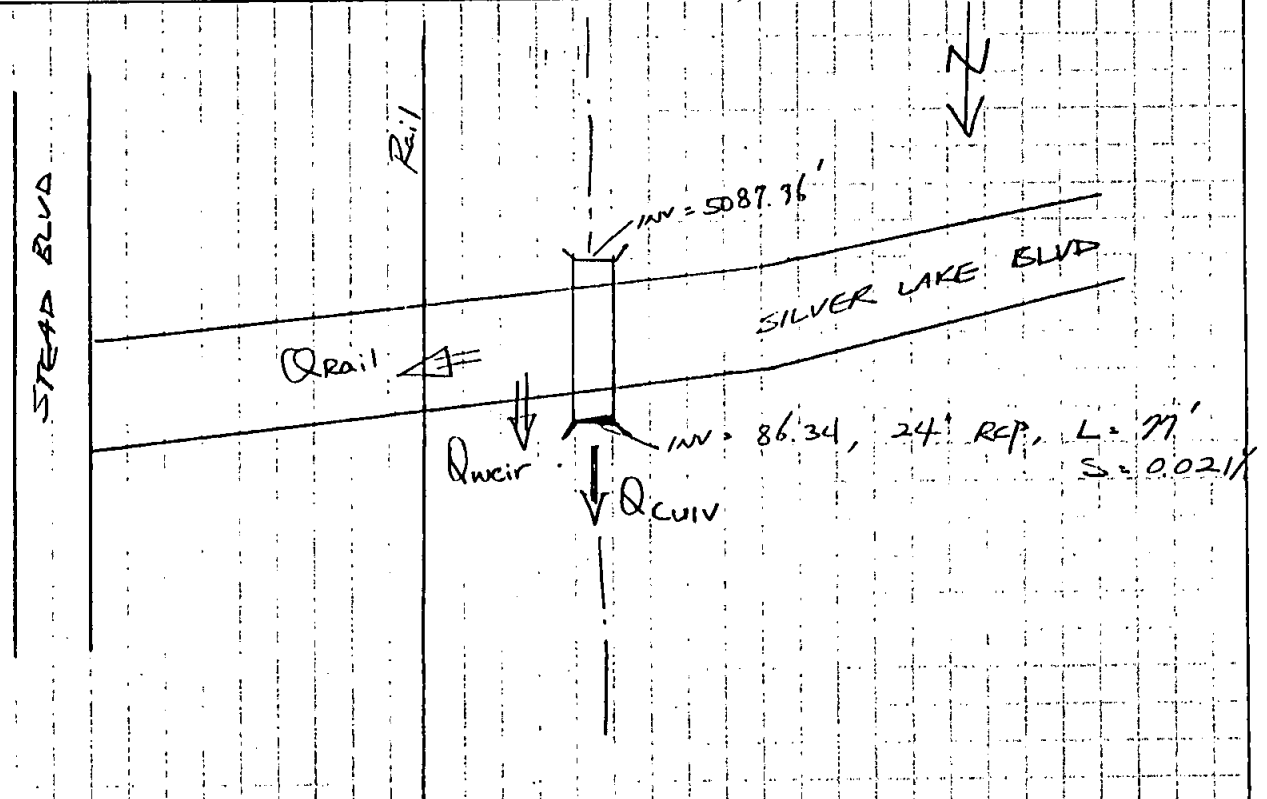
PROJECT Stead Drainage Master

DATE 4/14/99

SUBJECT Split flows (Basin RSD)

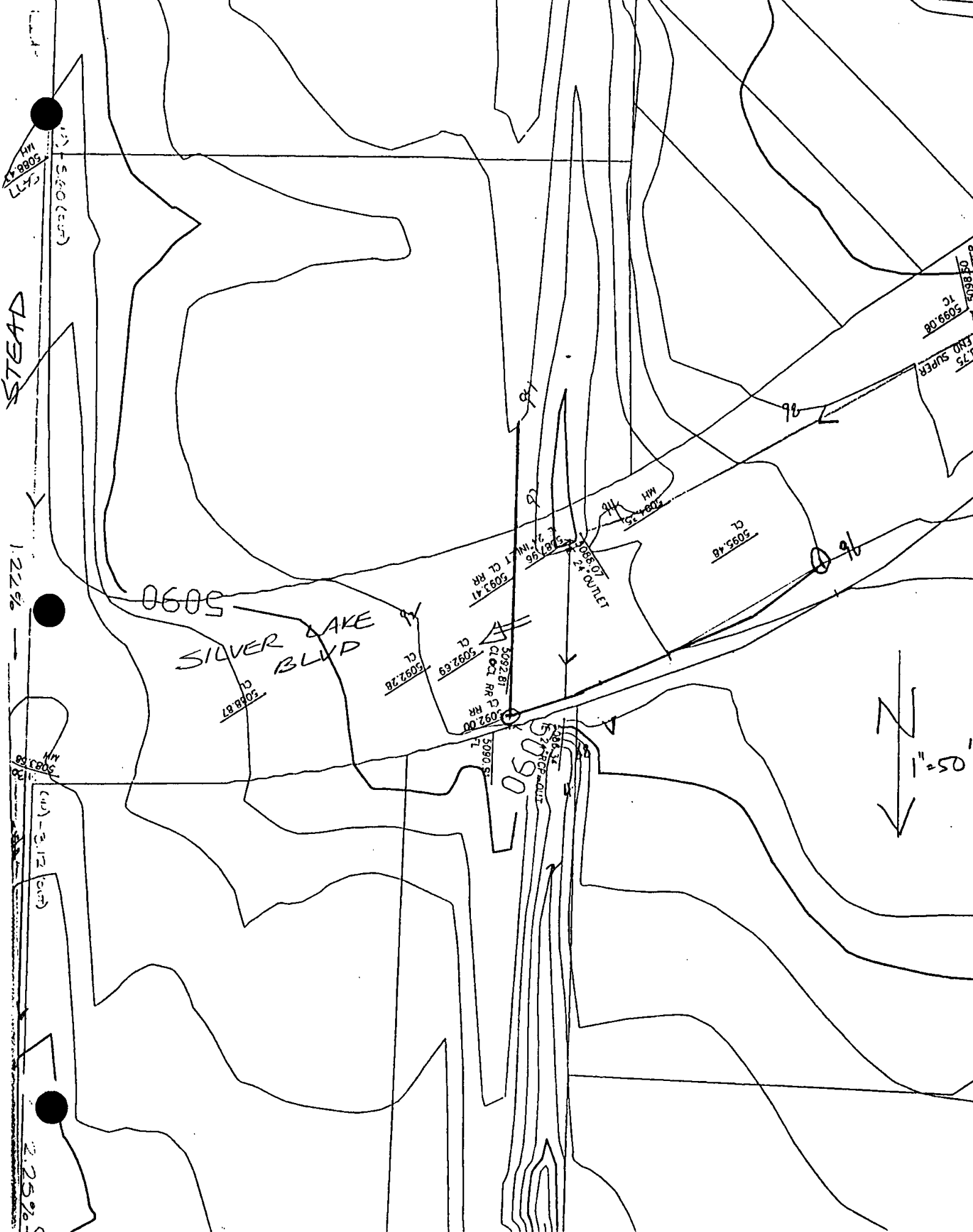
DESIGNED \_\_\_\_\_

CHECKED \_\_\_\_\_



| Elev.   | $Q_{cuiv}$ (CFS) | $Q_{rail}$ | $Q_{weir}$ | $Q_{total}$ |
|---------|------------------|------------|------------|-------------|
| 5087.96 | 0                | 0          | 0          | 0           |
| 92.0    | 26 (4.64)        | 0          | 0          | 26          |
| 92.5    | 28 (1.54)        | 26         | 7          | 61          |
| 93.0    | 30 (5.04)        | 166        | 41         | 237         |
| 93.5    | 32 (5.54)        | 469        | 114        | 615         |

| $\Delta I$               | 0' | 26' | 61' | 237' | 615' |
|--------------------------|----|-----|-----|------|------|
| to Stead Blvd $\Delta Q$ | 0' | 0'  | 26' | 166' | 469' |



PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

April 14, 1999  
24" RCP UNDER SILVER LAKE BLVD ✓  
IE= 87.96' ✓

=====

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 2.00 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 1 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 77.0 ✓   |
| Culvert Slope (feet per foot).....                    | 0.0210 ✓ |

=====

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater<br>Inlet Control<br>Depth (ft) | Normal<br>Outlet Control<br>Depth (ft) | Critical<br>Depth (ft) | Depth at<br>Depth (ft) | Outlet<br>Depth (ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|------------------------------------------|----------------------------------------|------------------------|------------------------|----------------------|--------------------------|
| 5.0                | 1.00                    | 1.11                                     | -0.13                                  | 0.53                   | 0.79                   | 0.53                 | 7.54                     |
| 10.0               | 1.00                    | 1.69                                     | 0.33                                   | 0.76                   | 1.13                   | 0.76                 | 9.10                     |
| 15.0               | 2.00                    | 2.26                                     | 1.25                                   | 0.95                   | 1.40                   | 0.95                 | 10.18                    |
| 20.0               | 3.00                    | 2.95                                     | 2.93                                   | 1.13                   | 1.61                   | 1.13                 | 10.96                    |
| 25.0               | 2.00                    | 3.86                                     | 2.79                                   | 1.31                   | 1.76                   | 1.31                 | 11.49                    |
| 30.0               | 2.00                    | 4.97                                     | 3.85                                   | 1.51                   | 1.86                   | 1.51                 | 11.82                    |
| 35.0               | 2.00                    | 6.28                                     | 5.11                                   | 1.78                   | 1.92                   | 1.78                 | 11.84                    |
| 40.0               | 2.00                    | 7.79                                     | 6.55                                   | 2.00                   | 1.95                   | 2.00                 | 12.73                    |
| 45.0               | 2.00                    | 9.51                                     | 8.19                                   | 2.00                   | 1.97                   | 2.00                 | 14.32                    |

=====

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Project 160002-08  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Silver Lake Blvd split flow  
- Rail Road &

CROSS SECTION PARAMETERS:

FILENAME: SLV-RR1.SEC

No. of Cross Section Points: 4 Bed Slope: 0.02100 Max Elev.: 94.00  
Bank Stations.....Left: 1004.0 Right.....: 1064.0 Min Elev.: 92.00  
Encroachment Stations..Left: \_\_\_\_\_ Right.....: \_\_\_\_\_  
Manning-n Values.....LOB: 0.016 CHANNEL...: 0.016 ROB.....: 0.035

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev. | Sta.    | No. | Elev. | Sta.    | No. | Elev. | Sta.    |
|-----|-------|---------|-----|-------|---------|-----|-------|---------|
| 1)  | 92.00 | 1004.00 | 2)  | 92.81 | 1036.00 | 3)  | 93.41 | 1064.00 |
| 4)  | 94.00 | 1129.00 |     |       |         |     |       |         |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | nc  | ALPHA | TW(ft) | A(sf) | WP(ft) | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|--------|----------|
| 92.50    | 26.4   | 5.3    | 1.88 | 0.016 | 1.0 | 19.8  | 4.9    | 19.8  | 92.64  |          |
| 93.00    | 165.5  | 8.3    | 2.10 | 0.016 | 1.0 | 40.9  | 19.9   | 40.9  | 93.34  |          |
| 93.50    | 468.5  | 10.1   | 2.20 | 0.016 | 1.0 | 69.9  | 46.4   | 69.9  | 94.03  |          |
| 94.00    | 832.9  | 8.8    | 2.08 | 0.021 | 1.4 | 125.0 | 95.1   | 125.0 | 94.50  |          |

NOTES:

Project 260002-8  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

WEIR FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

Silver Lake Blvd split flow

— Silver Lake

CROSS SECTION PARAMETERS:

FILENAME: slvr1ke1.SEC

No. of Cross Section Points: 3 ~~Bed Slope = 0.0000~~ Max Elev.: 96.00 ✓  
Bank Stations.....Left: 1000.0 Right.....: 1147.0 Min Elev.: 92.00 ✓  
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)  | 96.00 | 1000.00 | 2)  | 94.00 | 1076.00 | 3)  | 92.00 | 1147.00 |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | H:max(ft) | H:ave(ft) | TW(ft) | A(sf) |
|----------|--------|-----------|-----------|--------|-------|
| 92.50    | 7.3    | 0.50      | 0.25      | 17.8   | 4.4   |
| 93.00    | 41.2   | 1.00      | 0.50      | 35.5   | 17.8  |
| 93.50    | 113.5  | 1.50      | 0.75      | 53.3   | 39.9  |
| 94.00    | 232.9  | 2.00      | 1.00      | 71.0   | 71.0  |

NOTES:



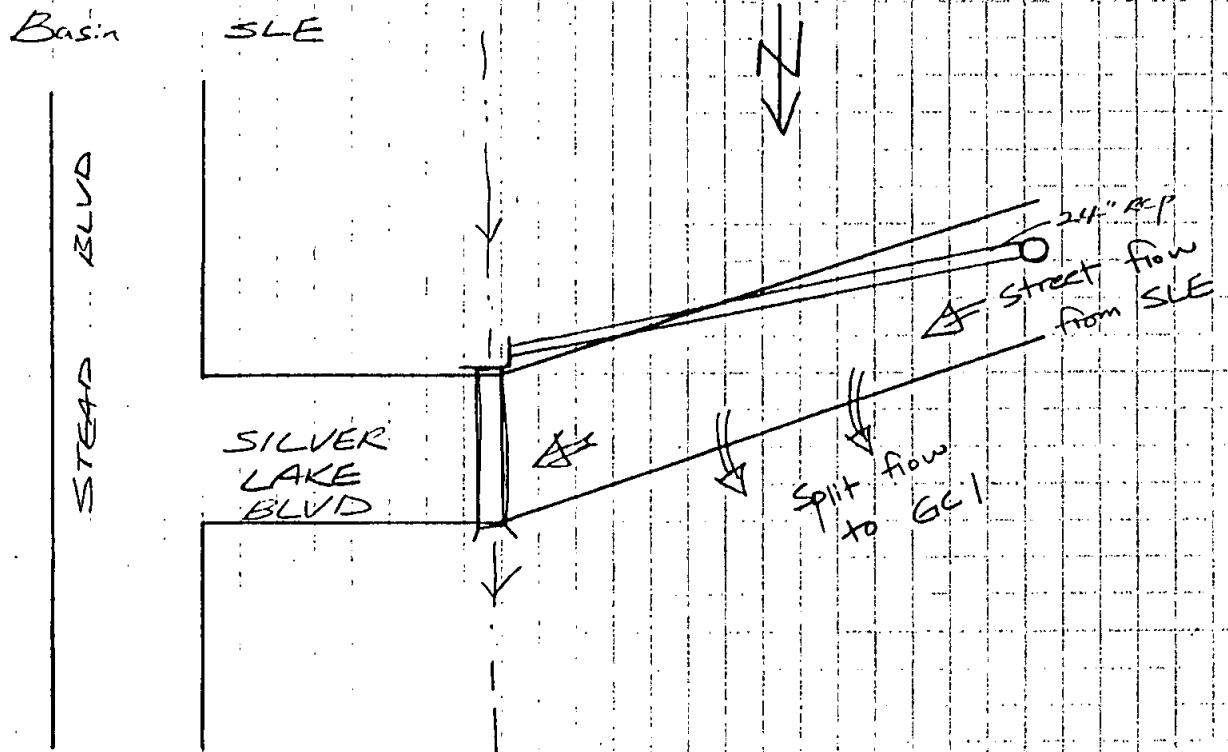
# STANTECH CONSULTING INC.

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Sparks, NV 89431-6092  
(702) 358-6931  
Fax: 358-6954

JOB NO. 26000208

SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT Stead Marker Plan DATE \_\_\_\_\_  
SUBJECT Split flow Calculations (SLE) DESIGNED \_\_\_\_\_ CHECKED \_\_\_\_\_

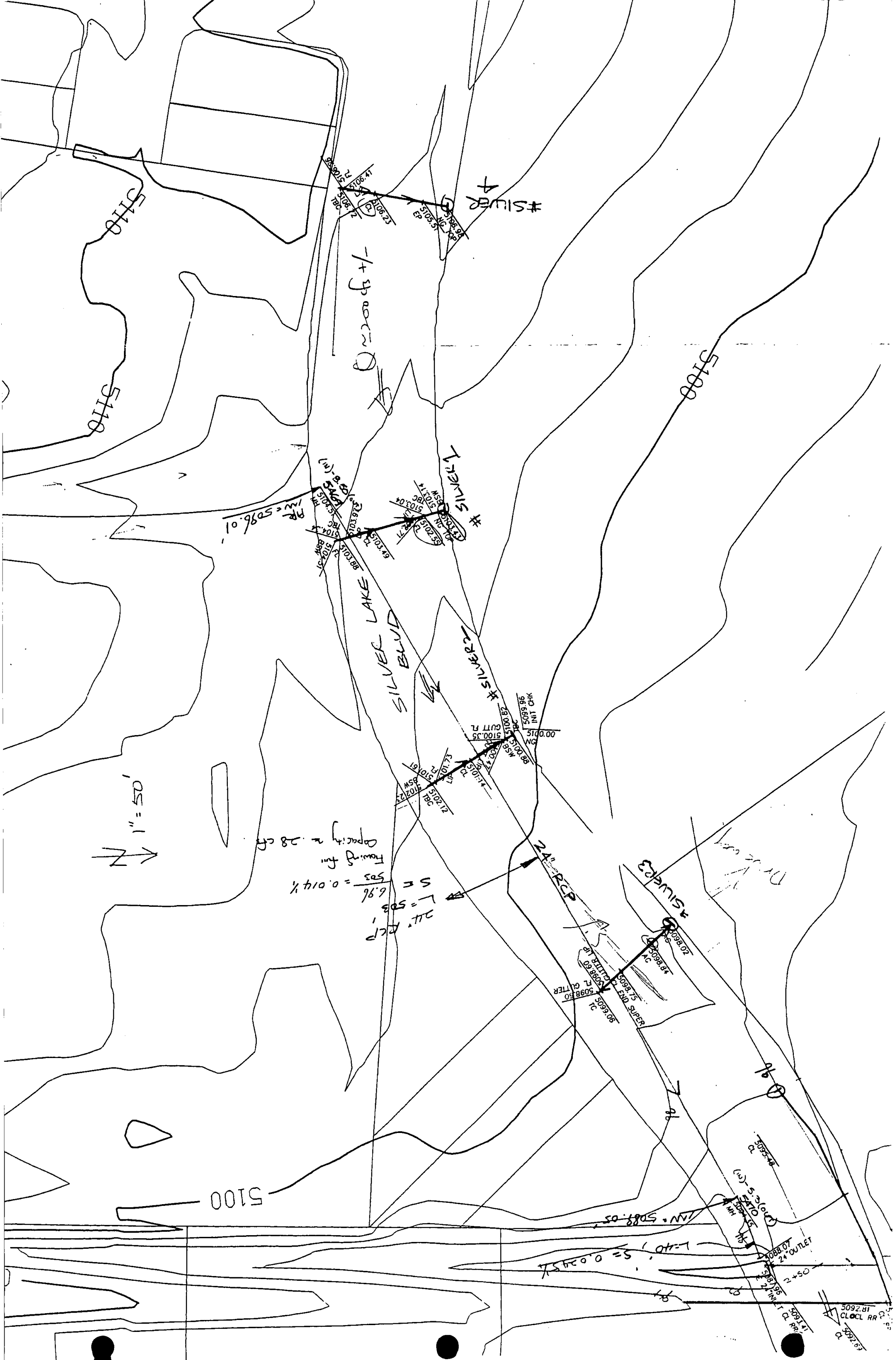


24" RCP Pipe Capacity = assume flowing full Capacity  
= 28 cfs

Flows from Basin SLE

assume No street flow will get to the channel @ CP RSD

|    |   |    |     |     |                          |
|----|---|----|-----|-----|--------------------------|
| DI | 0 | 28 | 100 | 300 |                          |
| DQ | 0 | 28 | 28  | 28  | Divert 24" RCP to CP RSD |
| BQ | 0 | 0  | 72  | 272 | Divert to GC1            |







Project 26000208  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

SILVER LAKE BLVD  
STREET Cross-Section # SILVER4

CROSS SECTION PARAMETERS:

FILENAME: silver4.SEC

No. of Cross Section Points: 6 Bed Slope: 0.01100 Max Elev.: 5106.98  
Bank Stations.....Left: 1015.0 Right.....: 1066.5 Min Elev.: 5105.51  
Encroachment Stations..Left: 1000.0 Right.....: 1066.5  
Manning-n Values.....LOB: 0.035 CHANNEL...: 0.016 ROB.....: 0.035

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta. No. | Elev. | Sta. No. | Elev.   | Sta. |         |         |
|-----|---------|----------|-------|----------|---------|------|---------|---------|
| 1)  | 5106.98 | 1000.00  | 2)    | 5105.51  | 1015.00 | 3)   | 5106.23 | 1045.00 |
| 4)  | 5106.41 | 1064.00  | 5)    | 5106.26  | 1066.00 | 6)   | 5106.72 | 1066.50 |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 5106.00  | 18.6   | 3.0    | 1.14 | 0.020 | 1.2 | 25.4  | 6.2    | 25.5  | 5106.03 |          |
| 5106.20  | 46.4   | 3.8    | 1.21 | 0.020 | 1.2 | 35.8  | 12.4   | 35.8  | 5106.28 |          |
| 5106.40  | 85.2   | 3.9    | 1.21 | 0.020 | 1.1 | 59.0  | 21.6   | 59.1  | 5106.45 |          |
| 5106.80  | 289.6  | 6.2    | 1.39 | 0.020 | 1.2 | 64.7  | 46.6   | 64.9  | 5107.00 |          |
| 5106.98  | 411.5  | 7.0    | 1.44 | 0.020 | 1.2 | 66.5  | 58.4   | 66.8  | 5107.23 |          |

NOTES:

Capacity  $\approx 412$  cfs

O.K.

Project 26000208  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

SILVER LAKE END

Street Cross-section # SILVER1

CROSS SECTION PARAMETERS:

FILENAME: SILVER1.SEC

No. of Cross Section Points: 10 Bed Slope: 0.01500 Max Elev.: 5104.51  
Bank Stations.....Left: 1008.0 Right.....: 1070.0 Min Elev.: 5102.55  
Encroachment Stations..Left: Right.....:  
Manning-n Values.....LOB: 0.035 CHANNEL...: 0.016 ROB.....: 0.035

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta.    | No. | Elev.   | Sta.    | No. | Elev.   | Sta.    |
|-----|---------|---------|-----|---------|---------|-----|---------|---------|
| 1)  | 5103.43 | 1000.00 | 2)  | 5103.14 | 1008.00 | 3)  | 5103.04 | 1012.00 |
| 4)  | 5102.55 | 1013.00 | 5)  | 5102.71 | 1015.00 | 6)  | 5103.49 | 1045.00 |
| 7)  | 5103.97 | 1063.00 | 8)  | 5103.88 | 1065.00 | 9)  | 5104.34 | 1066.00 |
| 10) | 5104.51 | 1070.00 |     |         |         |     |         |         |

COMPUTED PARAMETERS:

| L(ft)   | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|---------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 5102.80 | 1.3    | 2.3    | 1.34 | 0.016 | 1.0 | 6.0   | 0.6    | 6.0   | 5102.82 |          |
| 5103.00 | 9.3    | 3.6    | 1.50 | 0.016 | 1.0 | 14.1  | 2.6    | 14.2  | 5103.07 |          |
| 5103.20 | 29.0   | 4.4    | 1.57 | 0.016 | 1.0 | 27.5  | 6.7    | 27.6  | 5103.30 |          |
| 5103.43 | 73.8   | 5.0    | 1.58 | 0.018 | 1.1 | 42.7  | 14.7   | 42.8  | 5103.58 |          |
| 5103.60 | 131.1  | 5.8    | 1.60 | 0.019 | 1.1 | 49.1  | 22.5   | 49.3  | 5103.79 |          |
| 5104.00 | 342.0  | 7.5    | 1.67 | 0.019 | 1.1 | 65.3  | 45.3   | 65.4  | 5104.29 |          |

NOTES:

Street Capacity  $\approx 74$  cfs.

Project 26000208  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

SILVER LAKE BLVD

Street Cross-section # SILVER2

CROSS SECTION PARAMETERS:

FILENAME: SILVER2.SEC

No. of Cross Section Points: 8 Bed Slope: 0.01500 Max Elev.: 5102.12  
Bank Stations.....Left: 1000.0 Right.....: 1057.5 Min Elev.: 5100.35  
Encroachment Stations..Left: Right.....:  
Manning-n Values.....LOB: 0.035 CHANNEL...: 0.016 ROB.....: 0.035

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta.    | No. | Elev.   | Sta.    | No. | Elev.   | Sta.    |
|-----|---------|---------|-----|---------|---------|-----|---------|---------|
| 1)  | 5100.88 | 1000.00 | 2)  | 5100.82 | 1005.00 | 3)  | 5100.35 | 1005.50 |
| 4)  | 5100.47 | 1007.00 | 5)  | 5101.14 | 1030.00 | 6)  | 5101.73 | 1055.00 |
| 7)  | 5101.61 | 1057.00 | 8)  | 5102.12 | 1057.50 |     |         |         |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 5100.70  | 4.4    | 3.1    | 1.44 | 0.016 | 1.0 | 9.8   | 1.4    | 9.9   | 5100.75 |          |
| 5100.80  | 9.6    | 3.8    | 1.51 | 0.016 | 1.0 | 13.3  | 2.6    | 13.5  | 5100.88 |          |
| 5100.88  | 14.2   | 3.7    | 1.50 | 0.016 | 1.0 | 21.1  | 3.9    | 21.3  | 5100.95 |          |
| 5101.00  | 31.1   | 4.7    | 1.60 | 0.016 | 1.0 | 25.2  | 6.7    | 25.4  | 5101.11 |          |
| 5101.40  | 137.6  | 7.0    | 1.77 | 0.016 | 1.0 | 41.0  | 19.8   | 41.2  | 5101.66 |          |
| 5101.60  | 227.8  | 7.9    | 1.83 | 0.016 | 1.0 | 49.5  | 28.8   | 49.7  | 5101.90 |          |

NOTES:

Street Capacity  $\approx$  14 cfs

Project 26000208  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

SILVER LAKE BLVD

STREET CROSS-SECTION # SILVER3

CROSS SECTION PARAMETERS:

FILENAME: SILVER3.SEC

No. of Cross Section Points: 6 Bed Slope: 0.02500 Max Elev.: 5099.06  
Bank Stations.....Left: 1017.0 Right.....: 1061.5 Min Elev.: 5098.60  
Encroachment Stations..Left: 1017.0 Right.....:  
Manning-n Values.....LOB: 0.016 CHANNEL...: 0.016 ROB.....: 0.035

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta.    | No. | Elev.   | Sta.    | No. | Elev.   | Sta.    |
|-----|---------|---------|-----|---------|---------|-----|---------|---------|
| 1)  | 5098.02 | 1000.00 | (2) | 5098.84 | 1017.00 | 3)  | 5098.75 | 1042.00 |
| 4)  | 5098.60 | 1059.00 | 5)  | 5098.60 | 1061.00 | 6)  | 5099.06 | 1061.50 |

COMPUTED PARAMETERS:

WSEL(ft) Q(cfs) V(fps) Fr No. ne ALPHA TW(ft) A(sf) WP(ft) CRWS(ft)

98.84 (14.0) 3.2 1.76 0.016 1.0 44.3 4.4 44.4 5098.89

NOTES:

PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

March 8, 2000  
Silver Lake Blvd Culvert at Golf Course Channel  
Existing 24" RCP  
801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Diameter (feet).....                          | 2.00   |
| FHWA Chart Number (1,2 or 3).....                     | 1      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 80.0   |
| Culvert Slope (feet per foot).....                    | 0.0100 |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater Depth<br>(ft) | Headwater Inlet<br>(ft) | Normal Depth<br>(ft) | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|-------------------------|----------------------|------------------------|-------------------------|--------------------------|
| 10.0               | 2.00                    | 1.69                    | 1.59                 | 0.93                   | 1.13                    | 6.98                     |
| 20.0               | 2.00                    | 2.95                    | 2.77                 | 1.46                   | 1.61                    | 8.11                     |
| 30.0               | 2.00                    | 4.97                    | 4.72                 | 2.00                   | 1.86                    | 9.55                     |
| 40.0               | 2.00                    | 7.79                    | 7.46                 | 2.00                   | 1.95                    | 12.73                    |
| 50.0               | 2.00                    | 11.42                   | 10.99                | 2.00                   | 1.98                    | 15.92                    |
| 60.0               | 2.00                    | 15.86                   | 15.29                | 2.00                   | 1.99                    | 19.10                    |

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Stantec

GC-F  
JOB NO. 801 00208

SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT Golf Course Channel - at Silver Lake Blvd DATE 3/8/00  
SUBJECT Proposed Culvert Under Silver Lake Blvd DESIGNED (M) CHECKED \_\_\_\_\_

### Existing Conditions

24" RCP

$$Q_{E100} = 281 \text{ cfs}$$

L = 80'

$$Q_{CAP} = 30 \text{ cfs}$$

S = .01

Assume inlet Control

Approx 4' head

US. Channel Typ = 25' bw, 2:1 SS, S = .02, L = 3700', D = 4.5'

### Proposed Conditions

→ ~~10' x 5' RCB~~ or 12' x 6' RCB under Silver Lake Blvd.

L = 80'

$$Q_{P100} = 462 \text{ cfs}$$

S = .01

Assume Inlet Control  
head varies

Utility Conflicts ?

→ 3' Grouted Rip Rap drop structure 40' length

→ Minor channel grading to shape channel and drop channel bed slightly (~1') near Silver Lake Blvd US. of prop. drop struct.

→ Rip Rap Channel betw CPAW3 and CPRSD  
Typ sxn = 25' bw, 2:1 SS, S = .02, D = 4.5' w/Ab, V = 8fps

BOX CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

March 8, 2000  
Silver Lake Blvd. Culvert @ Golf Course Channel  
Proposed ~~10' x 8'~~ RCB  
~~12' x 6'~~  
801 00208

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PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Span (Width of Opening) (feet).....           | 12.00  |
| Culvert Rise (Height of Opening) (feet).....          | 6.00   |
| FHWA Chart Number (8,9,10,11,12 or 13).....           | 8      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0120 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 80.0   |
| Culvert Slope (feet per foot).....                    | 0.0100 |

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PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater<br>Inlet Control<br>Depth (ft) | Normal<br>Outlet Control<br>Depth (ft) | Critical<br>Depth (ft) | Depth at<br>Depth (ft) | Outlet<br>Depth (ft) | Velocity<br>Outlet Velocity<br>(fps) |
|--------------------|-------------------------|------------------------------------------|----------------------------------------|------------------------|------------------------|----------------------|--------------------------------------|
| 100.0              | 6.00                    | 2.03                                     | 5.25                                   | 0.83                   | 1.29                   | 6.00                 | 1.39                                 |
| 200.0              | 6.00                    | 3.25                                     | 5.40                                   | 1.29                   | 2.05                   | 6.00                 | 2.78                                 |
| 300.0              | 6.00                    | 4.30                                     | 5.64                                   | 1.68                   | 2.69                   | 6.00                 | 4.17                                 |
| 400.0              | 6.00                    | 5.24                                     | 5.98                                   | 2.04                   | 3.26                   | 6.00                 | 5.56                                 |
| 500.0              | 6.00                    | 6.11                                     | 6.42                                   | 2.37                   | 3.78                   | 6.00                 | 6.94                                 |

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# Silver Shores Dr Flood Carrying Capacity Worksheet for Irregular Channel

| Project Description |                                                |
|---------------------|------------------------------------------------|
| Project File        | p:\civil\6000208\hydrau~1\flowma~1\steadmp.fm2 |
| Worksheet           | Silver Shores Dr Flood Carrying Capacity       |
| Flow Element        | Irregular Channel                              |
| Method              | Manning's Formula                              |
| Solve For           | Water Elevation                                |

| Input Data                           |                |                |             |           |
|--------------------------------------|----------------|----------------|-------------|-----------|
| Channel Slope                        |                | 0.033000 ft/ft |             |           |
| Elevation range: 0.00 ft to 0.60 ft. |                |                |             |           |
| Station (ft)                         | Elevation (ft) | Start Station  | End Station | Roughness |
| 995.00                               | 0.60           | 995.00         | 1065.00     | 0.016     |
| 1000.00                              | 0.50           |                |             |           |
| 1000.01                              | 0.00           |                |             |           |
| 1030.00                              | 0.60           |                |             |           |
| 1060.00                              | 0.00           |                |             |           |
| 1060.01                              | 0.50           |                |             |           |
| 1065.00                              | 0.60           |                |             |           |
| Discharge                            | 28.00          | ft³/s          |             |           |

| Results                   |          |                    |  |
|---------------------------|----------|--------------------|--|
| Wld. Mannings Coefficient | 0.016    |                    |  |
| Water Surface Elevation   | 0.33     | ft                 |  |
| Flow Area                 | 5.55     | ft <sup>2</sup>    |  |
| Wetted Perimeter          | 33.99    | ft                 |  |
| Top Width                 | 33.33    | ft                 |  |
| Depth                     | 0.33     | ft                 |  |
| Critical Water Elev.      | 0.45     | ft                 |  |
| Critical Slope            | 0.006273 | ft/ft              |  |
| Velocity                  | 5.04     | ft/s               |  |
| Velocity Head             | 0.40     | ft                 |  |
| Specific Energy           | 0.73     | ft                 |  |
| Froude Number             | 2.18     |                    |  |
| Full Flow Capacity        | 127.37   | ft <sup>3</sup> /s |  |
| Flow is supercritical.    |          |                    |  |
| Flow is divided.          |          |                    |  |

**Silver Shores Dr Flood Carrying Capacity**  
**Cross Section for Irregular Channel**

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**Project Description**

|              |                                                |
|--------------|------------------------------------------------|
| Project File | p:\civil\6000208\hydrau~1\flowma~1\steadmp.fm2 |
| Worksheet    | Silver Shores Dr Flood Carrying Capacity       |
| Flow Element | Irregular Channel                              |
| Method       | Manning's Formula                              |
| Solve For    | Water Elevation                                |

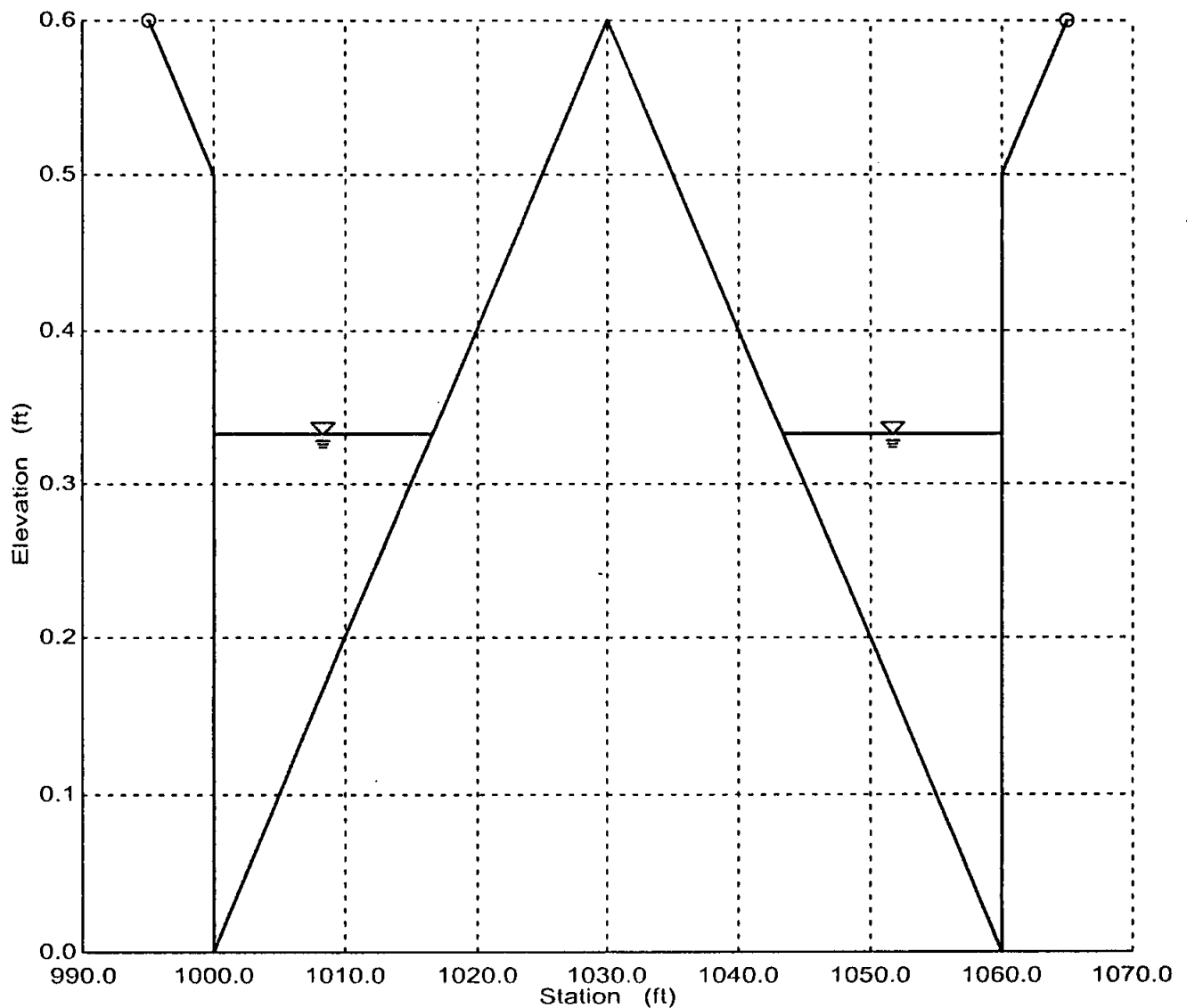
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**Section Data**

|                           |                          |
|---------------------------|--------------------------|
| Wtd. Mannings Coefficient | 0.016                    |
| Channel Slope             | 0.033000 ft/ft           |
| Water Surface Elevation   | 0.33 ft                  |
| Discharge                 | 28.00 ft <sup>3</sup> /s |

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**Rating Table for Channel between CPAW3 and CPRSD**  
**Rating Table for Irregular Channel**

| Project Description |                                                |
|---------------------|------------------------------------------------|
| Project File        | p:\civil\6000208\hydrau~1\flowma~1\steadmp.fm2 |
| Worksheet           | Ex Channel between CPAW3 and CPRSD             |
| Flow Element        | Irregular Channel                              |
| Method              | Manning's Formula                              |
| Solve For           | Water Elevation                                |

| Constant Data |                |
|---------------|----------------|
| Channel Slope | 0.020000 ft/ft |

| Input Data |         |         |                          |
|------------|---------|---------|--------------------------|
|            | Minimum | Maximum | Increment                |
| Discharge  | 200.00  | 500.00  | 25.00 ft <sup>3</sup> /s |

| Rating Table                      |                              |                                    |
|-----------------------------------|------------------------------|------------------------------------|
| Discharge<br>(ft <sup>3</sup> /s) | Wtd. Mannings<br>Coefficient | Water Surface<br>Elevation<br>(ft) |
| 200.00                            | 0.030                        | 5127.64                            |
| 225.00                            | 0.030                        | 5127.74                            |
| 250.00                            | 0.030                        | 5127.88                            |
| 275.00                            | 0.030                        | 5128.01                            |
| 300.00                            | 0.030                        | 5128.08                            |
| 325.00                            | 0.030                        | 5128.13                            |
| 350.00                            | 0.030                        | 5128.19                            |
| 375.00                            | 0.030                        | 5128.24                            |
| 400.00                            | 0.030                        | 5128.30                            |
| 425.00                            | 0.030                        | 5128.35                            |
| 450.00                            | 0.030                        | 5128.40                            |
| 475.00                            | 0.030                        | 5128.45                            |
| 500.00                            | 0.030                        | 5128.50                            |

**Typ. Sxn. btw. CPAW3 & CPRSD Q=230**  
**Worksheet for Irregular Channel**

| <b>Project Description</b> |                                                |
|----------------------------|------------------------------------------------|
| Project File               | p:\civil\6000208\hydrau~1\flowma~1\steadmp.fm2 |
| Worksheet                  | Ex Channel between CPAW3 and CPRSD             |
| Flow Element               | Irregular Channel                              |
| Method                     | Manning's Formula                              |
| Solve For                  | Water Elevation                                |

| Input Data                                 |                |                    |             |           |
|--------------------------------------------|----------------|--------------------|-------------|-----------|
| Channel Slope                              | 0.020000 ft/ft |                    |             |           |
| Elevation range: 5125.10 ft to 5140.00 ft. |                |                    |             |           |
| Station (ft)                               | Elevation (ft) | Start Station      | End Station | Roughness |
| 1000.00                                    | 5140.00        | 1000.00            | 1085.00     | 0.030     |
| 1029.00                                    | 5125.80        |                    |             |           |
| 1037.00                                    | 5127.80        |                    |             |           |
| 1045.00                                    | 5128.00        |                    |             |           |
| 1055.00                                    | 5125.10        |                    |             |           |
| 1085.00                                    | 5140.00        |                    |             |           |
| Discharge                                  | 230.00         | ft <sup>3</sup> /s |             |           |

| <b>Results</b>            |          |                    |
|---------------------------|----------|--------------------|
| Wtd. Mannings Coefficient | 0.030    |                    |
| Water Surface Elevation   | 5127.76  | ft                 |
| Flow Area                 | 30.82    | ft <sup>2</sup>    |
| Wetted Perimeter          | 28.02    | ft                 |
| Top Width                 | 26.32    | ft                 |
| Depth                     | 2.66     | ft                 |
| Critical Water Elev.      | 5128.02  | ft                 |
| Critical Slope            | 0.013686 | ft/ft              |
| Velocity                  | 7.46     | ft/s               |
| Velocity Head             | 0.87     | ft                 |
| Specific Energy           | 5128.62  | ft                 |
| Froude Number             | 1.22     |                    |
| Full Flow Capacity        | 21984.92 | ft <sup>3</sup> /s |
| Flow is supercritical.    |          |                    |
| Flow is divided.          |          |                    |

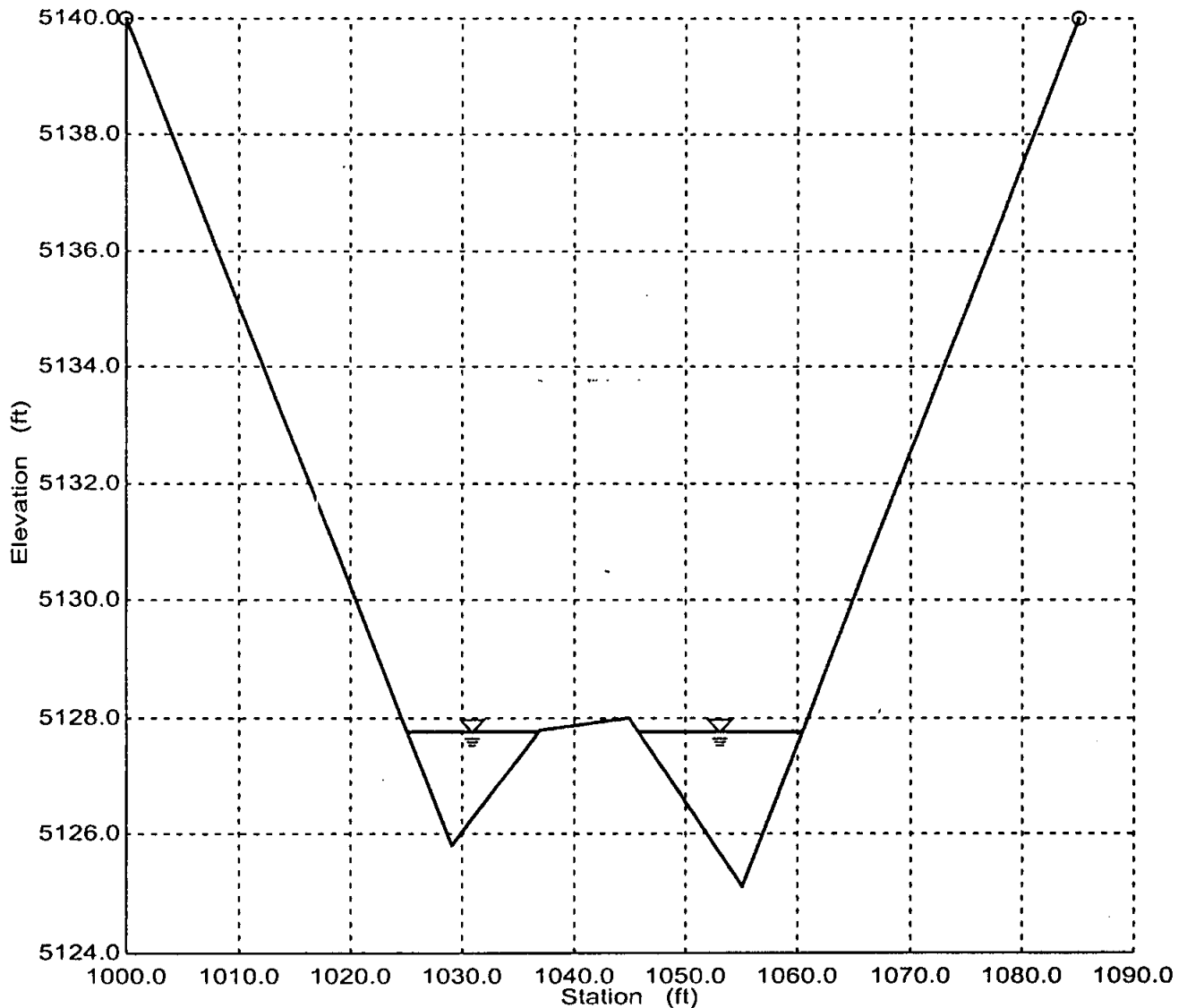
**Typical Cross Section between CPAW3 and CPRSD**  
**Cross Section for Irregular Channel**

**Project Description**

|              |                                                |
|--------------|------------------------------------------------|
| Project File | p:\civil\6000208\hydrau~1\flowma~1\steadmp.fm2 |
| Worksheet    | Ex Channel between CPAW3 and CPRSD             |
| Flow Element | Irregular Channel                              |
| Method       | Manning's Formula                              |
| Solve For    | Water Elevation                                |

**Section Data**

|                           |                           |
|---------------------------|---------------------------|
| Wtd. Mannings Coefficient | 0.030                     |
| Channel Slope             | 0.020000 ft/ft            |
| Water Surface Elevation   | 5127.76 ft                |
| Discharge                 | 230.00 ft <sup>3</sup> /s |



**Typ. Sxn. btw. CPAW3 & CPRSD Q=462**  
**Worksheet for Irregular Channel**

| <b>Project Description</b> |                                                |
|----------------------------|------------------------------------------------|
| Project File               | p:\civil\6000208\hydrau~1\flowma~1\steadmp.fm2 |
| Worksheet                  | Ex Channel between CPAW3 and CPRSD             |
| Flow Element               | Irregular Channel                              |
| Method                     | Manning's Formula                              |
| Solve For                  | Water Elevation                                |

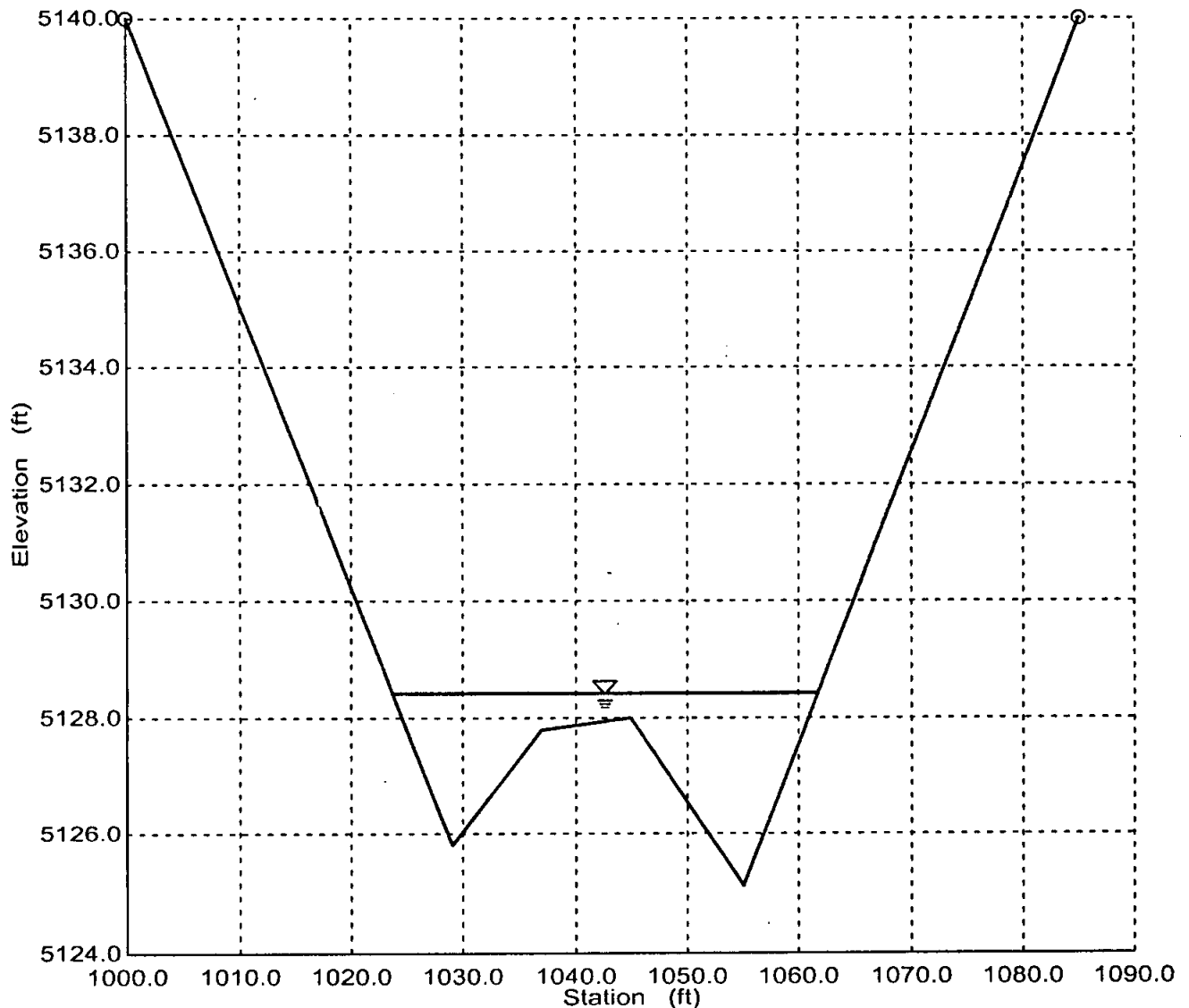
| Input Data                                 |                |               |             |           |
|--------------------------------------------|----------------|---------------|-------------|-----------|
| Channel Slope                              | 0.020000 ft/ft |               |             |           |
| Elevation range: 5125.10 ft to 5140.00 ft. |                |               |             |           |
| Station (ft)                               | Elevation (ft) | Start Station | End Station | Roughness |
| 1000.00                                    | 5140.00        | 1000.00       | 1085.00     | 0.030     |
| 1029.00                                    | 5125.80        |               |             |           |
| 1037.00                                    | 5127.80        |               |             |           |
| 1045.00                                    | 5128.00        |               |             |           |
| 1055.00                                    | 5125.10        |               |             |           |
| 1085.00                                    | 5140.00        |               |             |           |
| Discharge                                  | 462.00         | ft³/s         |             |           |

| <b>Results</b>            |          |                    |
|---------------------------|----------|--------------------|
| Wtd. Mannings Coefficient | 0.030    |                    |
| Water Surface Elevation   | 5128.42  | ft                 |
| Flow Area                 | 54.05    | ft <sup>2</sup>    |
| Wetted Perimeter          | 40.10    | ft                 |
| Top Width                 | 38.05    | ft                 |
| Depth                     | 3.32     | ft                 |
| Critical Water Elev.      | 5128.68  | ft                 |
| Critical Slope            | 0.011970 | ft/ft              |
| Velocity                  | 8.55     | ft/s               |
| Velocity Head             | 1.14     | ft                 |
| Specific Energy           | 5129.56  | ft                 |
| Froude Number             | 1.26     |                    |
| Full Flow Capacity        | 21984.92 | ft <sup>3</sup> /s |
| Flow is supercritical.    |          |                    |

# Typical Cross Section between CPAW3 and CPRSD Cross Section for Irregular Channel

| Project Description |                                                |
|---------------------|------------------------------------------------|
| Project File        | p:\civil\6000208\hydrau~1\flowma~1\steadmp.fm2 |
| Worksheet           | Ex Channel between CPAW3 and CPRSD             |
| Flow Element        | Irregular Channel                              |
| Method              | Manning's Formula                              |
| Solve For           | Water Elevation                                |

| Section Data              |                           |
|---------------------------|---------------------------|
| Wtd. Mannings Coefficient | 0.030                     |
| Channel Slope             | 0.020000 ft/ft            |
| Water Surface Elevation   | 5128.42 ft                |
| Discharge                 | 462.00 ft <sup>3</sup> /s |



**Moya Boulevard at Red Rock Road Improvements**  
**CP GR3, CP MOY, CP CHAN**

[illegible]

|                         |           |
|-------------------------|-----------|
| TOTAL CONSTRUCTION COST | \$335,491 |
|-------------------------|-----------|

|                       |                 |
|-----------------------|-----------------|
| TOTAL DESIGN SERVICES | <u>\$33,000</u> |
|-----------------------|-----------------|

|                             |          |
|-----------------------------|----------|
| TOTAL CONSTRUCITON SERVICES | \$40,800 |
|-----------------------------|----------|

BY TMM



# Drainage Master Plan for Stead, Nevada

Moya Boulevard at Red Rock Road Improvements Downstream Channel  
CP CHAN

### PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

[illegible]

|          |           |
|----------|-----------|
| SUBTOTAL | \$387,500 |
|----------|-----------|

\$58,125

TOTAL CONSTRUCTION COST

\$445,625

RIGHT-OF-WAY (105,000 SF)

**\$105,000**

## DESIGN SERVICES

|                         |          |
|-------------------------|----------|
| ENGINEERING DESIGN (6%) | \$28,000 |
|-------------------------|----------|

|                                  |         |
|----------------------------------|---------|
| HYDROLOGY (WA. CO. REQUIREMENTS) | \$3,500 |
|----------------------------------|---------|

|                                  |         |
|----------------------------------|---------|
| SURVEYING (TOPOGRAPHIC + LEGALS) | \$4,000 |
|----------------------------------|---------|

|              |         |
|--------------|---------|
| GEOTECHNICAL | \$3,500 |
|--------------|---------|

|                       |                 |
|-----------------------|-----------------|
| TOTAL DESIGN SERVICES | <u>\$39,000</u> |
|-----------------------|-----------------|

## CONSTRUCTION SERVICES

|                    |          |
|--------------------|----------|
| SURVEYING STAKEOUT | \$10,000 |
|--------------------|----------|

|                 |          |
|-----------------|----------|
| QUALITY CONTROL | \$40,500 |
|-----------------|----------|

|                             |         |
|-----------------------------|---------|
| CONSTRUCTION ADMINISTRATION | \$4,000 |
|-----------------------------|---------|

|                             |          |
|-----------------------------|----------|
| TOTAL CONSTRUCTION SERVICES | \$54,500 |
|-----------------------------|----------|

|                    |           |
|--------------------|-----------|
| TOTAL PROJECT COST | \$644,125 |
|--------------------|-----------|

BY TMM

proposed channel  
 $S = .012$   
 $d = 4.5'$   
 $L = 2000'$   
 $bw = 18'$   
 $2:1$  SS

1-18' - 1 3'  
 $243,000 \text{ ft}^3$   
 $9,000 \text{ yd}^3$

RipRAP

$38' \times 2000' = 76,000 \text{ SF}$   
 $= 8500 \text{ SY}$

TW =  $36' + 15'$  Access Rd  
 $= 51' \times 2000' = 102,000 \text{ ft}^2$   
 $= 2.3 \rightarrow 2.5 \text{ ac}$

ROW

Mid channel grading

$V = 11 \text{ FPS}$

$1 = 250' \times (22 \times 5.5) \times (1/2 \times 5.5) (11)$   
 $37,133 \text{ ft}^3$   
 $1400 \text{ yd}^3$

ROW =  $(36' + 15') 200' = 9600 \text{ SF}$   
 $= 1100 \text{ SY}$

Grouted Rip Rap

$33' \times 200' = 6600 \text{ SF}$   
 $= 735 \text{ SY}$

Existing  
 $3 \times 8 \times 4'$  RCB's  
 $L = 70'$

Proposed  
 $2 \times 8 \times 4'$  RCB's  
 $1 \times 4 \times 4'$  RCB

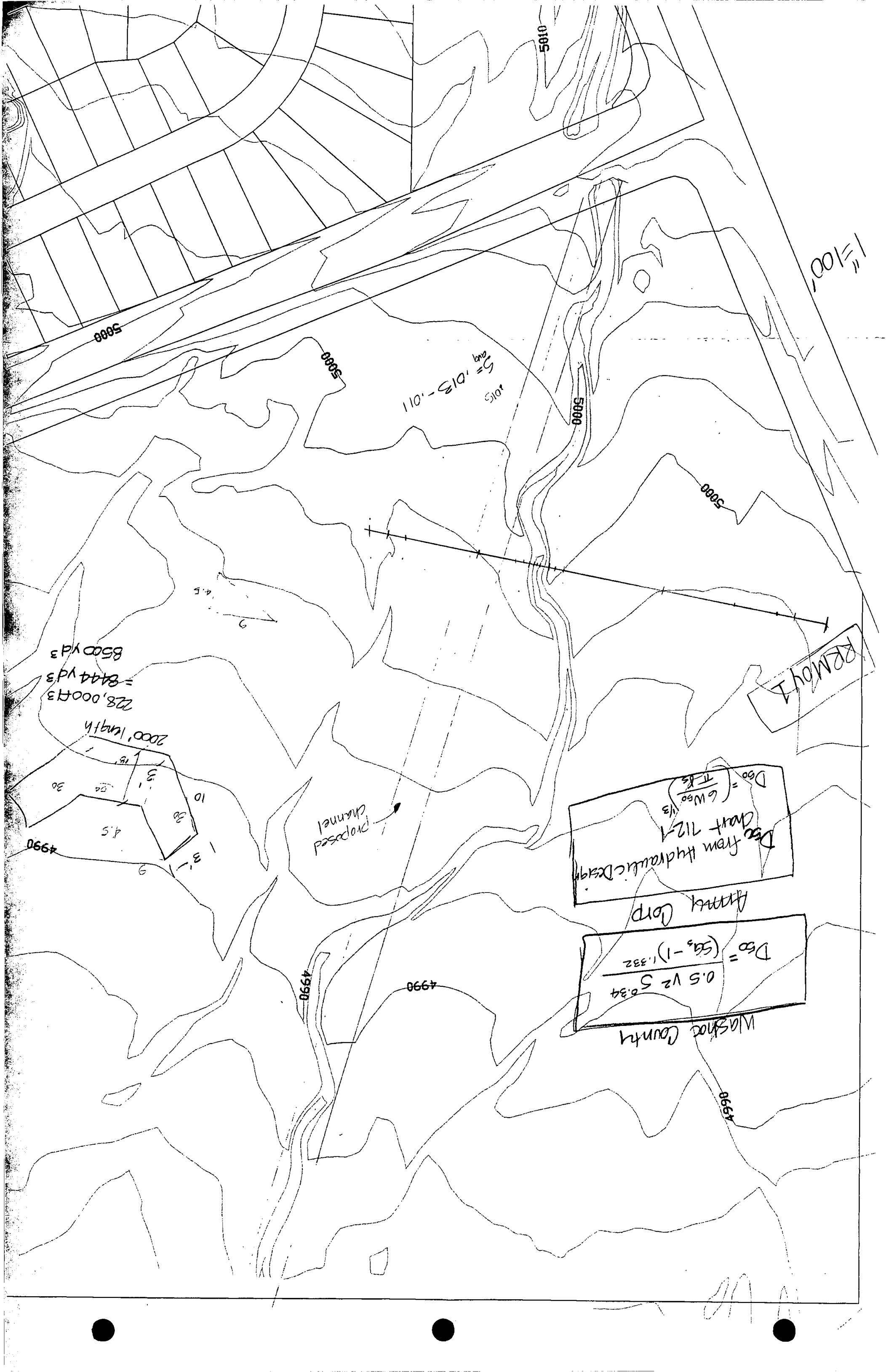
$12,705 \text{ ft}^3$   
 $470.6 \text{ yd}^3$   
 $2310 \text{ ft}^2$   
 $236.7 \text{ yd}^2$

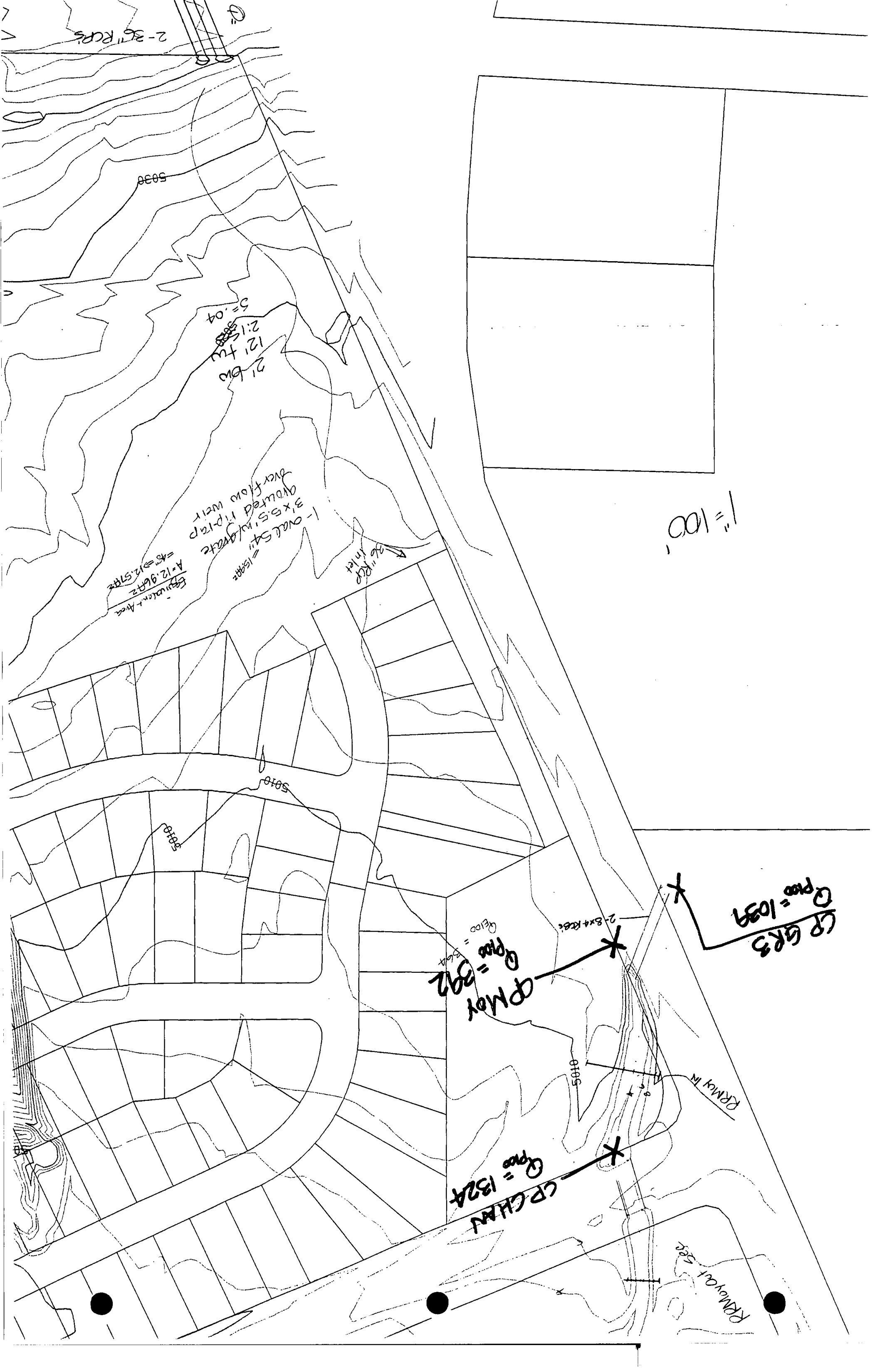
Proposed  $12' \times 4' \times 102'$

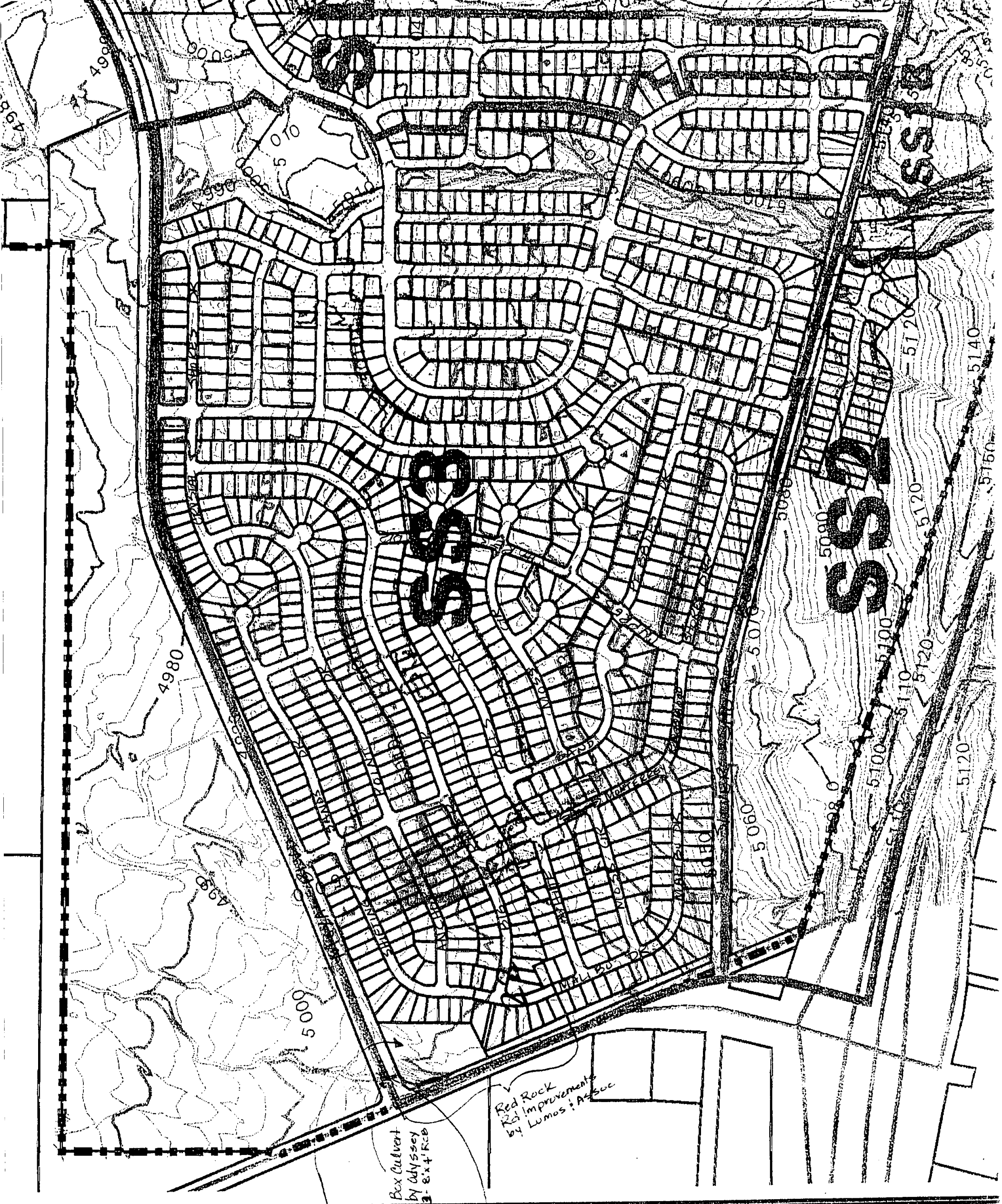
$6.5'$  deep  
 $12.0'$  wide

Existing  $2 \times 8 \times 4'$  RCB's  
 $L = 102'$

$12,265.5 \text{ ft}^3$   
 $455 \text{ yd}^3$  Ex!  
 Embank  
 $286 \text{ SY} = 300$   
 $1" = 200'$







Future Improvement  
Site - Comment  
on necessary  
improvements

Need to upgrade  
this structure



STANTEC CONSULTING INC.  
950 Industrial Way  
Sparks, Nevada 89431  
Tel: (775) 358-6931 Fax: (775) 358-6954

JOB NO. \_\_\_\_\_

**Stantec**

SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT Red Rock at Moya Improvements

DATE \_\_\_\_\_

SUBJECT \_\_\_\_\_

DESIGNED \_\_\_\_\_

CHECKED \_\_\_\_\_

- Upgrade culverts under Moya and under Red Rock
- Widen channel between X channel has sufficient capacity
- Require d.s. improvements w/ future development

- Box Culverts under Red Rock Road

Construct 1 add'l 12' x 4' RCB, L = 102'

- Box Culverts under Moya Blvd

Construct add'l 2 - 8' x 4' RCB's and 1 - 4' x 4' RCB

- Proposed Channel D.S. of Moya Blvd. Culverts

18' BW, 2:1 SS, gunnite lined channel approx 2000'  
to Silver Lake or rip-rap lined 18" Riprap



STANTEC CONSULTING INC.  
950 Industrial Way  
Sparks, Nevada 89431  
Tel: (775) 358-6931 Fax: (775) 358-6954

Stantec

JOB NO. 80100208

SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT Proposed Culvert under Moya near Red Rock DATE 3/6/00  
SUBJECT \_\_\_\_\_ DESIGNED (TIX) CHECKED \_\_\_\_\_

3- 8'x4' RCB's under Moya Blvd at Red Rock Rd Channel

3- 8'x4' RCB's

L = 63'

S = 0.01

h = 5.5'

← assumed inlet control

Max Capacity  $\approx 750$  cfs  $\ll Q_{Existing} = 1249$  cfs

Proposed  $Q = 1324$

Existing  $Q = 1249$

Proposed  $Q = 1324$

Add 2- 8'x4' RCB's and 1- 42" RCP or 4x4 RCB

Red Rock Rd Channel Existing Conditions Capacity

• Channel designed for 349 cfs

• Currently

|           | Existing | Proposed |
|-----------|----------|----------|
| $Q_5$     | 226 cfs  | 284 cfs  |
| $Q_{100}$ | 1249 cfs | 1324 cfs |
| $Q_5$     |          |          |
| $Q_{100}$ | 364 cfs  | 392 cfs  |

Downstream

Upstream

Field Meas

Gunnite Channel

6' deep 2:1 ss

10' bw straight

uniform to

Moya

2- 8'x4' RCB's under Red Rock Rd from GC3

2- 8'x4' RCB's

L = 102'

S = 0.01

h = 6.7'

Max Capacity  $\approx 600$  cfs

Proposed  $Q_{100} = 1039$  cfs

1- 54" Oval RCP w/ grate and grouted lip rap overflow struct  
Upstream Natural Channel Along Red Rock 2' bw 12' tw 2:1 ss  
2- 36" RCP's under Silver Lake (Near Red Rock)

General Channel Capacity - OK

Need Add'l Improvements for Structure under Moya Blvd  
at Red Rock Rd.

BOX CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

March 13, 2000  
Moya Blvd at Red Rock Road  
5 - 8' x 4' RCB's Proposed 2  
801 00208

=====

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Span (Width of Opening) (feet).....           | 8.00   |
| Culvert Rise (Height of Opening) (feet).....          | 4.00   |
| FHWA Chart Number (8,9,10,11,12 or 13).....           | 8      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 3      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 63.0   |
| Culvert Slope (feet per foot).....                    | 0.0100 |

=====

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater<br>Inlet Control<br>Depth (ft) | Normal<br>Outlet Control<br>Depth (ft) | Critical<br>Depth (ft) | Normal<br>Depth (ft) | Critical<br>Depth at<br>Outlet (ft) | Outlet<br>Velocity<br>(fps) |
|--------------------|-------------------------|------------------------------------------|----------------------------------------|------------------------|----------------------|-------------------------------------|-----------------------------|
| 50.0               | 4.00                    | 1.80                                     | 3.43                                   | 0.75                   | 1.07                 | 4.00                                | 1.56                        |
| 100.0              | 4.00                    | 2.88                                     | 3.63                                   | 1.17                   | 1.69                 | 4.00                                | 3.13                        |
| 150.0              | 4.00                    | 3.79                                     | 3.95                                   | 1.53                   | 2.22                 | 4.00                                | 4.69                        |
| 200.0              | 4.00                    | 4.60                                     | 4.41                                   | 1.86                   | 2.69                 | 1.86                                | 13.42                       |
| 250.0              | 4.00                    | 5.86                                     | 4.99                                   | 2.18                   | 3.12                 | 2.18                                | 14.36                       |
| 300.0              | 4.00                    | 7.00                                     | 5.70                                   | 2.47                   | 3.52                 | 2.47                                | 15.16                       |

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BOX CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

March 6, 2000  
Moya at Red Rock  
Proposed 4' x 4' RCB  
8010 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Span (Width of Opening) (feet).....           | 4.00   |
| Culvert Rise (Height of Opening) (feet).....          | 4.00   |
| FHWA Chart Number (8,9,10,11,12 or 13).....           | 8      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 63.0   |
| Culvert Slope (feet per foot).....                    | 0.0100 |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater Inlet<br>Depth (ft) | Headwater Outlet<br>Control | Normal Depth<br>(ft) | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|-------------------------------|-----------------------------|----------------------|------------------------|-------------------------|--------------------------|
| 10.0               | 4.00                    | 0.90                          | 3.38                        | 0.43                 | 0.58                   | 4.00                    | 0.63                     |
| 20.0               | 4.00                    | 1.44                          | 3.41                        | 0.68                 | 0.92                   | 4.00                    | 1.25                     |
| 30.0               | 4.00                    | 1.90                          | 3.47                        | 0.90                 | 1.20                   | 4.00                    | 1.88                     |
| 40.0               | 4.00                    | 2.32                          | 3.55                        | 1.10                 | 1.46                   | 4.00                    | 2.50                     |
| 50.0               | 4.00                    | 2.70                          | 3.64                        | 1.29                 | 1.69                   | 4.00                    | 3.13                     |
| 60.0               | 4.00                    | 3.06                          | 3.76                        | 1.47                 | 1.91                   | 4.00                    | 3.75                     |
| 70.0               | 4.00                    | 3.41                          | 3.91                        | 1.64                 | 2.12                   | 4.00                    | 4.38                     |
| 75.0               | 4.00                    | 3.57                          | 3.99                        | 1.73                 | 2.22                   | 4.00                    | 4.69                     |
| 80.0               | 4.00                    | 3.73                          | 4.07                        | 1.81                 | 2.32                   | 4.00                    | 5.00                     |
| 90.0               | 4.00                    | 4.05                          | 4.26                        | 1.98                 | 2.51                   | 4.00                    | 5.63                     |
| 100.0              | 4.00                    | 4.36                          | 4.47                        | 2.14                 | 2.69                   | 4.00                    | 6.25                     |
| 110.0              | 4.00                    | 4.65                          | 4.70                        | 2.30                 | 2.86                   | 4.00                    | 6.88                     |

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BOX CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

March 13, 2000  
Red Rock Road at GC3  
Proposed 12' x 4' RCB  
801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Span (Width of Opening) (feet).....           | 12.00  |
| Culvert Rise (Height of Opening) (feet).....          | 4.00   |
| FHWA Chart Number (8,9,10,11,12 or 13).....           | 10     |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 102.0  |
| Culvert Slope (feet per foot).....                    | 0.0010 |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth<br>(ft) | Headwater<br>Inlet Control<br>Depth<br>(ft) | Headwater<br>Outlet Control<br>Depth<br>(ft) | Normal<br>Depth<br>(ft) | Critical<br>Depth<br>(ft) | Depth at<br>Outlet<br>(ft) | Outlet<br>Velocity<br>(fps) |
|--------------------|----------------------------|---------------------------------------------|----------------------------------------------|-------------------------|---------------------------|----------------------------|-----------------------------|
| 150.0              | 4.00                       | 2.77                                        | 4.17                                         | 2.41                    | 1.69                      | 4.00                       | 3.13                        |
| 200.0              | 4.00                       | 3.36                                        | 4.38                                         | 2.93                    | 2.05                      | 4.00                       | 4.17                        |
| 250.0              | 4.00                       | 3.90                                        | 4.65                                         | 3.43                    | 2.38                      | 4.00                       | 5.21                        |
| 300.0              | 4.00                       | 4.40                                        | 4.98                                         | 3.90                    | 2.69                      | 4.00                       | 6.25                        |
| 325.0              | 4.00                       | 4.65                                        | 5.17                                         | 4.00                    | 2.83                      | 4.00                       | 6.77                        |
| 350.0              | 4.00                       | 4.99                                        | 5.38                                         | 4.00                    | 2.98                      | 4.00                       | 7.29                        |
| 375.0              | 4.00                       | 5.41                                        | 5.60                                         | 4.00                    | 3.12                      | 4.00                       | 7.81                        |
| 400.0              | 4.00                       | 5.76                                        | 5.83                                         | 4.00                    | 3.26                      | 4.00                       | 8.33                        |
| 425.0              | 4.00                       | 6.10                                        | 6.08                                         | 4.00                    | 3.39                      | 4.00                       | 8.85                        |
| 450.0              | 4.00                       | 6.46                                        | 6.34                                         | 4.00                    | 3.52                      | 4.00                       | 9.38                        |
| 475.0              | 4.00                       | 6.83                                        | 6.62                                         | 4.00                    | 3.65                      | 4.00                       | 9.90                        |
| 500.0              | 4.00                       | 7.23                                        | 6.92                                         | 4.00                    | 3.78                      | 4.00                       | 10.42                       |

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TRAPEZOIDAL CHANNEL ANALYSIS  
RATING CURVE COMPUTATION

March 13, 2000  
Moya Blvd at Red Rock Road  
Proposed channel section downstream of Moya Blvd  
801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                              | VALUE  |
|----------------------------------------------------------|--------|
| Channel Bottom Slope (feet per foot).....                | 0.0120 |
| Manning's Roughness Coefficient (n-value).....           | 0.0200 |
| Channel Side Slope - Left Side (horizontal/vertical).... | 2.00   |
| Channel Side Slope - Right Side (horizontal/vertical)... | 2.00   |
| Channel Bottom Width (feet).....                         | 18.0   |

PROGRAM RESULTS:

| Depth<br>(ft) | Flow Rate<br>(cfs) | Velocity<br>(fps) | Froude Number | Velocity Head(ft) | Energy Head(ft) | Flow Area<br>(sq ft) | Top Width<br>(ft) |
|---------------|--------------------|-------------------|---------------|-------------------|-----------------|----------------------|-------------------|
| 1.0           | 150.6              | 7.53              | 1.392         | 0.881             | 1.881           | 20.0                 | 22.0              |
| 2.0           | 496.6              | 11.29             | 1.529         | 1.978             | 3.978           | 44.0                 | 26.0              |
| 3.0           | 1018.7             | 14.15             | 1.609         | 3.108             | 6.108           | 72.0                 | 30.0              |
| 3.1           | 1080.6             | 14.40             | 1.616         | 3.222             | 6.322           | 75.0                 | 30.4              |
| 3.2           | 1144.4             | 14.66             | 1.622         | 3.336             | 6.536           | 78.1                 | 30.8              |
| 3.3           | 1210.0             | 14.91             | 1.628         | 3.450             | 6.750           | 81.2                 | 31.2              |
| 3.4           | 1277.4             | 15.15             | 1.634         | 3.564             | 6.964           | 84.3                 | 31.6              |
| 3.5           | 1346.6             | 15.39             | 1.640         | 3.678             | 7.178           | 87.5                 | 32.0              |
| 3.6           | 1417.7             | 15.63             | 1.646         | 3.792             | 7.392           | 90.7                 | 32.4              |
| 3.7           | 1490.6             | 15.86             | 1.651         | 3.906             | 7.606           | 94.0                 | 32.8              |
| 3.8           | 1565.4             | 16.09             | 1.657         | 4.021             | 7.821           | 97.3                 | 33.2              |
| 3.9           | 1642.0             | 16.32             | 1.662         | 4.135             | 8.035           | 100.6                | 33.6              |
| 4.0           | 1720.5             | 16.54             | 1.667         | 4.250             | 8.250           | 104.0                | 34.0              |

$D = 3.45'$

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.3 (c) 1986  
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BOX CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

February 29, 2000

Moya Blvd at Red Rock Rd.

3 ~~2~~-8'x4' RCB's Existing Capacity  
801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Span (Width of Opening) (feet).....           | 8.00   |
| Culvert Rise (Height of Opening) (feet).....          | 4.00   |
| FHWA Chart Number (8,9,10,11,12 or 13).....           | 8      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 3      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 63.0   |
| Culvert Slope (feet per foot).....                    | 0.0100 |

PROGRAM RESULTS:

| Flow Rate (cfs) | Tailwater Depth (ft) | Headwater Depth Inlet Control (ft) | Headwater Depth Outlet Control (ft) | Normal Depth (ft) | Critical Depth (ft) | Depth at Outlet (ft) | Outlet Velocity (fps) |
|-----------------|----------------------|------------------------------------|-------------------------------------|-------------------|---------------------|----------------------|-----------------------|
| 50.0            | 4.00                 | 1.80                               | 3.43                                | 0.75              | 1.07                | 4.00                 | 1.56                  |
| 100.0           | 4.00                 | 2.88                               | 3.63                                | 1.17              | 1.69                | 4.00                 | 3.13                  |
| 150.0           | 4.00                 | 3.79                               | 3.95                                | 1.53              | 2.22                | 4.00                 | 4.69                  |
| 200.0           | 4.00                 | 4.60                               | 4.41                                | 1.86              | 2.69                | 1.86                 | 13.42                 |
| 250.0           | 4.00                 | 5.86                               | 4.99                                | 2.18              | 3.12                | 2.18                 | 14.36                 |
| 300.0           | 4.00                 | 7.00                               | 5.70                                | 2.47              | 3.52                | 2.47                 | 15.16                 |

X 3 = 750 cfs  
X 5 = 1250 cfs

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BOX CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

March 7, 2000  
Red Rock Road at GC3  
2 - 4' x 8' RCB's Existing  
801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Span (Width of Opening) (feet).....           | 8.00   |
| Culvert Rise (Height of Opening) (feet).....          | 4.00   |
| FHWA Chart Number (8,9,10,11,12 or 13).....           | 10     |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 102.0  |
| Culvert Slope (feet per foot).....                    | 0.0100 |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater<br>Inlet Control<br>Depth (ft) | Headwater<br>Outlet Control<br>Depth (ft) | Normal<br>Depth (ft) | Critical<br>Depth (ft) | Depth at<br>Outlet (ft) | Outlet<br>Velocity<br>(fps) |
|--------------------|-------------------------|------------------------------------------|-------------------------------------------|----------------------|------------------------|-------------------------|-----------------------------|
| 100.0              | 4.00                    | 2.77                                     | 3.26                                      | 1.17                 | 1.69                   | 4.00                    | 3.13                        |
| 125.0              | 4.00                    | 3.22                                     | 3.42                                      | 1.36                 | 1.96                   | 4.00                    | 3.91                        |
| 150.0              | 4.00                    | 3.64                                     | 3.61                                      | 1.53                 | 2.22                   | 1.53                    | 12.24                       |
| 175.0              | 4.00                    | 4.03                                     | 3.83                                      | 1.70                 | 2.46                   | 1.70                    | 12.86                       |
| 200.0              | 4.00                    | 4.40                                     | 4.10                                      | 1.86                 | 2.69                   | 1.86                    | 13.42                       |
| 225.0              | 4.00                    | 4.78                                     | 4.39                                      | 2.02                 | 2.91                   | 2.02                    | 13.91                       |
| 250.0              | 4.00                    | 5.41                                     | 4.72                                      | 2.18                 | 3.12                   | 2.18                    | 14.36                       |
| 275.0              | 4.00                    | 5.93                                     | 5.09                                      | 2.33                 | 3.32                   | 2.33                    | 14.78                       |
| 300.0              | 4.00                    | 6.46                                     | 5.49                                      | 2.47                 | 3.52                   | 2.47                    | 15.16                       |
| 325.0              | 4.00                    | 7.03                                     | 5.93                                      | 2.62                 | 3.71                   | 2.62                    | 15.52                       |
| 350.0              | 4.00                    | 7.65                                     | 6.40                                      | 2.76                 | 3.90                   | 2.76                    | 15.85                       |
| 375.0              | 4.00                    | 8.31                                     | 6.91                                      | 2.90                 | 4.00                   | 2.90                    | 16.16                       |
| 400.0              | 4.00                    | 9.02                                     | 7.45                                      | 3.04                 | 4.00                   | 3.04                    | 16.45                       |

x 2 = 600 cfs

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Table  
Rating Table for Trapezoidal Channel

| Project Description |                                     |
|---------------------|-------------------------------------|
| Project File        | untitled                            |
| Worksheet           | Silver Shores/Red Rock Road Channel |
| Flow Element        | Trapezoidal Channel                 |
| Method              | Manning's Formula                   |
| Solve For           | Channel Depth                       |

| Constant Data        |          |       |
|----------------------|----------|-------|
| Mannings Coefficient | 0.035    | A     |
| Channel Slope        | 0.011300 | ft/ft |
| Left Side Slope      | 2.00     | H : V |
| Right Side Slope     | 2.00     | H : V |
| Bottom Width         | 12.00    | ft    |

--- could drop  
for gumbel

| Input Data |         |         |                          |
|------------|---------|---------|--------------------------|
|            | Minimum | Maximum | Increment                |
| Discharge  | 220.00  | 1340.00 | 20.00 ft <sup>3</sup> /s |

### Rating Table

| Discharge<br>(ft <sup>3</sup> /s) | Depth<br>(ft) |
|-----------------------------------|---------------|
|-----------------------------------|---------------|

|        |      |          |                |
|--------|------|----------|----------------|
| 220.00 | 2.16 | 226 cfs  | 5yr (E) D.S.   |
| 240.00 | 2.27 | 2.19'    |                |
| 260.00 | 2.37 |          |                |
| 280.00 | 2.47 | 284 cfs  | 5yr (P) D.S.   |
| 300.00 | 2.56 | 2.48'    |                |
| 320.00 | 2.65 |          |                |
| 340.00 | 2.74 | 364 cfs  | 100yr (E) U.S. |
| 360.00 | 2.82 | D ≈ 2.8' |                |
| 380.00 | 2.91 | 392 cfs  | 100yr (P) U.S. |
| 400.00 | 2.99 | D ≈ 3'   |                |
| 420.00 | 3.07 |          |                |
| 440.00 | 3.14 |          |                |
| 460.00 | 3.22 |          |                |
| 480.00 | 3.29 |          |                |
| 500.00 | 3.37 |          |                |
| 520.00 | 3.44 |          |                |
| 540.00 | 3.50 |          |                |
| 560.00 | 3.57 |          |                |
| 580.00 | 3.64 |          |                |
| 600.00 | 3.70 |          |                |
| 620.00 | 3.77 |          |                |
| 640.00 | 3.83 |          |                |
| 660.00 | 3.89 |          |                |

Table  
Rating Table for Trapezoidal Channel

| Rating Table                      |               |
|-----------------------------------|---------------|
| Discharge<br>(ft <sup>3</sup> /s) | Depth<br>(ft) |
| 680.00                            | 3.95          |
| 700.00                            | 4.01          |
| 720.00                            | 4.07          |
| 740.00                            | 4.13          |
| 760.00                            | 4.19          |
| 780.00                            | 4.24          |
| 800.00                            | 4.30          |
| 820.00                            | 4.35          |
| 840.00                            | 4.41          |
| 860.00                            | 4.46          |
| 880.00                            | 4.51          |
| 900.00                            | 4.56          |
| 920.00                            | 4.61          |
| 940.00                            | 4.67          |
| 960.00                            | 4.72          |
| 980.00                            | 4.76          |
| 1000.00                           | 4.81          |
| 1020.00                           | 4.86          |
| 1040.00                           | 4.91          |
| 1060.00                           | 4.96          |
| 1080.00                           | 5.00          |
| 1100.00                           | 5.05          |
| 1120.00                           | 5.10          |
| 1140.00                           | 5.14          |
| 1160.00                           | 5.19          |
| 1180.00                           | 5.23          |
| 1200.00                           | 5.27          |
| 1220.00                           | 5.32          |
| 1240.00                           | 5.36          |
| 1260.00                           | 5.40          |
| 1280.00                           | 5.45          |
| 1300.00                           | 5.49          |
| 1320.00                           | 5.53          |
| 1340.00                           | 5.57          |

1249 cfs 100yr (E) D.S.  
5.38'

1324 cfs 100yr (P) D.S.  
5.54'

**Worksheet for Red Rock Road Channel**  
**Worksheet for Trapezoidal Channel**

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**Project Description**

---

|              |                                     |
|--------------|-------------------------------------|
| Project File | untitled                            |
| Worksheet    | Silver Shores/Red Rock Road Channel |
| Flow Element | Trapezoidal Channel                 |
| Method       | Manning's Formula                   |
| Solve For    | Channel Depth                       |

---

---

**Input Data**

---

|                      |                            |
|----------------------|----------------------------|
| Mannings Coefficient | 0.035                      |
| Channel Slope        | 0.011300 ft/ft             |
| Left Side Slope      | 2.00 H : V                 |
| Right Side Slope     | 2.00 H : V                 |
| Bottom Width         | 12.00 ft                   |
| Discharge            | 1249.00 ft <sup>3</sup> /s |

---

---

**Results**

---

|                  |          |                 |
|------------------|----------|-----------------|
| Depth            | 5.38     | ft              |
| Flow Area        | 122.49   | ft <sup>2</sup> |
| Wetted Perimeter | 36.07    | ft              |
| Top Width        | 33.52    | ft              |
| Critical Depth   | 5.21     | ft              |
| Critical Slope   | 0.012877 | ft/ft           |
| Velocity         | 10.20    | ft/s            |
| Velocity Head    | 1.62     | ft              |
| Specific Energy  | 7.00     | ft              |
| Froude Number    | 0.94     |                 |

---

Flow is subcritical.

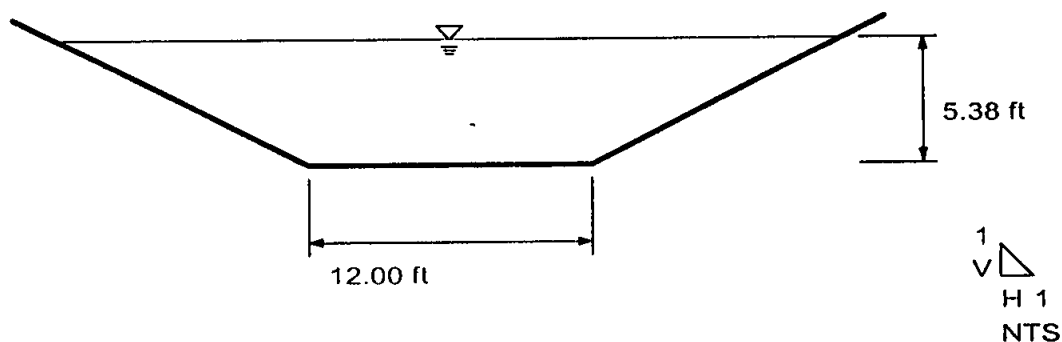
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# **Cross Section at Red Rock Channel** **Cross Section for Trapezoidal Channel**

| Project Description |                                     |
|---------------------|-------------------------------------|
| Project File        | untitled                            |
| Worksheet           | Silver Shores/Red Rock Road Channel |
| Flow Element        | Trapezoidal Channel                 |
| Method              | Manning's Formula                   |
| Solve For           | Channel Depth                       |

| Section Data         |                            |
|----------------------|----------------------------|
| Mannings Coefficient | 0.035                      |
| Channel Slope        | 0.011300 ft/ft             |
| Depth                | 5.38 ft                    |
| Left Side Slope      | 2.00 H : V                 |
| Right Side Slope     | 2.00 H : V                 |
| Bottom Width         | 12.00 ft                   |
| Discharge            | 1249.00 ft <sup>3</sup> /s |



**Worksheet for Red Rock Road Channel**  
**Worksheet for Trapezoidal Channel**

---

**Project Description**

---

|              |                                     |
|--------------|-------------------------------------|
| Project File | untitled                            |
| Worksheet    | Silver Shores/Red Rock Road Channel |
| Flow Element | Trapezoidal Channel                 |
| Method       | Manning's Formula                   |
| Solve For    | Channel Depth                       |

---

---

**Input Data**

---

|                      |          |                    |
|----------------------|----------|--------------------|
| Mannings Coefficient | 0.035    |                    |
| Channel Slope        | 0.011300 | ft/ft              |
| Left Side Slope      | 2.00     | H : V              |
| Right Side Slope     | 2.00     | H : V              |
| Bottom Width         | 12.00    | ft                 |
| Discharge            | 1324.00  | ft <sup>3</sup> /s |

---

---

**Results**

---

|                  |          |                 |
|------------------|----------|-----------------|
| Depth            | 5.54     | ft              |
| Flow Area        | 127.84   | ft <sup>2</sup> |
| Wetted Perimeter | 36.77    | ft              |
| Top Width        | 34.16    | ft              |
| Critical Depth   | 5.37     | ft              |
| Critical Slope   | 0.012780 | ft/ft           |
| Velocity         | 10.36    | ft/s            |
| Velocity Head    | 1.67     | ft              |
| Specific Energy  | 7.21     | ft              |
| Froude Number    | 0.94     |                 |

---

Flow is subcritical.

---

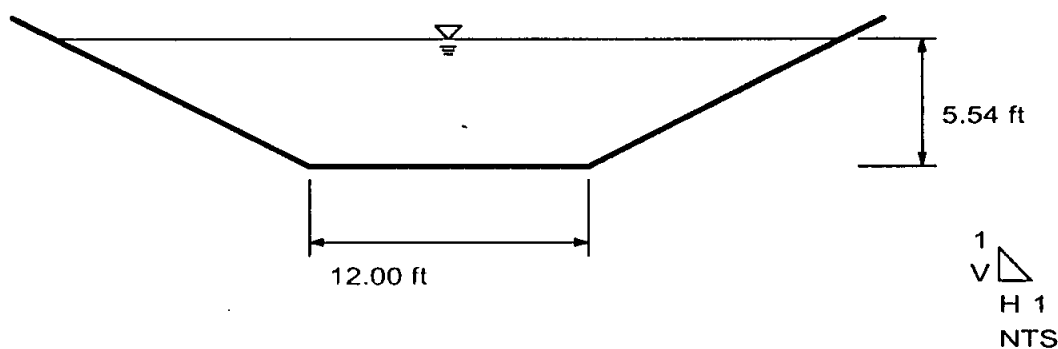
# **Cross Section at Red Rock Channel** **Cross Section for Trapezoidal Channel**

## **Project Description**

|              |                                     |
|--------------|-------------------------------------|
| Project File | untitled                            |
| Worksheet    | Silver Shores/Red Rock Road Channel |
| Flow Element | Trapezoidal Channel                 |
| Method       | Manning's Formula                   |
| Solve For    | Channel Depth                       |

## **Section Data**

|                      |                            |
|----------------------|----------------------------|
| Mannings Coefficient | 0.035                      |
| Channel Slope        | 0.011300 ft/ft             |
| Depth                | 5.54 ft                    |
| Left Side Slope      | 2.00 H : V                 |
| Right Side Slope     | 2.00 H : V                 |
| Bottom Width         | 12.00 ft                   |
| Discharge            | 1324.00 ft <sup>3</sup> /s |



Project \_\_\_\_\_  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CROSS SECTION PARAMETERS:

FILENAME: RRMoyIn.SEC

No. of Cross Section Points: 7 Bed Slope: 0.01400 Max Elev.: 5011.50  
Bank Stations.....Left: 1000.0 Right.....: 1093.0 Min Elev.: 5004.30  
Encroachment Stations..Left: Right.....:  
Manning-n Values.....LOB: 0.030 CHANNEL...: 0.030 ROB.....: 0.030

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta.    | No. | Elev.   | Sta.    | No. | Elev.   | Sta.    |
|-----|---------|---------|-----|---------|---------|-----|---------|---------|
| 1)  | 5010.20 | 1000.00 | 2)  | 5010.00 | 1007.00 | 3)  | 5006.00 | 1020.00 |
| 4)  | 5004.30 | 1032.00 | 5)  | 5006.00 | 1047.00 | 6)  | 5010.00 | 1058.00 |
| 7)  | 5011.50 | 1093.00 |     |         |         |     |         |         |

COMPUTED PARAMETERS:

| SEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|---------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 5005.00 | 11.3   | 2.9    | 0.86 | 0.030 | 1.0 | 11.1  | 3.9    | 11.2  | 5004.95 |          |
| 5006.00 | 120.1  | 5.2    | 1.00 | 0.030 | 1.0 | 27.0  | 23.0   | 27.2  | 5006.00 |          |
| 5007.00 | 420.8  | 7.9    | 1.11 | 0.030 | 1.0 | 33.0  | 53.0   | 33.5  | 5007.13 |          |
| 5008.00 | 890.2  | 10.0   | 1.17 | 0.030 | 1.0 | 39.0  | 89.0   | 39.9  | 5008.30 |          |
| 5009.00 | 1537.3 | 11.7   | 1.21 | 0.030 | 1.0 | 45.0  | 131.0  | 46.2  | 5009.48 |          |
| 5010.00 | 2374.8 | 13.3   | 1.25 | 0.030 | 1.0 | 51.0  | 179.0  | 52.5  | 5010.90 |          |

NOTES:

Project \_\_\_\_\_  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CROSS SECTION PARAMETERS:

FILENAME: RRMoyOut.SEC

No. of Cross Section Points: 8 Bed Slope: 0.01100 Max Elev.: 5006.30  
Bank Stations.....Left: 1000.0 Right.....: 1040.0 Min Elev.: 5002.50  
Encroachment Stations..Left: Right.....:  
Manning-n Values.....LOB: 0.035 CHANNEL...: 0.035 ROB.....: 0.035

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta.    | No. | Elev.   | Sta.    | No. | Elev.   | Sta.    |
|-----|---------|---------|-----|---------|---------|-----|---------|---------|
| 1)  | 5006.30 | 1000.00 | 2)  | 5006.00 | 1008.00 | 3)  | 5004.00 | 1013.00 |
| 4)  | 5002.50 | 1020.00 | 5)  | 5002.50 | 1024.00 | 6)  | 5004.00 | 1030.00 |
| 7)  | 5006.00 | 1035.00 | 8)  | 5006.30 | 1040.00 |     |         |         |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 3.00     | 7.0    | 2.3    | 0.66 | 0.035 | 1.0 | 8.3   | 3.1    | 8.4   | 5002.89 |          |
| 5004.00  | 65.8   | 4.2    | 0.76 | 0.035 | 1.0 | 17.0  | 15.8   | 17.3  | 5003.80 |          |
| 5005.00  | 210.3  | 6.0    | 0.83 | 0.035 | 1.0 | 22.0  | 35.3   | 22.7  | 5004.78 |          |
| 5006.00  | 439.8  | 7.4    | 0.87 | 0.035 | 1.0 | 27.0  | 59.8   | 28.1  | 5005.77 |          |
| 5006.30  | 442.2  | 6.3    | 0.85 | 0.035 | 1.0 | 40.0  | 69.8   | 41.1  | 5005.76 |          |

NOTES:

Project \_\_\_\_\_  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CROSS SECTION PARAMETERS:

FILENAME: RRMoy 1.SEC

No. of Cross Section Points: 18 Bed Slope: 0.00500 Max Elev.: 5000.20  
Bank Stations.....Left: 1000.0 Right.....: 1552.0 Min Elev.: 4995.90  
Encroachment Stations..Left: Right.....:  
Manning-n Values.....LOB: 0.030 CHANNEL...: 0.030 ROB.....: 0.030

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta.    | No. | Elev.   | Sta.    | No. | Elev.   | Sta.    |
|-----|---------|---------|-----|---------|---------|-----|---------|---------|
| 1)  | 4999.00 | 1000.00 | 2)  | 4998.00 | 1040.00 | 3)  | 4997.70 | 1052.00 |
| 4)  | 4997.80 | 1116.00 | 5)  | 4998.00 | 1205.00 | 6)  | 5000.00 | 1330.00 |
| 7)  | 5000.20 | 1341.00 | 8)  | 5000.00 | 1350.00 | 9)  | 4996.00 | 1360.00 |
| 10) | 4995.90 | 1365.00 | 11) | 4996.00 | 1370.00 | 12) | 4998.00 | 1375.00 |
| 13) | 4999.60 | 1380.00 | 14) | 4999.60 | 1390.00 | 15) | 4998.00 | 1440.00 |
| 16) | 4998.80 | 1518.00 | 17) | 4997.40 | 1530.00 | 18) | 4998.00 | 1552.00 |

ROUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | nc  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 4996.00  | 0.2    | 0.5    | 0.37 | 0.030 | 1.0 | 10.0  | 0.5    | 10.0  | 4995.97 |          |
| 4997.00  | 40.7   | 3.1    | 0.59 | 0.030 | 1.0 | 15.0  | 13.0   | 15.4  | 4996.70 |          |
| 4998.00  | 104.1  | 1.6    | 0.51 | 0.030 | 1.0 | 212.1 | 65.4   | 213.0 | 4997.29 |          |
| 4998.50  | 504.5  | 2.5    | 0.57 | 0.030 | 1.0 | 334.9 | 202.1  | 335.9 | 4998.26 |          |
| 4999.00  | 1309.1 | 3.3    | 0.61 | 0.030 | 1.0 | 436.4 | 398.1  | 437.6 | 4998.68 |          |
| 4999.10  | 1536.8 | 3.5    | 0.62 | 0.030 | 1.0 | 446.3 | 442.3  | 447.6 | 4998.78 |          |

NOTES:

PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

March 7, 2000  
Red Rock Channel Structures  
Existing 54" Oval RCP  
801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Diameter (feet).....                          | 4.00   |
| FHWA Chart Number (1,2 or 3).....                     | 1      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 30.0   |
| Culvert Slope (feet per foot).....                    | 0.0500 |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater (ft)<br>Inlet Control | Normal Depth<br>Outlet Control | Critical Depth<br>(ft) | Depth at<br>(ft) | Outlet Velocity<br>(ft) | Outlet<br>(fps) |
|--------------------|-------------------------|---------------------------------|--------------------------------|------------------------|------------------|-------------------------|-----------------|
| 50.0               | 4.00                    | 3.12                            | 2.90                           | 1.07                   | 2.12             | 1.07                    | 18.54           |
| 100.0              | 4.00                    | 5.21                            | 4.12                           | 1.53                   | 3.03             | 1.53                    | 22.58           |
| 150.0              | 4.00                    | 8.35                            | 6.14                           | 1.91                   | 3.60             | 1.91                    | 25.25           |
| 200.0              | 4.00                    | 12.76                           | 8.98                           | 2.29                   | 3.85             | 2.29                    | 26.93           |

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TRAPEZOIDAL CHANNEL ANALYSIS  
RATING CURVE COMPUTATION

March 7, 2000  
Red Rock Natural Channel  
Existing Conditions  
801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                              | VALUE  |
|----------------------------------------------------------|--------|
| Channel Bottom Slope (feet per foot).....                | 0.0300 |
| Manning's Roughness Coefficient (n-value).....           | 0.0350 |
| Channel Side Slope - Left Side (horizontal/vertical).... | 2.00   |
| Channel Side Slope - Right Side (horizontal/vertical)... | 2.00   |
| Channel Bottom Width (feet).....                         | 2.0    |

PROGRAM RESULTS:

| Depth<br>(ft) | Flow Rate<br>(cfs) | Velocity<br>(fps) | Froude Number | Velocity Head(ft) | Energy Head(ft) | Flow Area<br>(sq ft) | Top Width<br>(ft) |
|---------------|--------------------|-------------------|---------------|-------------------|-----------------|----------------------|-------------------|
| 1.0           | 21.3               | 5.34              | 1.152         | 0.442             | 1.442           | 4.0                  | 6.0               |
| 1.5           | 49.9               | 6.66              | 1.212         | 0.688             | 2.188           | 7.5                  | 8.0               |
| 2.0           | 93.8               | 7.82              | 1.258         | 0.949             | 2.949           | 12.0                 | 10.0              |
| 2.5           | 155.5              | 8.88              | 1.296         | 1.225             | 3.725           | 17.5                 | 12.0              |
| 3.0           | 237.1              | 9.88              | 1.330         | 1.515             | 4.515           | 24.0                 | 14.0              |
| 3.5           | 340.8              | 10.82             | 1.359         | 1.818             | 5.318           | 31.5                 | 16.0              |
| 4.0           | 468.7              | 11.72             | 1.385         | 2.132             | 6.132           | 40.0                 | 18.0              |
| 4.5           | 622.7              | 12.58             | 1.409         | 2.457             | 6.957           | 49.5                 | 20.0              |
| 5.0           | 804.7              | 13.41             | 1.431         | 2.793             | 7.793           | 60.0                 | 22.0              |
| 5.5           | 1016.6             | 14.22             | 1.452         | 3.139             | 8.639           | 71.5                 | 24.0              |
| 6.0           | 1260.0             | 15.00             | 1.471         | 3.494             | 9.494           | 84.0                 | 26.0              |

3.75'  $\approx$  392 cfs

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.3 (c) 1986  
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(713) 440-3787. A manual with equations & flow chart is available.



## Drainage Master Plan for Stead, Nevada

Moya Detention Basin Improvements  
CP LEA, DETMO

### PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

| ITEM NO. | QUANTITY | UNIT | DESCRIPTION                          | UNIT COST | TOTAL COST  |
|----------|----------|------|--------------------------------------|-----------|-------------|
| 1        | 600      | SY   | REMOVE EXISTING PAVEMENT             | \$5.00    | \$3,000.00  |
| 2        | 1750     | CY   | EXCAVATION AND EMBANKMENT            | \$5.00    | \$8,750.00  |
| 3        | 600      | SY   | 6 INCH PLANTMIX BITUMINOUS PAVEMENT  | \$12.00   | \$7,200.00  |
| 4        | 600      | SY   | 6 INCH TYPE 2 CLASS B AGGREGATE BASE | \$4.00    | \$2,400.00  |
| 5        | 100      | LF   | CURB AND GUTTER                      | \$8.00    | \$800.00    |
| 6        | 450      | LF   | 30 INCH RCP                          | \$68.00   | \$30,600.00 |
| 7        | 130      | LF   | 36 INCH RCP                          | \$75.00   | \$9,750.00  |
| 8        | 2        | LS   | HEADWALL DOUBLE 30 INCH              | LS        | \$18,000.00 |
| 9        | 2        | LS   | HEADWALL DOUBLE 36 INCH              | LS        | \$20,000.00 |
| 10       | 200      | LF   | 4 INCH SOLID YELLOW LINE             | \$2.20    | \$440.00    |
| 11       | 1        | LS   | TRAFFIC CONTROL                      | LS        | \$10,000.00 |
| 12       |          |      |                                      |           | \$0.00      |
| 13       |          |      |                                      |           | \$0.00      |
| 14       |          |      |                                      |           | \$0.00      |
| 15       |          |      |                                      |           | \$0.00      |
| 16       |          |      |                                      |           | \$0.00      |
| 17       |          |      |                                      |           | \$0.00      |
| 18       |          |      |                                      |           | \$0.00      |
| 19       |          |      |                                      |           | \$0.00      |
| 20       |          |      |                                      |           | \$0.00      |
| 21       |          |      |                                      |           | \$0.00      |
| 22       |          |      |                                      |           | \$0.00      |
| 23       |          |      |                                      |           | \$0.00      |
| 24       |          |      |                                      |           | \$0.00      |

SUBTOTAL \$110,940

CONTINGENCY (15%) \$16,641

TOTAL CONSTRUCTION COST \$127,581

RIGHT-OF-WAY (0 SF) \$0

#### DESIGN SERVICES

ENGINEERING DESIGN (6%) \$8,000

HYDROLOGY (WA. CO. REQUIREMENTS) \$3,500

SURVEYING (TOPOGRAPHIC + LEGALS) \$3,500

GEOTECHNICAL \$3,500

TOTAL DESIGN SERVICES \$18,500

#### CONSTRUCTION SERVICES

SURVEYING STAKEOUT \$3,000

QUALITY CONTROL \$11,500

CONSTRUCTION ADMINISTRATION \$1,500

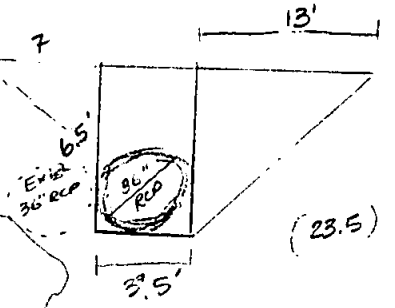
TOTAL CONSTRUCTION SERVICES \$16,000

TOTAL PROJECT COST \$162,081

BY TMM

L=130'  
1-36" RCP  
IC=4965.15 W  
IC=4964.98 OUT  
TOR=4971.6

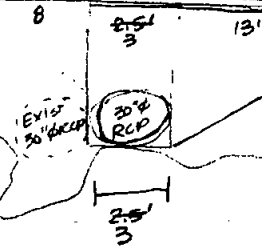
Pavement  
25' x 100' = 2500'  
277.8 yd<sup>3</sup>  
EX:EM  
65' x 130' = 8450 ft<sup>2</sup>  
313 yd<sup>3</sup>  
80' x 130' = 10,400  
385 yd<sup>3</sup>



Row for utility  
Easment  
375' x 15' = 5625 SF

L=450'  
1-30" RCP  
IC=4964.95 W  
IC=4964.14 OUT  
TOR=4971.5

D=6.55'  
Pavement  
25' x 100' = 2500'  
278 yd<sup>3</sup>  
EX:EM  
80' x 450'  
= 36,000 ft<sup>2</sup>  
1333 yd<sup>3</sup>





**Stantech**  
Consulting

# STANTECH CONSULTING INC.

Formerly SEA, Incorporated

950 Industrial Way  
Sparks, NV 89431-6092

(702) 358-6931  
Fax: 358-6954

JOB NO. 801 00208

SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT Moya Detention Basin

DATE 3/21/00

SUBJECT Proposed Improvements

DESIGNED (TM) CHECKED \_\_\_\_\_

★ 100-year event only ★

Add 1-36" RCP to Northern Outlet

Add 1-30" RCP to Southern Outlet

| Elev | Q 2-36" RCP's | Q 2-30" RCP's | Q Road | Q TOTAL |
|------|---------------|---------------|--------|---------|
| 65   | 0             | 0             | 0      | 0       |
| 66   | 0             | 0             | 0      | 0       |
| 68   | 0             | 0             | 0      | 0       |
| 70.0 | 84            | 38            | 0      | 122     |
| 70.5 | 98            | 46            | 0      | 144     |
| 71.0 | 112           | 50            | 77     | 239     |
| 71.4 | 120           | 54            | 839    | 1013    |

DETMO ELEV = 4970.52

SLWSE ELEV = 4965.01 w/det.  
= 4965.24 w/o det.

6127 ac. ft  
6323 ac. ft

★ 5-year event only ★

DETMO ELEV = 4966.80

SLWSE = 4960.59 w/det.  
= 4960.93 w/o det.

2757 ac. ft  
3011 ac. ft



**Stantech**  
Consulting

# STANTECH CONSULTING INC.

Formerly SEA, Incorporated

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Sparks, NV 89431-6092  
(702) 358-6931  
Fax: 358-6954

JOB NO. 26000208

SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT Stead Drainage Master Plan DATE 7/23/99

SUBJECT Moya Detention Basin DESIGNED JS CHECKED \_\_\_\_\_

100 - Year, 24 - hour Ponding WSEL from  
Silver Lake  $\approx 68.7' \pm$  ✓, NAVD

→ Need to recalculate the culvert discharge Rating.

Outlet ①  $\Rightarrow$  36" RCP, I.E. = 65.15' ✓  
T.W. = ( 3.7' - ) Outlet I.E. = 64.98' ✓

Outlet ②  $\Rightarrow$  30" RCP, I.E. = 64.95' ✓  
Outlet I.E. = 64.19' ✓

T.W. = ( 4.5' - )

Use Tailwater elev  $\approx$  Silver Lake 100-year  
WSEL  
 $\approx 68.7'$

★ < 100-year, 24-hour event only > ★

| Elev   | Q 36" RCP | Q 30" RCP | Q Road | Q Total |
|--------|-----------|-----------|--------|---------|
| 65 ✓   | 0 ✓       | 0 ✓       | 0 ✓    | 0 ✓     |
| 66 ✓   | 0 ✓       | 0 ✓       | 0 ✓    | 0 ✓     |
| 68 ✓   | 0 ✓       | 0 ✓       | 0 ✓    | 0 ✓     |
| 70 ✓   | 42 ✓      | 19 ✓      | 0 ✓    | 61 ✓    |
| 71 ✓   | 56 ✓      | 25 ✓      | 77 ✓   | 158 ✓   |
| 71.4 ✓ | 60 ✓      | 27 ✓      | 839 ✓  | 926 ✓   |

PIPE CULVERT ANALYSIS ✓  
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 13, 1999  
Stead Master Plan ✓  
Moya Detention Basin ✓  
Northern Outlet Culvert 36" rcp ✓

\* apply for only 100-year  
storm.

Invert = 65.15'

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 3.00 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 1 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 130.0 ✓  |
| Culvert Slope (feet per foot).....                    | 0.0013 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater (ft)<br>Inlet Control | Headwater (ft)<br>Outlet Control | Normal Depth<br>(ft) | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|---------------------------------|----------------------------------|----------------------|------------------------|-------------------------|--------------------------|
| 5.0                | 3.70                    | 0.95                            | 3.55                             | 0.93                 | 0.70                   | 3.00                    | 0.71                     |
| 7.0                | 3.70                    | 1.14                            | 3.57                             | 1.11                 | 0.83                   | 3.00                    | 0.99                     |
| 10.0               | 3.70                    | 1.38                            | 3.61                             | 1.35                 | 1.00                   | 3.00                    | 1.41                     |
| 12.0               | 3.70                    | 1.53                            | 3.64                             | 1.50                 | 1.10                   | 3.00                    | 1.70                     |
| 15.0               | 3.70                    | 1.74                            | 3.70                             | 1.71                 | 1.23                   | 3.00                    | 2.12                     |
| 18.0               | 3.70                    | 1.94                            | 3.78                             | 1.94                 | 1.36                   | 3.00                    | 2.55                     |
| 20.0               | 3.70                    | 2.07                            | 3.83                             | 2.09                 | 1.43                   | 3.00                    | 2.83                     |
| 24.0               | 3.70                    | 2.32                            | 3.97                             | 2.45                 | 1.58                   | 3.00                    | 3.40                     |
| 28.0               | 3.70                    | 2.57                            | 4.12                             | 3.00                 | 1.71                   | 3.00                    | 3.96                     |
| 32.0               | 3.70                    | 2.81                            | 4.31                             | 3.00                 | 1.83                   | 3.00                    | 4.53                     |
| 36.0               | 3.70                    | 3.05                            | 4.51                             | 3.00                 | 1.95                   | 3.00                    | 5.09                     |
| 40.0               | 3.70                    | 3.30                            | 4.74                             | 3.00                 | 2.06                   | 3.00                    | 5.66                     |
| 44.0               | 3.70                    | 3.61                            | 5.00                             | 3.00                 | 2.16                   | 3.00                    | 6.22                     |
| 48.0               | 3.70                    | 3.89                            | 5.27                             | 3.00                 | 2.26                   | 3.00                    | 6.79                     |
| 52.0               | 3.70                    | 4.16                            | 5.58                             | 3.00                 | 2.34                   | 3.00                    | 7.36                     |
| 56.0               | 3.70                    | 4.51                            | 5.90                             | 3.00                 | 2.43                   | 3.00                    | 7.92                     |
| 60.0               | 3.70                    | 4.88                            | 6.26                             | 3.00                 | 2.50                   | 3.00                    | 8.49                     |
| 64.0               | 3.70                    | 5.27                            | 6.63                             | 3.00                 | 2.57                   | 3.00                    | 9.05                     |
| 68.0               | 3.70                    | 5.69                            | 7.03                             | 3.00                 | 2.63                   | 3.00                    | 9.62                     |

\* apply to only 100-year  
storm

PIPE CULVERT ANALYSIS ✓  
COMPUTATION OF CULVERT PERFORMANCE CURVE ✓

August 13, 1999  
Stead Master Plan ✓  
Moya Detention Basin ✓  
Southern Outlet culvert 30" rcp ✓

Invert = 64.95'

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 2.50 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 1 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 450.0 ✓  |
| Culvert Slope (feet per foot).....                    | 0.0017 ✓ |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Inlet<br>Depth (ft) | Headwater (ft)<br>Control | Outlet<br>Depth (ft)<br>Control | Normal<br>Depth (ft) | Critical<br>Depth (ft) | Outlet<br>Velocity<br>(ft/s) |
|--------------------|-------------------------|---------------------|---------------------------|---------------------------------|----------------------|------------------------|------------------------------|
| 5.0                | 4.50                    | 1.01                | 3.83                      | 0.93                            | 0.74                 | 2.50                   | 1.02                         |
| 10.0               | 4.50                    | 1.50                | 4.10                      | 1.38                            | 1.06                 | 2.50                   | 2.04                         |
| 14.0               | 4.50                    | 1.83                | 4.45                      | 1.73                            | 1.26                 | 2.50                   | 2.85                         |
| 18.0               | 4.50                    | 2.16                | 4.91                      | 2.24                            | 1.44                 | 2.50                   | 3.67                         |
| 22.0               | 4.50                    | 2.48                | 5.49                      | 2.50                            | 1.59                 | 2.50                   | 4.48                         |
| 26.0               | 4.50                    | 2.80                | 6.19                      | 2.50                            | 1.74                 | 2.50                   | 5.30                         |
| 30.0               | 4.50                    | 3.21                | 7.00                      | 2.50                            | 1.87                 | 2.50                   | 6.11                         |

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# Moya Detention Basin

Northern inlet: 36" RCP IE= 65.15

Southern inlet: 30" RCP IE= 64.95

| Elevation | H <sub>36</sub> | Q <sub>36</sub> | H <sub>30</sub> | Q <sub>30</sub> | Q <sub>road</sub> | Q <sub>total</sub> |
|-----------|-----------------|-----------------|-----------------|-----------------|-------------------|--------------------|
| 65.0      | 0.00 ✓          | 0 ✓             | 0.05 ✓          | 0 ✓             | 0 ✓               | 0 ✓                |
| 66.0      | 0.85 ✓          | 0 ✓             | 1.05 ✓          | 5 ✓             | 0                 | 5 ✓                |
| 67.0      | 1.85 ✓          | 8 ✓             | 2.05 ✓          | 15 ✓            | 0                 | 23 ✓               |
| 68.0      | 2.85 ✓          | 29 ✓            | 3.05 ✓          | 22 ✓            | 0                 | 51 ✓               |
| 69.0      | 3.85 ✓          | 43 ✓            | 4.05 ✓          | 27 ✓            | 0                 | 70 ✓               |
| 70.0      | 4.85 ✓          | 55 ✓            | 5.05 ✓          | 31 ✓            | 0 ✓               | 86 ✓               |
| 70.8      | 5.65 ✓          | 63 ✓            | 5.85 ✓          | 34 ✓            | 1 ✓               | 98 ✓               |
| 70.9      | 5.75 ✓          | 64 ✓            | 5.95 ✓          | 35 ✓            | 4822 ✓            | 147121 ✓           |
| 71.0      | 5.85 ✓          | 65 ✓            | 6.05 ✓          | 35 ✓            | 6577 ✓            | 165177 ✓           |
| 71.1      | 5.95 ✓          | 66 ✓            | 6.15 ✓          | 35 ✓            | 450177 ✓          | 254280 ✓           |
| 71.2      | 6.05 ✓          | 67 ✓            | 6.25 ✓          | 36 ✓            | 282335 ✓          | 385438 ✓           |
| 71.3      | 6.15 ✓          | 68 ✓            | 6.35 ✓          | 36 ✓            | 466552 ✓          | 570656 ✓           |
| 71.4      | 6.25 ✓          | 69 ✓            | 6.45 ✓          | 36 ✓            | 707839 ✓          | 842944 ✓           |

Detention Stage / storage / Q Rating

|                        |      |        |        |        |         |         |
|------------------------|------|--------|--------|--------|---------|---------|
| Area (A <sub>c</sub> ) | 0 ✓  | 51.2 ✓ | 59.1 ✓ | 72.6 ✓ | 120.9 ✓ | 140.2 ✓ |
| Elev                   | 65 ✓ | 66 ✓   | 68 ✓   | 70 ✓   | 71 ✓    | 71.4 ✓  |
| Q (cfs)                | 0 ✓  | 5 ✓    | 51 ✓   | 86 ✓   | 177 ✓   | 944 ✓   |
|                        |      | 10     | 102    | 172    | 277     | 1049    |

Rating O.K. for  
5-year storm.

SOQ needs to be modified for a  
100-year storm.

Project Extend Muster  
Project No. 208  
Sheet No.      of       
Calculated by      Date     

**WEIR FLOW COMPUTATIONS**

**LOCATION/DESCRIPTION:**

Moya Blvd Profile

**CROSS SECTION PARAMETERS:**

FILENAME: moya-cl.SEC

No. of Cross Section Points: 9 ~~8~~ ~~Slope: 0.00018~~ Max Elev.: 72.65  
Bank Stations.....Left: 570.0 Right.....: 4070.0 Min Elev.: 70.75  
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)  | 72.25 ✓ | 570.00 ✓  | 2)  | 70.75 ✓ | 970.00 ✓  | 3)  | 72.25 ✓ | 1370.00 ✓ |
| 4)  | 70.75 ✓ | 1770.00 ✓ | 5)  | 72.25 ✓ | 2170.00 ✓ | 6)  | 70.75 ✓ | 2570.00 ✓ |
| 7)  | 72.65 ✓ | 3070.00 ✓ | 8)  | 70.75 ✓ | 3570.00 ✓ | 9)  | 72.65 ✓ | 4070.00 ✓ |

**COMPUTED PARAMETERS:**

| WSEL(ft) | Q(cfs) | H:max(ft) | H:ave(ft) | TW(ft) | A(sf) |
|----------|--------|-----------|-----------|--------|-------|
| 70.90    | 21.5   | 0.15      | 0.08      | 318.4  | 23.9  |
| 71.00    | 77.0   | 0.25      | 0.13      | 530.7  | 66.3  |
| 71.10    | 178.5  | 0.35      | 0.17      | 743.0  | 130.0 |
| 71.20    | 334.5  | 0.45      | 0.22      | 955.3  | 214.9 |
| 71.30    | 552.4  | 0.55      | 0.28      | 1167.6 | 321.1 |
| 71.40    | 838.8  | 0.65      | 0.33      | 1379.8 | 448.4 |

**NOTES:**



PIPE CULVERT ANALYSIS ✓  
COMPUTATION OF CULVERT PERFORMANCE CURVE

May 4, 1999  
Stead Master Plan  
Moya Detention Basin  
Northern outlet culvert 36" RCP

I.E. ≈ 65.15'

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 3.00 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 1 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 130.0 ✓  |
| Culvert Slope (feet per foot).....                    | 0.0013 ✓ |

Culvert info  
from  
Moya Blvd plan  
dated 8/90  
by SEA

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater<br>Inlet Control<br>(ft) | Normal<br>Outlet Control<br>(ft) | Critical<br>Depth (ft) | Depth<br>(ft) | Outlet<br>Depth (ft) | Outlet<br>Velocity<br>(fps) |
|--------------------|-------------------------|------------------------------------|----------------------------------|------------------------|---------------|----------------------|-----------------------------|
| 8.0                | 0.80 ✓                  | 1.23                               | 1.83                             | 1.19                   | 0.89          | 0.89                 | 4.54                        |
| 29.0               | 1.50 ✓                  | 2.63                               | 2.84                             | 3.00                   | 1.74          | 1.74                 | 6.81                        |
| 43.0               | 1.85 ✓                  | 3.50                               | 3.80                             | 3.00                   | 2.14          | 2.14                 | 7.99                        |
| 44.0               | 1.85 ✓                  | 3.61                               | 3.88                             | 3.00                   | 2.16          | 2.16                 | 8.07                        |
| 55.0               | 2.05 ✓                  | 4.42                               | 4.82                             | 3.00                   | 2.41          | 2.41                 | 9.05                        |
| 63.0               | 2.20 ✓                  | 5.17                               | 5.61                             | 3.00                   | 2.55          | 2.55                 | 9.83                        |
| 64.0               | 2.20 ✓                  | 5.27                               | 5.72                             | 3.00                   | 2.57          | 2.57                 | 9.93                        |
| 65.0               | 2.20 ✓                  | 5.38                               | 5.82                             | 3.00                   | 2.59          | 2.59                 | 10.03                       |
| 66.0               | 2.25 ✓                  | 5.48                               | 5.93                             | 3.00                   | 2.60          | 2.60                 | 10.14                       |
| 67.0               | 2.25 ✓                  | 5.59                               | 6.04                             | 3.00                   | 2.62          | 2.62                 | 10.25                       |
| 68.0               | 2.30 ✓                  | 5.69                               | 6.15                             | 3.00                   | 2.63          | 2.63                 | 10.35                       |
| 69.0               | 2.30 ✓                  | 5.80                               | 6.26                             | 3.00                   | 2.64          | 2.64                 | 10.46                       |

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Tailwater  
Depth from  
Trap channel Rating

TRAPEZOIDAL CHANNEL ANALYSIS  
RATING CURVE COMPUTATION

May 4, 1999  
Stead Master Plan  
Moya Detention Basin  
Outlet channel tailwater

IE = 64.95'

PROGRAM INPUT DATA:

| DESCRIPTION                                              | VALUE  |
|----------------------------------------------------------|--------|
| Channel Bottom Slope (feet per foot).....                | 0.0017 |
| Manning's Roughness Coefficient (n-value).....           | 0.0300 |
| Channel Side Slope - Left Side (horizontal/vertical).... | 3.00   |
| Channel Side Slope - Right Side (horizontal/vertical)... | 3.00   |
| Channel Bottom Width (feet).....                         | 5.0    |

Channel info  
from SEA's  
Moya End Plan

PROGRAM RESULTS:

| Depth<br>(ft) | Flow Rate<br>(cfs) | Velocity<br>(fps) | Froude<br>Number | Velocity<br>Head(ft) | Energy<br>Head(ft) | Flow Area<br>(sq ft) | Top Width<br>(ft) |
|---------------|--------------------|-------------------|------------------|----------------------|--------------------|----------------------|-------------------|
| 0.8           | 8.5                | 1.43              | 0.325            | 0.032                | 0.832              | 5.9                  | 9.8               |
| 1.0           | 13.0               | 1.62              | 0.335            | 0.041                | 1.041              | 8.0                  | 11.0              |
| 1.5           | 28.8               | 2.02              | 0.353            | 0.063                | 1.563              | 14.2                 | 14.0              |
| 1.6           | 32.8               | 2.09              | 0.356            | 0.068                | 1.668              | 15.7                 | 14.6              |
| 1.7           | 37.1               | 2.16              | 0.359            | 0.073                | 1.773              | 17.2                 | 15.2              |
| 1.8           | 41.8               | 2.23              | 0.361            | 0.077                | 1.877              | 18.7                 | 15.8              |
| 1.9           | 46.7               | 2.30              | 0.364            | 0.082                | 1.982              | 20.3                 | 16.4              |
| 2.0           | 52.0               | 2.37              | 0.366            | 0.087                | 2.087              | 22.0                 | 17.0              |
| 2.1           | 57.7               | 2.43              | 0.369            | 0.092                | 2.192              | 23.7                 | 17.6              |
| 2.2           | 63.6               | 2.49              | 0.371            | 0.097                | 2.297              | 25.5                 | 18.2              |
| 2.3           | 70.0               | 2.56              | 0.373            | 0.101                | 2.401              | 27.4                 | 18.8              |
| 2.4           | 76.6               | 2.62              | 0.375            | 0.106                | 2.506              | 29.3                 | 19.4              |
| 2.5           | 83.7               | 2.68              | 0.378            | 0.111                | 2.611              | 31.3                 | 20.0              |
| 2.6           | 91.1               | 2.74              | 0.380            | 0.116                | 2.716              | 33.3                 | 20.6              |

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.3 (c) 1986  
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Approx tailwater depths for 36"  
12CP northern outlet culvert  
rating.

PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

May 4, 1999  
Stead Master Plan ✓  
Moya Detention Basin ✓  
Southern outlet culvert ✓ 30" RCP ✓

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 2.50 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 1 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 450.0 ✓  |
| Culvert Slope (feet per foot).....                    | 0.0017 ✓ |

Current info  
from SEA's  
Moya Blvd Plan  
dated 8/90.

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater Inlet<br>Depth (ft) | Headwater Outlet<br>Depth (ft) | Normal Depth<br>(ft) | Critical Depth<br>(ft) | Outlet Depth<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|-------------------------------|--------------------------------|----------------------|------------------------|----------------------|--------------------------|
| 5.0                | 0.00                    | 1.01                          | 0.94                           | 0.93                 | 0.74                   | 0.93                 | 3.00                     |
| 15.0               | 0.00                    | 1.92                          | 1.95                           | 1.83                 | 1.31                   | 1.31                 | 5.78                     |
| 22.0               | 0.00                    | 2.48                          | 3.04                           | 2.50                 | 1.59                   | 1.59                 | 6.66                     |
| 27.0               | 0.00                    | 2.89                          | 4.01                           | 2.50                 | 1.77                   | 1.77                 | 7.26                     |
| 31.0               | 0.00                    | 3.27                          | 4.92                           | 2.50                 | 1.90                   | 1.90                 | 7.76                     |
| 34.0               | 0.00                    | 3.58                          | 5.67                           | 2.50                 | 1.98                   | 1.98                 | 8.15                     |
| 35.0               | 0.00                    | 3.70                          | 5.93                           | 2.50                 | 2.01                   | 2.01                 | 8.28                     |
| 36.0               | 0.00                    | 3.82                          | 6.20                           | 2.50                 | 2.03                   | 2.03                 | 8.41                     |
| 37.0               | 0.00                    | 3.94                          | 6.48                           | 2.50                 | 2.06                   | 2.06                 | 8.55                     |

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uses the depth @ outlet



STANTEC CONSULTING INC.  
950 Industrial Way  
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JOB NO. \_\_\_\_\_

Stantec

SHEET 1 OF 1

PROJECT

Stead Master Plan

DATE

12/8/99

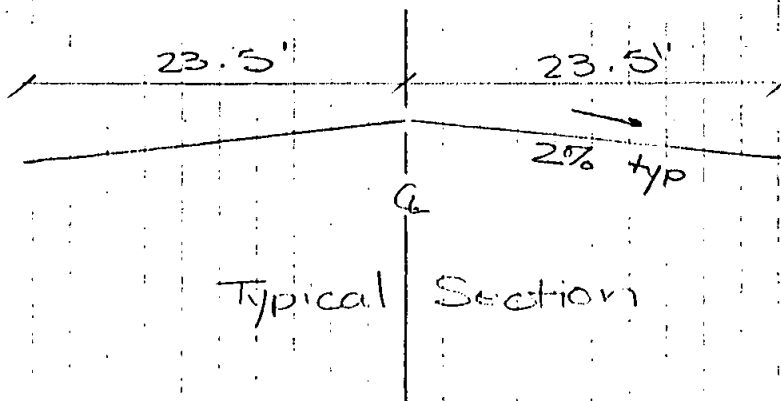
SUBJECT

Moya Blvd

DESIGNED

JB

CHECKED



Typical Section

Low point elevation = 70.75 (Reno topo)

Using Reno Public Works standards,  
max flooding =  $\frac{1}{2}$  lane width adjacent  
to lip/curb & gutter

$$70.75 - 2\% \left( \frac{23.5}{2} \right) = 70.52'$$

Adjust SQ cord for Moya  
Detention so that max ponding  
elevation  $\sim 70.5'$

Preliminary analysis indicates that increasing SQ  
by  $\sim 50$  cfs will achieve USEL  $\sim 70.5'$   
Silver Lake storage will increase  $\sim 11$  ac-ft

Designed channel to Silver Lake



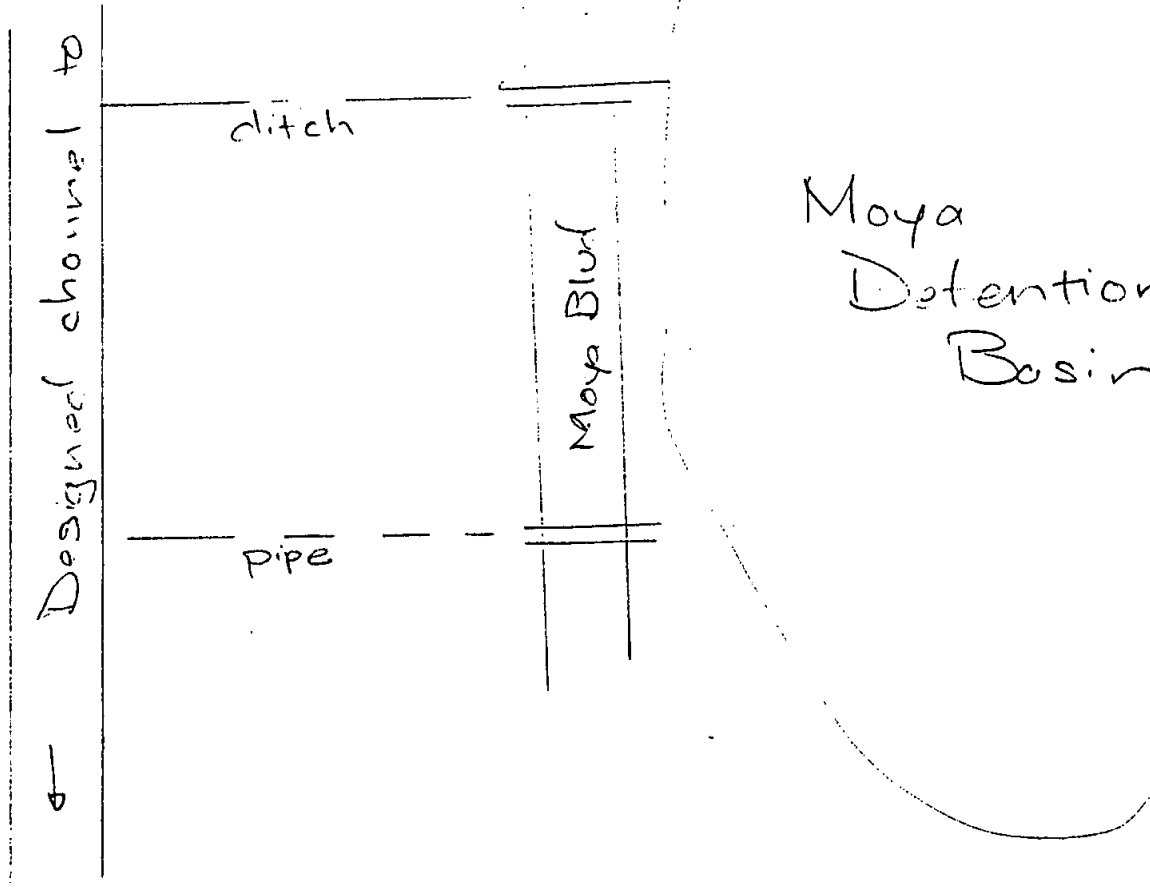
ditch

pipe

Moya Blvd

Moya  
Detention  
Basin

Silver  
Lake





## Drainage Master Plan for Stead, Nevada

Other Moya Boulevard Culvert Improvements  
CP SS3@48", CP SLB, CP GC3

### PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

| ITEM NO. | QUANTITY | UNIT | DESCRIPTION                              | UNIT COST | TOTAL COST   |
|----------|----------|------|------------------------------------------|-----------|--------------|
| 1        | 500      | SY   | REMOVE EXISTING PAVEMENT                 | \$5.00    | \$2,500.00   |
| 2        | 7900     | CY   | EXCAVATION AND EMBANKMENT                | \$5.00    | \$39,500.00  |
| 3        | 100      | LF   | TRIPLE 6' X 4' RCB's                     | \$800.00  | \$80,000.00  |
| 4        | 2        | LS   | HEADWALL TRIPLE 6' X 4' RCB              | LS        | \$16,000.00  |
| 5        | 80       | SY   | RIPRAP, CLASS 150 W/FILT.FAB., DS CHAN   | \$25.00   | \$2,000.00   |
| 6        | 3500     | SY   | REVEGETATION/SEEDING DS CHANNEL          | \$5.00    | \$17,500.00  |
| 7        | 4210     | SY   | RIPRAP, CLASS 300 W/FILT. FAB., US CHAN. | \$35.00   | \$147,350.00 |
| 8        | 400      | SY   | GROUTED RIPRAP FOR DROPS & INLET         | \$85.00   | \$34,000.00  |
| 9        | 500      | SY   | 6 INCH PLANTMIX BITUMINOUS PAVEMENT      | \$5.00    | \$2,500.00   |
| 10       | 500      | SY   | 6 INCH TYPE 2 CLASS B AGGREGATE BASE     | \$10.00   | \$5,000.00   |
| 11       | 100      | LF   | CURB AND GUTTER REPLACEMENT              | \$8.00    | \$800.00     |
| 12       | 1300     | LF   | FENCING                                  | \$5.00    | \$6,500.00   |
| 13       | 100      | LF   | 4 INCH SOLID YELLOW LINE - DOUBLE        | \$2.20    | \$220.00     |
| 14       | 100      | LF   | 4 INCH BROKEN WHITE LINE                 | \$1.15    | \$115.00     |
| 15       | 100      | LF   | REMOVE EXISTING 3 - 18" CMAP's           | \$25.00   | \$2,500.00   |
| 16       | 1        | LS   | REMOVE EXISTING DROP W/GRATE             | LS        | \$1,000.00   |
| 17       | 1        | LS   | TRAFFIC CONTROL                          | LS        | \$35,000.00  |
| 18       |          | LF   |                                          | \$0.00    | \$0.00       |
| 19       |          | LF   |                                          | \$0.00    | \$0.00       |
| 20       |          | LF   |                                          | \$0.00    | \$0.00       |
| 21       |          | LF   |                                          | \$0.00    | \$0.00       |
| 22       |          | LF   |                                          | \$0.00    | \$0.00       |
| 23       |          | LS   |                                          | \$0.00    | \$0.00       |
| 24       |          | LS   |                                          | \$0.00    | \$0.00       |

|                         |                 |
|-------------------------|-----------------|
| SUBTOTAL                | \$392,485       |
| CONTINGENCY (15%)       | <u>\$58,873</u> |
| TOTAL CONSTRUCTION COST | \$451,358       |

|                          |          |
|--------------------------|----------|
| RIGHT-OF-WAY (92,000 SF) | \$92,000 |
|--------------------------|----------|

|                                  |                |
|----------------------------------|----------------|
| DESIGN SERVICES                  |                |
| ENGINEERING DESIGN (6%)          | \$27,000       |
| HYDROLOGY (WA. CO. REQUIREMENTS) | \$3,500        |
| SURVEYING (TOPOGRAPHIC + LEGALS) | \$3,000        |
| GEOTECHNICAL                     | <u>\$3,500</u> |
| TOTAL DESIGN SERVICES            | \$37,000       |

|                             |                |
|-----------------------------|----------------|
| CONSTRUCTION SERVICES       |                |
| SURVEYING STAKEOUT          | \$10,000       |
| QUALITY CONTROL             | \$41,000       |
| CONSTRUCTION ADMINISTRATION | <u>\$4,000</u> |
| TOTAL CONSTRUCTION SERVICES | \$55,000       |

|                    |           |
|--------------------|-----------|
| TOTAL PROJECT COST | \$635,358 |
|--------------------|-----------|

BY TMM







STANTEC CONSULTING INC.  
950 Industrial Way  
Sparks, Nevada 89431  
Tel: (775) 358-6931 Fax: (775) 358-6954

JOB NO. 801 00208

Stantec

SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT Proposed Culverts under Moya

DATE 3/7/00

SUBJECT "Other" Moya Culverts at <sup>SS3 @ 48"</sup> GC3

DESIGNED TM

CHECKED \_\_\_\_\_

SS3 at 48" RCP - filled w/ 1' sediment

48" RCP

L = 250' assumed

S = .01

Assume inlet control

h = 6 1/2'

Proposed  $Q_{100} = 229$  cfs

$Q_{E100} = 219$  cfs

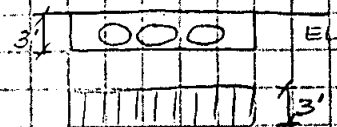
$Q_{prop} \approx 150$  cfs

Proposed 6' x 4' RCB

Other Culverts Under Moya at GC3

3- 18" CMAPS (squashed)

Proposed  $Q = 266$  and  
422 cfs



outlet good - have some fall  
Need to design channel in cut  
along Moya plus new culverts  
lined channels

Designed Channel

- Steep slope  $\Rightarrow$  1.1% will have high  $Fr^*$
- road crossings for incised channel
- Improvements DS property to provide necessary head
- OR let overflow & provide Dip section

Outlet channel

Silver Lake Elevation = 65.22 (NGVD) and 68.70 (NAVD)

$\therefore$  @ <sup>Culvert</sup> outlet el = 63.5, 5.2' tailwater



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JOB NO. \_\_\_\_\_

**Stantec**

SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT

Other Moya Culverts Improvements

DATE \_\_\_\_\_

SUBJECT

DESIGNED

*TM*

CHECKED

- Propose 6'x4' RCB, 250' long under Moya Blvd at 553 to replace existing 48" RCP.
- Rip rap line existing channel from outlet of subdivision at Red Baron Blvd to first drop structure
- Propose 4 - 3' drop structures, and 530' designed, rip-rapped channel 10' bw, 2:1 ss, 27' TW.
- Propose triple 4'x5' RCB's w/ 1' head, 100' long at 0.5% slope
- Propose outlet channel, L=600', varying bw, 3:1 ss, no lining
- Propose

TRAPEZOIDAL CHANNEL ANALYSIS  
NORMAL DEPTH COMPUTATION

March 29, 2000  
Proposed Channel upstream of CP SLB  
10'bw, 2:1ss, s=.028  
801 00208

PROGRAM INPUT DATA:

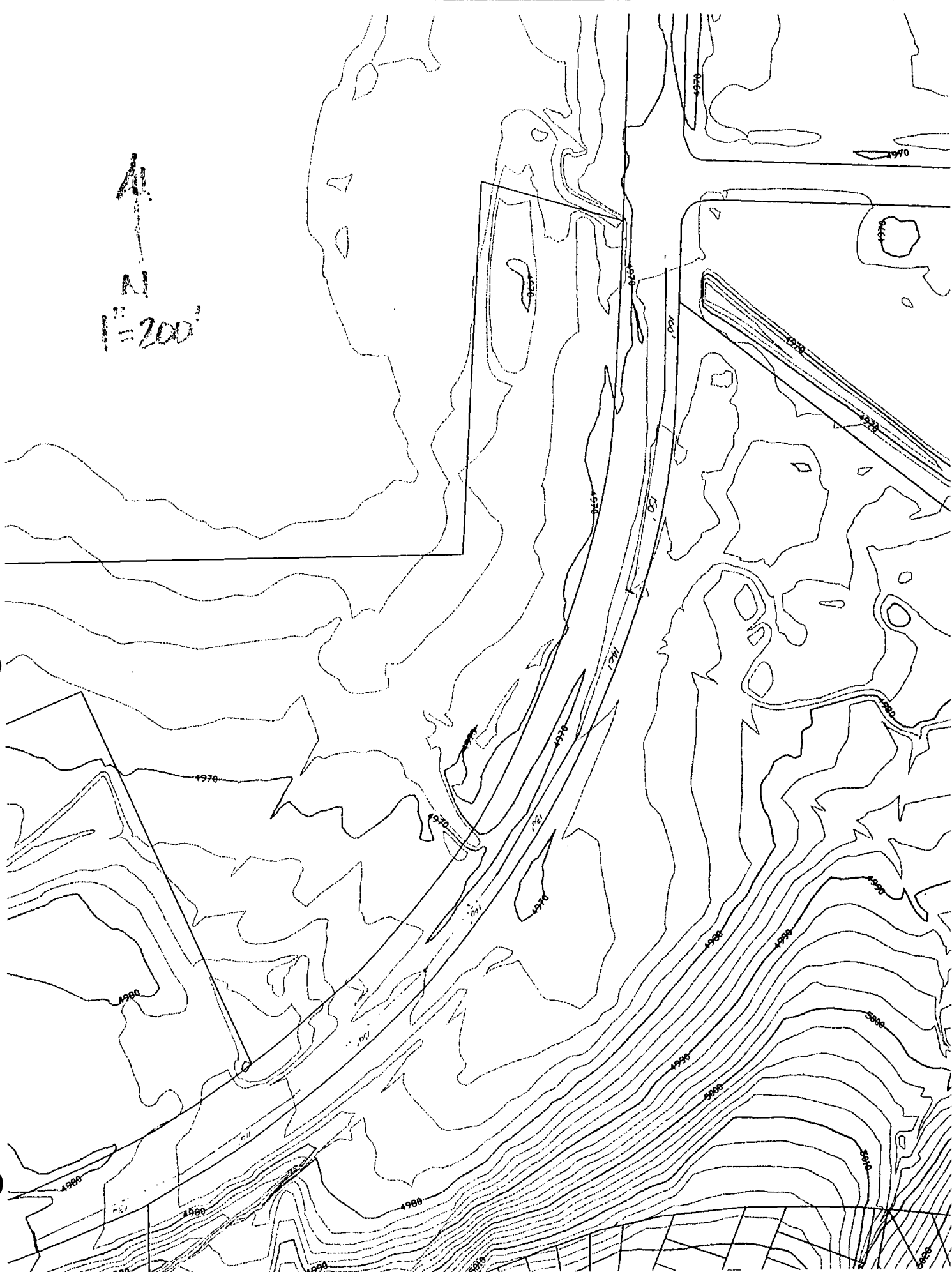
| DESCRIPTION                                              | VALUE  |
|----------------------------------------------------------|--------|
| Flow Rate (cubic feet per second).....                   | 266.0  |
| Channel Bottom Slope (feet per foot).....                | 0.0280 |
| Manning's Roughness Coefficient (n-value).....           | 0.0400 |
| Channel Side Slope - Left Side (horizontal/vertical).... | 2.00   |
| Channel Side Slope - Right Side (horizontal/vertical)... | 2.00   |
| Channel Bottom Width (feet).....                         | 8.0    |

PROGRAM RESULTS:

| DESCRIPTION                                     | VALUE |
|-------------------------------------------------|-------|
| Normal Depth (feet).....                        | 2.40  |
| Flow Velocity (feet per second).....            | 8.65  |
| Froude Number (Flow is Super-Critical).....     | 1.153 |
| Velocity Head (feet).....                       | 1.16  |
| Energy Head (feet).....                         | 3.56  |
| Cross-Sectional Area of Flow (square feet)..... | 30.76 |
| Top Width of Flow (feet).....                   | 17.61 |

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.3 (c) 1986  
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(713) 440-3787. A manual with equations & flow chart is available.

1"=200'



BOX CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

March 13, 2000  
Other Moya Culverts 48" @ SS3  
Proposed 6' x 4' RCB, assumes inlet control  
801 00208

=====

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Span (Width of Opening) (feet).....           | 6.00   |
| Culvert Rise (Height of Opening) (feet).....          | 4.00   |
| FHWA Chart Number (8,9,10,11,12 or 13).....           | 8      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 250.0  |
| Culvert Slope (feet per foot).....                    | 0.0100 |

=====

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Inlet<br>Depth (ft) | Headwater<br>Depth (ft) | Outlet<br>Depth (ft) | Normal<br>Depth (ft) | Critical<br>Depth (ft) | Depth at<br>Outlet (ft) | Outlet<br>Velocity<br>(fps) |
|--------------------|-------------------------|---------------------|-------------------------|----------------------|----------------------|------------------------|-------------------------|-----------------------------|
| 50.0               | 4.00                    | 2.05                | 1.67                    | 0.92                 | 1.29                 | 0.92                   | 9.05                    |                             |
| 100.0              | 4.00                    | 3.29                | 2.16                    | 1.47                 | 2.05                 | 1.47                   | 11.33                   |                             |
| 125.0              | 4.00                    | 3.84                | 2.54                    | 1.72                 | 2.38                 | 1.72                   | 12.13                   |                             |
| 150.0              | 4.00                    | 4.36                | 2.99                    | 1.95                 | 2.69                 | 1.95                   | 12.79                   |                             |
| 175.0              | 4.00                    | 5.09                | 3.53                    | 2.18                 | 2.98                 | 2.18                   | 13.36                   |                             |
| 200.0              | 4.00                    | 5.91                | 4.15                    | 2.41                 | 3.26                 | 2.41                   | 13.86                   |                             |
| 225.0              | 4.00                    | 6.62                | 4.86                    | 2.62                 | 3.52                 | 2.62                   | 14.30                   |                             |
| 229.0              | 4.00                    | 6.74                | 4.98                    | 2.66                 | 3.56                 | 2.66                   | 14.36                   |                             |
| 250.0              | 4.00                    | 7.42                | 5.65                    | 2.84                 | 3.78                 | 2.84                   | 14.69                   |                             |
| 300.0              | 4.00                    | 9.26                | 7.47                    | 3.25                 | 4.00                 | 3.25                   | 15.38                   |                             |

=====

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BOX CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

March 13, 2000  
Other Moya Blvd Culverts  
Proposed 3 - 6' x 4' RCB's under Moya at CP GC3  
801 00208

=====

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Span (Width of Opening) (feet).....           | 6.00   |
| Culvert Rise (Height of Opening) (feet).....          | 4.00   |
| FWHA Chart Number (8,9,10,11,12 or 13).....           | 10     |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 100.0  |
| Culvert Slope (feet per foot).....                    | 0.0050 |

=====

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater<br>Inlet Control<br>Depth (ft) | Normal<br>Outlet Control<br>Depth (ft) | Critical<br>Depth (ft) | Depth at<br>Outlet (ft) | Outlet<br>Velocity<br>(fps) |
|--------------------|-------------------------|------------------------------------------|----------------------------------------|------------------------|-------------------------|-----------------------------|
| 25.0               | 5.50                    | 1.33                                     | 5.03                                   | 0.73                   | 0.81                    | 4.00                        |
| 50.0               | 5.50                    | 2.12                                     | 5.13                                   | 1.16                   | 1.29                    | 4.00                        |
| 75.0               | 5.50                    | 2.77                                     | 5.29                                   | 1.53                   | 1.69                    | 4.00                        |
| 100.0              | 5.50                    | 3.36                                     | 5.51                                   | 1.87                   | 2.05                    | 4.00                        |
| 125.0              | 5.50                    | 3.90                                     | 5.79                                   | 2.20                   | 2.38                    | 4.00                        |
| 130.0              | 5.50                    | 4.00                                     | 5.86                                   | 2.26                   | 2.44                    | 4.00                        |
| 140.0              | 5.50                    | 4.21                                     | 6.00                                   | 2.39                   | 2.57                    | 4.00                        |
| 150.0              | 5.50                    | 4.40                                     | 6.14                                   | 2.51                   | 2.69                    | 4.00                        |

x3 = 420 cfs

=====

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TRAPEZOIDAL CHANNEL ANALYSIS  
RATING CURVE COMPUTATION

March 13, 2000  
Other Moya Culverts  
Proposed Outlet Channel from CP GC3 to Silver Lake  
801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                              | VALUE  |
|----------------------------------------------------------|--------|
| Channel Bottom Slope (feet per foot).....                | 0.0030 |
| Manning's Roughness Coefficient (n-value).....           | 0.0350 |
| Channel Side Slope - Left Side (horizontal/vertical).... | 3.00   |
| Channel Side Slope - Right Side (horizontal/vertical)... | 3.00   |
| Channel Bottom Width (feet).....                         | 10.0   |

PROGRAM RESULTS:

| Depth<br>(ft) | Flow Rate<br>(cfs) | Velocity<br>(fps) | Froude<br>Number | Velocity<br>Head(ft) | Energy<br>Head(ft) | Flow Area<br>(sq ft) | Top Width<br>(ft) |
|---------------|--------------------|-------------------|------------------|----------------------|--------------------|----------------------|-------------------|
| 1.0           | 26.0               | 2.00              | 0.391            | 0.062                | 1.062              | 13.0                 | 16.0              |
| 2.0           | 93.7               | 2.93              | 0.428            | 0.133                | 2.133              | 32.0                 | 22.0              |
| 3.0           | 208.1              | 3.65              | 0.451            | 0.207                | 3.207              | 57.0                 | 28.0              |
| 3.5           | 285.0              | 3.97              | 0.460            | 0.245                | 3.745              | 71.7                 | 31.0              |
| 4.0           | 376.3              | 4.28              | 0.468            | 0.284                | 4.284              | 88.0                 | 34.0              |
| 4.1           | 396.3              | 4.33              | 0.470            | 0.292                | 4.392              | 91.4                 | 34.6              |
| 4.2           | 416.9              | 4.39              | 0.471            | 0.300                | 4.500              | 94.9                 | 35.2              |
| 4.3           | 438.2              | 4.45              | 0.473            | 0.308                | 4.608              | 98.5                 | 35.8              |
| 4.4           | 460.1              | 4.51              | 0.474            | 0.315                | 4.715              | 102.1                | 36.4              |
| 4.5           | 482.7              | 4.56              | 0.476            | 0.323                | 4.823              | 105.7                | 37.0              |
| 5.0           | 605.1              | 4.84              | 0.483            | 0.364                | 5.364              | 125.0                | 40.0              |
| 5.3           | 686.6              | 5.00              | 0.486            | 0.388                | 5.688              | 137.3                | 41.8              |
| 5.5           | 744.3              | 5.11              | 0.489            | 0.405                | 5.905              | 145.7                | 43.0              |

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TRAPEZOIDAL CHANNEL ANALYSIS  
RATING CURVE COMPUTATION

March 13, 2000  
Other Moya Culverts Proposed Improvements  
Proposed 10'bw, 2:1ss, 27'tw, Rip Rap Lined Channel  
801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                              | VALUE  |
|----------------------------------------------------------|--------|
| Channel Bottom Slope (feet per foot).....                | 0.0120 |
| Manning's Roughness Coefficient (n-value).....           | 0.0350 |
| Channel Side Slope - Left Side (horizontal/vertical).... | 2.00   |
| Channel Side Slope - Right Side (horizontal/vertical)... | 2.00   |
| Channel Bottom Width (feet).....                         | 10.0   |

PROGRAM RESULTS:

| Depth<br>(ft) | Flow Rate<br>(cfs) | Velocity<br>(fps) | Froude Number | Velocity Head<br>(ft) | Energy Head<br>(ft) | Flow Area<br>(sq ft) | Top Width<br>(ft) |
|---------------|--------------------|-------------------|---------------|-----------------------|---------------------|----------------------|-------------------|
| 1.0           | 49.3               | 4.10              | 0.781         | 0.262                 | 1.262               | 12.0                 | 14.0              |
| 2.0           | 169.0              | 6.03              | 0.853         | 0.566                 | 2.566               | 28.0                 | 18.0              |
| 3.0           | 360.2              | 7.51              | 0.895         | 0.875                 | 3.875               | 48.0                 | 22.0              |
| 3.3           | 420.1              | 7.83              | 0.904         | 0.953                 | 4.203               | 53.6                 | 23.0              |
| 3.5           | 484.9              | 8.15              | 0.912         | 1.031                 | 4.531               | 59.5                 | 24.0              |
| 4.0           | 630.2              | 8.75              | 0.927         | 1.190                 | 5.190               | 72.0                 | 26.0              |
| 4.3           | 710.9              | 9.04              | 0.934         | 1.269                 | 5.519               | 78.6                 | 27.0              |

$Q = 216$   $D = 2.5$   
 $Q = 422$   $D = 3.3$

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# Existing Ditch Worksheet for Irregular Channel

| Project Description |                                                |
|---------------------|------------------------------------------------|
| Project File        | p:\civil\6000208\hydrau~1\flowma~1\steadmp.fm2 |
| Worksheet           | GC SLB Existing Ditch                          |
| Flow Element        | Irregular Channel                              |
| Method              | Manning's Formula                              |
| Solve For           | Water Elevation                                |

| Input Data                                 |                |                |             |           |
|--------------------------------------------|----------------|----------------|-------------|-----------|
| Channel Slope                              |                | 0.032000 ft/ft |             |           |
| Elevation range: 4987.80 ft to 4994.00 ft. |                |                |             |           |
| Station (ft)                               | Elevation (ft) | Start Station  | End Station | Roughness |
| 1000.00                                    | 4994.00        | 1000.00        | 1042.00     | 0.035     |
| 1020.00                                    | 4992.00        |                |             |           |
| 1025.00                                    | 4990.00        |                |             |           |
| 1030.00                                    | 4987.80        |                |             |           |
| 1032.00                                    | 4990.00        |                |             |           |
| 1035.00                                    | 4992.00        |                |             |           |
| 1042.00                                    | 4992.50        |                |             |           |
| Discharge                                  | 266.00         | ft³/s          |             |           |

| Results                   |          |                    |
|---------------------------|----------|--------------------|
| Wtd. Mannings Coefficient | 0.035    |                    |
| Water Surface Elevation   | 4991.72  | ft                 |
| Flow Area                 | 25.72    | ft <sup>2</sup>    |
| Wetted Perimeter          | 16.19    | ft                 |
| Top Width                 | 13.90    | ft                 |
| Depth                     | 3.92     | ft                 |
| Critical Water Elev.      | 4992.42  | ft                 |
| Critical Slope            | 0.017592 | ft/ft              |
| Velocity                  | 10.34    | ft/s               |
| Velocity Head             | 1.66     | ft                 |
| Specific Energy           | 4993.39  | ft                 |
| Froude Number             | 1.34     |                    |
| Full Flow Capacity        | 1107.40  | ft <sup>3</sup> /s |
| Flow is supercritical.    |          |                    |

**Cross Section Existing Ditch CP SLB**  
**Cross Section for Irregular Channel**

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**Project Description**

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|              |                                                |
|--------------|------------------------------------------------|
| Project File | p:\civil\6000208\hydrau~1\flowma~1\steadmp.fm2 |
| Worksheet    | GC SLB Existing Ditch                          |
| Flow Element | Irregular Channel                              |
| Method       | Manning's Formula                              |
| Solve For    | Water Elevation                                |

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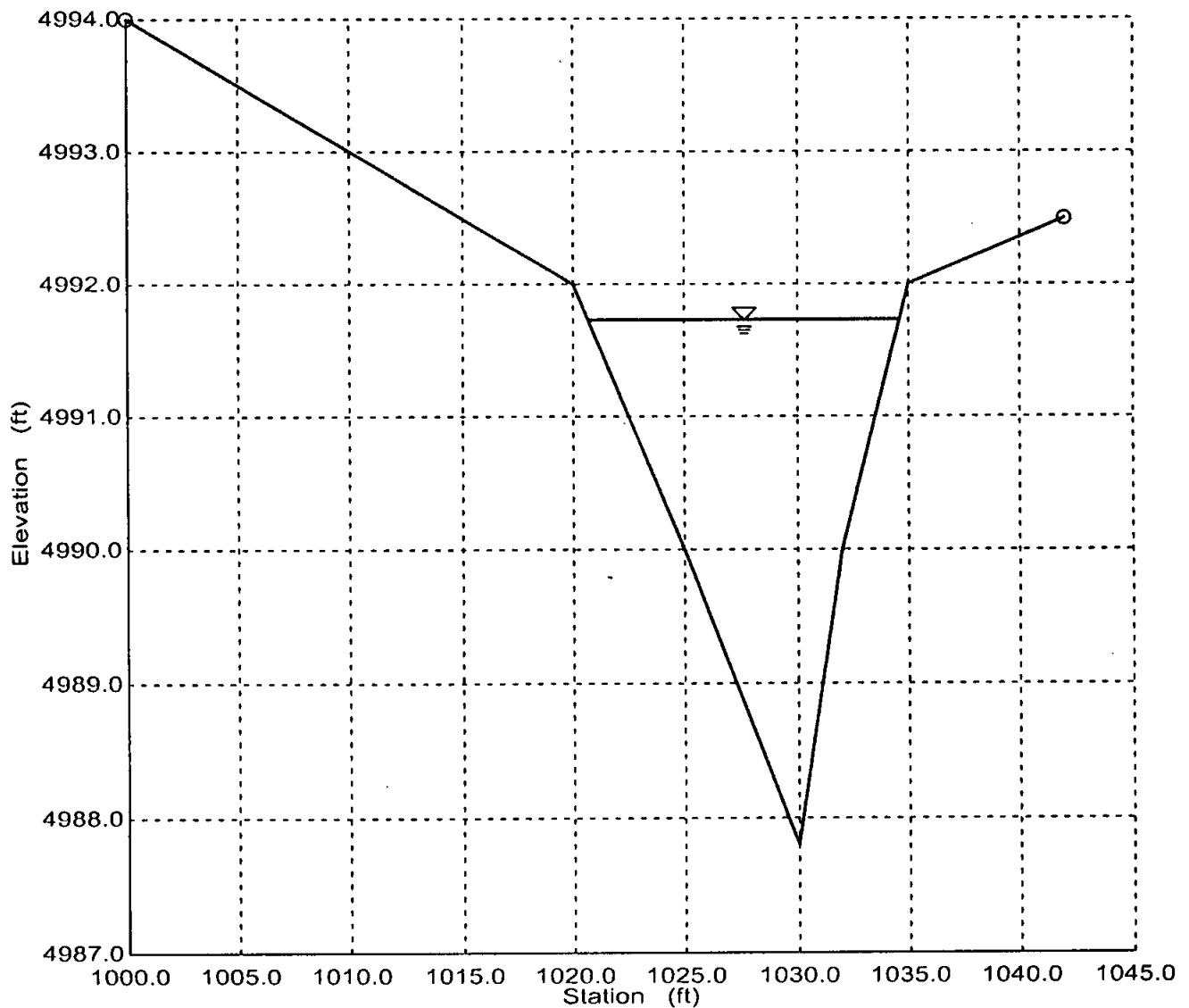
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**Section Data**

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|                           |                           |
|---------------------------|---------------------------|
| Wtd. Mannings Coefficient | 0.035                     |
| Channel Slope             | 0.032000 ft/ft            |
| Water Surface Elevation   | 4991.72 ft                |
| Discharge                 | 266.00 ft <sup>3</sup> /s |

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**Existing Ditch CP SLB  
Worksheet for Irregular Channel**

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**Project Description**

|              |                                                |
|--------------|------------------------------------------------|
| Project File | p:\civil\6000208\hydrau~1\flowma~1\steadmp.fm2 |
| Worksheet    | GC SLB Existing Ditch                          |
| Flow Element | Irregular Channel                              |
| Method       | Manning's Formula                              |
| Solve For    | Water Elevation                                |

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**Input Data**

Channel Slope 0.032000 ft/ft

Elevation range: 4987.80 ft to 4994.00 ft.

| Station (ft) | Elevation (ft) | Start Station | End Station | Roughness |
|--------------|----------------|---------------|-------------|-----------|
| 1000.00      | 4994.00        | 1000.00       | 1042.00     | 0.035     |
| 1020.00      | 4992.00        |               |             |           |
| 1025.00      | 4990.00        |               |             |           |
| 1030.00      | 4987.80        |               |             |           |
| 1032.00      | 4990.00        |               |             |           |
| 1035.00      | 4992.00        |               |             |           |
| 1042.00      | 4992.50        |               |             |           |

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|           |        |                    |
|-----------|--------|--------------------|
| Discharge | 266.00 | ft <sup>3</sup> /s |
|-----------|--------|--------------------|

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**Results**

|                           |          |                    |
|---------------------------|----------|--------------------|
| Wtd. Mannings Coefficient | 0.035    |                    |
| Water Surface Elevation   | 4991.72  | ft                 |
| Flow Area                 | 25.72    | ft <sup>2</sup>    |
| Wetted Perimeter          | 16.19    | ft                 |
| Top Width                 | 13.90    | ft                 |
| Depth                     | 3.92     | ft                 |
| Critical Water Elev.      | 4992.42  | ft                 |
| Critical Slope            | 0.017592 | ft/ft              |
| Velocity                  | 10.34    | ft/s               |
| Velocity Head             | 1.66     | ft                 |
| Specific Energy           | 4993.39  | ft                 |
| Froude Number             | 1.34     |                    |
| Full Flow Capacity        | 1107.40  | ft <sup>3</sup> /s |
| Flow is supercritical.    |          |                    |

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PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

March 8, 2000  
Moya Blvd Other Culverts  
48" @ CP SS3 Existing  
801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Diameter (feet).....                          | 4.00   |
| FHWA Chart Number (1,2 or 3).....                     | 1      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 2      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 200.0  |
| Culvert Slope (feet per foot).....                    | 0.0500 |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater (ft)<br>Inlet Control | Headwater (ft)<br>Outlet Control | Normal Depth<br>(ft) | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|---------------------------------|----------------------------------|----------------------|------------------------|-------------------------|--------------------------|
| 50.0               | 4.00                    | 3.09                            | -5.39                            | 1.07                 | 2.12                   | 1.07                    | 18.54                    |
| 100.0              | 4.00                    | 4.83                            | -3.56                            | 1.53                 | 3.03                   | 1.53                    | 22.58                    |
| 200.0              | 4.00                    | 10.35                           | 3.76                             | 2.29                 | 3.85                   | 2.29                    | 26.93                    |
| 250.0              | 4.00                    | 14.51                           | 9.24                             | 2.65                 | 3.93                   | 2.65                    | 28.24                    |
| 300.0              | 4.00                    | 19.60                           | 15.95                            | 3.09                 | 3.97                   | 3.09                    | 28.77                    |
| 350.0              | 4.00                    | 25.61                           | 23.88                            | 4.00                 | 3.98                   | 4.00                    | 27.85                    |

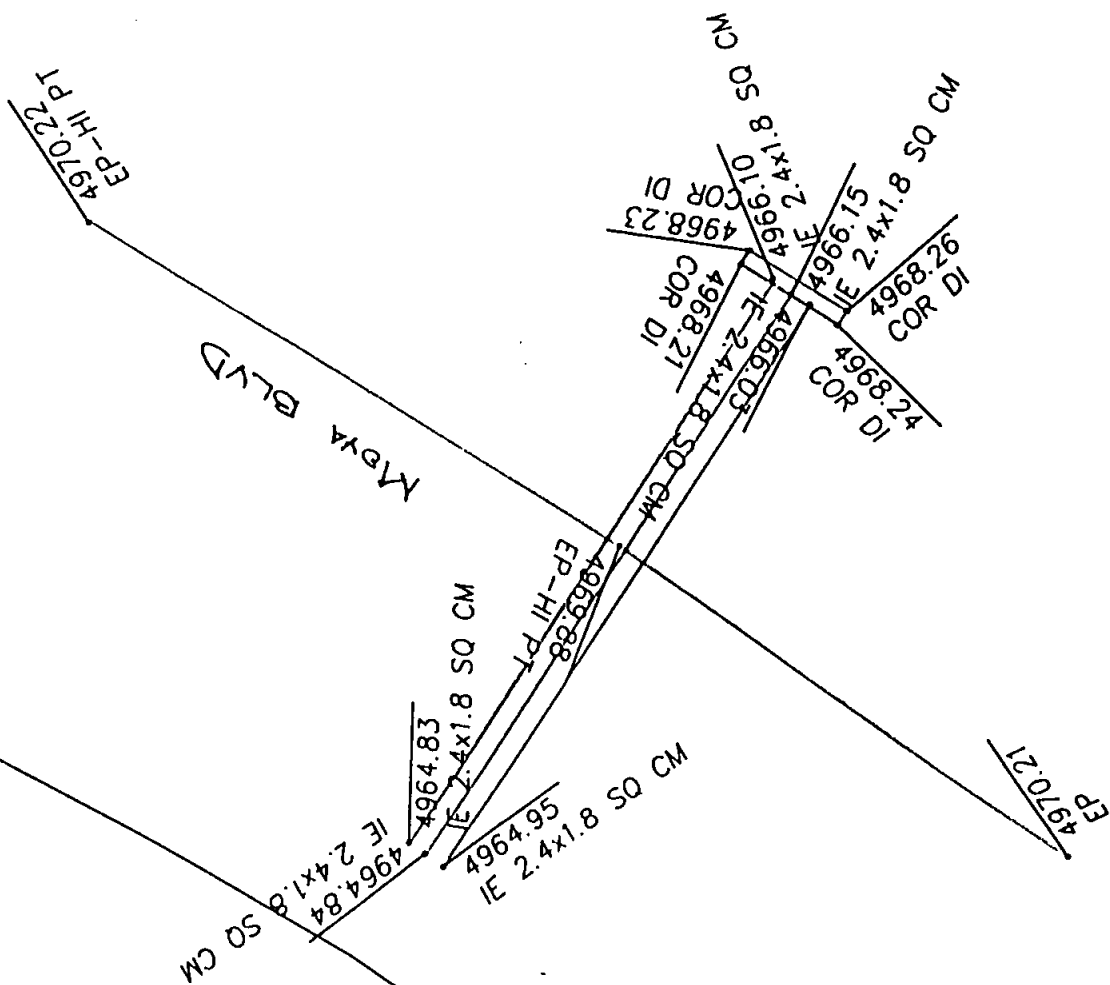
*Q ≈ 230 cfs*

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63

11:30

2



PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 24, 1999

48" RCP under Moya near school

\* assume inlet control for preliminary capacity check  
available head @ inlet - approximately 8'

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE    |
|-------------------------------------------------------|----------|
| Culvert Diameter (feet).....                          | 4.00 ✓   |
| FHWA Chart Number (1,2 or 3).....                     | 1 ✓      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1 ✓      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 ✓ |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50 ✓   |
| Culvert Length (feet).....                            | 250.0    |
| Culvert Slope (feet per foot).....                    | 0.0100   |

} Bogus.

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater (ft)<br>Inlet Control | Normal Depth<br>Outlet Control | Critical Depth<br>(ft) | Depth at<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|---------------------------------|--------------------------------|------------------------|------------------|--------------------------|
| 20.0               | 2.00                    | 1.82                            | 0.27                           | 1.01                   | 1.32             | 1.01                     |
| 40.0               | 2.00                    | 2.72                            | 0.87                           | 1.44                   | 1.89             | 1.44                     |
| 60.0               | 2.00                    | 3.52                            | 1.63                           | 1.80                   | 2.33             | 1.80                     |
| 80.0               | 3.00                    | 4.32                            | 2.57                           | 2.14                   | 2.71             | 2.14                     |
| 100.0              | 3.00                    | 5.22                            | 3.69                           | 2.46                   | 3.03             | 2.46                     |
| 120.0              | 3.00                    | 6.31                            | 5.01                           | 2.79                   | 3.30             | 2.79                     |
| 140.0              | 3.00                    | 7.62                            | 6.51                           | 3.22                   | 3.51             | 3.22                     |
| 150.0              | 4.00                    | 8.33                            | 7.53                           | 3.45                   | 3.60             | 3.45                     |
| 160.0              | 4.00                    | 9.13                            | 8.36                           | 4.00                   | 3.67             | 4.00                     |
| 170.0              | 4.00                    | 9.96                            | 9.24                           | 4.00                   | 3.73             | 4.00                     |

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Max Capacity assuming inlet control  
 $\approx 150 \text{ cfs} < 220 \text{ cfs} \pm$   
 ↑  
 100-Year Peak.

**Existing Ditch CP SLB**  
**Worksheet for Irregular Channel**

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**Project Description**

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|              |                                                |
|--------------|------------------------------------------------|
| Project File | p:\civil\6000208\hydrau~1\flowma~1\steadmp.fm2 |
| Worksheet    | GC SLB Existing Ditch                          |
| Flow Element | Irregular Channel                              |
| Method       | Manning's Formula                              |
| Solve For    | Water Elevation                                |

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**Input Data**

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Channel Slope 0.027700 ft/ft

Elevation range: 4987.80 ft to 4994.00 ft.

| Station (ft) | Elevation (ft) | Start Station | End Station | Roughness |
|--------------|----------------|---------------|-------------|-----------|
| 1000.00      | 4994.00        | 1000.00       | 1042.00     | 0.035     |
| 1020.00      | 4992.00        |               |             |           |
| 1025.00      | 4990.00        |               |             |           |
| 1030.00      | 4987.80        |               |             |           |
| 1032.00      | 4990.00        |               |             |           |
| 1035.00      | 4992.00        |               |             |           |
| 1042.00      | 4992.50        |               |             |           |

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Discharge 266.00 ft<sup>3</sup>/s

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**Results**

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|                           |          |                    |
|---------------------------|----------|--------------------|
| Wtd. Mannings Coefficient | 0.035    |                    |
| Water Surface Elevation   | 4991.83  | ft                 |
| Flow Area                 | 27.16    | ft <sup>2</sup>    |
| Wetted Perimeter          | 16.65    | ft                 |
| Top Width                 | 14.31    | ft                 |
| Depth                     | 4.03     | ft                 |
| Critical Water Elev.      | 4992.42  | ft                 |
| Critical Slope            | 0.017592 | ft/ft              |
| Velocity                  | 9.79     | ft/s               |
| Velocity Head             | 1.49     | ft                 |
| Specific Energy           | 4993.32  | ft                 |
| Froude Number             | 1.25     |                    |
| Full Flow Capacity        | 1030.32  | ft <sup>3</sup> /s |
| Flow is supercritical.    |          |                    |

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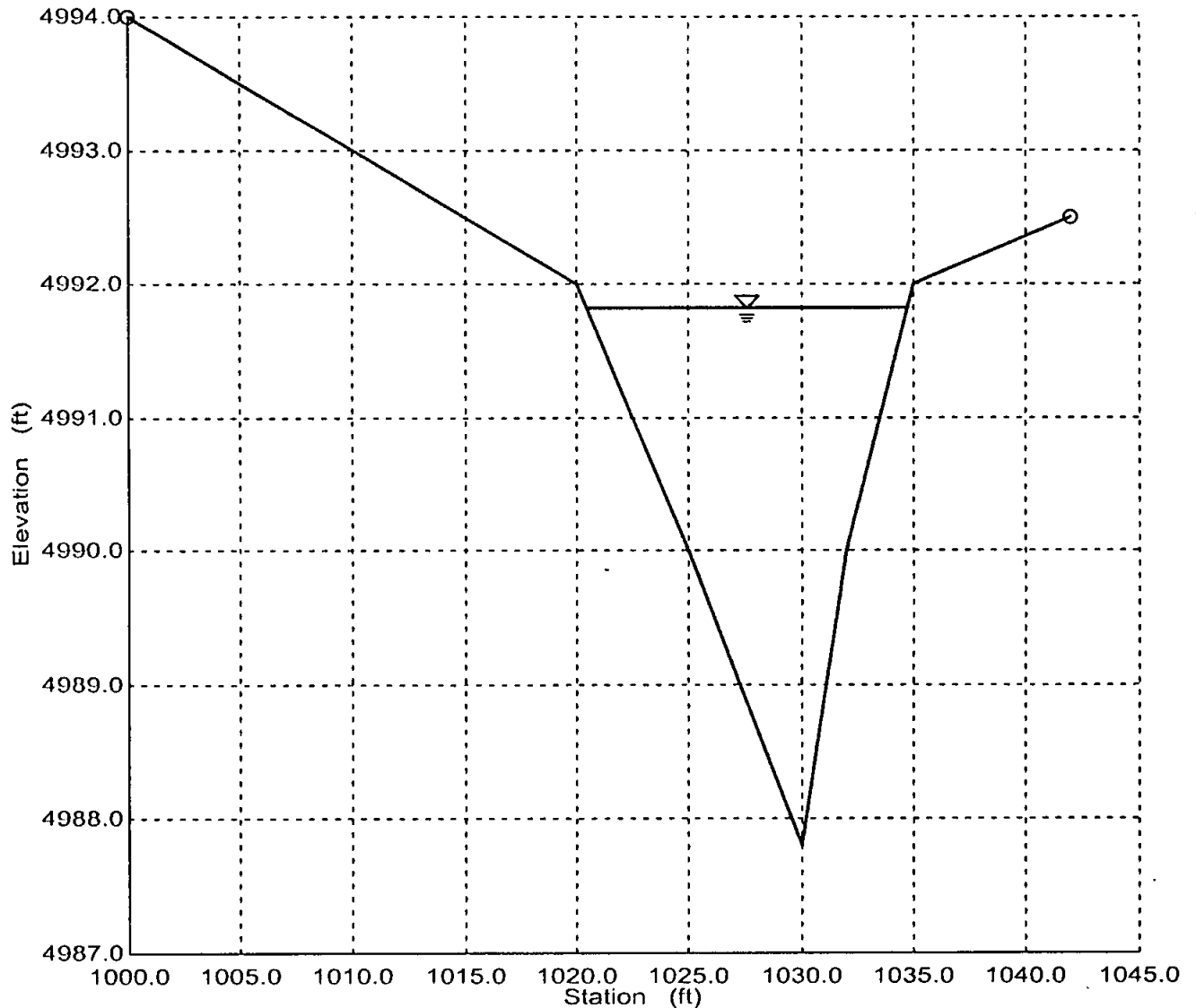
# **Cross Section Existing Ditch CP SLB** **Cross Section for Irregular Channel**

## **Project Description**

|              |                                                |
|--------------|------------------------------------------------|
| Project File | p:\civil\6000208\hydrau~1\flowma~1\steadmp.fm2 |
| Worksheet    | GC SLB Existing Ditch                          |
| Flow Element | Irregular Channel                              |
| Method       | Manning's Formula                              |
| Solve For    | Water Elevation                                |

## **Section Data**

|                           |                           |
|---------------------------|---------------------------|
| Wtd. Mannings Coefficient | 0.035                     |
| Channel Slope             | 0.027700 ft/ft            |
| Water Surface Elevation   | 4991.83 ft                |
| Discharge                 | 266.00 ft <sup>3</sup> /s |





## Drainage Master Plan for Stead, Nevada

Donnelley Channel Improvements  
CP LEA

### PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

| ITEM NO. | QUANTITY | UNIT | DESCRIPTION                          | UNIT COST   | TOTAL COST   |
|----------|----------|------|--------------------------------------|-------------|--------------|
| 1        | 2800     | SY   | REMOVE EXISTING PAVEMENT             | \$5.00      | \$14,000.00  |
| 2        | 14000    | CY   | EXCAVATION AND EMBANKMENT            | \$5.00      | \$70,000.00  |
| 3        | 2800     | SY   | 6 INCH PLANTMIX BITUMINOUS PAVEMENT  | \$10.00     | \$28,000.00  |
| 4        | 2800     | SY   | 6 INCH TYPE 2 CLASS B AGGREGATE BASE | \$4.00      | \$11,200.00  |
| 5        | 600      | LF   | CURB AND GUTTER                      | \$8.00      | \$4,800.00   |
| 6        | 533      | CY   | BERM W/ COMPACTION                   | \$6.50      | \$3,464.50   |
| 7        | 650      | LF   | DOUBLE 24' X 4' RC MEGA BOX CULVERT  | \$1,050.00  | \$682,500.00 |
| 8        | 10       | LS   | HEAD/WINGWALL FOR ALL CONSPAN        | \$40,000.00 | \$400,000.00 |
| 9        | 300      | LF   | 4 INCH SOLID WHITE LINE              | \$2.20      | \$660.00     |
| 10       | 14600    | SY   | REVEGETATION/SEEDING CHANNEL         | \$5.00      | \$73,000.00  |
| 11       | 1        | LS   | TRAFFIC CONTROL                      | LS          | \$10,000.00  |
| 12       |          | SY   |                                      | \$0.00      | \$0.00       |
| 13       |          | SY   |                                      | \$0.00      | \$0.00       |
| 14       |          | LF   |                                      | \$0.00      | \$0.00       |
| 15       |          | LF   |                                      | \$0.00      | \$0.00       |
| 16       |          | EA   |                                      | \$0.00      | \$0.00       |
| 17       |          | EA   |                                      | \$0.00      | \$0.00       |
| 18       |          | EA   |                                      | \$0.00      | \$0.00       |
| 19       |          | EA   |                                      | \$0.00      | \$0.00       |
| 20       |          | EA   |                                      | \$0.00      | \$0.00       |
| 21       |          | LF   |                                      | \$0.00      | \$0.00       |
| 22       |          | EA   |                                      | \$0.00      | \$0.00       |
| 23       |          | LS   |                                      | \$0.00      | \$0.00       |

|                         |                  |
|-------------------------|------------------|
| SUBTOTAL                | \$1,297,625      |
| CONTINGENCY (15%)       | <u>\$194,644</u> |
| TOTAL CONSTRUCTION COST | \$1,492,268      |

|                                    |           |
|------------------------------------|-----------|
| RIGHT-OF-WAY/EASEMENT (380,000 SF) | \$380,000 |
|------------------------------------|-----------|

|                                  |                |
|----------------------------------|----------------|
| DESIGN SERVICES                  |                |
| ENGINEERING DESIGN (6%)          | \$78,000       |
| HYDROLOGY (WA. CO. REQUIREMENTS) | \$7,500        |
| SURVEYING (TOPOGRAPHIC + LEGALS) | \$9,000        |
| GEOTECHNICAL                     | <u>\$7,500</u> |
| TOTAL DESIGN SERVICES            | \$102,000      |

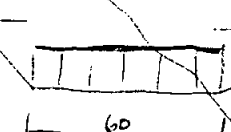
|                             |                 |
|-----------------------------|-----------------|
| CONSTRUCTION SERVICES       |                 |
| SURVEYING STAKEOUT          | \$28,500        |
| QUALITY CONTROL             | \$118,000       |
| CONSTRUCTION ADMINISTRATION | <u>\$11,000</u> |
| TOTAL CONSTRUCTION SERVICES | \$157,500       |

|                    |             |
|--------------------|-------------|
| TOTAL PROJECT COST | \$2,131,768 |
|--------------------|-------------|

DATE 4/3/00  
BY TMM

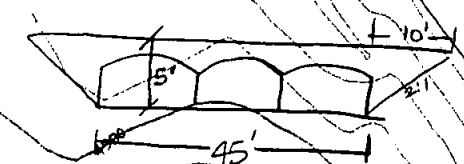
$Ex + EM$   
 $\frac{1}{2} \times 22' \times 4' \times 1000' = 88,000 CF$   
 $= 3260 CY$   
 $ROW$   
 $(22' + 4') \times 1000' = 37,000 SF$

6-10'x4' RCB's  
D=3.1  $\Rightarrow$  4.1



Pavement  $80' \times 45' = 3600 SF$   
 $= 360 SY$

$Ex + EM$   
 $[60 \times 5 + 10 \times 5] \times 40 = 14,000 CF$   
 $= 520 CY$



$Ex + EM =$   
 $40 [(45 \times 5) + (10 \times 5)]$   
 $= 11,000 CF$   
 $= 408 CY$

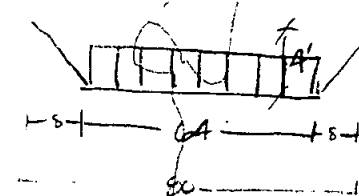
PAVEMENT  
 $65 \times 40 = 2600 SF$   
 $= 290 SY$

$Ex + EM$   
 $75 [(45 \times 5) + (10 \times 5)]$   
 $= 20,625 CF$   
 $= 765 CY$

Pavement  
 $65 \times 75 = 4875 SF$   
 $= 541 SY$

3-14'x4' RCB's

8-8'x3' RCB's



Pavement  
 $80' \times 75' = 6000 SF$   
 $= 667 SY$

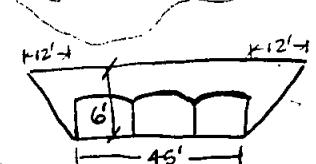
$Ex + EM$   
 $\frac{1}{2} [(64 \times 4) + (8 \times 4)] \times 75 = 21,600 CF$   
 $= 800 CY$

$Ex + EM$   
 $\frac{1}{2} [(32' \times 4') \times 1220]$   
 $= 156,160 CF$   
 $= 5785 CY$

$ROW$   
 $(32' + 5') \times 1220 = 57340 SF$

ROW

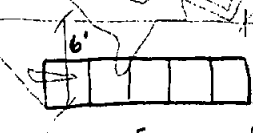
Avg. access  
 $80' + 15' = 4750$   
 $= 451,250 SF$   
 40 access  
 $80 \times 4750 = 380,000 SF$



$Ex + EM$   
 $50 [(45 \times 6) + (12 \times 6)]$   
 $= 17,100 CF$   
 $= 633 CY$

Pavement  
 $10 \times 50 = 3500 SF$   
 $= 390 SY$

5-10'x4' RCB's



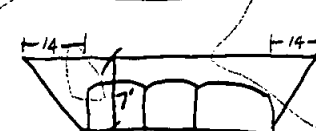
Pavement  
 $74 \times 50 = 3700 SF$   
 $= 411 SY$

$Ex + EM$   
 $\frac{1}{2} [(50 \times 6) + (12 \times 6)] \times 50 = 18,600 CF$   
 $= 689 CY$



$Ex + EM$   
 $80 [(45 \times 5) + (10 \times 5)]$   
 $= 22,000 CF$   
 $= 815 CY$

PAVEMENT  
 $65 \times 80 = 5200 SF$   
 $= 578 SY$



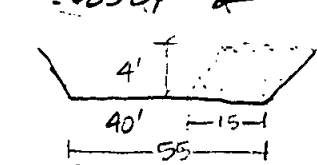
$Ex + EM$   
 $80 [(45 \times 7) + (14 \times 7)]$   
 $= 33,040 CF$   
 $= 1225 CY$

PAVEMENT  
 $73 \times 80 = 5840 SF$   
 $= 650 SY$



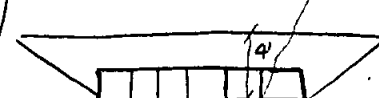
Pavement  
 $80 \times 78 = 6240 SF$   
 $= 698 SY$

$Ex + EM$   
 $\frac{1}{2} [(50 \times 7) + (7 \times 14)] \times 80$   
 $= 39,540 CF$   
 $= 1521 CY$



$Ex + EM$   
 $\frac{1}{2} [(40 \times 4) + (15 \times 4)] \times 55$   
 $= 4,500 CF$   
 $= 1667 CY$

12-8'x3' RCB's, 75' bw, 96' TW  
 D=2.55 2.5' depth  
 6-8'x3' RCB's  
 D=3'



Pavement  
 $64 \times 80 = 5120 SF$   
 $= 568 SY$

$Ex + EM$   
 $[48 \times 4] + (8 \times 4) \times 80 = 17,120 CF$   
 $= 624 CY$

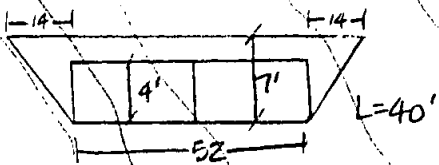
Berm

$325' \times 22' = 7150 SF$   
 $16' \times 10' \times 161' = 2576 SF$   
 $= 14400 CF = 533 CY$

Vegetation Replacement  
 Avg 35' wide improvement  
 Approx 3750' long  
 131,250 SF  
 14,583 SY

Total Channel  
 $Ex + EM = 9212 CY$   
 use 9250 CY

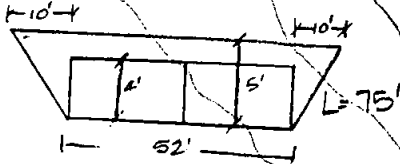
2- 24'x4' MEGA Box Culverts



Pavement  
 $40 \times 80$   
 $= 3200 \text{ SF}$   
 $= 356 \text{ SY}$

Ex + EM  
 $7[(40 \times 52) + (40 \times 14)]$   
 $= 18480 \text{ CF}$   
 $= 684 \text{ CY}$

2- 24'x4' MEGA Box Culverts



Pavement  
 $75 \times 72$   
 $= 5400 \text{ SF}$   
 $= 600 \text{ SY}$

Ex + EM  
 $5[(75 \times 52) + (75 \times 14)]$   
 $= 24750 \text{ CF}$   
 $= 917 \text{ CY}$

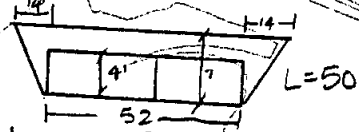
Total Pavement

2751 SY  
 $\downarrow$   
 $2800 \text{ SY}$

Total Ex + EM

4745 CY  
 $\downarrow$   
 $4800 \text{ CY}$

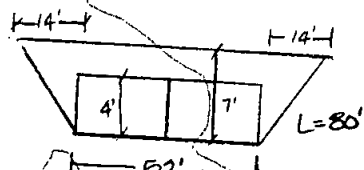
2- 24'x4' MEGA Box Culverts



Pavement  
 $50 \times 80$   
 $= 4000 \text{ SF}$   
 $= 444 \text{ SY}$

Ex + EM  
 $7[(50 \times 52) + (50 \times 14)]$   
 $= 23100 \text{ CF}$   
 $= 856 \text{ CY}$

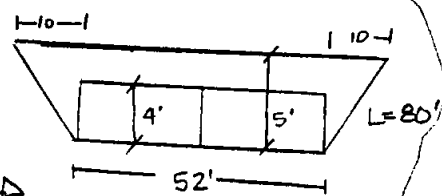
2- 24'x4' MEGA Box Culverts



Pavement  
 $80 \times 80$   
 $= 6400 \text{ SF}$   
 $= 711 \text{ SY}$

Ex + EM  
 $7[(80 \times 52) + (80 \times 14)]$   
 $= 36060 \text{ CF}$   
 $= 1369 \text{ CY}$

2- 24'x4' MEGA Box Culverts

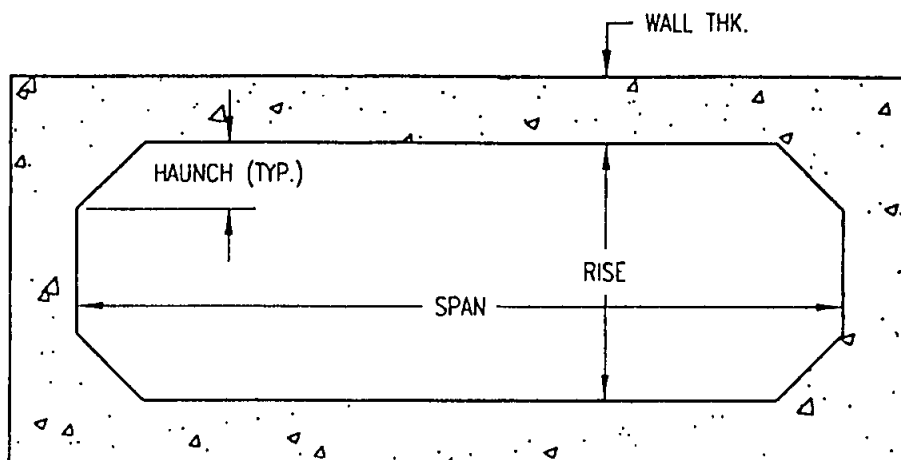


Pavement  
 $80 \times 72$   
 $= 5760 \text{ SF}$   
 $= 640 \text{ SY}$

Ex + EM  
 $5[(80 \times 52) + (80 \times 10)]$   
 $= 24800 \text{ CF}$   
 $= 919 \text{ CY}$

Option A

# Reinforced Concrete MEGA Box Culvert



| SPAN | RISE | WALL THK.<br>MIN. | HAUNCH | WIEGHT/LIN. FT. | JOINT LENGTH |
|------|------|-------------------|--------|-----------------|--------------|
| 14'  | 4'   | 12"               | 12"    | 6,300 lbs.      | 6.00'        |
| 14'  | 6'   | 12"               | 12"    | 6,900 lbs.      | 6.00'        |
| 14'  | 8'   | 12"               | 12"    | 7,500 lbs.      | 6.00'        |
| 16'  | 4'   | 12"               | 12"    | 6,900 lbs.      | 6.00'        |
| 16'  | 6'   | 12"               | 12"    | 7,500 lbs.      | 6.00'        |
| 16'  | 8'   | 12"               | 12"    | 8,100 lbs.      | 6.00'        |
| 18'  | 4'   | 12"               | 12"    | 7,500 lbs.      | 6.00'        |
| 18'  | 6'   | 12"               | 12"    | 8,100 lbs.      | 6.00'        |
| 18'  | 8'   | 12"               | 12"    | 8,700 lbs.      | 6.00'        |
| 20'  | 4'   | 12"               | 12"    | 8,100 lbs.      | 6.00'        |
| 20'  | 6'   | 12"               | 12"    | 8,700 lbs.      | 6.00'        |
| 20'  | 8'   | 12"               | 12"    | 9,300 lbs.      | 6.00'        |
| 22'  | 4'   | 12"               | 12"    | 8,700 lbs.      | 6.00'        |
| 22'  | 6'   | 12"               | 12"    | 9,300 lbs.      | 6.00'        |
| 22'  | 8'   | 12"               | 12"    | 9,900 lbs.      | 6.00'        |
| 24'  | 4'   | 12"               | 12"    | 9,300 lbs.      | 6.00'        |
| 24'  | 6'   | 12"               | 12"    | 9,900 lbs.      | 6.00'        |
| 24'  | 8'   | 12"               | 12"    | 10,500 lbs.     | 6.00'        |

## NOTES:

1. Consult Hydro Conduit Corporation for further details not listed.
2. Weights are based on 12" walls. Actual weights may vary depending on design criteria.
3. Designs per ASTM Specifications C-850 or C-789 depending on cover.

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 Issued 03/00

BOX CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

April 6, 2000  
Donnelley Channel Improvements  
Proposed 24' x 4' RCMegaB under Driveway #1  
801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Span (Width of Opening) (feet).....           | 24.00  |
| Culvert Rise (Height of Opening) (feet).....          | 4.00   |
| FHWA Chart Number (8,9,10,11,12 or 13).....           | 8      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 80.0   |
| Culvert Slope (feet per foot).....                    | 0.0008 |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater Depth<br>(ft) | Headwater Inlet<br>(ft) Control | Headwater Outlet<br>(ft) Control | Normal Depth<br>(ft) | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|---------------------------------|----------------------------------|----------------------|------------------------|-------------------------|--------------------------|
| 100.0              | 3.00                    | 1.28                            | 2.96                             | 1.21                 | 0.81                   | 3.00                    | 1.39                     |
| 125.0              | 3.00                    | 1.48                            | 2.98                             | 1.39                 | 0.94                   | 3.00                    | 1.74                     |
| 150.0              | 3.00                    | 1.68                            | 3.00                             | 1.56                 | 1.07                   | 3.00                    | 2.08                     |
| 175.0              | 3.00                    | 1.87                            | 3.02                             | 1.72                 | 1.18                   | 3.00                    | 2.43                     |
| 190.0              | 3.00                    | 1.98                            | 3.04                             | 1.81                 | 1.25                   | 3.00                    | 2.64                     |
| 200.0              | 3.00                    | 2.05                            | 3.05                             | 1.87                 | 1.29                   | 3.00                    | 2.78                     |
| 225.0              | 3.00                    | 2.22                            | 3.08                             | 2.02                 | 1.40                   | 3.00                    | 3.13                     |
| 250.0              | 3.00                    | 2.38                            | 3.11                             | 2.16                 | 1.50                   | 3.00                    | 3.47                     |
| 275.0              | 3.00                    | 2.55                            | 3.15                             | 2.29                 | 1.60                   | 3.00                    | 3.82                     |
| 284.0              | 3.00                    | 2.60                            | 3.17                             | 2.34                 | 1.63                   | 3.00                    | 3.94                     |
| 300.0              | 3.00                    | 2.70                            | 3.19                             | 2.42                 | 1.69                   | 3.00                    | 4.17                     |
| 325.0              | 3.00                    | 2.85                            | 3.24                             | 2.55                 | 1.79                   | 3.00                    | 4.51                     |

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BOX CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

April 6, 2000  
Donnelley Channel Improvements  
Proposed 24' x 4' RCMegaB under Driveway #2  
801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Span (Width of Opening) (feet).....           | 24.00  |
| Culvert Rise (Height of Opening) (feet).....          | 4.00   |
| FHWA Chart Number (8,9,10,11,12 or 13).....           | 8      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 80.0   |
| Culvert Slope (feet per foot).....                    | 0.0008 |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater (ft)<br>Inlet Control | Headwater (ft)<br>Outlet Control | Normal Depth<br>(ft) | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|---------------------------------|----------------------------------|----------------------|------------------------|-------------------------|--------------------------|
| 100.0              | 3.00                    | 1.28                            | 2.96                             | 1.21                 | 0.81                   | 3.00                    | 1.39                     |
| 125.0              | 3.00                    | 1.48                            | 2.98                             | 1.39                 | 0.94                   | 3.00                    | 1.74                     |
| 150.0              | 3.00                    | 1.68                            | 3.00                             | 1.56                 | 1.07                   | 3.00                    | 2.08                     |
| 175.0              | 3.00                    | 1.87                            | 3.02                             | 1.72                 | 1.18                   | 3.00                    | 2.43                     |
| 190.0              | 3.00                    | 1.98                            | 3.04                             | 1.81                 | 1.25                   | 3.00                    | 2.64                     |
| 200.0              | 3.00                    | 2.05                            | 3.05                             | 1.87                 | 1.29                   | 3.00                    | 2.78                     |
| 225.0              | 3.00                    | 2.22                            | 3.08                             | 2.02                 | 1.40                   | 3.00                    | 3.13                     |
| 250.0              | 3.00                    | 2.38                            | 3.11                             | 2.16                 | 1.50                   | 3.00                    | 3.47                     |
| 275.0              | 3.00                    | 2.55                            | 3.15                             | 2.29                 | 1.60                   | 3.00                    | 3.82                     |
| 284.0              | 3.00                    | 2.60                            | 3.17                             | 2.34                 | 1.63                   | 3.00                    | 3.94                     |
| 300.0              | 3.00                    | 2.70                            | 3.19                             | 2.42                 | 1.69                   | 3.00                    | 4.17                     |
| 325.0              | 3.00                    | 2.85                            | 3.24                             | 2.55                 | 1.79                   | 3.00                    | 4.51                     |

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BOX CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

April 6, 2000  
Donnelley Channel Improvements  
Proposed 24' x 4' RCMega8 under Crossing #3  
801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Span (Width of Opening) (feet).....           | 24.00  |
| Culvert Rise (Height of Opening) (feet).....          | 4.00   |
| FHWA Chart Number (8,9,10,11,12 or 13).....           | 8      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 50.0   |
| Culvert Slope (feet per foot).....                    | 0.0008 |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth<br>(ft) | Headwater<br>Inlet<br>Depth<br>(ft) | Headwater<br>Outlet<br>Depth<br>(ft) | Normal<br>Depth<br>(ft) | Critical<br>Depth<br>(ft) | Depth at<br>Outlet<br>(ft) | Outlet<br>Velocity<br>(fps) |
|--------------------|----------------------------|-------------------------------------|--------------------------------------|-------------------------|---------------------------|----------------------------|-----------------------------|
| 100.0              | 3.00                       | 1.28                                | 2.99                                 | 1.21                    | 0.81                      | 3.00                       | 1.39                        |
| 125.0              | 3.00                       | 1.48                                | 3.00                                 | 1.39                    | 0.94                      | 3.00                       | 1.74                        |
| 150.0              | 3.00                       | 1.68                                | 3.02                                 | 1.56                    | 1.07                      | 3.00                       | 2.08                        |
| 175.0              | 3.00                       | 1.87                                | 3.04                                 | 1.72                    | 1.18                      | 3.00                       | 2.43                        |
| 190.0              | 3.00                       | 1.98                                | 3.06                                 | 1.81                    | 1.25                      | 3.00                       | 2.64                        |
| 200.0              | 3.00                       | 2.05                                | 3.07                                 | 1.87                    | 1.29                      | 3.00                       | 2.78                        |
| 225.0              | 3.00                       | 2.22                                | 3.10                                 | 2.02                    | 1.40                      | 3.00                       | 3.13                        |
| 250.0              | 3.00                       | 2.38                                | 3.13                                 | 2.16                    | 1.50                      | 3.00                       | 3.47                        |
| 275.0              | 3.00                       | 2.55                                | 3.17                                 | 2.29                    | 1.60                      | 3.00                       | 3.82                        |
| 284.0              | 3.00                       | 2.60                                | 3.18                                 | 2.34                    | 1.63                      | 3.00                       | 3.94                        |
| 300.0              | 3.00                       | 2.70                                | 3.21                                 | 2.42                    | 1.69                      | 3.00                       | 4.17                        |
| 325.0              | 3.00                       | 2.85                                | 3.25                                 | 2.55                    | 1.79                      | 3.00                       | 4.51                        |

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BOX CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

April 6, 2000  
Donnelley Channel Improvements  
Proposed 24' x 4' RCMegaB under Crossing #4  
801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Span (Width of Opening) (feet).....           | 24.00  |
| Culvert Rise (Height of Opening) (feet).....          | 4.00   |
| FHWA Chart Number (8,9,10,11,12 or 13).....           | 8      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 75.0   |
| Culvert Slope (feet per foot).....                    | 0.0008 |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth<br>(ft) | Headwater Inlet<br>Control<br>(ft) | Headwater Outlet<br>Control<br>(ft) | Normal Depth<br>(ft) | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|----------------------------|------------------------------------|-------------------------------------|----------------------|------------------------|-------------------------|--------------------------|
| 100.0              | 3.00                       | 1.28                               | 2.97                                | 1.21                 | 0.81                   | 3.00                    | 1.39                     |
| 125.0              | 3.00                       | 1.48                               | 2.98                                | 1.39                 | 0.94                   | 3.00                    | 1.74                     |
| 150.0              | 3.00                       | 1.68                               | 3.00                                | 1.56                 | 1.07                   | 3.00                    | 2.08                     |
| 175.0              | 3.00                       | 1.87                               | 3.03                                | 1.72                 | 1.18                   | 3.00                    | 2.43                     |
| 190.0              | 3.00                       | 1.98                               | 3.04                                | 1.81                 | 1.25                   | 3.00                    | 2.64                     |
| 200.0              | 3.00                       | 2.05                               | 3.05                                | 1.87                 | 1.29                   | 3.00                    | 2.78                     |
| 225.0              | 3.00                       | 2.22                               | 3.08                                | 2.02                 | 1.40                   | 3.00                    | 3.13                     |
| 250.0              | 3.00                       | 2.38                               | 3.12                                | 2.16                 | 1.50                   | 3.00                    | 3.47                     |
| 275.0              | 3.00                       | 2.55                               | 3.15                                | 2.29                 | 1.60                   | 3.00                    | 3.82                     |
| 284.0              | 3.00                       | 2.60                               | 3.17                                | 2.34                 | 1.63                   | 3.00                    | 3.94                     |
| 300.0              | 3.00                       | 2.70                               | 3.19                                | 2.42                 | 1.69                   | 3.00                    | 4.17                     |
| 325.0              | 3.00                       | 2.85                               | 3.24                                | 2.55                 | 1.79                   | 3.00                    | 4.51                     |

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BOX CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

April 6, 2000  
Donnelley Channel Improvements  
Proposed 24' x 4' RCMegaB under Crossing #5  
801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Span (Width of Opening) (feet).....           | 24.00  |
| Culvert Rise (Height of Opening) (feet).....          | 4.00   |
| FHWA Chart Number (8,9,10,11,12 or 13).....           | 8      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 40.0   |
| Culvert Slope (feet per foot).....                    | 0.0008 |

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth<br>(ft) | Headwater Inlet<br>Depth Control<br>(ft) | Headwater Outlet<br>Depth Control<br>(ft) | Normal Depth<br>(ft) | Critical Depth<br>(ft) | Depth at Outlet<br>(ft) | Outlet Velocity<br>(fps) |
|--------------------|----------------------------|------------------------------------------|-------------------------------------------|----------------------|------------------------|-------------------------|--------------------------|
| 100.0              | 3.00                       | 1.28                                     | 2.99                                      | 1.21                 | 0.81                   | 3.00                    | 1.39                     |
| 125.0              | 3.00                       | 1.48                                     | 3.01                                      | 1.39                 | 0.94                   | 3.00                    | 1.74                     |
| 150.0              | 3.00                       | 1.68                                     | 3.03                                      | 1.56                 | 1.07                   | 3.00                    | 2.08                     |
| 175.0              | 3.00                       | 1.87                                     | 3.05                                      | 1.72                 | 1.18                   | 3.00                    | 2.43                     |
| 190.0              | 3.00                       | 1.98                                     | 3.07                                      | 1.81                 | 1.25                   | 3.00                    | 2.64                     |
| 200.0              | 3.00                       | 2.05                                     | 3.08                                      | 1.87                 | 1.29                   | 3.00                    | 2.78                     |
| 225.0              | 3.00                       | 2.22                                     | 3.10                                      | 2.02                 | 1.40                   | 3.00                    | 3.13                     |
| 250.0              | 3.00                       | 2.38                                     | 3.14                                      | 2.16                 | 1.50                   | 3.00                    | 3.47                     |
| 275.0              | 3.00                       | 2.55                                     | 3.17                                      | 2.29                 | 1.60                   | 3.00                    | 3.82                     |
| 284.0              | 3.00                       | 2.60                                     | 3.18                                      | 2.34                 | 1.63                   | 3.00                    | 3.94                     |
| 300.0              | 3.00                       | 2.70                                     | 3.21                                      | 2.42                 | 1.69                   | 3.00                    | 4.17                     |
| 325.0              | 3.00                       | 2.85                                     | 3.25                                      | 2.55                 | 1.79                   | 3.00                    | 4.51                     |

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TRAPEZOIDAL CHANNEL ANALYSIS  
RATING CURVE COMPUTATION

March 10, 2000  
Donnelley Channel  
Proposed 50'bw, 3:1ss Channel  
801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                              | VALUE       |
|----------------------------------------------------------|-------------|
| Channel Bottom Slope (feet per foot).....                | 0.0015      |
| Manning's Roughness Coefficient (n-value).....           | 0.0350      |
| Channel Side Slope - Left Side (horizontal/vertical).... | 3.00        |
| Channel Side Slope - Right Side (horizontal/vertical)... | 3.00        |
| Channel Bottom Width (feet).....                         | <u>50.0</u> |

PROGRAM RESULTS:

| Depth<br>(ft) | Flow Rate<br>(cfs) | Velocity<br>(fps) | Froude<br>Number | Velocity<br>Head(ft) | Energy<br>Head(ft) | Flow Area<br>(sq ft) | Top Width<br>(ft) |
|---------------|--------------------|-------------------|------------------|----------------------|--------------------|----------------------|-------------------|
| 1.0           | 83.7               | 1.58              | 0.286            | 0.039                | 1.039              | 53.0                 | 56.0              |
| 2.0           | 271.3              | 2.42              | 0.318            | 0.091                | 2.091              | 112.0                | 62.0              |
| 3.0           | 545.5              | 3.08              | 0.337            | 0.148                | 3.148              | 177.0                | 68.0              |
| 3.1           | 577.6              | 3.14              | 0.338            | 0.153                | 3.253              | 183.8                | 68.6              |
| 3.2           | 610.4              | 3.20              | 0.340            | 0.159                | 3.359              | 190.7                | 69.2              |
| 3.3           | 644.0              | 3.26              | 0.341            | 0.165                | 3.465              | 197.7                | 69.8              |
| 3.4           | 678.5              | 3.32              | 0.343            | 0.171                | 3.571              | 204.7                | 70.4              |
| 3.5           | 713.8              | 3.37              | 0.344            | 0.176                | 3.676              | 211.7                | 71.0              |
| 4.0           | 902.7              | 3.64              | 0.350            | 0.206                | 4.206              | 248.0                | 74.0              |

$D = 3.07'$   
 $Q_{100} = 568, D = 3.15$

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.3 (c) 1986  
Dodson & Associates, Inc., 5629 FM 1960 W., #314, Houston, TX 77069  
(713) 440-3787. A manual with equations & flow chart is available.

TRAPEZOIDAL CHANNEL ANALYSIS  
RATING CURVE COMPUTATION

March 10, 2000  
Donnelley Channel  
Proposed 55'bw, 3:1ss Channel  
801 00208

PROGRAM INPUT DATA:

| DESCRIPTION                                              | VALUE       |
|----------------------------------------------------------|-------------|
| Channel Bottom Slope (feet per foot).....                | 0.0015      |
| Manning's Roughness Coefficient (n-value).....           | 0.0350      |
| Channel Side Slope - Left Side (horizontal/vertical).... | 3.00        |
| Channel Side Slope - Right Side (horizontal/vertical)... | 3.00        |
| Channel Bottom Width (feet).....                         | <u>55.0</u> |

PROGRAM RESULTS:

| Depth<br>(ft) | Flow Rate<br>(cfs) | Velocity<br>(fps) | Froude<br>Number | Velocity<br>Head(ft) | Energy<br>Head(ft) | Flow Area<br>(sq ft) | Top Width<br>(ft) |
|---------------|--------------------|-------------------|------------------|----------------------|--------------------|----------------------|-------------------|
| 1.0           | 91.9               | 1.58              | 0.286            | 0.039                | 1.039              | 58.0                 | 61.0              |
| 2.0           | 297.2              | 2.44              | 0.318            | 0.092                | 2.092              | 122.0                | 67.0              |
| 3.0           | 596.3              | 3.11              | 0.337            | 0.150                | 3.150              | 192.0                | 73.0              |
| 3.5           | 779.2              | 3.40              | 0.345            | 0.179                | 3.679              | 229.2                | 76.0              |
| 4.0           | 984.2              | 3.67              | 0.351            | 0.209                | 4.209              | 268.0                | 79.0              |

*Q<sub>max</sub> = 568, D = 3.0'*

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.3 (c) 1986  
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(713) 440-3787. A manual with equations & flow chart is available.



STANTEC CONSULTING INC.  
950 Industrial Way  
Sparks, Nevada 89431  
Tel: (775) 358-6931 Fax: (775) 358-6954

JOB NO. 801 00208

**Stantec**

SHEET \_\_\_\_\_ OF \_\_\_\_\_

PROJECT Donnelley Channel

DATE 3/7/00

SUBJECT \_\_\_\_\_

DESIGNED

TM

CHECKED \_\_\_\_\_

Existing Channel

Varying capacity

Existing Culverts

1<sup>st</sup> Driveway 4-18"  $\phi$  RCP's w/ headwall and grate

4-18" RCP's

$$Q_{cap} = 40 cfs$$

L = 80'

S = .0015

$$Q_{PI00} = 568 cfs$$

PIPE CULVERT ANALYSIS  
COMPUTATION OF CULVERT PERFORMANCE CURVE

March 9, 2000  
Donnelley Channel Driveway #1  
Existing 4 - 18" RCP's  
801 00208

=====

PROGRAM INPUT DATA:

| DESCRIPTION                                           | VALUE  |
|-------------------------------------------------------|--------|
| Culvert Diameter (feet).....                          | 1.50   |
| FHWA Chart Number (1,2 or 3).....                     | 1      |
| Scale Number on Chart (Type of Culvert Entrance)..... | 1      |
| Manning's Roughness Coefficient (n-value).....        | 0.0130 |
| Entrance Loss Coefficient of Culvert Opening.....     | 0.50   |
| Culvert Length (feet).....                            | 80.0   |
| Culvert Slope (feet per foot).....                    | 0.0015 |

=====

PROGRAM RESULTS:

| Flow Rate<br>(cfs) | Tailwater<br>Depth (ft) | Headwater<br>Inlet Control<br>(ft) | Normal Depth<br>Outlet Control<br>(ft) | Critical Depth<br>(ft) | Depth at<br>(ft) | Outlet<br>Depth (ft) | Outlet Velocity<br>(fps) |
|--------------------|-------------------------|------------------------------------|----------------------------------------|------------------------|------------------|----------------------|--------------------------|
| 10.0               | 4.00                    | 2.28                               | 5.35                                   | 1.50                   | 1.27             | 1.50                 | 5.66                     |
| 15.0               | 4.00                    | 3.87                               | 7.18                                   | 1.50                   | 1.41             | 1.50                 | 8.49                     |
| 20.0               | 4.00                    | 6.10                               | 9.75                                   | 1.50                   | 1.47             | 1.50                 | 11.32                    |

=====

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Project \_\_\_\_\_  
 Project No. \_\_\_\_\_  
 Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
 Calculated by \_\_\_\_\_ Date \_\_\_\_\_

# UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CROSS SECTION PARAMETERS:

FILENAME: DONN-100.SEC

No. of Cross Section Points: 13 Bed Slope: 0.00150 Max Elev.: 4980.00  
 Bank Stations.....Left: 1130.0 Right.....: 1462.0 Min Elev.: 4972.00  
 Encroachment Stations..Left: Right.....:  
 Manning-n Values.....LOB: 0.020 CHANNEL...: 0.035 ROB.....: 0.035

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta. No. | Elev. | Sta. No. | Elev.   | Sta. |         |         |
|-----|---------|----------|-------|----------|---------|------|---------|---------|
| 1)  | 4980.00 | 1000.00  | 2)    | 4978.00  | 1008.00 | 3)   | 4977.00 | 1015.00 |
| 4)  | 4976.50 | 1025.00  | 5)    | 4977.00  | 1078.00 | 6)   | 4976.50 | 1130.00 |
| 7)  | 4976.00 | 1168.00  | 8)    | 4972.00  | 1180.00 | 9)   | 4972.00 | 1220.00 |
| 10) | 4974.00 | 1228.00  | 11)   | 4976.00  | 1328.00 | 12)  | 4978.00 | 1460.00 |
| 13) | 4980.00 | 1462.00  |       |          |         |      |         |         |

COMPUTED PARAMETERS:

| L(ft)   | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft)        |
|---------|--------|--------|------|-------|-----|-------|--------|-------|---------|-----------------|
| 4973.00 | 67.7   | 1.6    | 0.28 | 0.035 | 1.0 | 47.0  | 43.5   | 47.3  | 4972.43 |                 |
| 4974.00 | 222.1  | 2.4    | 0.32 | 0.035 | 1.0 | 54.0  | 94.0   | 54.6  | 4972.95 |                 |
| 4974.50 | 283.8  | 2.2    | 0.31 | 0.035 | 1.0 | 80.5  | 127.6  | 81.2  | 4973.11 |                 |
| 4975.00 | 395.7  | 2.3    | 0.31 | 0.035 | 1.0 | 107.0 | 174.5  | 107.7 | 4973.38 | $Q_{max} = 568$ |
| 4975.50 | 559.6  | 2.4    | 0.32 | 0.035 | 1.0 | 133.5 | 234.6  | 134.3 | 4973.71 | $cl. = 79.6$    |
| 4976.00 | 780.8  | 2.5    | 0.32 | 0.035 | 1.0 | 160.0 | 308.0  | 160.9 | 4974.20 |                 |

NOTES:

$Q = 568 \text{ cfs}$   
 $Q_{max}$

$D = 3.5'$

Project \_\_\_\_\_  
 Project No. \_\_\_\_\_  
 Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
 Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CROSS SECTION PARAMETERS:

FILENAME: DONN-80.SEC

No. of Cross Section Points: 15 Bed Slope: 0.00150 Max Elev.: 4978.00  
 Bank Stations.....Left: 1143.0 Right.....: 1705.0 Min Elev.: 4972.00  
 Encroachment Stations..Left: Right.....:  
 Manning-n Values.....LOB: 0.020 CHANNEL...: 0.035 ROB.....: 0.035

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.          | Sta.    | No. | Elev.          | Sta.    | No. | Elev.   | Sta.    |
|-----|----------------|---------|-----|----------------|---------|-----|---------|---------|
| 1)  | 4978.00        | 1000.00 | 2)  | 4976.30        | 1031.00 | 3)  | 4976.80 | 1072.00 |
| 4)  | 4976.00        | 1108.00 | 5)  | 4975.80        | 1112.00 | 6)  | 4976.00 | 1119.00 |
| 7)  | 4976.90        | 1128.00 | 8)  | 4976.70        | 1143.00 | 9)  | 4976.00 | 1157.00 |
| 10) | <u>4972.00</u> | 1169.00 | 11) | <u>4972.00</u> | 1210.00 | 12) | 4974.00 | 1219.00 |
| 13) | 4976.00        | 1420.00 | 14) | 4976.20        | 1486.00 | 15) | 4978.00 | 1705.00 |

COMPUTED PARAMETERS:

| L(ft)   | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|---------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 4973.00 | 69.5   | 1.6    | 0.28 | 0.035 | 1.0 | 48.5  | 44.8   | 48.8  | 4972.43 |          |
| 4974.00 | 228.6  | 2.4    | 0.32 | 0.035 | 1.0 | 56.0  | 97.0   | 56.5  | 4972.96 |          |
| 4974.50 | 266.4  | 1.9    | 0.30 | 0.035 | 1.0 | 107.8 | 137.9  | 108.4 | 4973.04 |          |
| 4975.00 | 396.5  | 1.9    | 0.30 | 0.035 | 1.0 | 159.5 | 204.8  | 160.2 | 4973.35 |          |
| 4975.50 | 612.9  | 2.1    | 0.31 | 0.035 | 1.0 | 211.3 | 297.4  | 212.0 | 4973.80 |          |
| 4976.00 | 906.6  | 2.2    | 0.31 | 0.035 | 1.0 | 274.0 | 417.1  | 274.9 | 4974.52 |          |

$Q_{100} = 508$   
 $cl = 75.5$

NOTES:

$Q = 508 \text{ cfs}$   
 $P_{100}$

$D = 3.5'$

Project \_\_\_\_\_  
 Project No. \_\_\_\_\_  
 Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
 Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CROSS SECTION PARAMETERS:

FILENAME: DONN-60.SEC

No. of Cross Section Points: 8 Bed Slope: 0.00150 Max Elev.: 4980.10  
 Bank Stations.....Left: 1102.0 Right.....: 1200.0 Min Elev.: 4972.00  
 Encroachment Stations..Left: Right.....:  
 Manning-n Values.....LOB: 0.020 CHANNEL...: 0.035 ROB.....: 0.035

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta. No. | Elev. | Sta. No. | Elev.   | Sta. |         |         |
|-----|---------|----------|-------|----------|---------|------|---------|---------|
| 1)  | 4980.10 | 1000.00  | 2)    | 4979.50  | 1040.00 | 3)   | 4979.80 | 1065.00 |
| 4)  | 4978.00 | 1102.00  | 5)    | 4972.00  | 1118.00 | 6)   | 4972.00 | 1169.00 |
| 7)  | 4978.00 | 1189.00  | 8)    | 4978.20  | 1200.00 |      |         |         |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft)         |
|----------|--------|--------|------|-------|-----|-------|--------|-------|---------|------------------|
| 3.00     | 85.3   | 1.6    | 0.29 | 0.035 | 1.0 | 57.0  | 54.0   | 57.3  | 4972.43 |                  |
| 4974.00  | 276.4  | 2.4    | 0.32 | 0.035 | 1.0 | 63.0  | 114.0  | 63.7  | 4972.95 |                  |
| 4974.50  | 405.4  | 2.8    | 0.33 | 0.035 | 1.0 | 66.0  | 146.3  | 66.8  | 4973.21 | $Q_{1100} = 568$ |
| 4975.00  | 555.6  | 3.1    | 0.34 | 0.035 | 1.0 | 69.0  | 180.0  | 70.0  | 4973.48 | $el = 75.1$      |
| 4975.50  | 726.8  | 3.4    | 0.34 | 0.035 | 1.0 | 72.0  | 215.3  | 73.1  | 4973.77 |                  |
| 4976.00  | 918.9  | 3.6    | 0.35 | 0.035 | 1.0 | 75.0  | 252.0  | 76.3  | 4974.06 |                  |

NOTES:

$$Q_{rim} = 594 \text{ cfs}$$

$$D = 3.1'$$



Project \_\_\_\_\_  
 Project No. \_\_\_\_\_  
 Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
 Calculated by \_\_\_\_\_ Date \_\_\_\_\_

# UNIFORM FLOW COMPUTATIONS

## LOCATION/DESCRIPTION:

## CROSS SECTION PARAMETERS:

FILENAME: DONN-40.SEC

No. of Cross Section Points: 14 Bed Slope: 0.00150 Max Elev.: 4978.00  
 Bank Stations.....Left: 1000.0 Right.....: 1589.0 Min Elev.: 4970.00  
 Encroachment Stations..Left: Right.....:  
 Manning-n Values.....LOB: 0.035 CHANNEL...: 0.035 ROB.....: 0.035

## CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta. No. | Elev. | Sta. No. | Elev.   | Sta. |         |         |
|-----|---------|----------|-------|----------|---------|------|---------|---------|
| 1)  | 4978.00 | 1000.00  | 2)    | 4976.70  | 1010.00 | 3)   | 4978.00 | 1048.00 |
| 4)  | 4976.00 | 1062.00  | 5)    | 4977.70  | 1085.00 | 6)   | 4977.70 | 1108.00 |
| 7)  | 4976.30 | 1223.00  | 8)    | 4976.00  | 1241.00 | 9)   | 4970.00 | 1265.00 |
| 10) | 4970.00 | 1300.00  | 11)   | 4976.00  | 1324.00 | 12)  | 4977.00 | 1336.00 |
| 13) | 4976.40 | 1400.00  | 14)   | 4978.00  | 1589.00 |      |         |         |

## PUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 4971.00  | 59.9   | 1.5    | 0.28 | 0.035 | 1.0 | 43.0  | 39.0   | 43.2  | 4970.43 |          |
| 4972.00  | 199.1  | 2.3    | 0.31 | 0.035 | 1.0 | 51.0  | 86.0   | 51.5  | 4970.96 |          |
| 4973.00  | 411.0  | 2.9    | 0.33 | 0.035 | 1.0 | 59.0  | 141.0  | 59.7  | 4971.51 |          |
| 4973.50  | 544.8  | 3.2    | 0.34 | 0.035 | 1.0 | 63.0  | 171.5  | 63.9  | 4971.81 |          |
| 4974.00  | 697.9  | 3.4    | 0.35 | 0.035 | 1.0 | 67.0  | 204.0  | 68.0  | 4972.10 |          |
| 4974.50  | 870.6  | 3.7    | 0.35 | 0.035 | 1.0 | 71.0  | 238.5  | 72.1  | 4972.41 |          |

$Q = 568 \text{ cfs}$   
 $sl = 73.6$

## NOTES:

$Q_{P100} = 568 \text{ cfs}$

$D = 3.6'$

Project \_\_\_\_\_  
 Project No. \_\_\_\_\_  
 Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
 Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CROSS SECTION PARAMETERS:

FILENAME: DOWN-20.SEC

No. of Cross Section Points: 10 Bed Slope: 0.00150 Max Elev.: 4978.00  
 Bank Stations.....Left: 1000.0 Right.....: 1508.0 Min Elev.: 4970.00  
 Encroachment Stations..Left: Right.....:  
 Manning-n Values.....LOB: 0.035 CHANNEL...: 0.035 ROB.....: 0.035

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta. No. | Elev. | Sta. No. | Elev.   | Sta. |         |         |
|-----|---------|----------|-------|----------|---------|------|---------|---------|
| 1)  | 4978.00 | 1000.00  | 2)    | 4976.00  | 1032.00 | 3)   | 4974.00 | 1088.00 |
| 4)  | 4974.00 | 1135.00  | 5)    | 4972.00  | 1147.00 | 6)   | 4970.00 | 1178.00 |
| 7)  | 4970.00 | 1193.00  | 8)    | 4972.00  | 1200.00 | 9)   | 4974.00 | 1230.00 |
| 10) | 4976.00 | 1508.00  |       |          |         |      |         |         |

COMPUTED PARAMETERS:

| ELEV(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 4971.00  | 32.3   | 1.3    | 0.27 | 0.035 | 1.0 | 34.0  | 24.5   | 34.2  | 4970.47 |          |
| 4972.00  | 131.5  | 1.9    | 0.30 | 0.035 | 1.0 | 53.0  | 68.0   | 53.3  | 4971.05 |          |
| 4973.00  | 315.9  | 2.4    | 0.32 | 0.035 | 1.0 | 74.0  | 131.5  | 74.5  | 4971.69 |          |
| 4973.50  | 448.6  | 2.6    | 0.32 | 0.035 | 1.0 | 84.5  | 171.1  | 85.0  | 4972.03 |          |
| 4974.00  | 611.7  | 2.8    | 0.33 | 0.035 | 1.0 | 95.0  | 216.0  | 95.6  | 4972.36 |          |
| 4974.50  | 622.0  | 2.0    | 0.30 | 0.035 | 1.0 | 225.5 | 307.9  | 226.1 | 4972.37 |          |

$Q = 568$   
 $d = 73.8$

NOTES:

$$Q_{P100} = 568 \text{ cfs}$$

$$D = 3.8'$$

Project \_\_\_\_\_  
Project No. \_\_\_\_\_  
Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CROSS SECTION PARAMETERS:

FILENAME: DONN-10.SEC

No. of Cross Section Points: 11 Bed Slope: 0.00150 Max Elev.: 4976.00  
Bank Stations.....Left: 1000.0 Right.....: 1375.0 Min Elev.: 4969.00  
Encroachment Stations..Left: Right.....:  
Manning-n Values.....LOB: 0.035 CHANNEL...: 0.035 ROB.....: 0.035

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta. No. | Elev. | Sta. No. | Elev.   | Sta. |         |         |
|-----|---------|----------|-------|----------|---------|------|---------|---------|
| 1)  | 4976.00 | 1000.00  | 2)    | 4974.00  | 1020.00 | 3)   | 4974.00 | 1055.00 |
| 4)  | 4972.00 | 1069.00  | 5)    | 4970.00  | 1075.00 | 6)   | 4969.00 | 1081.00 |
| 7)  | 4969.00 | 1097.00  | 8)    | 4970.00  | 1101.00 | 9)   | 4972.00 | 1109.00 |
| 10) | 4974.00 | 1116.00  | 11)   | 4976.00  | 1375.00 |      |         |         |

COMPUTED PARAMETERS:

| L(ft)   | Q(cfs) | V(fps) | Fr   | No.   | nc  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|---------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 4970.00 | 29.8   | 1.4    | 0.28 | 0.035 | 1.0 | 26.0  | 21.0   | 26.2  | 4969.45 |          |
| 4971.00 | 109.2  | 2.2    | 0.31 | 0.035 | 1.0 | 33.0  | 50.5   | 33.5  | 4970.01 |          |
| 4972.00 | 237.1  | 2.7    | 0.33 | 0.035 | 1.0 | 40.0  | 87.0   | 40.8  | 4970.57 |          |
| 4973.00 | 407.9  | 3.1    | 0.34 | 0.035 | 1.0 | 50.5  | 132.3  | 51.5  | 4971.16 |          |
| 4973.50 | 518.0  | 3.3    | 0.34 | 0.035 | 1.0 | 55.8  | 158.8  | 56.8  | 4971.46 |          |
| 4974.00 | 646.3  | 3.4    | 0.35 | 0.035 | 1.0 | 61.0  | 188.0  | 62.2  | 4971.79 |          |

$Q = 668$   
 $Q = 730$

NOTES:

$Q_{100} = 568 \text{ cfs}$

$D = 4.8'$

Project \_\_\_\_\_  
 Project No. \_\_\_\_\_  
 Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
 Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CROSS SECTION PARAMETERS:

FILENAME: DONN-5.SEC

No. of Cross Section Points: 8 Bed Slope: 0.00150 Max Elev.: 4974.00  
 Bank Stations.....Left: 1000.0 Right.....: 1930.0 Min Elev.: 4968.00  
 Encroachment Stations..Left: Right.....:  
 Manning-n Values.....LOB: 0.035 CHANNEL...: 0.035 ROB.....: 0.035  
 CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta. No. | Elev. | Sta. No. | Elev.   | Sta. |         |         |
|-----|---------|----------|-------|----------|---------|------|---------|---------|
| 1)  | 4974.00 | 1000.00  | 2)    | 4972.00  | 1520.00 | 3)   | 4970.00 | 1525.00 |
| 4)  | 4968.00 | 1530.00  | 5)    | 4968.00  | 1546.00 | 6)   | 4970.00 | 1550.00 |
| 7)  | 4972.00 | 1555.00  | 8)    | 4974.00  | 1930.00 |      |         |         |

COMPUTED PARAMETERS:

| WSEL(ft) | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|----------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 4970.00  | 91.7   | 2.2    | 0.31 | 0.035 | 1.0 | 25.0  | 41.0   | 25.9  | 4968.96 |          |
| 4971.00  | 190.1  | 2.8    | 0.32 | 0.035 | 1.0 | 30.0  | 68.5   | 31.2  | 4969.51 |          |
| 4972.00  | 326.6  | 3.2    | 0.34 | 0.035 | 1.0 | 35.0  | 101.0  | 36.6  | 4970.10 |          |
| 4973.00  | 485.3  | 1.3    | 0.28 | 0.035 | 1.0 | 482.5 | 359.8  | 484.1 | 4970.67 |          |
| 4973.20  | 665.4  | 1.4    | 0.28 | 0.035 | 1.0 | 572.1 | 465.3  | 573.7 | 4972.29 |          |
| 4973.50  | 1027.8 | 1.6    | 0.29 | 0.035 | 1.0 | 706.3 | 656.9  | 707.9 | 4972.65 |          |

$Q_{max} = 568$   
 $cl = 73.1$

NOTES:

$$Q_{P100} = 568 \text{ cfs}$$

$$D = 5.1'$$

Project \_\_\_\_\_  
 Project No. \_\_\_\_\_  
 Sheet No. \_\_\_\_\_ of \_\_\_\_\_  
 Calculated by \_\_\_\_\_ Date \_\_\_\_\_

UNIFORM FLOW COMPUTATIONS

LOCATION/DESCRIPTION:

CROSS SECTION PARAMETERS:

FILENAME: MOYA-100.SEC

No. of Cross Section Points: 10 Bed Slope: 0.00150 Max Elev.: 4973.00  
 Bank Stations.....Left: 1000.0 Right.....: 1322.0 Min Elev.: 4966.80  
 Encroachment Stations..Left: Right.....:  
 Manning-n Values.....LOB: 0.035 CHANNEL...: 0.035 ROB.....: 0.035

CROSS SECTION POINTS - Elevations & Stations in feet:

| No. | Elev.   | Sta. No. | Elev. | Sta. No. | Elev.   | Sta. |         |         |
|-----|---------|----------|-------|----------|---------|------|---------|---------|
| 1)  | 4973.00 | 1000.00  | 2)    | 4972.00  | 1025.00 | 3)   | 4970.00 | 1030.00 |
| 4)  | 4968.00 | 1035.00  | 5)    | 4966.80  | 1039.00 | 6)   | 4966.80 | 1051.00 |
| 7)  | 4968.00 | 1054.00  | 8)    | 4970.00  | 1058.00 | 9)   | 4972.00 | 1122.00 |
| 10) | 4973.00 | 1322.00  |       |          |         |      |         |         |

COMPUTED PARAMETERS:

| EL(ft)  | Q(cfs) | V(fps) | Fr   | No.   | ne  | ALPHA | TW(ft) | A(sf) | WP(ft)  | CRWS(ft) |
|---------|--------|--------|------|-------|-----|-------|--------|-------|---------|----------|
| 4971.00 | 263.0  | 2.4    | 0.31 | 0.035 | 1.0 | 62.5  | 110.9  | 64.0  | 4968.86 |          |
| 4972.00 | 486.1  | 2.6    | 0.32 | 0.035 | 1.0 | 97.0  | 190.6  | 98.7  | 4969.71 |          |
| 4972.50 | 514.1  | 1.9    | 0.30 | 0.035 | 1.0 | 209.5 | 267.2  | 211.2 | 4969.80 |          |
| 4972.60 | 548.5  | 1.9    | 0.30 | 0.035 | 1.0 | 232.0 | 289.3  | 233.7 | 4969.91 |          |
| 4972.80 | 638.9  | 1.9    | 0.30 | 0.035 | 1.0 | 277.0 | 340.1  | 278.7 | 4970.45 |          |
| 4973.00 | 757.7  | 1.9    | 0.30 | 0.035 | 1.0 | 322.0 | 400.1  | 323.7 | 4970.81 |          |

$Q = 568$   
 $el = 72.7$

NOTES:

$$Q_{plan} = 568 \text{ cfs}$$

$$D = 5.9'$$



STANTEC CONSULTING INC.  
950 Industrial Way  
Sparks, Nevada 89431  
Tel: (775) 358-6931 Fax: (775) 358-6954

JOB NO. 26000208

**Stantec**

SHEET 1 OF 1

PROJECT Stead Master Plan  
SUBJECT Retention Basin\*

DATE 12/8/99

DESIGNED JS CHECKED

Silver Lake existing conditions:

6128 acre-ft

4965.01 water surface

Alternative location

Silver Lake  
Storage USEL

RR1

6125 ac-ft

4965.01

FR2

6125 ac-ft

4965.01

CP FRD

6125 ac-ft

4965.01

Basin

Hydrograph storage

FR1

1225 ac-ft

FR2

516 ac-ft

RR1

491 ac-ft

SK4

591 ac-ft

\* 250 ac-ft storage



**Correspondence** **1**

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**Previous Studies** **2**

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**Existing Conditions Hydrologic  
and Hydraulic Backup Data** **3**

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**Proposed Conditions  
Hydrologic Backup Data** **4**

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**Proposed Conditions Hydraulic  
Backup Data** **5**

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**Quantities and Cost Estimates** **6**

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**Survey Data** **7**

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**References** **8**

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| Priority                                             | Improvement Site                                                | Probable Cost |
|------------------------------------------------------|-----------------------------------------------------------------|---------------|
| 1                                                    | Golf Course Channel Improvements                                | \$3,615,850   |
| 2                                                    | Moya Boulevard at Red Rock Road Improvements                    | \$419,291     |
| 2                                                    | Moya Boulevard at Red Rock Road Improvements Downstream Channel | \$644,125     |
| 2                                                    | Moya Detention Basin Improvements                               | \$162,081     |
| 2                                                    | Other Moya Boulevard Culvert Improvements                       | \$635,358     |
| 3                                                    | Donnelley Channel Improvements                                  | \$2,131,768   |
| Total Costs For All Improvements (year 2000 dollars) |                                                                 | \$7,608,473   |

## Drainage Master Plan for Stead, Nevada

Golf Course Channel Improvements  
CP AW3, CP RSD, CP GC1, CP GC2

### PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

| ITEM NO. | QUANTITY | UNIT | DESCRIPTION                          | UNIT COST   | TOTAL COST   |
|----------|----------|------|--------------------------------------|-------------|--------------|
| 1        | 1550     | SY   | REMOVE EXISTING PAVEMENT             | \$5.00      | \$7,750.00   |
| 2        | 2        | EA   | NDOT TYPE 11 DROP INLET              | \$5,000.00  | \$10,000.00  |
| 3        | 1        | LS   | UTILITY RELOCATION                   | LS          | \$10,000.00  |
| 4        | 1550     | SY   | 6 INCH PLANTMIX BITUMINOUS PAVEMENT  | \$10.00     | \$15,500.00  |
| 5        | 1550     | SY   | 6 INCH TYPE 2 CLASS B AGGREGATE BASE | \$4.00      | \$6,200.00   |
| 6        | 250      | LF   | CURB AND GUTTER                      | \$8.00      | \$2,000.00   |
| 7        | 500      | LF   | 4 INCH SOLID YELLOW LINE             | \$2.20      | \$1,100.00   |
| 8        | 500      | LF   | 4 INCH SOLID WHITE LINE              | \$2.20      | \$1,100.00   |
| 9        | 34000    | CY   | EXCAVATION AND EMBANKMENT            | \$5.00      | \$170,000.00 |
| 10       | 28500    | SY   | RIPRAP, CLASS 300 W/FILT. FAB.       | \$35.00     | \$997,500.00 |
| 11       | 1180     | SY   | GROUTED RIPRAP DROP STRUCTURES       | \$85.00     | \$100,300.00 |
| 12       | 4230     | CY   | GROUTED RIPRAP FOR CHANNEL           | \$70.00     | \$296,100.00 |
| 13       | 2500     | CY   | BERM W/ COMPACTION                   | \$6.50      | \$16,250.00  |
| 14       | 80       | LF   | SINGLE 12' X 6' RCB                  | \$800.00    | \$64,000.00  |
| 15       | 2        | EA   | HEADWALL/WINGWALL FOR 12'X6' RCB     | \$16,000.00 | \$32,000.00  |
| 16       | 165      | LF   | TRIPLE 10'X5' RCB                    | \$1,200.00  | \$198,000.00 |
| 17       | 2        | EA   | HEADWALL/WINWALL FOR 3-10'X5' RCB    | \$28,000.00 | \$56,000.00  |
| 18       | 1        | LS   | TUMBLING ENERGY DISSIPATOR ADDITION  | LS          | \$122,500.00 |
| 19       | 1        | LS   | PLUG AND ABANDON 36" RCP             | LS          | \$1,200.00   |
| 20       | 1        | LS   | TRAFFIC CONTROL                      | LS          | \$100,000.00 |
| 21       |          |      |                                      |             | \$0.00       |
| 22       |          |      |                                      |             | \$0.00       |
| 23       |          |      |                                      |             | \$0.00       |
| 24       |          |      |                                      |             | \$0.00       |

SUBTOTAL \$2,207,500  
CONTINGENCY (15%) \$331,125  
TOTAL CONSTRUCTION COST \$2,538,625

RIGHT-OF-WAY/EASEMENT (550,225 SF) \$550,225

DESIGN SERVICES  
ENGINEERING DESIGN (6%) \$152,500  
HYDROLOGY (WA. CO. REQUIREMENTS) \$25,000  
SURVEYING (TOPOGRAPHIC + LEGALS) \$18,000  
GEOTECHNICAL \$25,000  
TOTAL DESIGN SERVICES \$220,500

CONSTRUCTION SERVICES  
SURVEYING STAKEOUT \$55,500  
QUALITY CONTROL \$230,000  
CONSTRUCTION ADMINISTRATION \$21,000  
TOTAL CONSTRUCTION SERVICES \$306,500

TOTAL PROJECT COST \$3,615,850

BY TMM

# Drainage Master Plan for Stead, Nevada

**Moya Boulevard at Red Rock Road Improvements**  
**CP GR3, CP MOY, CP CHAN**

### PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

[illegible]

|                         |           |
|-------------------------|-----------|
| SUBTOTAL                | \$291,731 |
| CONTINGENCY (15%)       | \$43,760  |
| TOTAL CONSTRUCTION COST | \$335,491 |

|                          |          |
|--------------------------|----------|
| RIGHT-OF-WAY (10,000 SF) | \$10,000 |
|--------------------------|----------|

|                                  |                 |
|----------------------------------|-----------------|
| DESIGN SERVICES                  |                 |
| ENGINEERING DESIGN (6%)          | \$22,000.00     |
| HYDROLOGY (WA. CO. REQUIREMENTS) | \$3,500         |
| SURVEYING (TOPOGRAPHIC + LEGALS) | \$4,000         |
| GEOTECHNICAL                     | <u>\$3,500</u>  |
| TOTAL DESIGN SERVICES            | <u>\$33,000</u> |

|                             |                 |
|-----------------------------|-----------------|
| CONSTRUCTION SERVICES       |                 |
| SURVEYING STAKEOUT          | \$7,500         |
| QUALITY CONTROL             | \$30,500        |
| CONSTRUCTION ADMINISTRATION | <u>\$2,800</u>  |
| TOTAL CONSTRUCTION SERVICES | <u>\$40,800</u> |

|                    |           |
|--------------------|-----------|
| TOTAL PROJECT COST | \$419,291 |
|--------------------|-----------|

BY TMM

## Drainage Master Plan for Stead, Nevada

Moya Boulevard at Red Rock Road Improvements Downstream Channel  
CP CHAN

### PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

[illegible]

BY TMM

## Stead Master Plan Improvements, Phase 1

Moya Detention Basin Improvements  
CP LEA, DETMO

### PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

| ITEM NO. | QUANTITY | UNIT | DESCRIPTION                          | UNIT COST | TOTAL COST  |
|----------|----------|------|--------------------------------------|-----------|-------------|
| 1        | 66       | SY   | REMOVE EXISTING PAVEMENT             | \$5.00    | \$330.00    |
| 2        | 780      | CY   | EXCAVATION AND EMBANKMENT            | \$5.00    | \$3,900.00  |
| 3        | 66       | SY   | 6 INCH PLANTMIX BITUMINOUS PAVEMENT  | \$12.00   | \$792.00    |
| 4        | 66       | SY   | 6 INCH TYPE 2 CLASS B AGGREGATE BASE | \$4.00    | \$264.00    |
| 5        | 30       | LF   | CURB AND GUTTER                      | \$8.00    | \$240.00    |
| 6        | 442      | LF   | 30 INCH RCP                          | \$68.00   | \$30,056.00 |
| 7        | 132      | LF   | 36 INCH RCP                          | \$75.00   | \$9,900.00  |
| 8        | 2        | LS   | HEADWALL DOUBLE 30 INCH              | LS        | \$18,000.00 |
| 9        | 2        | LS   | HEADWALL DOUBLE 36 INCH              | LS        | \$20,000.00 |
| 10       | 100      | LF   | 4 INCH SOLID YELLOW LINE             | \$2.20    | \$220.00    |
| 11       | 1        | LS   | TRAFFIC CONTROL                      | LS        | \$10,000.00 |
| 12       | 28       | SF   | REMOVE AND REPLACE SIDEWALK          | \$9.00    | \$252.00    |
| 13       |          |      |                                      |           | \$0.00      |
| 14       |          |      |                                      |           | \$0.00      |
| 15       |          |      |                                      |           | \$0.00      |
| 16       |          |      |                                      |           | \$0.00      |
| 17       |          |      |                                      |           | \$0.00      |
| 18       |          |      |                                      |           | \$0.00      |
| 19       |          |      |                                      |           | \$0.00      |
| 20       |          |      |                                      |           | \$0.00      |
| 21       |          |      |                                      |           | \$0.00      |
| 22       |          |      |                                      |           | \$0.00      |
| 23       |          |      |                                      |           | \$0.00      |
| 24       |          |      |                                      |           | \$0.00      |

SUBTOTAL \$93,954

CONTINGENCY (15%) \$14,093

TOTAL CONSTRUCTION COST \$108,047

RIGHT-OF-WAY (2525 SF) @ \$2 SQ. FT. \$5,050

#### CONSTRUCTION SERVICES

SURVEYING STAKEOUT \$3,000

QUALITY CONTROL \$11,500

CONSTRUCTION ADMINISTRATION \$1,500

TOTAL CONSTRUCTION SERVICES \$16,000

TOTAL PROJECT COST \$129,097

BY TMM

## Drainage Master Plan for Stead, Nevada

Moya Detention Basin Improvements  
CP LEA, DETMO

### PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

| ITEM NO. | QUANTITY | UNIT | DESCRIPTION                          | UNIT COST | TOTAL COST  |
|----------|----------|------|--------------------------------------|-----------|-------------|
| 1        | 600      | SY   | REMOVE EXISTING PAVEMENT             | \$5.00    | \$3,000.00  |
| 2        | 1750     | CY   | EXCAVATION AND EMBANKMENT            | \$5.00    | \$8,750.00  |
| 3        | 600      | SY   | 6 INCH PLANTMIX BITUMINOUS PAVEMENT  | \$12.00   | \$7,200.00  |
| 4        | 600      | SY   | 6 INCH TYPE 2 CLASS B AGGREGATE BASE | \$4.00    | \$2,400.00  |
| 5        | 100      | LF   | CURB AND GUTTER                      | \$8.00    | \$800.00    |
| 6        | 450      | LF   | 30 INCH RCP                          | \$68.00   | \$30,600.00 |
| 7        | 130      | LF   | 36 INCH RCP                          | \$75.00   | \$9,750.00  |
| 8        | 2        | LS   | HEADWALL DOUBLE 30 INCH              | LS        | \$18,000.00 |
| 9        | 2        | LS   | HEADWALL DOUBLE 36 INCH              | LS        | \$20,000.00 |
| 10       | 200      | LF   | 4 INCH SOLID YELLOW LINE             | \$2.20    | \$440.00    |
| 11       | 1        | LS   | TRAFFIC CONTROL                      | LS        | \$10,000.00 |
| 12       |          |      |                                      |           | \$0.00      |
| 13       |          |      |                                      |           | \$0.00      |
| 14       |          |      |                                      |           | \$0.00      |
| 15       |          |      |                                      |           | \$0.00      |
| 16       |          |      |                                      |           | \$0.00      |
| 17       |          |      |                                      |           | \$0.00      |
| 18       |          |      |                                      |           | \$0.00      |
| 19       |          |      |                                      |           | \$0.00      |
| 20       |          |      |                                      |           | \$0.00      |
| 21       |          |      |                                      |           | \$0.00      |
| 22       |          |      |                                      |           | \$0.00      |
| 23       |          |      |                                      |           | \$0.00      |
| 24       |          |      |                                      |           | \$0.00      |

|                         |                 |
|-------------------------|-----------------|
| SUBTOTAL                | \$110,940       |
| CONTINGENCY (15%)       | <u>\$16,641</u> |
| TOTAL CONSTRUCTION COST | \$127,581       |

|                     |     |
|---------------------|-----|
| RIGHT-OF-WAY (0 SF) | \$0 |
|---------------------|-----|

|                                  |                |
|----------------------------------|----------------|
| DESIGN SERVICES                  |                |
| ENGINEERING DESIGN (6%)          | \$8,000        |
| HYDROLOGY (WA. CO. REQUIREMENTS) | \$3,500        |
| SURVEYING (TOPOGRAPHIC + LEGALS) | \$3,500        |
| GEOTECHNICAL                     | <u>\$3,500</u> |
| TOTAL DESIGN SERVICES            | \$18,500       |

|                             |                |
|-----------------------------|----------------|
| CONSTRUCTION SERVICES       |                |
| SURVEYING STAKEOUT          | \$3,000        |
| QUALITY CONTROL             | \$11,500       |
| CONSTRUCTION ADMINISTRATION | <u>\$1,500</u> |
| TOTAL CONSTRUCTION SERVICES | \$16,000       |

|                    |           |
|--------------------|-----------|
| TOTAL PROJECT COST | \$162,081 |
|--------------------|-----------|

BY TMM

## Drainage Master Plan for Stead, Nevada

Other Moya Boulevard Culvert Improvements  
CP SS3@48", CP SLB, CP GC3

### PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

| ITEM NO. | QUANTITY | UNIT | DESCRIPTION                              | UNIT COST | TOTAL COST   |
|----------|----------|------|------------------------------------------|-----------|--------------|
| 1        | 500      | SY   | REMOVE EXISTING PAVEMENT                 | \$5.00    | \$2,500.00   |
| 2        | 7900     | CY   | EXCAVATION AND EMBANKEMENT               | \$5.00    | \$39,500.00  |
| 3        | 100      | LF   | TRIPLE 6' X 4' RCB's                     | \$800.00  | \$80,000.00  |
| 4        | 2        | LS   | HEADWALL TRIPLE 6' X 4' RCB              | LS        | \$16,000.00  |
| 5        | 80       | SY   | RIPRAP, CLASS 150 W/FILT.FAB., DS CHAN   | \$25.00   | \$2,000.00   |
| 6        | 3500     | SY   | REVEGETATION/SEEDING DS CHANNEL          | \$5.00    | \$17,500.00  |
| 7        | 4210     | SY   | RIPRAP, CLASS 300 W/FILT. FAB., US CHAN. | \$35.00   | \$147,350.00 |
| 8        | 400      | SY   | GROUTED RIPRAP FOR DROPS & INLET         | \$85.00   | \$34,000.00  |
| 9        | 500      | SY   | 6 INCH PLANTMIX BITUMINOUS PAVEMENT      | \$5.00    | \$2,500.00   |
| 10       | 500      | SY   | 6 INCH TYPE 2 CLASS B AGGREGATE BASE     | \$10.00   | \$5,000.00   |
| 11       | 100      | LF   | CURB AND GUTTER REPLACEMENT              | \$8.00    | \$800.00     |
| 12       | 1300     | LF   | FENCING                                  | \$5.00    | \$6,500.00   |
| 13       | 100      | LF   | 4 INCH SOLID YELLOW LINE - DOUBLE        | \$2.20    | \$220.00     |
| 14       | 100      | LF   | 4 INCH BROKEN WHITE LINE                 | \$1.15    | \$115.00     |
| 15       | 100      | LF   | REMOVE EXISTING 3 - 18" CMAP's           | \$25.00   | \$2,500.00   |
| 16       | 1        | LS   | REMOVE EXISTING DROP W/GRATE             | LS        | \$1,000.00   |
| 17       | 1        | LS   | TRAFFIC CONTROL                          | LS        | \$35,000.00  |
| 18       |          | LF   |                                          | \$0.00    | \$0.00       |
| 19       |          | LF   |                                          | \$0.00    | \$0.00       |
| 20       |          | LF   |                                          | \$0.00    | \$0.00       |
| 21       |          | LF   |                                          | \$0.00    | \$0.00       |
| 22       |          | LF   |                                          | \$0.00    | \$0.00       |
| 23       |          | LS   |                                          | \$0.00    | \$0.00       |
| 24       |          | LS   |                                          | \$0.00    | \$0.00       |

|                         |                 |
|-------------------------|-----------------|
| SUBTOTAL                | \$392,485       |
| CONTINGENCY (15%)       | <u>\$58,873</u> |
| TOTAL CONSTRUCTION COST | \$451,358       |

|                          |          |
|--------------------------|----------|
| RIGHT-OF-WAY (92,000 SF) | \$92,000 |
|--------------------------|----------|

|                                  |                |
|----------------------------------|----------------|
| DESIGN SERVICES                  |                |
| ENGINEERING DESIGN (6%)          | \$27,000       |
| HYDROLOGY (WA. CO. REQUIREMENTS) | \$3,500        |
| SURVEYING (TOPOGRAPHIC + LEGALS) | \$3,000        |
| GEOTECHNICAL                     | <u>\$3,500</u> |
| TOTAL DESIGN SERVICES            | \$37,000       |

|                             |                |
|-----------------------------|----------------|
| CONSTRUCTION SERVICES       |                |
| SURVEYING STAKEOUT          | \$10,000       |
| QUALITY CONTROL             | \$41,000       |
| CONSTRUCTION ADMINISTRATION | <u>\$4,000</u> |
| TOTAL CONSTRUCTION SERVICES | \$55,000       |

|                    |           |
|--------------------|-----------|
| TOTAL PROJECT COST | \$635,358 |
|--------------------|-----------|

BY TMM

## Drainage Master Plan for Stead, Nevada

Donnelley Channel Improvements  
CP LEA

### PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

| ITEM NO. | QUANTITY | UNIT | DESCRIPTION                          | UNIT COST   | TOTAL COST   |
|----------|----------|------|--------------------------------------|-------------|--------------|
| 1        | 2800     | SY   | REMOVE EXISTING PAVEMENT             | \$5.00      | \$14,000.00  |
| 2        | 14000    | CY   | EXCAVATION AND EMBANKMENT            | \$5.00      | \$70,000.00  |
| 3        | 2800     | SY   | 6 INCH PLANTMIX BITUMINOUS PAVEMENT  | \$10.00     | \$28,000.00  |
| 4        | 2800     | SY   | 6 INCH TYPE 2 CLASS B AGGREGATE BASE | \$4.00      | \$11,200.00  |
| 5        | 600      | LF   | CURB AND GUTTER                      | \$8.00      | \$4,800.00   |
| 6        | 533      | CY   | BERM W/ COMPACTION                   | \$6.50      | \$3,464.50   |
| 7        | 650      | LF   | DOUBLE 24' X 4' RC MEGA BOX CULVERT  | \$1,050.00  | \$682,500.00 |
| 8        | 10       | LS   | HEADWINGWALL FOR ALL CONSPAN         | \$40,000.00 | \$400,000.00 |
| 9        | 300      | LF   | 4 INCH SOLID WHITE LINE              | \$2.20      | \$660.00     |
| 10       | 14600    | SY   | REVEGETATION/SEEDING CHANNEL         | \$5.00      | \$73,000.00  |
| 11       | 1        | LS   | TRAFFIC CONTROL                      | LS          | \$10,000.00  |
| 12       |          | SY   |                                      | \$0.00      | \$0.00       |
| 13       |          | SY   |                                      | \$0.00      | \$0.00       |
| 14       |          | LF   |                                      | \$0.00      | \$0.00       |
| 15       |          | LF   |                                      | \$0.00      | \$0.00       |
| 16       |          | EA   |                                      | \$0.00      | \$0.00       |
| 17       |          | EA   |                                      | \$0.00      | \$0.00       |
| 18       |          | EA   |                                      | \$0.00      | \$0.00       |
| 19       |          | EA   |                                      | \$0.00      | \$0.00       |
| 20       |          | EA   |                                      | \$0.00      | \$0.00       |
| 21       |          | LF   |                                      | \$0.00      | \$0.00       |
| 22       |          | EA   |                                      | \$0.00      | \$0.00       |
| 23       |          | LS   |                                      | \$0.00      | \$0.00       |

|                         |                  |
|-------------------------|------------------|
| SUBTOTAL                | \$1,297,625      |
| CONTINGENCY (15%)       | <u>\$194,644</u> |
| TOTAL CONSTRUCTION COST | \$1,492,268      |

|                                    |           |
|------------------------------------|-----------|
| RIGHT-OF-WAY/EASEMENT (380,000 SF) | \$380,000 |
|------------------------------------|-----------|

|                                  |                |
|----------------------------------|----------------|
| DESIGN SERVICES                  |                |
| ENGINEERING DESIGN (6%)          | \$78,000       |
| HYDROLOGY (WA. CO. REQUIREMENTS) | \$7,500        |
| SURVEYING (TOPOGRAPHIC + LEGALS) | \$9,000        |
| GEOTECHNICAL                     | <u>\$7,500</u> |
| TOTAL DESIGN SERVICES            | \$102,000      |

|                             |                 |
|-----------------------------|-----------------|
| CONSTRUCTION SERVICES       |                 |
| SURVEYING STAKEOUT          | \$28,500        |
| QUALITY CONTROL             | \$118,000       |
| CONSTRUCTION ADMINISTRATION | <u>\$11,000</u> |
| TOTAL CONSTRUCTION SERVICES | \$157,500       |

|                    |             |
|--------------------|-------------|
| TOTAL PROJECT COST | \$2,131,768 |
|--------------------|-------------|

DATE 4/3/00  
BY TMM





**Correspondence 1**

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**Previous Studies 2**

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**Existing Conditions Hydrologic  
and Hydraulic Backup Data 3**

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**Proposed Conditions  
Hydrologic Backup Data 4**

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**Proposed Conditions Hydraulic  
Backup Data 5**

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**Quantities and Cost Estimates 6**

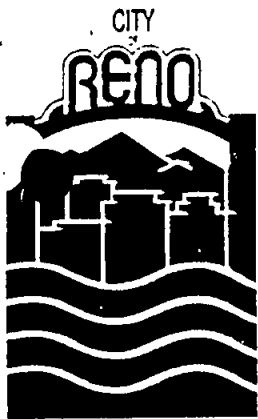
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**Survey Data 7**

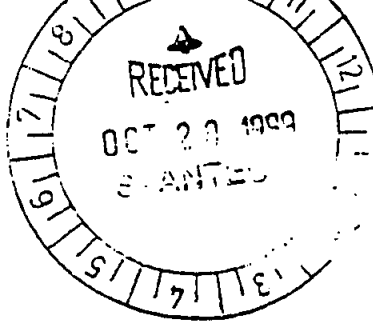
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**References 8**

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P.O. Box 1900  
Reno, Nevada 89505



~~HE~~  
~~TM~~  
~~LY~~

October 18, 1999

Re: Reference Datum for Vertical Elevations

To Whom It May Concern:

There are two different vertical datum references that are commonly used in our area. The NGVD '29 (National Geodetic Vertical Datum of 1929) and NAVD '88 (North American Vertical Datum of 1988). There is an approximate 3.52' difference, with the NGVD '29 being the numerically lower of the two.

The conversion from the old NGVD '29 to the new NAVD '88 will take about 10 to 15 years for all entities to complete. We, the City, converted our Reno Vertical Control system to the new NAVD '88 datum about two years ago and a lot of the firms in this area are using our benchmarks with elevations expressed on the new NAVD '88 datum.

The FEMA flood maps dated September 30, 1994, are still using the old NGVD '29 datum. Any flood zones where the Base Flood Elevation is determined (AE & AH) will require the elevation certificate to be in that datum. The conversion notes from the NAVD '88 to the NGVD '29 should be shown under "comments" on the back of the form. Any of the remaining flood zones may be in either datum as long as marked on the certificate.

The new FEMA Elevation Certificate (Form 81-31, Aug 99, expiring July 31, 2002) which is now available from FEMA or on their web site, has incorporated a box selection for both datums (question B11). This new form became effective August 1, 1999 and use of the new certificate will become mandatory on January 1, 2000, if the certification date is on or after that date. The new form and instruction packet are available from the FEMA Distribution Center at 800-480-2520.

Should you have any questions, please contact me at (775) 334-3831.

Sincerely,

ROBERT GOTTSACKER, P.E.  
DEVELOPMENT SERVICES  
ENGINEERING MANAGER

By:

*T. D. Landsaw*

Teresa D. Landsaw  
Engineering Technician

- ① J. BAZA
- ② J. BUFF
- ③ CC
- ④ LL
- ⑤ TM
- ⑥ LLL
- ⑦ JRE



**Fax: 358-6954**

SHEET \_\_\_\_\_ OF \_\_\_\_\_

DATE 7/3/85

SUBJECT Lake Elevation DESIGNED \_\_\_\_\_ CHECKED \_\_\_\_\_

100-YEAR LAKE WATER LEVEL  
Based on NGVD

$$NGVD + 3.75' = NAVD$$



*Formerly SEA, Incorporated*

950 Industrial Way  
Sparks, NV 89431-6092  
(702) 358-6931  
Fax: 358-6954

JOB NO. 80/00203

SHEET OF

PROJECT Steel Drainage Master Plan DATE 7/5/88  
SUBJECT NEVD 29 Vs. NAVD 88 DESIGNED JS CHECKED \_\_\_\_\_

SUBJECT NEVD 29 Vs. NAVD 88 DESIGNED JS CHECKED \_\_\_\_\_

## Renov Vertical Control System

[illegible]

## 1996 ABRIDGED SUPPLEMENT

 RENO VERTICAL CONTROL SYSTEM  
 ELEVATION DIRECTORY  
 NAVD 88

| No.  | Stamped | Bal. Elev. | Description                                                                                                                                                                                                                                                           | May 1996 |
|------|---------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 1558 | 1558    | 4565.359   | 1 1/2" DIA STL CAP - IN S/W ALONG<br>E. SIDE OF PLUMAS ST - 1000 FT<br>+/- N. OF THE CL INTERSECTION<br>OF MCCARRAN BLVD & PLUMAS ST -<br>S/W IS THE SECTION ACROSS A<br>DITCH CROSSING PLUMAS ST AT THE<br>LAKERIDGE GOLF COURSE AT THE<br>Sl/y PORTION OF # 3 HOLE. |          |
| 1559 | 1559    | 4543.557   | 1 1/2" DIA STL CAP - T/C - SE COR -<br>PLUMAS ST & MANZANITA LN -<br>+/- 11.7 FT S. OF THE BC.                                                                                                                                                                        |          |
| 1560 | 1560    | 4538.394   | 1 1/2" DIA STL CAP - T/C - S. SIDE<br>OF PLUMAS ST - OPPOSITE THE CL<br>PROLONGATION OF WENDY WAY.                                                                                                                                                                    |          |
| 1561 | 1561    | 4520.316   | 1 1/2" DIA STL CAP - T/C - SE COR -<br>PLUMAS ST & MOANA LN - 20.8 FT<br>S. OF THE BC.                                                                                                                                                                                |          |
| 1562 | 1562    | 5085.327   | 1 1/2" DIA STL CAP - T/C - SW COR -<br>STEAD BLVD & SILVER LAKE BLVD.                                                                                                                                                                                                 |          |
| 1564 | 1564    | 5040.962   | 1 1/2" DIA STL CAP - T/C - W. SIDE<br>OF STEAD BLVD - OPPOSITE THE CL<br>OF URAL ST.                                                                                                                                                                                  |          |
| 1565 | 1565    | 5013.025   | 1 1/2" DIA STL CAP - T/C - NW COR -<br>STEAD BLVD & ENTRANCE TO<br>J.C. PENNEY Co. FACILITY.                                                                                                                                                                          |          |

## 1996 ABRIDGED SUPPLEMENT

 RENO VERTICAL CONTROL SYSTEM  
 ELEVATION DIRECTORY  
 NAVD 88

| No.  | Stamped | Bal. Elev. | Description                                                                                                                            | May 1996 |
|------|---------|------------|----------------------------------------------------------------------------------------------------------------------------------------|----------|
| 1566 | 1566    | 4988.962   | 1 1/2" DIA STL CAP - T/C - SW COR -<br>STEAD BLVD & N. ENTRANCE TO<br>J.C. PENNEY Co. FACILITY.                                        |          |
| 1567 | 1567    | 4974.830   | 1 1/2" DIA STL CAP - T/C - NW COR -<br>STEAD BLVD & LEAR BLVD - 10 FT<br>W. OF CB.                                                     |          |
| 1568 | 1568    | 4979.786   | 1 1/2" DIA STL CAP - T/C - N. SIDE<br>OF LEAR BLVD - 100 FT +/- W. OF<br>WEST ENTRANCE TO R. R. DONNELLY<br>PLANT - 5 FT +/- W. OF FH. |          |
| 1569 | 1569    | 4604.122   | 1 1/2" DIA STL CAP - T/C - SW COR -<br>PLUMB LN & FALLEN LEAF CT -<br>NEAR BC ON PLUMB LN.                                             |          |
| 1570 | 1570    | 4975.742   | 1 1/2" DIA STL CAP - T/C - SE COR -<br>LEAR BLVD & KERNITE AVE - NEAR<br>STREET LIGHT.                                                 |          |
| 1571 | 1571    | 4975.950   | 1 1/2" DIA STL CAP - T/C - S. SIDE<br>OF LEAR BLVD - OPPOSITE THE<br>PROJECTED CL OF ZEOLITE DR.                                       |          |
| 1572 | 1572    | 4984.126   | 1 1/2" DIA STL CAP - T/C - E. SIDE<br>OF STEAD BLVD NEAR BC - SE COR -<br>STEAD BLVD & NORTON DR.                                      |          |

RENO VERTICAL CONTROL SYSTEM  
ELEVATION DIRECTORY

| No.  | Stamped | Bal. Elev. | Description (223)                                                                                                                      |
|------|---------|------------|----------------------------------------------------------------------------------------------------------------------------------------|
| 1566 | 1566    | 4985.211   | 1 1/2" DIA STL CAP - T/C - SW COR -<br>STEAD BLVD & N. ENTRANCE TO<br>J.C. PENNEY Co. FACILITY.                                        |
| 1567 | 1567    | 4971.079   | 1 1/2" DIA STL CAP - T/C - NW COR -<br>STEAD BLVD & LEAR BLVD - 10 FT<br>W. OF CB.                                                     |
| 1568 | 1568    | 4976.035   | 1 1/2" DIA STL CAP - T/C - N. SIDE<br>OF LEAR BLVD - 100 FT +/- W. OF<br>WEST ENTRANCE TO R. R. DONNELLY<br>PLANT - 5 FT +/- W. OF FH. |
| 1569 |         |            |                                                                                                                                        |
| 1570 | 1570    | 4971.992   | 1 1/2" DIA STL CAP - T/C - SE COR -<br>LEAR BLVD & KERNITE AVE - NEAR<br>STREET LIGHT.                                                 |
| 1571 | 1571    | 4972.200   | 1 1/2" DIA STL CAP - T/C - S. SIDE<br>OF LEAR BLVD - OPPOSITE THE<br>PROJECTED CL OF ZEOLITE DR.                                       |
| 1572 | 1572    | 4980.375   | 1 1/2" DIA STL CAP - T/C - E. SIDE<br>OF STEAD BLVD NEAR BC - SE COR -<br>STEAD BLVD & NORTON DR.                                      |
| 1573 | 1573    | 5003.111   | 1 1/2" DIA STL CAP - T/C - NW COR -<br>STEAD BLVD & MT ANDERSON ST -<br>NEAR EC.                                                       |



RENO VERTICAL CONTROL SYSTEM  
ELEVATION DIRECTORY

| No.  | Stamped | Bal. Elev. | Description (222)                                                                                                                                                                                                                                                     |
|------|---------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1558 | 1558    |            | 1 1/2" DIA STL CAP - IN S/W ALONG<br>E. SIDE OF PLUMAS ST - 1000 FT<br>+/- N. OF THE CL INTERSECTION<br>OF MCCARRAN BLVD & PLUMAS ST -<br>S/W IS THE SECTION ACROSS A<br>DITCH CROSSING PLUMAS ST AT THE<br>LAKERIDGE GOLF COURSE AT THE<br>S1/y PORTION OF # 3 HOLE. |
| 1559 | 1559    |            | 1 1/2" DIA STL CAP - T/C - SE COR -<br>PLUMAS ST & MANZANITA LN -<br>+/- 11.7 FT S. OF THE BC.                                                                                                                                                                        |
| 1560 | 1560    |            | 1 1/2" DIA STL CAP - T/C - S. SIDE<br>OF PLUMAS ST - OPPOSITE THE CL<br>PROLONGATION OF WENDY WAY.                                                                                                                                                                    |
| 1561 | 1561    |            | 1 1/2" DIA STL CAP - T/C - SE COR -<br>PLUMAS ST & MOANA LN - 20.8 FT<br>S. OF THE BC.                                                                                                                                                                                |
| 1562 | 1562    | 5081.577   | 1 1/2" DIA STL CAP - T/C - SW COR -<br>STEAD BLVD & SILVER LAKE BLVD.                                                                                                                                                                                                 |
| 1563 | 1563    | 5055.660   | 1 1/2" DIA STL CAP - T/C - E. SIDE<br>OF STEAD BLVD - N. OF SAGEWOOD<br>DR - 15 FT N. OF FH.                                                                                                                                                                          |
| 1564 | 1564    | 5037.211   | 1 1/2" DIA STL CAP - T/C - W. SIDE<br>OF STEAD BLVD - OPPOSITE THE CL<br>OF URAL ST.                                                                                                                                                                                  |
| 1565 | 1565    | 5009.275   | 1 1/2" DIA STL CAP - T/C - NW COR -<br>STEAD BLVD & ENTRANCE TO<br>J.C. PENNEY Co. FACILITY.                                                                                                                                                                          |

Slantec Job Number: 26300169

January 4, 1999

## City of Reno - Stead Hydro Basin Project

Horizontal Datum: NAD 1983 (92) CAHPGN, NV West State Plane Zone, U.S. Foot  
 Vertical Datum: NAVD 1988 (Based upon USC&GS BM A-299)

| Pl. No. | Northing      | Easting      | Elevation | Description                |
|---------|---------------|--------------|-----------|----------------------------|
| 11      | 14,898,540.93 | 2,254,918.83 | 5,356.86  | GP Tank (RTK Base Station) |
| 5001    | 14,899,559.96 | 2,258,723.60 | 5,110.89  | A299                       |
| 5002    | 14,913,442.91 | 2,261,130.70 | 5,027.44  | R298                       |
| 5003    | 14,904,930.81 | 2,252,863.93 | 4,974.29  | SW 531                     |
| 5004    | 14,897,824.21 | 2,255,723.02 | 5,329.65  | TOP RAIL                   |
| 5005    | 14,897,788.20 | 2,255,768.33 | 5,329.46  | TOP RAIL                   |
| 5006    | 14,897,736.52 | 2,255,854.01 | 5,328.79  | TOP RAIL                   |
| 5007    | 14,897,717.30 | 2,255,893.61 | 5,328.44  | TOP RAIL@CMP               |
| 5008    | 14,897,693.09 | 2,255,948.23 | 5,327.94  | TOP RAIL                   |
| 5009    | 14,897,671.71 | 2,255,998.22 | 5,327.60  | TOP RAIL                   |
| 5010    | 14,897,655.32 | 2,256,037.15 | 5,327.30  | TOP RAIL                   |
| 5011    | 14,897,616.51 | 2,256,128.89 | 5,326.55  | TOP RAIL                   |
| 5012    | 14,897,577.68 | 2,256,184.84 | 5,323.60  | FL                         |
| 5013    | 14,897,564.49 | 2,256,214.67 | 5,323.26  | FL                         |
| 5014    | 14,897,577.15 | 2,256,220.44 | 5,325.79  | TOP RAIL                   |
| 5015    | 14,897,609.16 | 2,256,145.98 | 5,326.38  | TOP RAIL                   |
| 5016    | 14,897,606.30 | 2,256,145.00 | 5,325.68  | TOP BALLAST                |
| 5017    | 14,897,603.33 | 2,256,143.56 | 5,324.41  | TOE BALLAST                |
| 5018    | 14,897,600.07 | 2,256,142.50 | 5,324.57  | NG                         |
| 5019    | 14,897,591.78 | 2,256,138.74 | 5,325.00  | NG                         |
| 5020    | 14,897,587.80 | 2,256,139.55 | 5,325.28  | NG                         |
| 5021    | 14,897,584.44 | 2,256,137.47 | 5,325.85  | NG                         |
| 5022    | 14,897,575.09 | 2,256,130.09 | 5,326.62  | NG                         |
| 5023    | 14,897,553.23 | 2,256,123.67 | 5,328.01  | NG                         |
| 5024    | 14,897,521.78 | 2,256,111.15 | 5,330.71  | NG                         |
| 5025    | 14,897,607.59 | 2,256,117.07 | 5,324.13  | FL                         |
| 5026    | 14,897,629.79 | 2,256,060.58 | 5,324.27  | FL                         |
| 5027    | 14,897,665.66 | 2,255,976.44 | 5,324.50  | FL                         |
| 5028    | 14,897,693.95 | 2,255,882.21 | 5,317.16  | IE 48" CMP                 |
| 5029    | 14,897,694.09 | 2,255,882.70 | 5,320.50  | TOP 48" CMP                |
| 5030    | 14,897,708.53 | 2,255,893.89 | 5,326.19  | TBM 1                      |
| 5031    | 14,897,765.87 | 2,255,917.37 | 5,310.78  | TOP 48" CMP                |
| 5032    | 14,897,549.61 | 2,256,278.47 | 5,325.37  | TOP RAIL                   |
| 5033    | 14,897,516.24 | 2,256,308.67 | 5,321.49  | FL                         |
| 5034    | 14,897,496.83 | 2,256,367.44 | 5,324.88  | TOP RAIL                   |
| 5035    | 14,897,425.68 | 2,256,449.29 | 5,324.28  | TOP RAIL@CMP               |
| 5036    | 14,897,416.24 | 2,256,438.67 | 5,316.64  | TOP 24" CMP                |
| 5037    | 14,897,415.79 | 2,256,438.83 | 5,314.94  | TOP SEDIMENT               |
| 5038    | 14,897,409.74 | 2,256,448.57 | 5,321.13  | TBM2                       |
| 5039    | 14,897,440.21 | 2,256,470.06 | 5,313.79  | IE 24" CMP                 |
| 5040    | 14,897,390.01 | 2,256,480.61 | 5,324.01  | TOP RAIL                   |
| 5041    | 14,897,329.98 | 2,256,523.98 | 5,323.70  | TOP RAIL                   |
| 5042    | 14,897,300.73 | 2,256,522.68 | 5,320.45  | FL                         |

Slantec Job Number: 26300169

January 4, 1999

## City of Reno - Slead Hydro Basin Project

Horizontal Datum: NAD 1983 (92) CAHPGN, NV West State Plane Zone, U.S. Feet  
 Vertical Datum: NAVD 1988 (Based upon USC&GS BM A-299)

| Pl. No. | Northing      | Easting      | Elevation | Description                |
|---------|---------------|--------------|-----------|----------------------------|
| 11      | 14,898,540.93 | 2,254,918.83 | 5,356.86  | CP Tank (RTK Base Station) |
| 5001    | 14,899,559.96 | 2,258,723.69 | 5,110.89  | A299                       |
| 5002    | 14,913,442.91 | 2,261,130.73 | 5,027.44  | R298                       |
| 5003    | 14,904,930.81 | 2,252,863.93 | 4,974.29  | SW S31                     |
| 5004    | 14,897,824.21 | 2,255,723.02 | 5,329.65  | TOP RAIL                   |
| 5005    | 14,897,788.29 | 2,255,768.33 | 5,329.46  | TOP RAIL                   |
| 5006    | 14,897,736.52 | 2,255,854.01 | 5,328.79  | TOP RAIL                   |
| 5007    | 14,897,717.30 | 2,255,893.61 | 5,328.44  | TOP RAIL@CMP               |
| 5008    | 14,897,693.09 | 2,255,948.23 | 5,327.94  | TOP RAIL                   |
| 5009    | 14,897,671.71 | 2,255,998.22 | 5,327.60  | TOP RAIL                   |
| 5010    | 14,897,655.32 | 2,256,037.15 | 5,327.30  | TOP RAIL                   |
| 5011    | 14,897,616.51 | 2,256,128.89 | 5,326.55  | TOP RAIL                   |
| 5012    | 14,897,577.68 | 2,256,184.84 | 5,323.60  | FL                         |
| 5013    | 14,897,564.49 | 2,256,214.67 | 5,323.26  | FL                         |
| 5014    | 14,897,577.15 | 2,256,220.44 | 5,325.79  | TOP RAIL                   |
| 5015    | 14,897,609.16 | 2,256,145.98 | 5,326.38  | TOP RAIL                   |
| 5016    | 14,897,606.30 | 2,256,145.00 | 5,325.68  | TOP BALLAST                |
| 5017    | 14,897,603.33 | 2,256,143.56 | 5,324.41  | TOE BALLAST                |
| 5018    | 14,897,600.07 | 2,256,142.50 | 5,324.57  | NG                         |
| 5019    | 14,897,591.78 | 2,256,138.74 | 5,325.00  | NG                         |
| 5020    | 14,897,587.80 | 2,256,139.55 | 5,325.28  | NG                         |
| 5021    | 14,897,584.44 | 2,256,137.47 | 5,325.85  | NG                         |
| 5022    | 14,897,575.09 | 2,256,130.09 | 5,326.62  | NG                         |
| 5023    | 14,897,553.23 | 2,256,123.67 | 5,328.01  | NG                         |
| 5024    | 14,897,521.78 | 2,256,111.15 | 5,330.71  | NG                         |
| 5025    | 14,897,607.59 | 2,256,117.07 | 5,324.13  | FL                         |
| 5026    | 14,897,629.79 | 2,256,060.58 | 5,324.27  | FL                         |
| 5027    | 14,897,665.66 | 2,255,976.44 | 5,324.50  | FL                         |
| 5028    | 14,897,693.95 | 2,255,882.21 | 5,317.16  | IE 48" CMP                 |
| 5029    | 14,897,694.09 | 2,255,882.70 | 5,320.50  | TOP 48" CMP                |
| 5030    | 14,897,708.53 | 2,255,893.89 | 5,326.19  | TBM 1                      |
| 5031    | 14,897,765.87 | 2,255,917.37 | 5,310.78  | TOP 48" CMP                |
| 5032    | 14,897,549.61 | 2,256,278.47 | 5,325.37  | TOP RAIL                   |
| 5033    | 14,897,516.24 | 2,256,308.67 | 5,321.49  | FL                         |
| 5034    | 14,897,496.83 | 2,256,367.44 | 5,324.88  | TOP RAIL                   |
| 5035    | 14,897,425.68 | 2,256,449.29 | 5,324.28  | TOP RAIL@CMP               |
| 5036    | 14,897,416.24 | 2,256,438.67 | 5,316.64  | TOP 24" CMP                |
| 5037    | 14,897,415.79 | 2,256,438.83 | 5,314.94  | TOP SEDIMENT               |
| 5038    | 14,897,409.74 | 2,256,448.57 | 5,321.13  | TBM2                       |
| 5039    | 14,897,440.21 | 2,256,470.06 | 5,313.79  | IE 24" CMP                 |
| 5040    | 14,897,390.01 | 2,256,480.61 | 5,324.01  | TOP RAIL                   |
| 5041    | 14,897,329.98 | 2,256,523.98 | 5,323.70  | TOP RAIL                   |
| 5042    | 14,897,300.73 | 2,256,522.68 | 5,320.45  | FL                         |

Stanlec Job Number: 26300169

January 4, 1999

## City of Reno - Stead Hydro Basin Project

Horizontal Datum: NAD 1983 (92) CAHPGN, NV West State Plane Zone, U.S. Feet

Vertical Datum: NAVD 1988 (Based upon USC&amp;GS BM A-299)

| Pl. No. | Northing      | Easting      | Elevation | Description  |
|---------|---------------|--------------|-----------|--------------|
| 5086    | 14,897,876.93 | 2,255,683.58 | 5,325.52  | IE 18" CMP   |
| 5087    | 14,895,682.42 | 2,257,697.21 | 5,310.95  | TOP RAIL     |
| 5088    | 14,895,754.32 | 2,257,651.71 | 5,310.79  | TOP RAIL@CMP |
| 5089    | 14,895,840.00 | 2,257,612.82 | 5,310.74  | TOP RAIL     |
| 5090    | 14,895,934.96 | 2,257,582.15 | 5,311.06  | TOP RAIL     |
| 5091    | 14,895,748.15 | 2,257,640.16 | 5,305.32  | TOP SED      |
| 5092    | 14,895,747.93 | 2,257,640.40 | 5,306.88  | TOP 24" CMP  |
| 5093    | 14,895,760.79 | 2,257,668.20 | 5,304.04  | TOP 24" CMP  |
| 5094    | 14,895,712.09 | 2,257,649.05 | 5,308.35  | FL           |
| 5095    | 14,895,684.06 | 2,257,678.34 | 5,308.68  | FL           |
| 5096    | 14,895,656.13 | 2,257,702.88 | 5,309.23  | FL           |
| 5097    | 14,895,650.62 | 2,257,706.39 | 5,309.34  | FL           |
| 5098    | 14,895,640.43 | 2,257,719.67 | 5,309.20  | FL           |
| 5099    | 14,895,650.31 | 2,257,708.81 | 5,310.02  | TBM 4        |
| 5100    | 14,895,656.52 | 2,257,716.99 | 5,310.91  | TOP RAIL     |
| 5101    | 14,895,654.59 | 2,257,714.85 | 5,310.16  | TOP BALLAST  |
| 5102    | 14,895,652.75 | 2,257,712.25 | 5,309.31  | TOE BALLAST  |
| 5103    | 14,895,646.22 | 2,257,704.11 | 5,309.61  | NG           |
| 5104    | 14,895,636.31 | 2,257,690.99 | 5,313.64  | NG           |
| 5105    | 14,895,546.83 | 2,257,803.88 | 5,307.98  | FL           |
| 5106    | 14,895,302.87 | 2,258,063.11 | 5,307.20  | TOP RAIL     |
| 5107    | 14,895,208.15 | 2,258,157.49 | 5,306.17  | TOP RAIL@CMP |
| 5108    | 14,895,193.78 | 2,258,142.21 | 5,295.70  | IE 24" CMP   |
| 5109    | 14,895,227.56 | 2,258,179.13 | 5,290.62  | IE 24" CMP   |
| 5110    | 14,895,161.55 | 2,258,203.88 | 5,305.71  | TOP RAIL     |
| 5111    | 14,895,081.16 | 2,258,284.00 | 5,304.83  | TOP RAIL     |
| 5112    | 14,894,989.87 | 2,258,359.43 | 5,302.08  | FL           |
| 5113    | 14,894,919.73 | 2,258,435.70 | 5,302.19  | FL           |
| 5114    | 14,894,883.69 | 2,258,472.51 | 5,301.90  | FL           |
| 5115    | 14,894,924.31 | 2,258,440.09 | 5,303.48  | TOP RAIL     |
| 5116    | 14,894,922.09 | 2,258,437.57 | 5,302.78  | TOP BALLAST  |
| 5117    | 14,894,916.93 | 2,258,433.05 | 5,303.26  | NG           |
| 5118    | 14,894,916.53 | 2,258,433.00 | 5,303.81  | TBM 5        |
| 5119    | 14,894,912.65 | 2,258,427.61 | 5,305.79  | NG           |
| 5120    | 14,894,420.18 | 2,258,942.08 | 5,299.16  | TOP RAIL     |
| 5121    | 14,894,475.45 | 2,258,887.00 | 5,299.53  | TOP RAIL@CMP |
| 5122    | 14,894,541.04 | 2,258,821.72 | 5,300.05  | TOP RAIL     |
| 5123    | 14,894,570.34 | 2,258,808.43 | 5,298.84  | FL           |
| 5124    | 14,894,528.11 | 2,258,852.57 | 5,297.38  | FL           |
| 5125    | 14,894,466.81 | 2,258,877.95 | 5,292.72  | IE 24" CMP   |
| 5126    | 14,894,456.86 | 2,258,895.74 | 5,297.26  | FL           |
| 5127    | 14,894,429.04 | 2,258,925.38 | 5,297.95  | FL           |
| 5128    | 14,894,415.74 | 2,258,939.06 | 5,298.29  | FL           |

Stanlec Job Number: 26300169

January 4, 1999

## City of Reno - Stead Hydro Basin Project

Horizontal Datum: NAD 1983 (92) CAHPGN, NV West State Plane Zone, U.S. Feet

Vertical Datum: NAVD 1988 (Based upon USC&amp;GS BM A-299)

| Pl. No. | Northing      | Easting      | Elevation | Description  |
|---------|---------------|--------------|-----------|--------------|
| 5086    | 14,897,876.93 | 2,255,683.58 | 5,325.52  | IE 18" CMP   |
| 5087    | 14,895,682.42 | 2,257,697.21 | 5,310.95  | TOP RAIL     |
| 5088    | 14,895,754.32 | 2,257,651.71 | 5,310.79  | TOP RAIL@CMP |
| 5089    | 14,895,840.00 | 2,257,612.82 | 5,310.74  | TOP RAIL     |
| 5090    | 14,895,934.96 | 2,257,582.15 | 5,311.06  | TOP RAIL     |
| 5091    | 14,895,748.15 | 2,257,640.16 | 5,305.32  | TOP SED      |
| 5092    | 14,895,747.93 | 2,257,640.40 | 5,306.88  | TOP 24" CMP  |
| 5093    | 14,895,760.79 | 2,257,668.20 | 5,304.04  | TOP 24" CMP  |
| 5094    | 14,895,712.09 | 2,257,649.05 | 5,308.35  | FL           |
| 5095    | 14,895,684.06 | 2,257,678.34 | 5,308.68  | FL           |
| 5096    | 14,895,656.13 | 2,257,702.88 | 5,309.23  | FL           |
| 5097    | 14,895,650.62 | 2,257,706.39 | 5,309.34  | FL           |
| 5098    | 14,895,640.43 | 2,257,719.67 | 5,309.20  | FL           |
| 5099    | 14,895,650.31 | 2,257,708.81 | 5,310.02  | TBM 4        |
| 5100    | 14,895,656.52 | 2,257,716.99 | 5,310.91  | TOP RAIL     |
| 5101    | 14,895,654.59 | 2,257,714.85 | 5,310.16  | TOP BALLAST  |
| 5102    | 14,895,652.75 | 2,257,712.25 | 5,309.31  | TOE BALLAST  |
| 5103    | 14,895,646.22 | 2,257,704.11 | 5,309.61  | NG           |
| 5104    | 14,895,636.31 | 2,257,690.99 | 5,313.64  | NG           |
| 5105    | 14,895,546.83 | 2,257,803.88 | 5,307.98  | FL           |
| 5106    | 14,895,302.87 | 2,258,063.11 | 5,307.20  | TOP RAIL     |
| 5107    | 14,895,208.15 | 2,258,157.49 | 5,306.17  | TOP RAIL@CMP |
| 5108    | 14,895,193.78 | 2,258,142.21 | 5,295.70  | IE 24" CMP   |
| 5109    | 14,895,227.56 | 2,258,179.13 | 5,290.62  | IE 24" CMP   |
| 5110    | 14,895,161.55 | 2,258,203.88 | 5,305.71  | TOP RAIL     |
| 5111    | 14,895,081.16 | 2,258,284.00 | 5,304.83  | TOP RAIL     |
| 5112    | 14,894,989.87 | 2,258,359.43 | 5,302.08  | FL           |
| 5113    | 14,894,919.73 | 2,258,435.70 | 5,302.19  | FL           |
| 5114    | 14,894,883.69 | 2,258,472.51 | 5,301.90  | FL           |
| 5115    | 14,894,924.31 | 2,258,440.09 | 5,303.48  | TOP RAIL     |
| 5116    | 14,894,922.09 | 2,258,437.57 | 5,302.78  | TOP BALLAST  |
| 5117    | 14,894,916.93 | 2,258,433.05 | 5,303.26  | NG           |
| 5118    | 14,894,916.53 | 2,258,433.00 | 5,303.81  | TBM 5        |
| 5119    | 14,894,912.65 | 2,258,427.61 | 5,305.79  | NG           |
| 5120    | 14,894,420.18 | 2,258,942.08 | 5,299.16  | TOP RAIL     |
| 5121    | 14,894,475.45 | 2,258,887.00 | 5,299.53  | TOP RAIL@CMP |
| 5122    | 14,894,541.04 | 2,258,821.72 | 5,300.05  | TOP RAIL     |
| 5123    | 14,894,570.34 | 2,258,808.43 | 5,298.84  | FL           |
| 5124    | 14,894,528.11 | 2,258,852.57 | 5,297.38  | FL           |
| 5125    | 14,894,466.81 | 2,258,877.95 | 5,292.72  | IE 24" CMP   |
| 5126    | 14,894,456.86 | 2,258,895.74 | 5,297.26  | FL           |
| 5127    | 14,894,429.04 | 2,258,925.38 | 5,297.95  | FL           |
| 5128    | 14,894,415.74 | 2,258,939.06 | 5,298.29  | FL           |

SC V06-50 Copyright Trimble Navigation Ltd, 1996.  
Serial no 0 29-Dec-98 16:04  
Angle Degrees Dist US Feet Press mm Hg  
Temp Celsius Coord N-E-Elv H.obs Right

NOTE SN Corrections South azimuth No, Grid orientation Increasing  
NOTE SN north/east, Mag Decl 0000'00", Cogo view Sea level distances  
NOTE SN Units Vert USFt, Horz USFt, Angle  $\phi$ , Velocity Kmph, Coord  
NOTE SN order NEE  
NOTE SN Corrections South azimuth No, Grid orientation Increasing  
NOTE SN north/east, Mag Decl 0000'00", Cogo view Sea level distances  
NOTE SN Corrections South azimuth No, Grid orientation Increasing  
NOTE SN north/east, Mag Decl 0000'00", Cogo view Ground distances  
NOTE SN Units Vert USFt, Horz USFt, Angle  $\phi$ , Velocity Kmph, Coord  
SN order NEE  
NOTE SN Units Vert USFt, Horz USFt, Angle  $\phi$ , Velocity Kmph, Coord  
NOTE SN order NEE  
NOTE SN Units Vert USFt, Horz USFt, Angle  $\phi$ , Velocity Kmph, Coord  
NOTE SN order NEE  
NOTE SN Units Vert USFt, Horz USFt, Angle  $\phi$ , Velocity Kmph, Coord  
NOTE SN order NEE  
NOTE SN Time Date 29/12/1998 Time 9 : 32 : 34  
NOTE SN Time Date 29/12/1998 Time 10 : 3 : 34  
NOTE SN Time Date 29/12/1998 Time 10 : 34 : 1  
NOTE NM 5028 PIPE PROTRUDING FROM CONC SACK WALL } PW7  
NOTE NM New base station detected  
NOTE NM New base station detected

SC V06-50 Copyright Trimble Navigation Ltd, 1996.  
 Serial no 0 29-Dec-98 16:04  
 Angle Degrees Dist US Feet Press mm Hg  
 Temp Celsius Coord N-E-Elv H.obs Right

NOTE SN Corrections South azimuth No, Grid orientation Increasing  
 NOTE SN north/east, Mag Decl 0000'00", Cogo view Sea level distances  
 NOTE SN Units Vert USFt, Horz USFt, Angle ø, Velocity Kmph, Coord  
 NOTE SN order NEE  
 NOTE SN Corrections South azimuth No, Grid orientation Increasing  
 NOTE SN north/east, Mag Decl 0000'00", Cogo view Sea level distances  
 NOTE SN Corrections South azimuth No, Grid orientation Increasing  
 NOTE SN north/east, Mag Decl 0000'00", Cogo view Ground distances  
 NOTE SN Units Vert USFt, Horz USFt, Angle ø, Velocity Kmph, Coord  
 SN order NEE  
 NOTE SN Units Vert USFt, Horz USFt, Angle ø, Velocity Kmph, Coord  
 NOTE SN order NEE  
 NOTE SN Units Vert USFt, Horz USFt, Angle ø, Velocity Kmph, Coord  
 NOTE SN order NEE  
 NOTE SN Units Vert USFt, Horz USFt, Angle ø, Velocity Kmph, Coord  
 NOTE SN order NEE  
 NOTE SN Time Date 29/12/1998 Time 9 : 32: 34  
 NOTE SN Time Date 29/12/1998 Time 10: 3 : 34  
 NOTE SN Time Date 29/12/1998 Time 10: 34: 1  
 NOTE NM 5028 PIPE PROTRUDING FROM CONC SACK WALL, } PW7  
 NM New base station detected  
 NOTE NM New base station detected

Starlec Job Number: 26300169

January 4, 1999

## City of Reno - Stead Hydro Basin Project

Horizontal Datum: NAD 1983 (92) CAHPGN, NV West State Plane Zone, U.S. Feet  
 Vertical Datum: NAVD 1988 (Based upon USC&GS BM A-299)

| Pl. No. | Northing      | Easting      | Elevation | Description  |
|---------|---------------|--------------|-----------|--------------|
| 5169    | 14,899,559.92 | 2,258,723.64 | 5,110.82  | 5001 CHK-IN  |
| 5170    | 14,892,972.20 | 2,264,779.55 | 5,253.95  | BM J22-1932  |
| 5171    | 14,892,859.08 | 2,264,829.92 | 5,256.23  | TOP RAIL     |
| 5172    | 14,892,820.71 | 2,264,881.21 | 5,255.68  | TOP RAIL     |
| 5173    | 14,892,782.43 | 2,264,932.49 | 5,255.23  | TOP RAIL     |
| 5174    | 14,892,733.62 | 2,264,997.91 | 5,254.64  | TOP RAIL     |
| 5175    | 14,892,679.77 | 2,265,069.94 | 5,254.09  | TOP RAIL     |
| 5176    | 14,892,621.79 | 2,265,147.46 | 5,253.29  | TOP RAIL@CMP |
| 5177    | 14,892,582.37 | 2,265,200.31 | 5,253.00  | TOP RAIL@CMP |
| 5178    | 14,892,530.32 | 2,265,269.87 | 5,252.40  | TOP RAIL@CMP |
| 5179    | 14,892,461.63 | 2,265,361.75 | 5,251.64  | TOP RAIL     |
| 5180    | 14,892,456.26 | 2,265,359.68 | 5,249.97  | FL           |
| 5181    | 14,892,492.50 | 2,265,311.31 | 5,250.54  | FL           |
| 5182    | 14,892,554.23 | 2,265,211.71 | 5,249.48  | FL           |
| 5183    | 14,892,547.68 | 2,265,224.53 | 5,250.54  | FL           |
| 5184    | 14,892,542.36 | 2,265,243.94 | 5,251.08  | FL           |
| 5185    | 14,892,543.21 | 2,265,243.11 | 5,251.09  | FL           |
| 5186    | 14,892,547.85 | 2,265,246.59 | 5,252.55  | TOP RAIL     |
| 5187    | 14,892,545.44 | 2,265,245.22 | 5,252.01  | TOP BALLAST  |
| 5188    | 14,892,536.67 | 2,265,238.21 | 5,251.28  | NG           |
| 5189    | 14,892,517.09 | 2,265,226.11 | 5,252.21  | NG           |
| 5190    | 14,892,497.08 | 2,265,213.31 | 5,253.74  | NG           |
| 5191    | 14,892,468.37 | 2,265,196.11 | 5,255.43  | NG           |
| 5192    | 14,892,529.78 | 2,265,224.33 | 5,252.38  | TBM9         |
| 5193    | 14,892,592.09 | 2,265,125.62 | 5,229.61  | IE 33"CMP    |
| 5194    | 14,892,656.97 | 2,265,180.62 | 5,225.40  | IE 33"CMP    |
| 5195    | 14,891,629.45 | 2,266,125.64 | 5,222.33  | IE 24"CMP    |
| 5196    | 14,891,831.46 | 2,266,022.85 | 5,245.15  | TOP RAIL     |
| 5197    | 14,891,772.64 | 2,266,065.99 | 5,244.44  | TOP RAIL     |
| 5198    | 14,891,702.69 | 2,266,117.38 | 5,243.72  | TOP RAIL     |
| 5199    | 14,891,643.55 | 2,266,160.86 | 5,243.38  | TOP RAIL@CMP |
| 5200    | 14,891,573.58 | 2,266,212.08 | 5,242.81  | TOP RAIL     |
| 5201    | 14,891,495.85 | 2,266,269.09 | 5,242.47  | TOP RAIL     |
| 5202    | 14,891,403.06 | 2,266,337.18 | 5,242.08  | TOP RAIL     |
| 5203    | 14,891,328.03 | 2,266,393.98 | 5,241.93  | TOP RAIL     |
| 5204    | 14,891,276.60 | 2,266,437.51 | 5,241.85  | TOP RAIL     |
| 5205    | 14,891,261.64 | 2,266,430.12 | 5,240.30  | FL           |
| 5206    | 14,891,306.75 | 2,266,392.89 | 5,240.38  | FL           |
| 5207    | 14,891,372.50 | 2,266,341.51 | 5,240.03  | FL           |
| 5208    | 14,891,343.61 | 2,266,363.43 | 5,240.14  | FL           |
| 5209    | 14,891,304.88 | 2,266,389.37 | 5,244.05  | NG           |
| 5210    | 14,891,313.47 | 2,266,400.36 | 5,240.47  | TOE BALLAST  |
| 5211    | 14,891,314.69 | 2,266,401.79 | 5,241.24  | TOP BALLAST  |



Stantec Job Number: 26300169

January 4, 1999

## City of Reno - Stead Hydro Basin Project

Horizontal Datum: NAD 1983 (92) CAHPGN, NV West State Plane Zone, U.S. Feet

Vertical Datum: NAVD 1988 (Based upon USC&amp;GS BM A-299)

| Pt. No. | Northing      | Easting      | Elevation | Description  |
|---------|---------------|--------------|-----------|--------------|
| 5212    | 14,891,316.20 | 2,266,403.46 | 5,241.78  | TOP RAIL     |
| 5213    | 14,891,428.29 | 2,266,299.61 | 5,239.78  | FL           |
| 5214    | 14,891,481.71 | 2,266,253.70 | 5,240.00  | FL           |
| 5215    | 14,891,518.92 | 2,266,220.66 | 5,239.41  | FL           |
| 5216    | 14,891,549.70 | 2,266,187.60 | 5,238.75  | FL           |
| 5217    | 14,891,685.15 | 2,266,189.38 | 5,217.38  | IE 24" CMP   |
| 5218    | 14,891,572.43 | 2,266,176.08 | 5,239.76  | TBM 10       |
| 5219    | 14,891,055.06 | 2,267,328.29 | 5,234.10  | TOP RAIL     |
| 5220    | 14,891,060.73 | 2,267,410.84 | 5,233.31  | TOP RAIL     |
| 5221    | 14,891,057.77 | 2,267,367.67 | 5,233.71  | TOP RAIL     |
| 5222    | 14,891,051.00 | 2,267,270.08 | 5,234.62  | TOP RAIL     |
| 5223    | 14,891,043.41 | 2,267,157.90 | 5,235.68  | TOP RAIL@CMP |
| 5224    | 14,891,037.60 | 2,267,068.57 | 5,236.54  | TOP RAIL     |
| 5225    | 14,891,035.10 | 2,266,976.50 | 5,237.59  | TOP RAIL     |
| 5226    | 14,891,063.55 | 2,267,451.91 | 5,233.01  | TOP RAIL     |
| 5227    | 14,891,069.85 | 2,267,581.54 | 5,232.10  | TOP RAIL     |
| 5228    | 14,891,067.52 | 2,267,695.23 | 5,231.14  | TOP RAIL     |
| 5229    | 14,891,060.69 | 2,267,708.17 | 5,229.52  | FL           |
| 5230    | 14,891,062.81 | 2,267,676.81 | 5,229.67  | FL           |
| 5231    | 14,891,063.89 | 2,267,644.91 | 5,229.85  | FL           |
| 5232    | 14,891,063.70 | 2,267,610.93 | 5,230.19  | FL           |
| 5233    | 14,891,063.72 | 2,267,575.59 | 5,230.48  | FL           |
| 5234    | 14,891,039.65 | 2,267,521.68 | 5,230.50  | FL           |
| 5235    | 14,891,034.35 | 2,267,462.37 | 5,230.81  | FL           |
| 5236    | 14,891,043.00 | 2,267,519.73 | 5,230.65  | FL           |
| 5237    | 14,891,034.45 | 2,267,462.46 | 5,230.66  | FL           |
| 5238    | 14,891,035.52 | 2,267,389.54 | 5,230.42  | FL           |
| 5239    | 14,891,068.66 | 2,267,542.18 | 5,232.49  | TOP RAIL     |
| 5240    | 14,891,066.06 | 2,267,542.12 | 5,231.82  | TOP BALLAST  |
| 5241    | 14,891,062.99 | 2,267,542.46 | 5,230.75  | TOE BALLAST  |
| 5242    | 14,891,046.84 | 2,267,544.48 | 5,230.88  | NG           |
| 5243    | 14,891,026.26 | 2,267,546.31 | 5,232.06  | NG           |
| 5244    | 14,890,996.25 | 2,267,550.36 | 5,234.41  | NG           |
| 5245    | 14,890,949.14 | 2,267,553.57 | 5,238.02  | NG           |
| 5246    | 14,891,081.83 | 2,267,164.73 | 5,215.96  | IE 24IN CMP  |
| 5247    | 14,891,012.75 | 2,267,151.69 | 5,217.39  | IE 24IN CMP  |
| 5248    | 14,891,012.76 | 2,267,151.69 | 5,217.39  | IE 24IN CMP  |
| 5249    | 14,891,018.68 | 2,267,288.73 | 5,230.92  | TBM 11       |
| 5250    | 14,890,785.59 | 2,268,691.05 | 5,192.09  | IE 24" CMP   |
| 5251    | 14,890,687.99 | 2,269,245.91 | 5,209.40  | TOP RAIL     |
| 5252    | 14,890,674.09 | 2,269,273.37 | 5,207.28  | FL           |
| 5253    | 14,890,684.62 | 2,269,233.86 | 5,208.16  | FL           |
| 5254    | 14,890,691.45 | 2,269,200.91 | 5,208.42  | FL           |

Slantec Job Number: 26300169

January 4, 1999

## City of Reno - Stead Hydro Basin Project

Horizontal Datum: NAD 1983 (92) CAHPGN, NV West State Plane Zone, U.S. Feet  
 Vertical Datum: NAVD 1988 (Based upon USC&GS BM A-299)

| P. No. | Northing      | Easting      | Elevation | Description      |
|--------|---------------|--------------|-----------|------------------|
| 5255   | 14,890,700.95 | 2,269,133.81 | 5,208.31  | FL               |
| 5256   | 14,890,712.93 | 2,269,081.87 | 5,208.32  | FL               |
| 5257   | 14,890,727.11 | 2,269,006.80 | 5,207.77  | FL               |
| 5258   | 14,890,757.42 | 2,268,904.73 | 5,208.56  | FL               |
| 5259   | 14,890,763.73 | 2,268,860.07 | 5,208.39  | FL               |
| 5260   | 14,890,779.53 | 2,268,784.71 | 5,203.41  | FL               |
| 5261   | 14,890,699.17 | 2,269,203.61 | 5,210.02  | TOP RAIL         |
| 5262   | 14,890,696.79 | 2,269,202.99 | 5,209.46  | TOP BALLAST      |
| 5263   | 14,890,693.15 | 2,269,201.84 | 5,208.37  | TOE BALLAST      |
| 5264   | 14,890,685.38 | 2,269,200.49 | 5,208.45  | NG               |
| 5265   | 14,890,664.83 | 2,269,196.14 | 5,210.48  | NG               |
| 5266   | 14,890,643.01 | 2,269,192.89 | 5,216.09  | NG               |
| 5267   | 14,890,714.90 | 2,269,144.24 | 5,210.72  | TOP RAIL         |
| 5268   | 14,890,750.85 | 2,269,008.49 | 5,212.68  | TOP RAIL         |
| 5269   | 14,890,783.07 | 2,268,886.29 | 5,214.41  | TOP RAIL         |
| 5270   | 14,890,815.95 | 2,268,761.68 | 5,216.18  | TOP RAIL         |
| 5271   | 14,890,849.17 | 2,268,636.31 | 5,218.10  | TOP RAIL         |
| 5272   | 14,890,865.91 | 2,268,769.37 | 5,190.34  | TOP 24" CMP      |
| 5273   | 14,890,866.42 | 2,268,769.58 | 5,189.14  | TOP SED          |
| 5274   | 14,890,703.28 | 2,268,989.65 | 5,211.30  | TBM 12           |
| 5275   | 14,897,870.03 | 2,258,051.26 | 5,182.52  | CL N.VIRGINIA    |
| 5276   | 14,897,820.36 | 2,258,141.84 | 5,176.47  | CL N.VIRGINIA    |
| 5277   | 14,897,768.30 | 2,258,236.55 | 5,170.86  | CL N.VIRGINIA    |
| 5278   | 14,897,717.19 | 2,258,328.77 | 5,168.76  | CL N.VIRGINIA    |
| 5279   | 14,897,679.52 | 2,258,397.00 | 5,169.29  | CL N.VIRGINIA@RR |
| 5280   | 14,897,624.93 | 2,258,496.78 | 5,170.18  | CL N.VIRGINIA    |
| 5281   | 14,897,568.00 | 2,258,599.87 | 5,168.99  | CL N.VIRGINIA    |
| 5282   | 14,897,515.08 | 2,258,697.33 | 5,165.84  | CL N.VIRGINIA    |
| 5283   | 14,897,485.26 | 2,258,754.94 | 5,163.44  | CL N.VIRG@STEAD  |
| 5284   | 14,897,430.74 | 2,258,853.52 | 5,159.07  | CL N.VIRGINIA    |
| 5285   | 14,897,377.68 | 2,258,949.87 | 5,154.53  | CL N.VIRGINIA    |
| 5286   | 14,897,322.89 | 2,259,050.18 | 5,149.83  | CL N.VIRGINIA    |
| 5287   | 14,897,244.15 | 2,259,193.00 | 5,143.44  | CL N.VIRGINIA    |
| 5288   | 14,897,687.67 | 2,258,473.90 | 5,156.42  | IE 36" CMP       |
| 5289   | 14,897,694.30 | 2,258,460.46 | 5,158.14  | IE 30" CMP       |
| 5290   | 14,897,704.19 | 2,258,285.56 | 5,165.87  | IE 30" CMP       |

SC V06-50 Copyright Trimble Navigation Ltd, 1996.

Serial no 0

30-Dec-98 16:30

Angle Degrees

Dist US Feet

Press mm Hg

Temp Celsius

Coord N-E-Elv

H.obs Right

NOTE SN Cp0XNOTE SO Method To the point, Stake deltas: H dist 0.060USft

NOTE SN north/east, Mag Decl 000'00", Cogo view Sea level distances

NOTE SN Units Vert USFt, Horz USFt, Angle 0, Velocity Kmph, Coord

NOTE SN order NEE

NOTE SN Corrections South azimuth No, Grid orientation Increasing

NOTE SN north/east, Mag Decl 000'00", Cogo view Sea level distances

NOTE SO Stake out Design Pt 5001 , Code A299

HIS ONE IS CON

NOTE SO 0.066USft Azimuth 308020'54"

NOTE SN Time Date 30/12/1998 Time 9 : 16: 40

NOTE NM 5177+5178 NOT@CMP

NOTE SN Time Date 30/12/1998 Time 9 : 48: 0

NOTE NM 5193 PROTRUDING MINOR COBBLES+GRAVEL PES

NOTE NM 5195 PROTRUDING PEL

NOTE NM 5195 NO SED PEL

NOTE SN Time Date 30/12/1998 Time 10: 18: 3

NOTE NM corrections South azimuth No, Grid orientation Increasing

NOTE NM 5213 HAS BEEN DONE BY THE CMP

NOTE NM New base station detected

NOTE SN Time Date 30/12/1998 Time 12: 54: 50

NOTE NM 5242 FL BREAK NOT WELL DEFINED ? PEL  
5230.28 NG

NOTE SN Time Date 30/12/1998 Time 13: 27: 20

NOTE NM 5248 PROTRUDING NO SEDIM PE7

3 NM 5250 PROTRUDING NO SED PH1

NOTE SN Time Date 30/12/1998 Time 13: 57: 50

NOTE SN Time Date 30/12/1998 Time 14: 46: 14

NOTE NM 5290 NO SED FLARED END SECTION

*W. Virginia 2' Steep*

Slantec Job Number: 26300169

January 4, 1999

## City of Reno - Stead Hydro Basin Project

Horizontal Datum: NAD 1983 (92) CAHPGN, NV West State Plane Zone, U.S. Feet  
 Vertical Datum: NAVD 1988 (Based upon USC&GS BM A-299)

| Pl. No. | Northing      | Easting      | Elevation | Description      |
|---------|---------------|--------------|-----------|------------------|
| 5291    | 14,896,895.86 | 2,257,592.30 | 5,234.21  | TOP 36" CMP      |
| 5292    | 14,896,895.88 | 2,257,591.90 | 5,231.28  | IE 36" CMP       |
| 5293    | 14,897,490.42 | 2,258,412.01 | 5,172.16  | TOP 36" CMP      |
| 5294    | 14,897,503.62 | 2,258,412.11 | 5,168.59  | IE 36" CMP       |
| 5295    | 14,899,559.93 | 2,258,723.67 | 5,110.85  | 5001-CHK         |
| 5296    | 14,901,113.04 | 2,249,064.94 | 5,095.75  | C/L FRONTAGE RD. |
| 5297    | 14,901,101.59 | 2,249,110.50 | 5,097.07  | C/L FRONTAGE RD. |
| 5298    | 14,901,090.26 | 2,249,156.37 | 5,098.51  | C/L FRONTAGE RD. |
| 5299    | 14,901,076.07 | 2,249,212.30 | 5,100.36  | C/L FRONTAGE INT |
| 5300    | 14,901,063.90 | 2,249,262.38 | 5,101.99  | C/L FRONTAGE RD  |
| 5301    | 14,901,051.60 | 2,249,311.36 | 5,103.56  | C/L FRONTAGE RD  |
| 5302    | 14,901,039.53 | 2,249,360.57 | 5,105.19  | C/L FRONTAGE RD  |
| 5303    | 14,901,026.56 | 2,249,418.89 | 5,107.18  | C/L FRONTAGE RD  |
| 5304    | 14,901,017.24 | 2,249,470.89 | 5,108.71  | C/L FRONTAGE RD  |
| 5305    | 14,901,010.54 | 2,249,524.51 | 5,110.11  | C/L FRONTAGE RD  |
| 5306    | 14,901,005.80 | 2,249,579.13 | 5,111.45  | C/L FRONTAGE RD  |
| 5307    | 14,901,165.11 | 2,249,236.76 | 5,095.94  | C/L RED ROCK RD  |
| 5308    | 14,901,114.05 | 2,249,222.86 | 5,098.95  | C/L RED ROCK RD  |
| 5309    | 14,901,076.36 | 2,249,212.68 | 5,100.35  | C/L RED ROCK INT |
| 5310    | 14,901,028.34 | 2,249,199.41 | 5,100.96  | C/L RED ROCK RD  |
| 5311    | 14,901,020.20 | 2,249,197.09 | 5,101.04  | C/L RED ROCK RD  |
| 5312    | 14,901,011.02 | 2,249,194.78 | 5,101.41  | C/L RED ROCK RD  |
| 5313    | 14,900,960.31 | 2,249,180.87 | 5,105.54  | C/L RED ROCK RD  |
| 5314    | 14,900,906.26 | 2,249,166.06 | 5,111.00  | C/L RED ROCK RD  |
| 5315    | 14,900,854.98 | 2,249,152.02 | 5,116.37  | C/L RED ROCK RD  |
| 5316    | 14,900,803.33 | 2,249,138.17 | 5,121.68  | C/L RED ROCK RD  |
| 5317    | 14,900,747.64 | 2,249,123.64 | 5,127.07  | C/L RED ROCK RD  |
| 5318    | 14,901,022.68 | 2,249,306.64 | 5,100.19  | TOP 30" RCP 24"  |
| 5319    | 14,901,022.45 | 2,249,306.66 | 5,098.44  | TOP SED          |
| 5320    | 14,901,095.88 | 2,249,324.07 | 5,096.02  | IE 24" RCP       |
| 5321    | 14,901,206.29 | 2,249,363.36 | 5,086.86  | IE 24" RCP       |
| 5322    | 14,901,204.06 | 2,249,353.59 | 5,087.71  | FL               |
| 5323    | 14,901,207.55 | 2,249,326.98 | 5,088.80  | FL               |
| 5324    | 14,901,215.20 | 2,249,299.73 | 5,091.02  | NG               |
| 5325    | 14,901,216.95 | 2,249,299.11 | 5,091.29  | EP               |
| 5326    | 14,901,201.01 | 2,249,281.04 | 5,092.22  | NG               |
| 5327    | 14,901,237.00 | 2,249,289.10 | 5,090.13  | PMT              |
| 5328    | 14,901,261.61 | 2,249,293.19 | 5,088.42  | PMT              |
| 5329    | 14,901,291.07 | 2,249,294.37 | 5,086.18  | FL GUTTER        |
| 5330    | 14,901,268.32 | 2,249,271.84 | 5,088.56  | PVMT             |
| 5331    | 14,901,226.89 | 2,249,257.80 | 5,091.60  | PVMT             |
| 5332    | 14,901,222.62 | 2,249,382.10 | 5,091.11  | PVMT             |
| 5333    | 14,901,196.92 | 2,249,385.20 | 5,088.75  | FL               |

Stantec Job Number: 26300169

January 4, 1999

City of Reno - Stead Hydro Basin Project

Horizontal Datum: NAD 1983 (92) CAHPGN, NV West State Plane Zone, U.S. Feet

Vertical Datum: NAVD 1988 (Based upon USC&amp;GS BM A-299)

| Pl. No. | Northing      | Easting      | Elevation | Description  |
|---------|---------------|--------------|-----------|--------------|
| 5334    | 14,901,732.39 | 2,249,435.83 | 5,054.53  | INIT         |
| 5335    | 14,901,675.30 | 2,249,440.69 | 5,057.61  | TOP 24 " RCP |
| 5336    | 14,901,675.36 | 2,249,440.65 | 5,055.68  | TOP SED      |
| 5337    | 14,904,930.80 | 2,252,863.94 | 4,974.23  | 5003 Chk     |

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|               |                 |             |
|---------------|-----------------|-------------|
| Serial no 0   | 31-Dec-98 12:51 |             |
| Angle Degrees | Dist US Feet    | Press mm Hg |
| Temp Celsius  | Coord N-E-Elv   | H.obs Right |

NOTE SN Corrections South azimuth No, Grid orientation Increasing

NOTE SN north/east, Mag Decl 000'00", Cogo view Sea level distances

NOTE SN Units Vert USFt, Horz USFt, Angle ø, Velocity Kmph, Coord

NOTE SN order NEE

NOTE SN Corrections South azimuth No, Grid orientation Increasing

NOTE SN north/east, Mag Decl 000'00", Cogo view Sea level distances

NOTE NM 5292 PROTRUDING W/DEBRIS GRATE SEDIMENT 0.1' DEEP FOR 2'

NOTE NM 5292 INTO PIPE FOLLOWING THIS PIPE CLEAR

NOTE NM 5293 ICE IN BOTTOM

NOTE NM 5294 FLARED END SECTION 5'LONG \*6.5'WIDE

NOTE SN Time Date 31/12/1998 Time 9 : 24: 22

NOTE SO Stake out Design Pt 5001 , Code A299

NOTE SO Method To the point, Stake deltas: H dist 0.074USft V dist

NOTE SO 0.045USft Azimuth 293ø13'20"

NOTE SN Time Date 31/12/1998 Time 9 : 55: 0

NOTE SN Time Date 31/12/1998 Time 10: 26: 28

NOTE NM 5319 APPROX .75' SED FLAIED END SECT 4' WIDE APPROX

NOTE NM 5318+19 PIPE ACTUALLY A 24" RCP

NOTE NM New base station detected

NOTE NM 5321 FLARED END SECTION 4'X4' NO SED

NOTE SN Time Date 31/12/1998 Time 11: 5 : 57

NOTE NM 5335 FLARED END SECT

NOTE SO Stake out Design Pt 5003 , Code SW S31

NOTE SO Method To the point, Stake deltas: H dist 0.019USft V dist

NOTE SO 0.062USft Azimuth 316°10'13"



5338,14908058.363,2259159.865,4988.985,MH  
5339,14908025.779,2259113.273,4988.272,DI  
5340,14907886.966,2259409.469,4985.413,MH  
5341,14907998.976,2259226.371,4987.048,MH  
5342,14907816.313,2259163.513,4980.371,MH  
5343,14907538.308,2258984.676,4972.247,CONC BOX  
5344,14907523.308,2259109.051,4975.413,MH  
5345,14907190.097,2259106.280,4974.616,MH  
5346,14907190.640,2259050.051,4975.957,MH  
5347,14907116.980,2258934.639,4970.927,IE 36"RCP  
5348,14907252.692,2258527.727,4976.337,BSW  
5349,14907249.452,2258623.132,4976.764,BSW  
5350,14907245.336,2258749.351,4976.117,BSW  
5351,14907239.101,2258931.078,4975.145,BSW  
5352,14907237.828,2258987.072,4974.828,BSW@BC  
5353,14907245.222,2259006.993,4975.009,BSW@POC  
5354,14907261.694,2259012.959,4975.074,BSW@EC  
5355,14907386.591,2259018.014,4975.604,BSW  
5356,14907527.724,2259023.278,4977.071,BSW  
5357,14907530.075,2259066.004,4976.750,TC-MEDIAN  
5358,14907509.747,2259066.950,4976.533,TC-MEDIAN  
5359,14907468.454,2259070.335,4976.149,TC-MEDIAN  
5360,14907426.884,2259070.533,4975.854,TC-MEDIAN  
5361,14907257.977,2259064.852,4975.902,TC-MEDIAN  
5362,14907217.185,2259058.297,4975.830,AC  
5363,14907183.672,2259054.123,4976.075,AC  
5364,14907116.989,2259051.286,4976.590,AC  
5365,14907115.987,2259051.196,4977.122,TC-MEDIAN  
5366,14906989.370,2259046.351,4978.434,TC-MEDIAN  
5367,14906982.633,2259045.634,4977.989,AC-CL+-  
5368,14906927.171,2259049.350,4978.759,AC-CL  
5369,14906897.881,2259039.665,4979.133,MH  
5370,14906933.888,2259100.783,4978.670,MH  
5371,14907140.302,2259138.145,4974.341,RENO BM-100  
5372,14907140.778,2259138.128,4973.813,FL-GUTTER  
5373,14907142.139,2259138.291,4973.883,LIP  
5374,14907168.762,2259138.259,4974.417,AC  
5375,14907169.413,2259138.146,4975.052,TC-FAKED  
5376,14907183.360,2259139.212,4974.942,CTR MEDIAN  
5377,14907198.340,2259139.818,4974.885,TC-FAKED  
5378,14907198.743,2259139.890,4974.317,AC  
5379,14907224.679,2259140.431,4973.852,LIP  
5380,14907226.604,2259140.459,4973.742,FL GUTTER  
5381,14907226.970,2259140.526,4974.184,TC  
5382,14907180.550,2259124.781,4974.621,AC  
5383,14907178.630,2259281.444,4975.435,AC  
5384,14907168.875,2259569.698,4977.261,AC  
5385,14907165.507,2259633.940,4976.918,AC  
5386,14907471.128,2259633.785,4973.124,DI  
5387,14907232.216,2258978.881,4974.770,BM 1567  
5388,14907232.082,2258978.878,4974.733,TC

5389,14907231.829,2258978.831,4974.280,GUTTER FL  
5390,14907229.746,2258978.691,4974.467,GUTTER LIP  
5391,14907196.361,2258977.382,4975.208,AC@MEDIAN  
5392,14907195.557,2258977.379,4975.680,TC-MEDIAN  
5393,14907191.436,2258977.142,4975.794,TC-MEDIAN  
5394,14907190.636,2258977.356,4975.237,AC@MEDIAN  
5395,14907148.364,2258973.904,4974.533,GUTTER LIP  
5396,14907146.449,2258973.803,4974.425,GUTTER FL  
5397,14907146.082,2258973.694,4974.843,TC  
5398,14907200.807,2258703.519,4977.250,TC-MEDIAN  
5399,14907196.202,2258600.768,4977.638,TC-MEDIAN  
5400,14907199.325,2258477.663,4976.837,TC-MEDIAN  
5401,14907283.506,2260731.924,4973.741,DI  
5402,14907298.810,2260868.999,4967.570,TOP PIPE  
5403,14906301.185,2259018.677,4987.911,MH  
5404,14905818.267,2259003.427,4995.719,MH  
5405,14905219.212,2258983.236,5004.379,MH  
5406,14904823.044,2258969.555,5010.383,MH  
5407,14904474.801,2258936.292,5015.194,MH  
5408,14904121.344,2258924.125,5020.423,MH  
5409,14903770.489,2258912.243,5025.743,MH  
5410,14903425.840,2258900.679,5032.634,MH  
5411,14903075.217,2258889.151,5040.111,MH  
5412,14902724.448,2258876.956,5047.490,MH  
5413,14902700.648,2258858.718,5044.177,IE 24" RCP  
5414,14902688.828,2258861.274,5047.542,TOP LIP 6\*6INLET  
5415,14902149.483,2258844.722,5057.752,FL OPEN DITCH  
5416,14901393.530,2258820.882,5072.785,24"RCP OUTLET  
5417,14901326.922,2258832.806,5077.091,24"RCP OUTLET  
5418,14901327.011,2258832.770,5076.914,MH  
5419,14901512.475,2258815.537,5074.727,TOP  
5420,14901512.634,2258823.789,5072.460,TOP AC DITCH  
5421,14901512.701,2258825.928,5071.334,FL AC DITCH  
5422,14901512.802,2258828.505,5072.296,TOP AC DITCH  
5423,14901512.696,2258836.491,5072.885,EP  
5424,14901511.664,2258873.721,5073.524,CL AC RD  
5425,14901510.593,2258910.350,5072.593,GUTTER LIP  
5426,14901510.359,2258912.064,5072.488,GUTTER FL  
5427,14901510.027,2258912.639,5072.922,TBC  
5428,14901510.186,2258918.934,5072.883,BSW  
5429,14901074.732,2258823.613,5082.405,MH  
5430,14901048.943,2258809.135,5083.584,MH  
5431,14901013.058,2258721.992,5088.870,CL  
5432,14901001.590,2258652.216,5092.278,CL  
5433,14900995.341,2258629.765,5092.693,CL  
5434,14900991.361,2258616.783,5092.806,CL@CL RR  
5435,14900945.751,2258513.806,5095.475,CL  
5436,14900864.169,2258410.921,5098.749,CL END SUPER  
5437,14900850.255,2258424.300,5099.055,TC  
5438,14900850.486,2258424.142,5098.595,FL GUTTER  
5439,14900851.774,2258422.837,5098.599,GUTTER LIP

5440,14900883.916,2258395.132,5098.844,AC  
5441,14900896.390,2258383.533,5098.023,AC  
5442,14900808.104,2258261.212,5100.003,NG  
5443,14900808.034,2258261.265,5099.960,INIT CHK  
5444,14900801.726,2258264.590,5100.883,BSW  
5445,14900797.372,2258267.024,5100.824,TBC  
5446,14900796.848,2258267.292,5100.351,GUTT FL  
5447,14900795.744,2258268.064,5100.465,GUTT LIP  
5448,14900775.612,2258279.021,5101.141,CL  
5449,14900754.326,2258292.677,5101.735,LIP  
5450,14900752.705,2258293.579,5101.615,FL  
5451,14900752.207,2258293.796,5102.123,TBC  
5452,14900748.738,2258296.041,5102.227,BSW  
5453,14900696.015,2258143.824,5104.514,BSW  
5454,14900699.906,2258142.938,5104.342,TBC  
5455,14900700.565,2258142.826,5103.876,FL  
5456,14900702.352,2258142.346,5103.973,LIP  
5457,14900719.574,2258136.607,5103.493,CL  
5458,14900749.211,2258129.824,5102.713,LIP  
5459,14900750.560,2258129.327,5102.547,FL  
5460,14900751.065,2258129.163,5103.042,TBC  
5461,14900755.891,2258128.012,5103.143,BSW  
5462,14900763.395,2258126.078,5103.433,NG TOP  
5463,14900768.854,2257944.815,5106.984,NG TOP  
5464,14900754.391,2257940.832,5105.507,EP  
5465,14900724.878,2257935.419,5106.227,CL  
5466,14900706.375,2257931.130,5106.406,LIP  
5467,14900704.538,2257930.833,5106.261,FL  
5468,14900703.905,2257930.877,5106.724,TBC  
5469,14900687.838,2258110.494,5104.508,MH  
5470,14900931.718,2258550.660,5094.352,MH  
5471,14900945.317,2258588.227,5088.074,IE 24"OUTLET  
5472,14900948.028,2258592.675,5087.964,IE 24"INLET  
5473,14900963.699,2258616.383,5093.411,CL RR  
5474,14901023.133,2258618.072,5092.003,CL RR  
5475,14901030.595,2258625.232,5090.913,FL  
5476,14901024.673,2258595.077,5086.343,IE 24"RCP-OUT  
5477,14900784.598,2258813.413,5088.427,MH  
5478,14900458.687,2258793.074,5093.578,MH  
5479,14900103.137,2258781.750,5099.200,MH  
5480,14900159.686,2259016.308,5096.007,MH  
5481,14899786.259,2258865.415,5104.406,MH  
5482,14899400.876,2258862.262,5109.170,FL  
5483,14899401.115,2258854.414,5110.489,BSW  
5484,14899400.263,2258849.443,5110.379,TBC  
5485,14899400.003,2258848.824,5109.969,FL  
5486,14899399.997,2258847.937,5109.925,LIP  
5487,14899394.008,2258809.359,5110.778,CL  
5488,14899394.769,2258774.939,5109.986,LIP  
5489,14899394.906,2258773.835,5109.962,FL  
5490,14899394.749,2258773.299,5110.470,TBC

5491,14899394.817,2258768.694,5110.539,BSW  
5492,14899396.168,2258759.231,5107.019,IE 24"CMP-IN  
5493,14898985.286,2258552.511,5118.119,IE 36"CMP-IN  
5494,14898993.778,2258553.434,5123.625, TOP BERM  
5495,14899064.854,2258568.421,5120.954, TOP BERM  
5496,14899065.166,2258559.037,5120.155, TOP 36"CMP  
5497,14899559.924,2258723.558,5110.897,BM A299 CHK-IN  
5498,14899559.936,2258723.572,5110.864,1-RE CHK  
5499,14899466.974,2258765.748,5108.997,MH  
5500,14899785.973,2258781.905,5104.395,MH  
5501,14899707.640,2258391.741,5120.526, TOP BERM  
5502,14899699.036,2258383.385,5117.329,NG  
5503,14899693.140,2258379.470,5117.691,NG  
5504,14899686.351,2258375.860,5119.929,NG  
5505,14899713.634,2258388.238,5116.604,TOE BERM  
5506,14899720.201,2258376.459,5115.679,FL  
5507,14899722.954,2258373.020,5116.868,NG  
5508,14899725.177,2258369.790,5116.607,NG  
5509,14899727.703,2258367.438,5117.737, TOP BALLAST  
5510,14899733.063,2258360.920,5117.488, TOP BALLAST  
5511,14899740.439,2258358.986,5116.406, TOP  
5512,14899747.704,2258350.713,5112.731,TOE  
5513,14899750.264,2258346.691,5112.766,TOE  
5514,14899755.197,2258340.659,5118.312, TOP  
5515,14899770.701,2258317.012,5118.459,NG  
5516,14899760.623,2258550.305,5108.141, TOP 48"RCP  
5517,14899789.679,2258551.621,5110.054,MH  
5518,14899896.565,2258533.823,5109.232,MH  
5519,14899964.582,2258538.246,5108.187,MH  
5520,14900223.873,2258601.531,5106.553,MH  
5521,14900271.865,2258570.002,5099.765,IE 24"CMP  
5522,14899559.986,2258723.624,5110.864,1-RERECHK  
5523,14898405.642,2258537.512,5131.492,IE 36"CMP  
5524,14898401.291,2258546.281,5134.423,FL  
5525,14898486.089,2258539.981,5130.439,IE 36"CMP  
5526,14897625.338,2258442.650,5168.475,FL  
5527,14897614.635,2258436.792,5170.217,E RAIL  
5528,14897652.991,2258415.761,5169.678,E RAIL@EP  
5529,14897675.632,2258402.277,5169.324,E RAIL@CL  
5530,14897700.957,2258386.466,5168.904,E RAIL@EP  
5531,14897763.675,2258341.612,5167.682,E RAIL  
5532,14897830.941,2258283.844,5166.163,E RAIL  
5533,14897827.367,2258280.529,5166.112,W RAIL  
5534,14897825.748,2258278.773,5165.262, TOP BALLAST  
5535,14897823.347,2258276.508,5164.520,TOE BALLAST  
5536,14897820.905,2258273.937,5164.177,FL  
5537,14897816.356,2258267.721,5164.316,TOE  
5538,14897809.775,2258259.179,5169.119, TOP  
5539,14899052.730,2257067.792,5191.641,IE 36"RCP  
5540,14899067.025,2257084.975,5196.689,NG  
5541,14899053.675,2257084.064,5195.398,FL

5542,14899037.372,2257084.037,5196.704,NG  
5543,14898680.101,2256672.992,5225.248,IE 24"CMP  
5544,14898678.441,2256676.280,5225.420,IE 24"CMP  
5545,14898590.344,2256631.265,5230.292,TOP 24"CMP  
5546,14898592.441,2256627.783,5230.334,TOP 36"CMP  
5547,14898661.363,2256610.110,5238.505,CL RD  
5548,14898636.670,2256655.113,5238.161,CL RD  
5549,14898518.832,2256780.549,5238.866,NG  
5550,14898526.194,2256784.261,5235.153,TOE  
5551,14898531.137,2256786.330,5235.005,FL  
5552,14898546.866,2256794.808,5236.124,EP  
5553,14898556.555,2256799.501,5236.398,CL  
5554,14898567.766,2256805.489,5235.894,EP  
5555,14898581.364,2256813.513,5234.600,FL/TOE  
5556,14898586.011,2256816.207,5237.071,NG  
5557,14898445.317,2256959.146,5234.346,TOP  
5558,14898448.900,2256961.325,5232.342,TOE  
5559,14898450.387,2256962.277,5232.208,FL  
5560,14898453.656,2256964.180,5232.801,EP  
5561,14898463.113,2256969.571,5232.938,CL  
5562,14898473.597,2256975.267,5232.479,EP  
5563,14898486.383,2256983.434,5231.569,NG  
5564,14898332.922,2257207.275,5227.715,CL  
5565,14898280.918,2257302.415,5225.276,CL  
5566,14898158.128,2257360.445,5222.039,DW  
5567,14898178.868,2257374.497,5221.686,DW  
5568,14898212.823,2257396.316,5221.397,EP  
5569,14898225.163,2257403.373,5221.761,CL  
5570,14898236.512,2257409.830,5221.419,EP  
5571,14898245.061,2257414.980,5220.410,FL  
5572,14898250.869,2257417.130,5221.757,TOP  
5573,14898308.433,2257316.960,5218.396,TOP 18"CMP  
5574,14898254.656,2257287.906,5218.087,IE 18"CMP -HWALL  
5575,14904131.857,2256943.991,5022.754,NG  
5576,14904129.272,2256938.587,5020.536,FL  
5577,14904127.546,2256934.352,5022.130,NG  
5578,14904126.268,2256931.020,5022.571,TOE BALLAST  
5579,14904125.144,2256928.532,5023.454,TOP BALLAST  
5580,14904121.079,2256919.731,5023.423,TOP BALLAST  
5581,14904118.892,2256916.455,5022.443,NG  
5582,14904120.015,2256917.423,5022.425,TOE BALLAST  
5583,14904118.048,2256913.064,5020.508,TOE  
5584,14904112.921,2256903.415,5020.596,TOE  
5585,14904110.281,2256897.494,5023.659,NG

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|               |                 |             |
|---------------|-----------------|-------------|
| Serial no 0   | 08-Mar-99 17:04 |             |
| Angle Degrees | Dist US Feet    | Press mm Hg |
| Temp Celsius  | Coord N-E-Elv   | H.obs Right |

NOTE SN Corrections South azimuth No, Grid orientation Increasing

NOTE SN north/east, Mag Decl 0000'00", Cogo view Sea level distances

NOTE SN Units Vert USFt, Horz USFt, Angle ø, Velocity Kmph, Coord

NOTE SN order NEE

NOTE SN Corrections South azimuth No, Grid orientation Increasing

NOTE SN north/east, Mag Decl 0000'00", Cogo view Sea level distances

NOTE SN Time Date 8 /3 /1999 Time 9 : 3 : 10

NOTE NM 5338 IN18"@4.3 -OUT @4.3

NOTE NM 5339 IN@18" PLUGGED

1 NM 5340 OUT -2.86@12" IN 12" FROM N -IN12" E

NOTE NM 5341 IN 12"N-IN 12"E@5.84 OUT 12"

NOTE NM 5342 IN -OUT 12"@4.28

NOTE NM 5343 IN-OUT 36"@5.1

NOTE NM 5344 IN 12"@5.43 IE TOP SED@8.46

NOTE NM 5345 IN 18"@4.6-- OUT 2\*12"@5.21

NOTE NM 5346 IN-W 42"@6.5--IN SW 42"@6.46--IN 2\*12"@6.3 OUT N--SQ 54

NOTE SN Time Date 8 /3 /1999 Time 9 : 35: 24

NOTE NM 5361 END MEDIAN

NOTE NM 5369 IN 36"@6.86--OUT 36"@7.46

NOTE NM 5370 12"IN-OUT@5.56

N- SN Time Date 8 /3 /1999 Time 10: 7 : 32

NOTE NM 5386 TOP SED IE -7.3

NOTE NM 5401 IE 9.94 TOP SED

NOTE SN Time Date 8 /3 /1999 Time 10: 42: 38

NOTE NM 5402 TOP SQ 6.6'\*4.2 -4.2 TO IE

NOTE NM 5403 IN 36"@8.0--IN 24"@8.0--OUT 36@8.5

NOTE NM 5404 IN-OUT 36"@8.02

NOTE SN Time Date 8 /3 /1999 Time 11: 29: 47

NOTE NM 540<sup>5</sup>~~5~~ IN 24"@7.4--IN 24@7.4 OUT 36@8.02

NOTE NM 5406 24" IN-OUT@7.38

NOTE NM 5407 24" IN-OUT--@7.2

NOTE NM 5408 24" IN-OUT @7.02

NOTE NM 540<sup>9</sup>~~8~~ 24" IN-OUT @7.3

NOTE NM 5410 24" IN-OUT @6.70

NOTE NM 5411 24" IN-OUT @6.56

NOTE NM 5412 24" IN-OUT @6.60

NOTE SN Time Date 8 /3 /1999 Time 12: 0 : 49

NOTE NM 5417 IN 24"@3.42-- OUT 24"@3.78

NOTE NM 5418 SEE NOTE FOR 5417 -- BAD DESC

NOTE NM 5429 24" IN-OUT @3.12

NOTE NM 5430 24" IN-OUT @2.76

NOTE SN Time Date 8 /3 /1999 Time 12: 33: 28

NOTE SO Stake out Design Pt 5442 , Code NG

NOTE SO Method To the point, Stake deltas: H dist 0.088USft V dist

NOTE SO 0.043USft Azimuth 323@01'23"

NOTE NM 5469 24"@8.50

NOTE NM 5470 24"@5.3

NOTE SN Time Date 8 /3 /1999 Time 13: 3 : 37

NOTE NM 5477 24"@5.60

NOTE NM 5478 24"@6.20

NOTE NM 5479 24"@5.66

NOTE NM 5480 24"@90DEG-@7.54

NOTE NM 5481 24"@4.2 IN 4.55 OUT

NOTE SN Time Date 8 /3 /1999 Time 13: 33: 54

NOTE NM 5496 -2.0 TO TOP SED

NOTE SO Stake out Design Pt 1 , Code BM A299 ,

NOTE SO Method To the point, Stake deltas: H dist 0.055USft V dist

NOTE SO -1.017USft Azimuth 50@35'22"

NOTE SO Stake out Design Pt 1 , Code BM A299 ,

NOTE SO Method To the point, Stake deltas: H dist 0.037USft V dist

NOTE SO -0.984USft Azimuth 50@43'11"

NOTE NM 5499 IN 24"@4.66--OUT 24"@6.08

NOTE NM 5500 IN 36"@6.0-IN 24"@5.44--OUT 24"@5.96--OUT 24"@2.90

NOTE NM 5516 3.0' TO TOP SED

NOTE NM 5517 IN 48"@6.78--OUT 36"N@5.8--OUT 36"E@7.1 Top 5110.05

NOTE NM 5518 36"@5.56

NOTE NM 5519 36"@5.06

NOTE SN Time Date 8 /3 /1999 Time 14: 35: 34

NOTE NM 5520 36"IN-24"OUT@4.76

NOTE SO Stake out Design Pt 1 , Code BM A299 ,



NOTE SO Method To the point, Stake deltas: H dist 0.036USft V dist  
SO 0.026USft Azimuth 221°40'56"  
NOTE SN Time Date 8 /3 /1999 Time 15: 16: 46  
NOTE NM 5545 ACTUALLY 36"--- -2.3 TO TOP SED  
NOTE NM 5546 -1.7 TO TOP SED



**Correspondence** **1**

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**Previous Studies** **2**

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**Existing Conditions Hydrologic  
and Hydraulic Backup Data** **3**

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**Proposed Conditions  
Hydrologic Backup Data** **4**

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**Proposed Conditions Hydraulic  
Backup Data** **5**

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**Quantities and Cost Estimates** **6**

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**Survey Data** **7**

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**References** **8**

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