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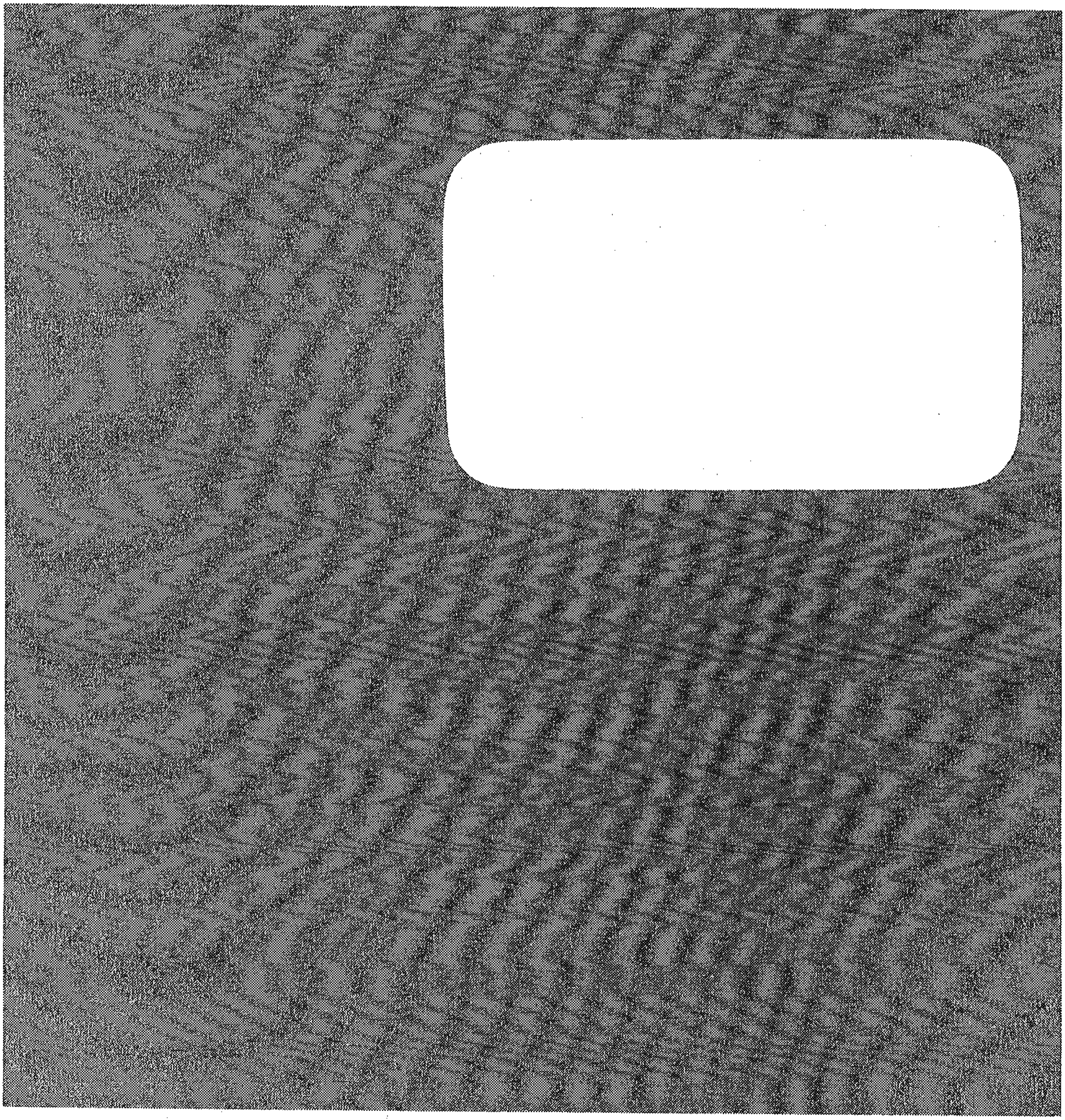

VOLUME I

SUPPLEMENTAL ENGINEERING REPORT
FOR
PLUMAS/MOANA STORM DRAIN

KENNEDY/JENKS/CHILTON
877041.00

MARCH 1989

REGISTERED PROFESSIONAL ENGINEER-STATE OF NEVADA
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EXP 6-30-90
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SUPPLEMENTAL ENGINEERING REPORT
PLUMAS/MOANA
STORM DRAIN PROJECT

FOR

CITY OF RENO
RENO, NEVADA

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EXECUTIVE SUMMARY

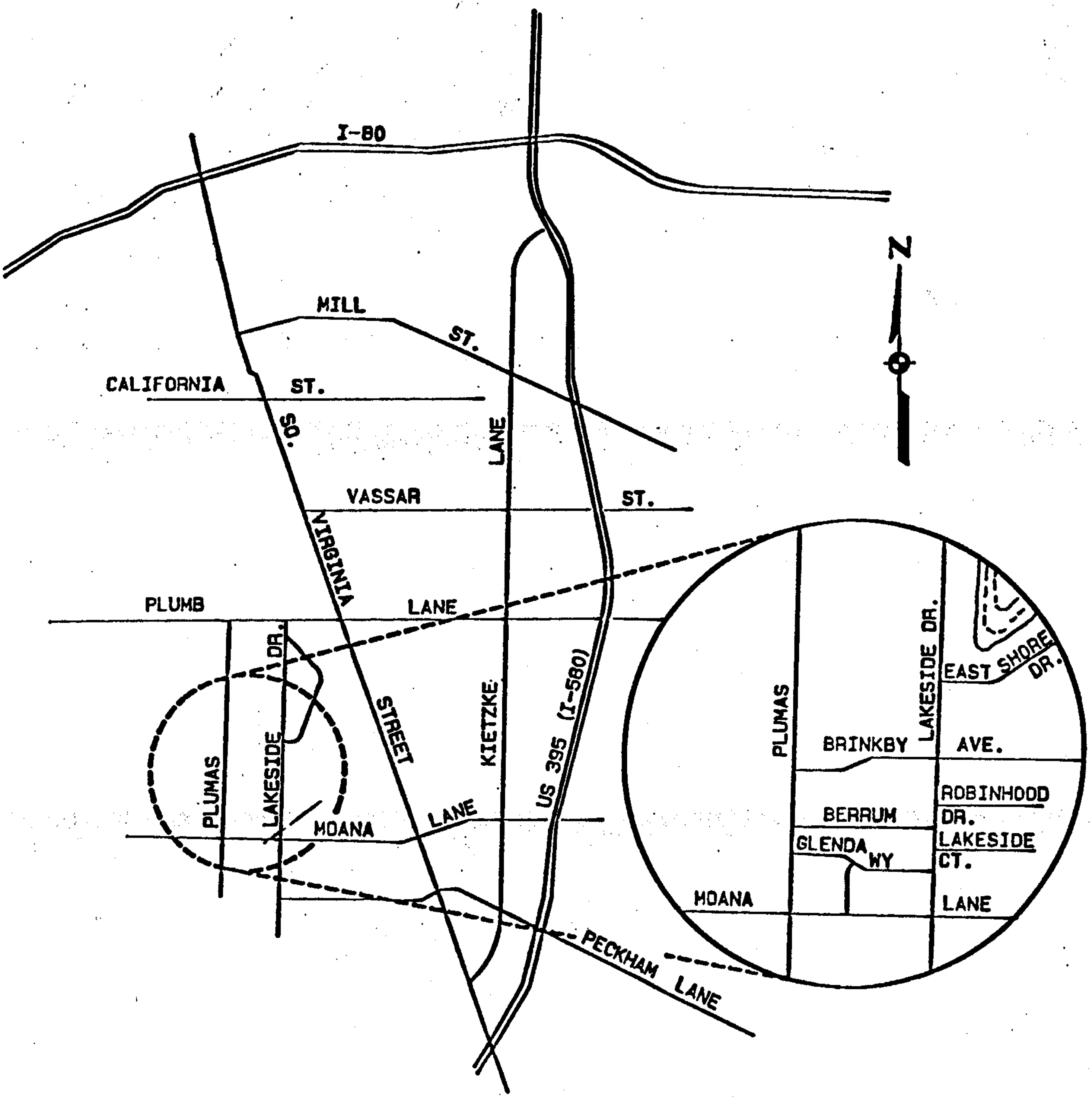
Kennedy/Jenks/Chilton analyzed three conceptual storm drain alternatives based upon HEC-1 hydrologic methodology for the determination of peak runoff flows for the Plumas/Moana Storm Drain project. This work was undertaken as an expanded study to evaluate upstream detention as a means to reduce overall construction costs. This supplemental report expands upon the work presented in the Preliminary Engineering Report for the Plumas/Moana Storm Drain submitted during April of 1988, amended and attached hereto.

The recommended alternative assumes the existence of the Dant Boulevard Storm Water Detention Dam and the associated attenuation of the 100-year, 24 hour peak flow. It does not assume the existence of the golf course detention basin(s). The recommended alternative is labeled as Option 6 of this supplemental report.

Option 6 consists of a new 36-inch diameter pipe installed in Glenda Way and connected to the existing detention basin constructed at the Manor Care development just west of Plumas Street. This new run will pick up the excess flow from this basin that the existing 36-inch and 24-inch conduit cannot accommodate. The new 36-inch pipe will run east down Glenda to the intersection with Lakeside Drive. At this point, it will combine with a new 60-inch diameter pipe to be installed in Lakeside from the intersection with Moana Lane. From the intersection of Lakeside and Glenda, the storm drain runs north in Lakeside Drive to Brinkby Avenue in a 96-inch pipe. At the intersection of Lakeside and Brinkby, the design runoff will be turned to the east and carried in a parallel system comprised of an existing 60-inch pipe and a new 66-inch pipe. Approximately 300 feet east of Lakeside, the flow will be combined and once again turned to the north. The runoff will then be conveyed in an upgraded, existing concrete lined open channel to Virginia Lake.

As presented in the initial report, local runoff will be handled by installing collector mains off of the major structure in Lakeside Drive. 24-inch diameter pipes will be installed in Berrum and Brinkby to intercept the local storm runoff and the flows carried in the existing 24-inch diameter CMP coming from the Manor Care detention basin at Plumas and Glenda. The local system will be designed to accommodate the 100-year storm flows.

For planning purposes, the total costs for the recommended storm drain facilities will range between $2.06 and $2.25 million.



VICINITY MAP
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FIGURE 1

CHAPTER 1

INTRODUCTION

In January of 1988, Kennedy/Jenks/Chilton was contracted by the city of Reno to provide preliminary design analysis of a storm drainage system to convey flood flows through the Plumas/Moana project site. The project site is bordered to the south by Moana Lane; to the north by Virginia Lake; to the west by Plumas Street; and to the east by Lakeside Drive. Tributary to the project site are two drainage basins which extend to the southwest and cover over 1.9 square miles of steeply sloping ground. The project scope entailed the evaluation of alternatives of combining existing storm drainage system components together with new facilities to convey 100-year, 24 hour runoff flows to Virginia Lake. The following 100-year runoff values were supplied by the City:

1. 575 cfs at Plumas and Glenda
2. 230 cfs at Lakeside and Moana

These values were developed using the "Rational Method".

The project area has a mix of new and older developments, primarily multiresidential units. The existing underground storm drainage systems appeared to have been built without master planning and without allowance for significant off-site inflows. Kennedy/Jenks/Chilton's Draft Engineering Report submitted to the City of Reno in April of 1988 concluded that the existing storm drainage system provided too little capacity to convey the 100-year flows and that a new system needed to be constructed. However, the costs developed for this new system proved to be substantial, between $2.5 and $3.0 million.

By amendment to the original agreement, the City of Reno requested that Kennedy/Jenks/Chilton expand its scope of work and study potential means by which to reduce peak flows entering the project site. This work was to include the re-evaluation of the hydrologic methodology used to develop 100-year peak flows and to explore viable storm water detention sites upstream of the project. This work was undertaken in the effort to reduce construction costs of the onsite facilities to previously established budgets set by the City. The following sections discuss Kennedy/Jenks/Chilton's hydrology studies, conceptual designs, conclusions and recommendations on the expanded scope of work.

CHAPTER 2

SCOPE OF WORK

The scope of work covered by the amended agreement with the City of Reno primarily consisted of evaluation of the upstream tributary areas for possible reductions in the 100-year peak runoff amounts. Upon completion of the upstream evaluation, any reductions gained were to be implemented in the conceptual design of an onsite storm water drainage system. A primary goal was to utilize existing drainage facilities to the greatest extent possible.

The hydrology of the tributary areas was re-analyzed using HEC-1 modeling. This was done to develop more site specific runoff values as well as providing hydrographs of the floods. Also, potential storm water detention dam sites were investigated to attenuate the runoff and reduce the peak flows to be carried through the project site to Virginia Lake. A target value for the reduction of the peak flows was not set. Any significant amount of upstream attenuation of the peak flow would reduce the size of the facilities onsite and thus reduce costs.

CHAPTER 3

HYDROLOGY

There are two offsite drainage basins tributary to the Plumas/Moana project area. The larger of the two basins enters the project at the intersection of Plumas and Glenda streets and has been designated as the "Plumas Tributary Area". The Plumas basin encompasses a large, narrow area of approximately 1038 acres that extends to the southwest nearly 4 miles. This drainage basin parallels Skyline Boulevard, lying to the east and is contained in a well defined channel (see Figure 2).

The smaller of the two drainage basins, designated as the "Moana Tributary Area" lies to the south of the project, south and southwest of Moana Lane. The Moana tributary area encompasses approximately 183 acres and is about 1 mile long (see Figure 2). Flood flows within this tributary area do not travel in well defined channels. However, the flows eventually reach the intersection of Moana Lane and Lakeside Drive.

Kennedy/Jenks/Chilton was directed by the City of Reno to perform HEC-1 computer modeling of the tributary areas above the Plumas/Moana study area described above. This hydrology study was to determine SCS runoff values for the subbasins and to allow for the development of flood hydrographs for routing purposes. The overall hydrology study is summarized in the report titled "Plumas/Moana Storm Drain Project, Draft Preliminary Hydrologic Analysis" which was prepared for the City of Reno in September 1988 (see attached copy, Appendix A).

The computed HEC-1 100-year, 24 hour peak flood flows at the intersection of Lakeside and Moana (Moana Tributary) is 153 cubic feet per second (CFS). The computed 100-year, 24 hour peak flood flows at the intersection of Glenda and Plumas (Plumas Tributary) is 972 cfs. The computed 100-year, 24 hour peak flow into Virginia Lake is 1175 cfs. These values compare to the City of Reno supplied flows as follows:

	CITY (Rational)	K/J/C (HEC-1)
Lakeside & Moana (Moana Trib.)	230 cfs	153 cfs
Plumas & Glenda (Plumas Trib.)	575 cfs	972 cfs
Virginia Lake	720 cfs*	1175 cfs

The HEC-1 (SCS) modeling incorporates the drainage basin's physical features, such as slope and soil type, into the runoff computations. It therefore is believed to be more representative of runoff that is the "Rational Method". The differences in the runoff values for the Plumas/Moana project shown above are derived from inclusion of the basin's physical properties into the runoff computations. The large increase at Plumas and Glenda can be explained by the steep terrain and the impermeable soils that overlay most of the subbasin.

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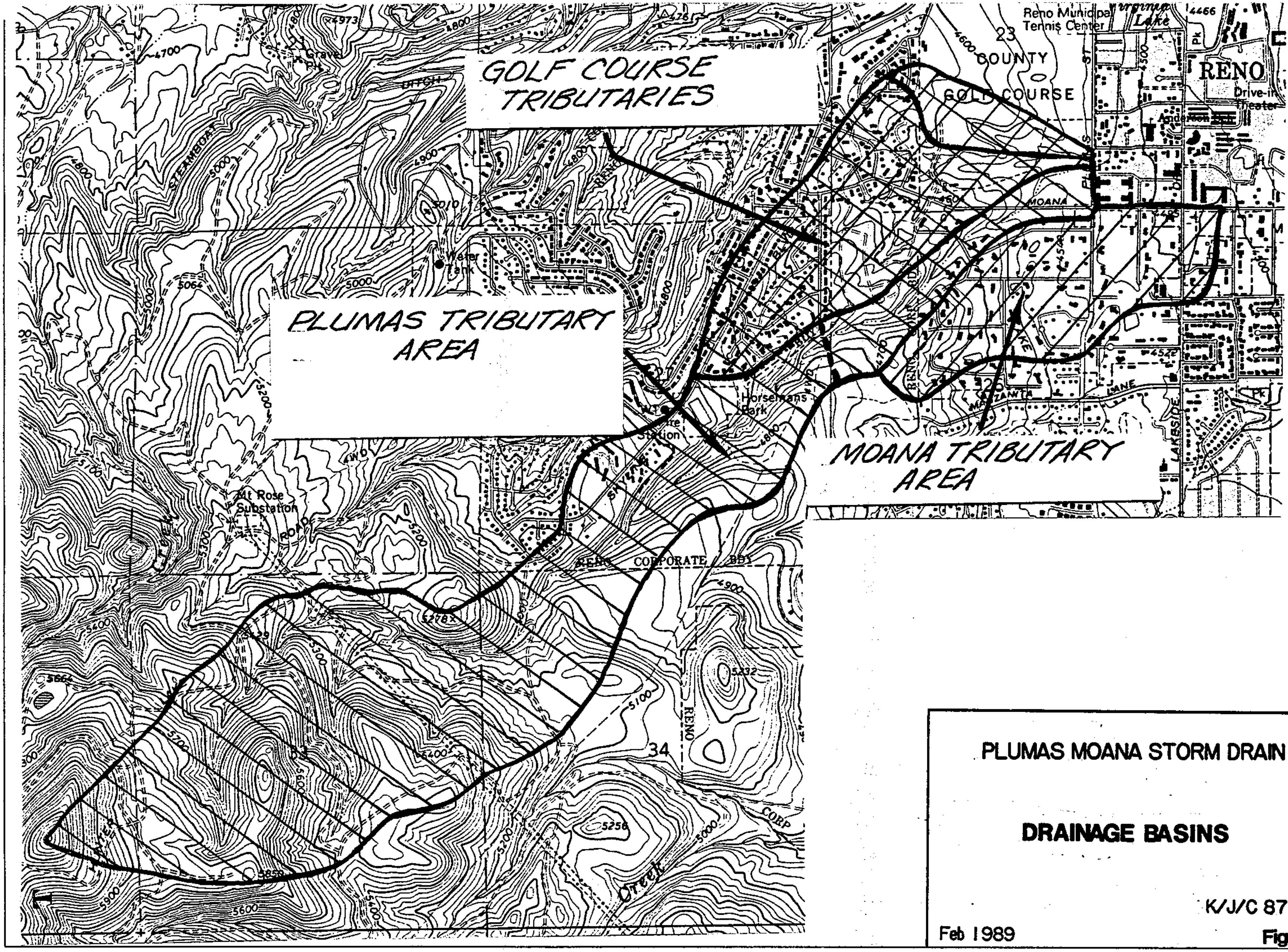
* Computed by K/J/C based on pipe flow through the project.

HEC-1 modeling allows for the development of flood hydrographs and the routing of floods through various systems, such as reservoirs and underground storm drain facilities. As requested by the City of Reno, Kennedy/Jenks/Chilton studied several detention dam sites to reduce the 100-year, 24 hour peak flows entering the project. Only detention sites within the "Plumas Tributary Area" were studied. The lower runoff computed for the "Moana Tributary" and the absence of suitable detention sites precluded study of that area for detention purposes.



PLUMAS MOANA STORM DRAIN

DRAINAGE BASINS

K/J/C 877041

Feb 1989

Figure 2

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CHAPTER 4

DETENTION DAM SITES

Kennedy/Jenks/Chilton studied several detention dam sites within the "Plumas Tributary Area". These included the following locations:

1. McCarran Road embankment adjacent to Skyline Boulevard.
2. Main drainage channel adjacent to Horsemans' Park.
3. Main drainage channel adjacent to the intersection of Dant Boulevard and Pioneer Drive.
4. Several locations on the Washoe County Golf Course.

Of the above sites, only the Dant Boulevard site and two sites on the Washoe County Golf Course were studied in depth. The other two site were too high in the basin to effectively reduce peak flows. The McCarran embankment was not designed or constructed as a detention dam, which left doubts about its efficacy as a dam embankment.

A. DANT BOULEVARD DAM

The Dant Boulevard dam site was deemed the best site on the main channel stem of the tributary. The site is in a well defined channel with adequate storage volume available for the 100-year, 24 hour runoff. The Dant site is low in the watershed and can capture approximately 63 percent of the total land area tributary to the Plumas/Moana project. By separate agreement with the City, Kennedy/Jenks/Chilton provided design services for the Dant Boulevard Detention Dam, which is due to begin construction during the early month of 1989 (see the "Design Report, Dant Boulevard Storm Water Detention Dam", November, 1988, prepared by Kennedy/Jenks/Chilton for the City of Reno).

Alone, the Dant Detention Dam reduces the 100-year, 24 hour peak flow at the intersection of Plumas and Glenda by 627 cfs; from 972 cfs to 345 cfs. The flow into Virginia Lake is reduced from 1175 cfs to 558 cfs; a 587 cfs reduction in runoff flows requiring underground conveyance structures.

B. GOLF COURSE TRIBUTARIES

Two sites within the Plumas Tributary on the Washoe County Gold Course were studied in the effort to reduce peak flows of 345 cfs at Plumas and Glenda. The subbasins tributary to the Golf Course from the west and southwest (see Figure 2) contribute approximately 200 cfs to the 100-year, 24 hour peak runoff at the intersection of Plumas and Glenda streets. Kennedy/Jenks/Chilton provided preliminary design analyses of two potential detention dam sites together with flood routings of the design flood. The two sites are within fairways located in the southern part of the golf course (see Figure 3).

The Washoe County Parks Department was contacted regarding use of the golf course for storm water detention. During a preliminary meeting with the park personnel, they expressed the willingness to allow storm water detention if permanent irrigation storage could be incorporated. Therefore, as directed by the City of Reno, Kennedy/Jenks/Chilton preliminarily sized the detention sites to incorporate at least 20 acre-feet of storage volume for golf course irrigation purposes. The 20 acre-feet of golf course storage was only analysed in one detention basin rather than splitting into both sites.

The tributary area to the Washoe County Golf Course is comprised of two subbasins that run parallel through the golf course. These two subbasins eventually join together at the east end of the golf course, just west of and adjacent to the Manor Care Development, which lies between the golf course and the intersection of Glenda Way and Plumas Street. The conference of the golf course subbasins is just upstream of the point in which the Dant Detention Dam subbasin comes into the natural drainage system.

The total 100-year, 24 hour runoff volume from both golf course subbasins is computed to be approximately 28 acre-feet, with 24 acre-feet in the southern-most basin and 4 acre feet in the northern basin. Kennedy/Jenks/Chilton produced topographic maps of two potential detention dam sites selected in conjunction with the City of Reno and Washoe County Parks personnel. Based on the required storage demands, the detention basins were sized to greatly attenuate the 100-year, 24 hour flood.

Preliminary design of the two detention sites on the golf course led to the conclusion that one site which coupled the runoff volume with the irrigation storage volume would be the most efficient design. The northern site proved too limited to provide for 24 acre-feet of storage (20 AF of irrigation and 4 AF of runoff) without excessive grading. Therefore, the southern fairway site was designed to accommodate 40 acre-feet of volume.

The southern fairway is much better suited for a large detention basin site than is the northern site (see Figure 11). The ground is flatter and the fairway is wider to allow for the basin while still retaining it "playability". Also, the southern fairway already must detain over 20 acre-feet of runoff and to expand its capacity to 40 acre-feet does not drastically impact the site. However, even on the southern fairway, the dam structure required to provide the desired storage will be approximately 20 feet high, thus requiring State of Nevada review and approval.

Preliminary routing through the basins indicate that the runoff entering the Plumas/Moana project site can be reduced from 345 cfs (with the Dant Dam) to approximately 149 cfs. With the golf course detention coupled with the Dant Dam, the peak 100-year 24 hour flow through the project site is computed to be approximately 362 cfs. This compares to the 720 cfs used in the development of the original alternative storm drain systems for the site. Table 1 below summarizes the 100-year, 24 hour runoff reductions of the various scenarios:

TABLE 1

SUMMARY OF DETENTION BASIN REDUCTIONS TO THE PEAK RUNOFF

Tributary	City Runoff (cfs)	K/J/C HEC-1 (cfs)	K/J/C HEC1 with Dant (cfs)	K/J/C HEC-1 With Dant & Golf Course (cfs)
Moana	230	153	153	153
Plumas	575	972	345	149
Virginia Lake	720	1175	558	362

PLUMAS MOANA STORM DRAIN

GOLF COURSE

DETENTION SITES

K/J/C 877041

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Figure 3

Kennedy/Jenks/Chilton

CHAPTER 5

STORM DRAIN CONCEPTUAL DESIGNS

A. APPROACH

Kennedy/Jenks/Chilton analyzed the existing storm drainage systems and found them to be under capacity to convey the design flows entering the project. However, based on the reduction in the design flows accomplished primarily by upstream detention, the existing storm drain facilities can be left in place and utilized in conjunction with new facilities. The new storm drainage facilities are sized to carry the flows in excess of the capacities of the existing drainage structures. Conceptual designs listed as Options 4, 5 and 6, investigated in this supplemental study assume the existence of the Dant Boulevard Detention Dam and its reduction to the peak flows. Options 4 and 5 assume that additional detention is provided on the Washoe County Golf Course.

B. ALTERNATIVES

The flows entering the project are reduced from those previously used for preliminary design. This reduction of flows allowed for the use of the existing storm drainage systems to a great extent. Kennedy/Jenks/Chilton provided analysis of three options in conjunction with the upstream storm water detention scenarios presented in the previous sections of this report. Each of these three options used existing storm drainage facilities to some degree.

The basic flow routes remain identical to those presented in the earlier report; only at reduced quantities. Options 4, 5 and 6 pick up the runoff from the "Plumas Tributary Area" at the newly constructed detention basin adjacent to the intersection of Plumas Street and Glenda Way; installed as part of the Manor Care development. No direct connection is made to the 7'x5' box culvert which empties into the Manor Care Detention Basin. Instead, the existing 36 inch and 24 inch storm drain pipes already providing discharge from this basin are augmented by a new storm drain sized to handle the excess flows.

Likewise, the runoff entering the project at the intersection of Moana Lane and Lakeside Drive is collected via catch basins and discharged into the new main trunk line system, which runs to the north down Lakeside Drive. The flows collected at Plumas and Glenda are run east down Glenda to the intersection with Lakeside, where the flows are combined with the "Lakeside Tributary Area" flows. From this point, the combined flows are conveyed north down Lakeside to the intersection with Brinkby Avenue. Options 4 and 5 differ at this location. Option 4 takes the flow from Lakeside and turns it to the east down Brinkby using the existing 60 inch pipe together with a new pipe run in parallel. Option 5 splits the Lakeside flows, with approximately on-half of the discharge running east down Brinkby in the existing pipe and the other half continuing north down Lakeside in a new storm drain pipe to Virginia Lake. Option 4 requires that the existing concrete lined channel running between Brinkby and Virginia Lake be upgraded to accommodate the design flows. Option 5 does not require any modifications to the channel.

Option 6 is similar to Option 4 in alignment. However, it differs in the fact that it assumes that no detention is provided on the Washoe county Golf Course. Therefore, Option 6 is designed to carry 558 cfs of peak flow, compared to the peak flow of 362 cfs assumed for Options 4 and 5.

Kennedy/Jenks/Chilton reviewed the flow paths of excess flood waters (approximately 50 cfs based on calculated capacities of the existing 36-inch and 24-inch pipes providing discharge from the detention basin) that would overtop Plumas Street at the Manor Car detention basin adjacent to Glenda Way. Based on the topographic maps produced for this project and field observations (no surveying), it appears that excess flows from the detention basin will primarily travel south down Plumas towards Moana. Significant flows down Glenda from the Plumas intersection do not appear possible. It further appears that the flow will be equally distributed on both sides of Plumas. At Moana, the flow will turn east and travel down Moana towards Lakeside. The portion of the flow carried on the north side of Moana will most likely turn to the north at the intersection of Clover Way and travel to the intersection of Glenda and Clover. A sump condition exits at the intersection of Clover Way and Glenda Way. The flows not conveyed to the underground system at this point would eventually be carried overland to the intersection of Glenda and Lakeside. The flood flows traveling down the south side of Moana would end up at the intersection of Lakeside and Moana, adding to the "Lakeside Tributary" flows. All along these flow paths are residential and commercial structures.

Therefore, based on the above observations, Kennedy/Jenks/Chilton decided to include underground pipe capacity in Glenda Way between Plumas and Lakeside to convey the excess flows and to alleviate the flooding potential to Plumas and Moana streets and the surrounding residential and commercial structures.

Options 4, 5, and 6 are briefly described below.

1. <u>Option 4</u>

Option 4 (see Figure 8) assumes full upstream detention with the Dant Dam and the Golf Course detention dam(s). The 149 cfs flow at Plumas and Glenda is conveyed down Glenda by a combination of three conduits; an existing 36 reinforced concrete pipe, an existing 24 inch corrugated metal pipe, and a new 36 inch reinforced concrete pipe installed parallel to the existing 36 inch conduit. The last 30 feet of the existing 36 RCP adjacent to Lakeside Drive must be replaced with a new section of 48 inch RCP due to the flat slope which reduces its capacity.

The 153 cfs inflow at the intersection of Moana Lane and Lakeside Drive is captured in large capacity catch basins located on all four corners of the intersection. This flow is then conveyed north towards Glenda Way in a 60 inch RCP. The 60 inch pipe will begin on the north side of the Moana/

Lakeside intersection so as to avoid most of the numerous existing utilities located in this intersection.

From the intersection of Glenda and Lakeside, the combined flow of approximately 302 cfs is carried north along Lakeside Drive to Brinkby Avenue. Between Glenda and Berrum, the flow is conveyed in a 78 inch RCP. At Berrum, the diverted flow carried by the 24 inch CMP from Plumas and Glenda is brought back into the system. The combined flow at the juncture is approximately 324 cfs, which exceeds the capacity of the 78 inch pipe. Therefore, between Berrum and Brinkby, the flow must be conveyed in an 84 inch RCP.

At Brinkby, the design runoff is divided into two 60 inch RCP conduits, one existing and one new, running to the east. These two conduits run approximately 290 feet along Brinbky to where the existing 60 inch pipe empties to the north into an existing concrete open channel with the following dimensions:

Bottom Width: 4 feet
Top width: 12 feet
Side slopes: 1:1
Bottom slope: 0.0036

The new 60 inch RCP will tie into the existing 60 inch pipe and together both pipes will discharge into the open channel.

The existing open channel does not possess adequate carrying capacity to handle the design flow and must be upgraded to accommodate the discharge. Basically, the top width will be widened by 4 feet, 8 inches to 16 feet, 8 inches with the addition of a flat slab on top of each channel sidewall. The depth of the channel will also be deepened 18 inches with vertical walls above the flat slabs. In addition, approximately 500 feet of the western sidewall of the existing channel will have to be removed and reconstructed to allow for the installation of the extra channel capacity section described above. This work will also require the placement of bankment materials on the west side of the channel.

2. Option 5

Option 5 (see Figure 8) is identical to Option 4 up to the intersection of Lakeside Drive and Brinkby Avenue. At this intersection, instead of turning all of the flow to the east, the design flow is split with approximately half going down Brinkby in the existing 60 inch RCP and the other half conveyed to the north down Lakeside in new 60 inch RCP. This option does not require any upgrading of the existing open channel and only minor adjustment to the upper end of the existing 60 inch pipe in Brinkby. However, the new 60 inch pipe must be installed deep (12± feet deep) to match the invert elevation required in the splitting structure at Brinkby.

3. Option 6

Option 6 (see Figure 8) follows the same routes as Option 4. However, the flows to be carried under Option 6 do not reflect upstream detention on the golf course and area therefore higher than the flows assumed for Option 4 (360 cfs versus 149 cfs at the intersection of Glenda and Plumas). This increase in design flow required larger pipe sizes to convey the runoff.

In the Glenda to Lakeside run, the new 36 inch RCP required under Option 4 must be increased to 60 inches. This scenario still includes utilizing the existing 36 inch pipe in parallel with the 60 inch pipe. Also, the existing 36 inch pipe still must be upsized to 48 inches for its final 300 feet as in Option 4. The run between Moana and Glenda along Lakeside remains unchanged in Option 6.

From Glenda to Brinkby, the 78 inch and 84 inch RCP conduits required under Option 4 must be increased to a 96 inch pipe to provide sufficient capacity. At Brinkby, the existing 60 inch pipe must be augmented with a parallel 66 inch RCP to handle the combined flow of 558 cfs. At the open channel 300 feet to the east of Lakeside, the flow will also be turned to the north as in Option 4. The extra capacity added to the concrete lined channel as part of Option 4 can also accommodate the increased flows of Option 6.

As in Option 4, Option 6 does not call for any work to be done on the existing triple barrel culvert that runs under Eastshore Drive and connects the open channel to Virginia Lake. The City of Reno has advised that the Eastshore culvert(s) is being replaced as part of another City sponsored project and will be designed to be compatible with the Plumas/Moana project.

C. ONSITE COLLECTION

The design of the onsite collection system changes very little from the original conceptual designs presented in the previous report. The placement of catch basins differs somewhat, especially at the intersection of Lakeside Drive and Moana Lane, where large capacity inlets will be installed to reduce the risk of flooding the commercial buildings to the east. For the remaining catch basin layout, see Figure 1, Options 4 and 6.

D. PRELIMINARY COSTS

Preliminary costs for Options 4, 5 and 6 were generated based on the conceptual designs discussed herein. The cost estimates are shown in Tables E, F and G contained in Appendix B.

Unit costs were derived from Nevada Department of Transportation bid tabulations, contractor supplied preliminary construction cost quotes, manufacturer quotes, City of Reno development costs, and in-house cost estimating guides. Not included in these estimates are utility relocation costs, construction quality control and project administration costs.

In summary, the preliminary construction costs for Options 4, 5 and 6 are:

	Option 4	Option 5	Option 6
Removals	$ 27,500	$ 29,500	$ 29,750
New Construction	$1,287,655	$1,396,630	$1,247,725
Subtotal	$1,315,155	$1,426,130	$1,277,475
Contingency (20%)	$ 263,031	$ 285,226	$ 255,495
Engineering (10%)	$ 157,819	$ 171,136	$ 153,297
Total	$1,736,005	$1,882,492	$1,686,267
Use Total	$1,750,000	$1,900,000	$1,700,000

Note: Engineering costs include preliminary design and final design costs only.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

1. General

The six storm drainage options studied for the Plumas/Moana Storm Drain project represent conservative design alternatives for two distinct runoff scenarios not entirely related to each other. Options 1 through 3 presented in the previous report provided for conveyance of flood runoff computed via the "Rational Method" and Options 4 through 6 represent conveyance of "HEC-1" generated runoff quantities. The HEC-1 hydrology yields much larger runoff values for these tributaries than does the Rational Method. However, with the inclusion of upstream detention as provided for in Options 4 through 6, the actual flows through the project are less than for Options 1, 2 and 3. Options 4 and 5 carry approximately 50% less flow than Options 1 through 3 (362 cfs versus 710 cfs). With no golf course detention, Option 6 still only carries approximately 558 cfs, or 80% of the design flows for Options 1 through 3.

The facilities sized for all options were designed for full flow conditions. Pressure systems were not explored due to flat slope on Lakeside Drive and the need to discharge catch basin flows into the main storm drain line at the intersection of Moana and Lakeside. The facilities are conservatively designed and will adequately convey the design flows through the project.

2. Utilities

As discussed in the previous report, utility conflicts are most prevalent in the intersection of Moana and Lakeside. All other areas are less troublesome and have sufficient clearance between existing utilities to allow the installation of the proposed storm drains. Trench shoring will be required for all installations, especially in Lakeside due to the depth of the trench and the proximity of the parallel utility lines.

3. Existing Storm Drains

Due to the lower flows, Options 4, 5 and 6 can significantly utilize most of the existing storm drain facilities within the project. As noted above, the existing structures do not have sufficient capacity to carry the design flows alone. New, parallel storm drains will be constructed next to the existing lines to accommodate the design flows. The existing line running between Moana and Glenda is grossly undersized and will be abandoned. A new conduit will be installed which can carry the entire design runoff of 153 cfs. This is the only existing pipe to be completely abandoned within the project.

4. Costs

The preliminary cost estimates for Options 4 through 6 do not include the construction costs for the Dant Boulevard detention dam. Through a cooperative arrangement with a local land developer, the City of Reno will in essence share in the costs to construct the Dant Boulevard dam. It is anticipated that the City's share will amount to approximately $355,000, including design and construction engineering services. The entire dam is estimated to cost approximately $800,000.

The estimates presented herein only represent those costs associated with onsite storm drain construction and the Washoe County Golf Course detention dam and basin. It is Kennedy/Jenks/Chilton's preliminary estimate that Options 4, 5 and 6 of the storm drain system to convey the HEC-1 generated 100-year, 24 hour runoff flows will cost between $1,700,000 and $1,900,000 to construct. For these estimates, it was assumed that the City of Reno would pay the entire cost associated with the construction of the detention facility on the golf course, including resodding the southern fairway. Any costs associated with underground irrigation lines, etc, on the golf course is not included in these estimates. No contribution from Washoe County was figured into the estimates.

Kennedy/Jenks/Chilton estimated that Options 1 through 3 would cost between $2.5 and $3.0 million to construct. The combined cost of Options 4 through 6 (including the Dant Dam cost) ranges from $2.06 to $2.25 million. The design flows for Options 4, 5 and 6 are lower than Options 1, 2 and 3 by some 50 percent to 20 percent, depending on the option comparison. Comparing the two most economical options (2 and 6), the reduction in the design flow is approximately 20 percent (720 cfs versus 558 cfs). The cost differences between these two options (Option 2 and Option 6) yields an 18 percent savings which is consistent with the reduction of the design flows.

It should be re-emphasized that Options 1 through 3 were based on "Rational Method" generated design flood flows, which were lower than the flows computed by the "HEC-1" methodology and used as the basis for the development of Options 4 through 6. If unattenuated flows were used to develop onsite alternatives (as was the case with Options 1 through 3) based upon HEC-1 methodology (now 1175 cfs instead of 720 cfs), the costs of those alternatives would be much greater than the $2.5 to $3.0 million generated for Options 1, 2 and 3.

Thus, the true value of providing upstream storm water detention is not borne by the cost comparisons between Options 1 through 3 and Options 4 through 6. These are not "like" comparisons, the basis of design are different. The true value would be illustrated by a cost comparison between Options 4, 5 and 6 with alternatives that convey unattenuated HEC-1 flows through the project.

B. RECOMMENDATIONS

Based on economics alone, Options 4 and 6 are very close to estimated costs, with only approximately $50,000 difference. Option 5 is considerably more expensive than Options 4 or 6, almost $200,000 more.

Option 4 includes the cost of the golf course detention dam and basin whereas Option 6 assumes no golf course detention and requires larger pipe sizes to convey the flows. If Washoe County provides matching funding for the golf course work, Option 4 would become the least expensive option, by about $50,000. However, there are several unknowns about the golf course and the County's ultimate willingness to participate in this work given the actual disturbance to the fairway that will have to take place. The detention dam and basin will forever alter the fairway and the manner in which it "plays". Also, the hole will be virtually unplayable during construction and the establishment period for the sod.

Therefore, based on the uncertainty of the golf course detention dam scenario proposed for Option 4, Kennedy/Jenks/Chilton recommends that Option 6 be the alternative selected as the design basis for the Plumas/Moana Storm Drain Project. It is conclusive that Option 6 is superior to Options 1 through 5 in that it is the least expensive option and the City of Reno does not have to enter into negotiations with a third party to proceed with the project.

As an alternative recommendation, Kennedy/Jenks/Chilton suggest that the design storm be modified to the 100-year, 6 hour event. This storm yields a lower peak runoff amount than the 100-year, 24 hour event by approximately 25 percent. Only the storm drainage facilities onsite would use this design storm, the upstream detention dam(s) would still utilize the 100-year, 24 hour event for sizing purposes.

The HEC-1 100-year, 6 hour storm event compares to the 24 hour storm as illustrated in Table 2 below:

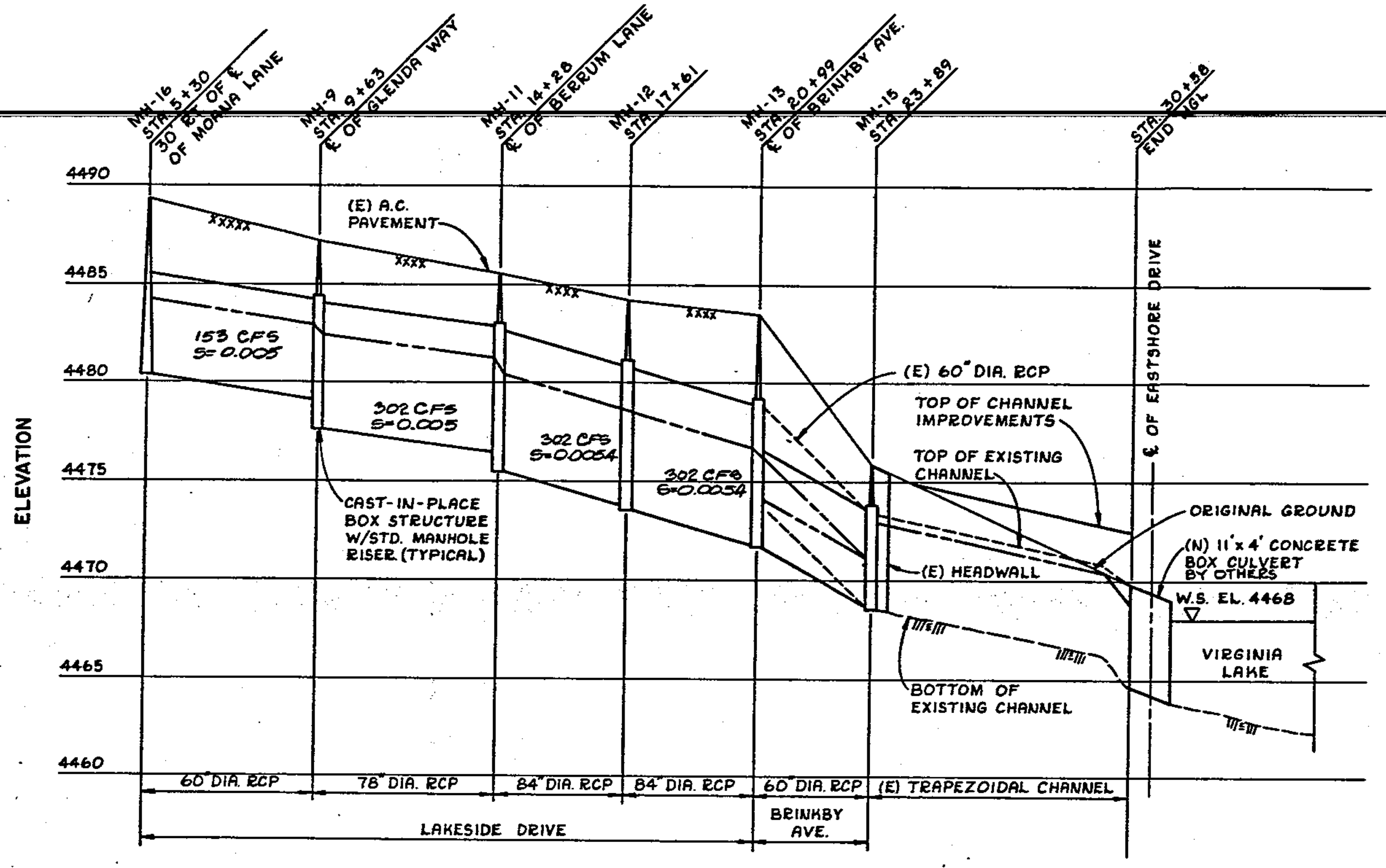
TABLE 2
HEC-1 24 Hour Versus 6 Hour Storms

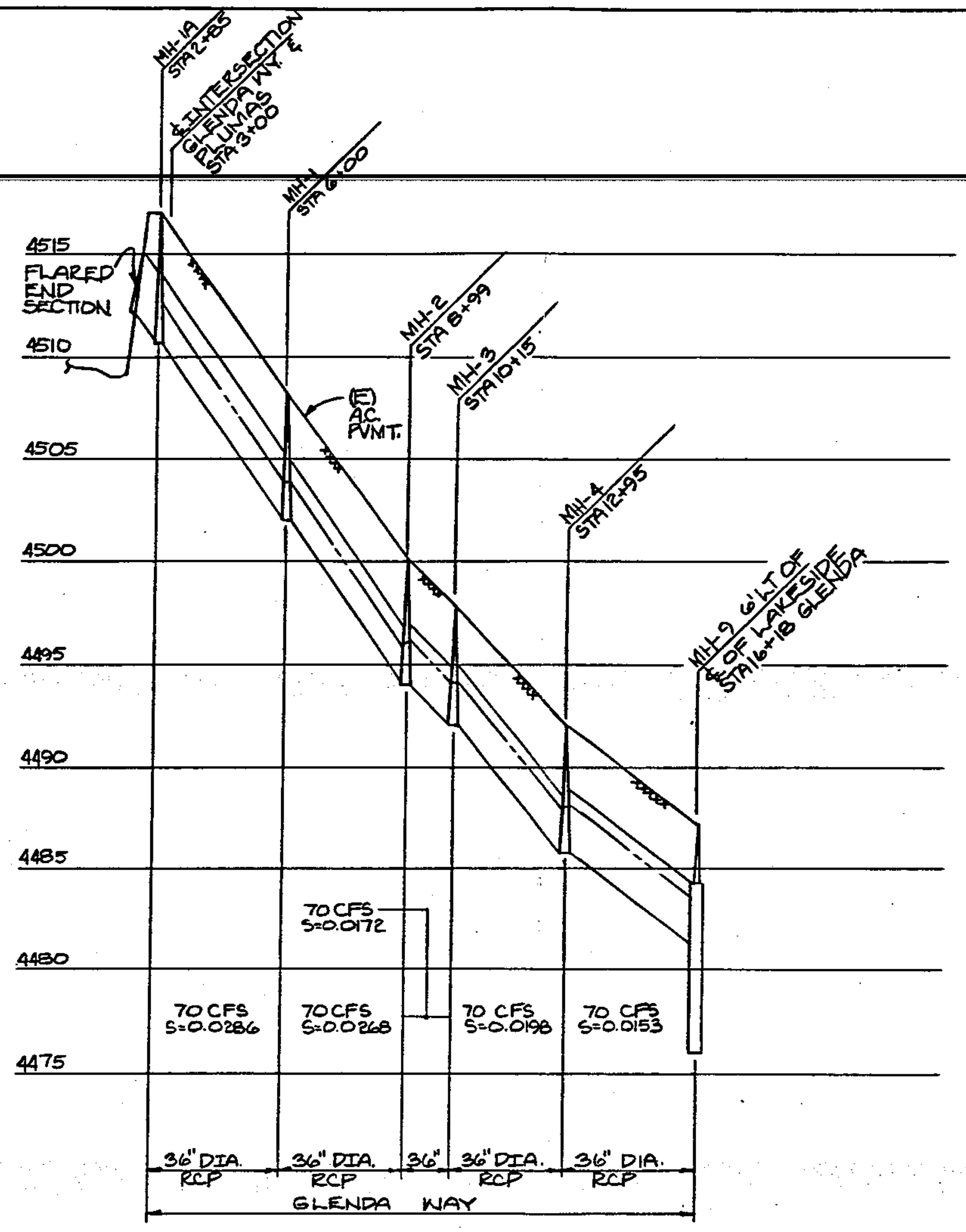
Tributary	City Runoff (cfs)	K/J/C HEC-1 (cfs)		K/J/C HEC1 with Dant (cfs)		K/J/C HEC-1 With Dant & Golf Course (cfs)	
		24 hr.	6 hr.	24 hr.	6 hr.	24 hr.	6 hr.
Moana	230	153	111	153	111	153	111
Plumas	575	972	697	345	260	149	112*
Virginia Lake	720	1175	853	558	422	362	272*

* 100-year, 6 hour flood routing for the case of the golf course detention basins were not developed. Figures shown are estimates

based on the percentage reductions developed for the Dant Dam flood routings (average of 25%).

Option 6, the recommended alternative based on the given storm and hydrology method, yielded a nearly 20% reduction in cost over the next preferred option, Option 2. The costs for Options 2 and 6 were developed based upon the underground conveyance of peak flows of 720 cfs and 558 cfs respectively. HEC-1 100-year, 6 hour flows are approximately 25% less than the 24 hour flows (see Table 2 above). Therefore, based on the similar reduction percentages, both in flows and costs, the 100-year, 6 hour storm event may save close to 20% of the costs associated with Option 6.





SCALE: HORIZ. 1"=200'
VERT. 1"=4'

Revised	Description	Submit.	Appr'd.	Date
Refer to Tracing for Latest Revision				

Reference Information and Notes:

Designed
Drawn
Checked
Date

City of Reno

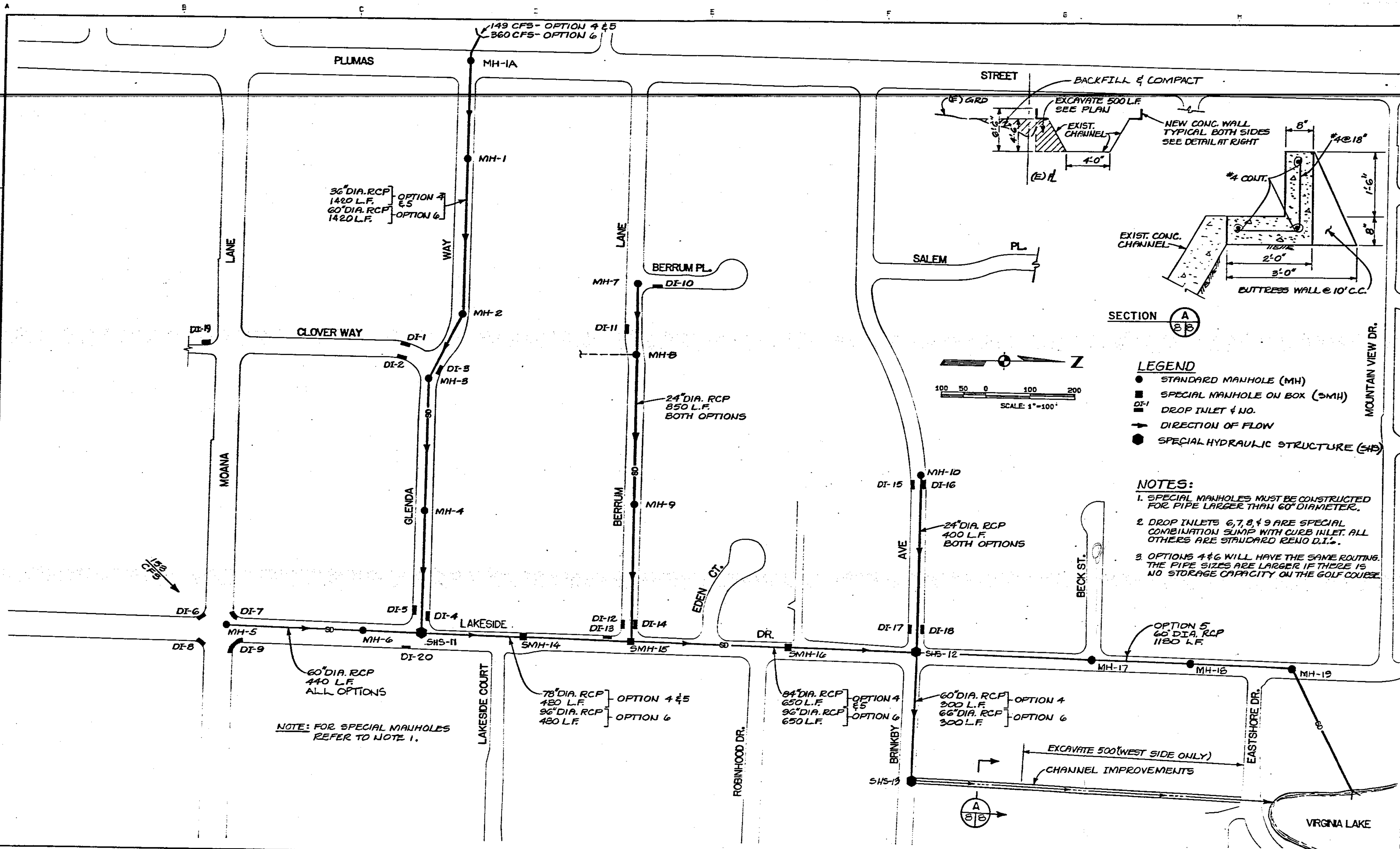
Kennedy/Jenks/Chilton Reno, Nevada

Submitted: Approved:

PLUMAS MOANA STORM DRAIN

HYDRAULIC PROFILE OF OPTION 4

Scale AS SHOWN
Job No. 877041.00
Figure 9
of



LEGEND
- ● STANDARD MANHOLE (MH)
- ■ SPECIAL MANHOLE ON BOX (SMH)
- DI-1 ▬ DROP INLET & NO.
- → DIRECTION OF FLOW
- ⬢ SPECIAL HYDRAULIC STRUCTURE (SHS)

NOTES:
1. SPECIAL MANHOLES MUST BE CONSTRUCTED FOR PIPE LARGER THAN 60" DIAMETER.
2. DROP INLETS 6,7,8,& 9 ARE SPECIAL COMBINATION SUMP WITH CURB INLET. ALL OTHERS ARE STANDARD RENO D.I.'s.
3. OPTIONS 4 & 6 WILL HAVE THE SAME ROUTING. THE PIPE SIZES ARE LARGER IF THERE IS NO STORAGE CAPACITY ON THE GOLF COURSE.

Revised	Description	Submit. Appr'd.	Date
Refer to Tracing for Latest Revision			

Reference Information and Notes:

Designed
Drawn
Checked
Date

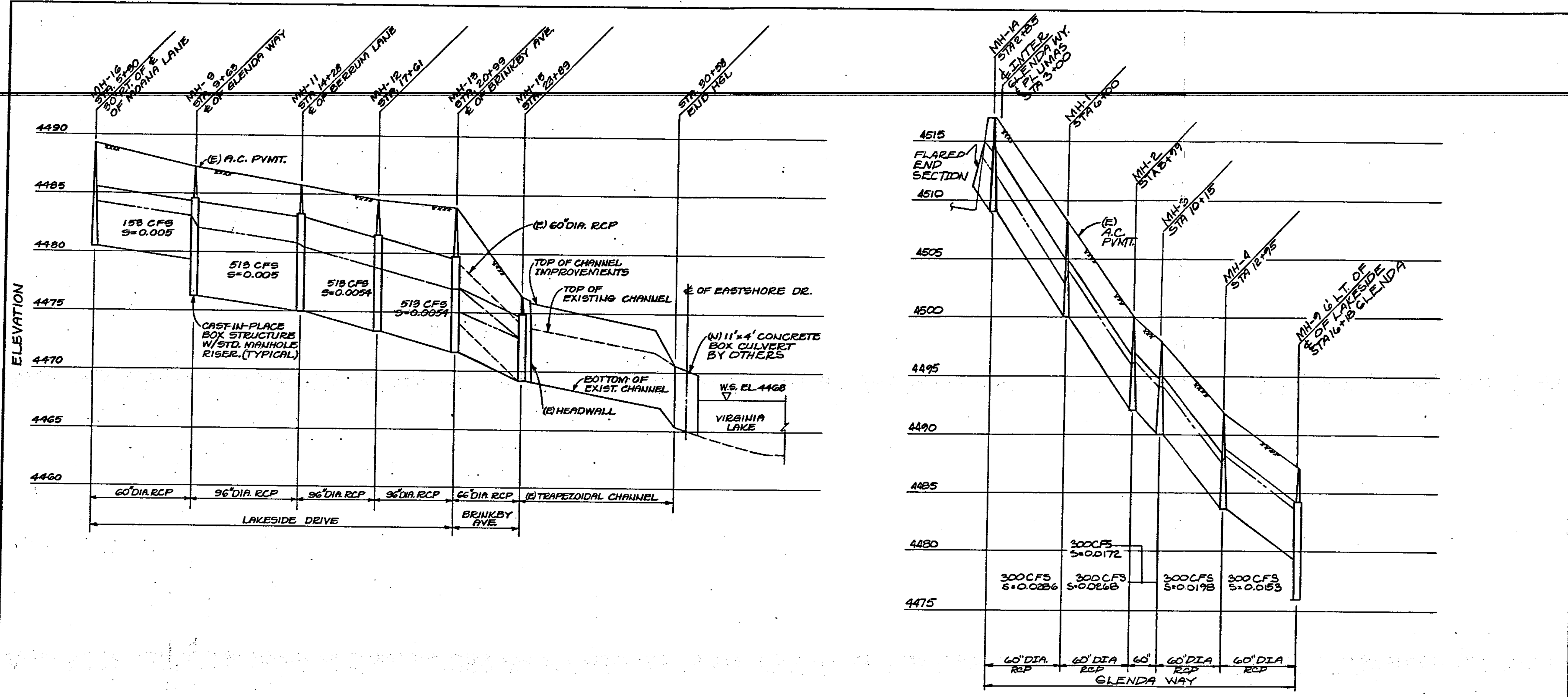
Kennedy/Jenks/Chilton Reno, Nevada

Submitted: Approved:

PLUMAS MOANA STORM DRAIN

PLAN OF OPTIONS 4,5,&6

Scale 1"= 100'
Job No. 877041
8



SCALE: HORIZ. 1"=200'
VERT. 1"=4'

Revised	Description	Submit.	Appr'd.	Date

Reference Information and Notes:

Designed
Drawn
Checked
Date

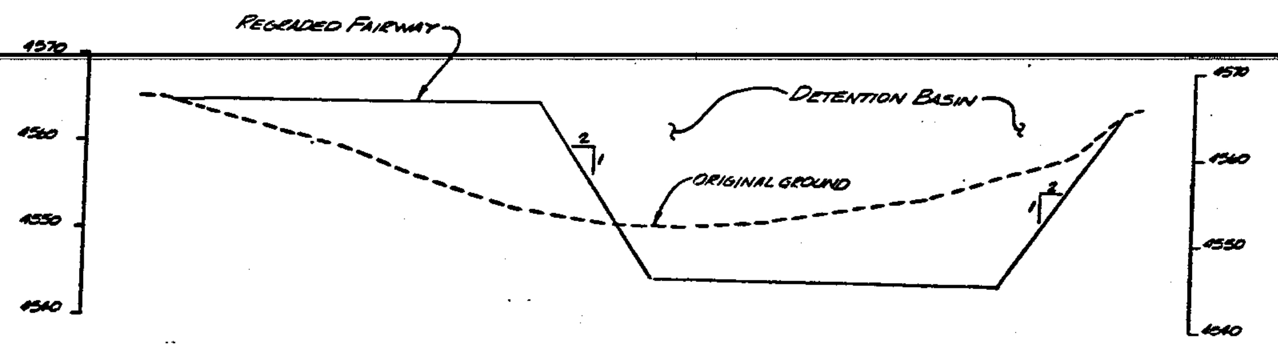
City of Reno

Submitted: Approved:

PLUMAS MOANA STORM DRAIN

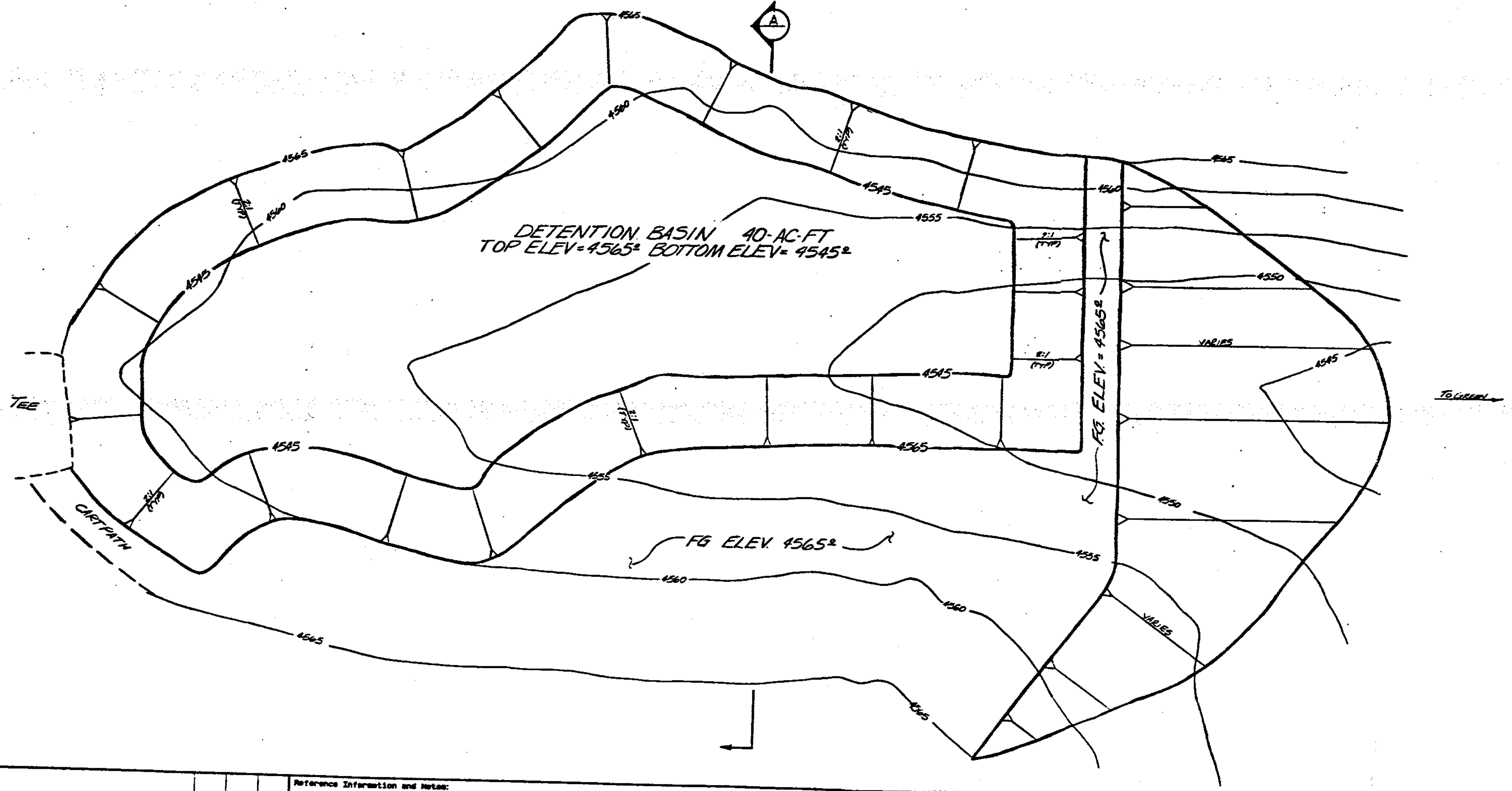
HYDRAULIC PROFILE OF OPTION 6

Scale AS SHOWN
Job No. 877041
Figure 10



DETENTION BASIN SECTION (A)

SCALE: HORIZ. 1"=30'
VERT. 1"=10'



Revised | Description | Submit. | Appr'd. | Date

Refer to Tracing for Latest Revision

Reference Information and Notes:

Designed PL
Drawn PL
Checked
Date 2-89

City of Reno

Kennedy/Jenks/Chilton Reno, Nevada

Submitted:
Approved:

PLUMAS MOANA STORM DRAIN

GOLF COURSE DETENTION BASIN

Scale 1" = 50'
Job No. B77041.C
Figure 11
of

APPENDIX A

PLUMAS/MOANA STORM DRAIN PROJECT
DRAFT PRELIMINARY HYDROLOGIC ANALYSIS
SEPTEMBER 1988

PLUMAS/MOANA
STORM DRAIN PROJECT
DRAFT PRELIMINARY
HYDROLOGIC ANALYSIS

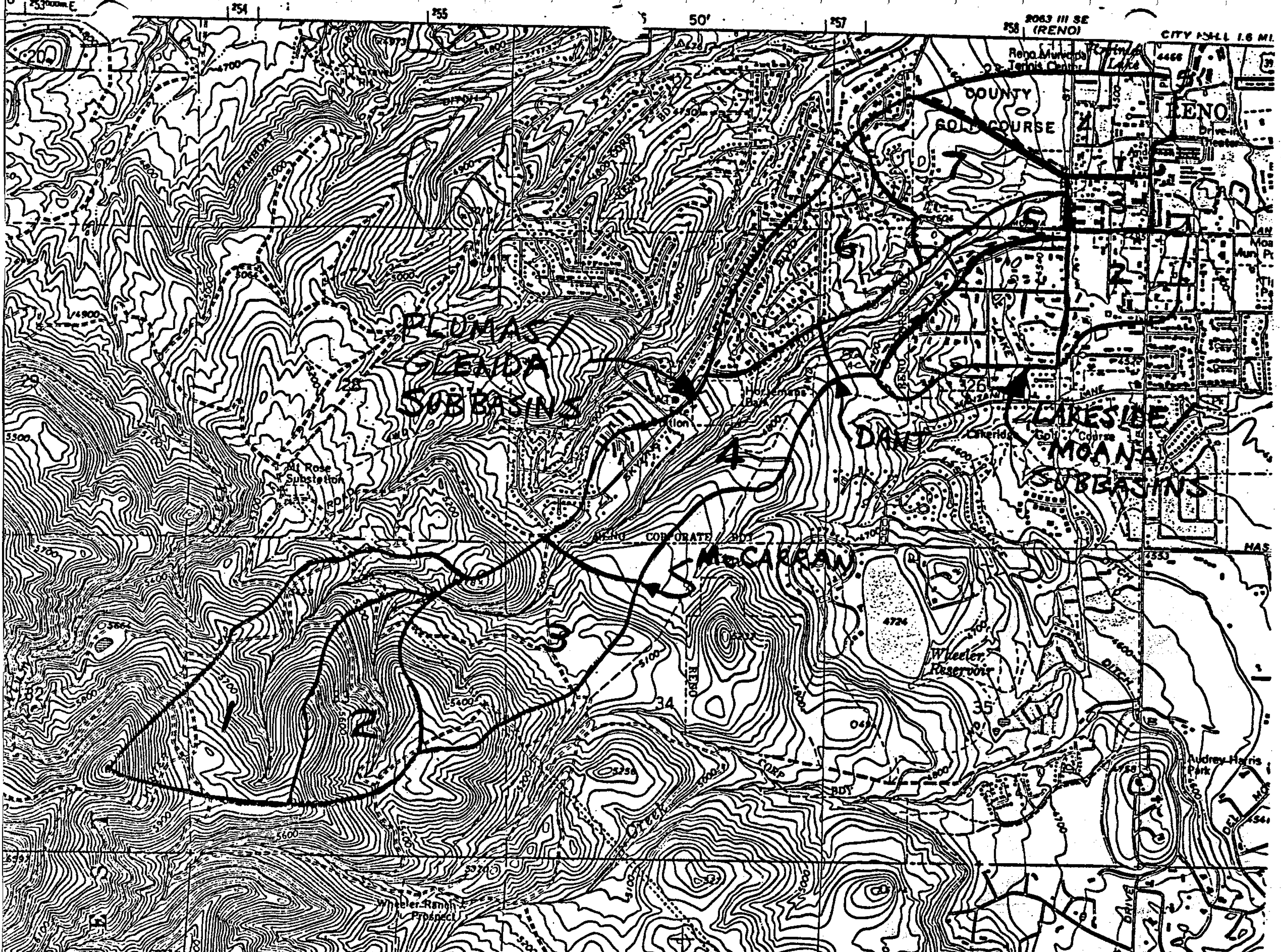
FOR

CITY OF RENO

RENO, NEVADA

September 1988

KENNEDY/JENKS/CHILTON
877041.00


PLUMAS/ GLENDA SUBBASINS
LAKESIDE/ MOANA SUBBASINS
DANT
McCARRAN
1
2
3
4
5
6
7
COUNTY GOLF COURSE
RENO
Reno Municipal Tennis Center
Virginia Lake
Wheeler Reservoir
Lakeridge Golf Course
Mt Rose Substation
Audrey Harris Park
Wheeler Ranch Prospect
RENO CORPORATE BDY
2063 III SE (RENO)
CITY HALL 1.6 MI.
253000m E.
254
255
50'
257
258
20
28
29
34
35
STEAMBOAT DITCH
4726
5000
5600

SUMMARY OF PEAK FLOWS BASED ON SCS METHODOLOGY
(FLOW IN CFS)

lood	Moana & Lakeside		At Dant Crossing		Flow At Plumas & Glenda				Flow Into Virigina Lake			
					No Dant		With Dant		No Dant		With Dant	
vent	6 Hr	24 Hr	6 Hr	24 Hr	6 Hr	24 Hr	6 Hr	24 Hr	6 Hr	24 Hr	6 Hr	24 Hr
5 Yr	34	56	151	261	198	347	105	154	252	430	158	238
10 Yr	46	73	207	339	275	452	131	186	346	555	201	293
25 Yr	73	107	337	503	446	667	186	255	554	816	294	409
50 Yr	95	135	446	630	590	855	228	309	726	1037	367	498
00 Yr	111	153	527	716	697	972	260	345	853	1175	422	558

DESIGN STORM PRECIPITATION AMOUNTS FROM NOAA ATLAS 2 FOR PLUMAS/MOANA WATERSHED

Return Period In Years	Precipitation Amount In Inches	
	6 Hour Storm	24 Hours Storm
2 Yr	0.8	1.2
5 Yr	1.0	1.6
10 Yr	1.25	1.8
25 Yr	1.4	2.2
50 Yr	1.6	2.5
100 Yr	1.8	2.7

PLUMAS/MOANA HYDROLOGY
SUMMARY OF RUNOFF PARAMETERS FOR SCS METHOD

Sub-basin Number	Curve Number	Time Of Concentration (Hours)	Lag Time (Hours) (=0.6Tc)	Travel Time Thru Down-Stream Reach	Accum.Time Of Concen. (Hours)	Accum.Lag Time (Hours)
Plumas						
1	85	0.51	0.31	-	0.51	0.31
2	85	0.44	0.27	-	0.51	0.31
3	85	0.51	0.31	0.05	0.56	0.34
4	85	0.92	0.55	0.15	0.92	0.55
5	86	0.92	0.55	0.12	1.04	0.62
6	84	0.89	0.53	-	0.89	0.53
7	85	0.92	0.55	0.08	0.97	0.58
Lakeside						
1	84	0.92	0.55	-	0.92	0.55
2	88	0.97	0.58	0.08	1.00	0.60
3	96	0.59	0.35	0.02	1.06*	0.64
4	95	0.66	0.40	0.02	1.08	0.65
5	95	0.59	0.35	0.02	1.10	0.66

* Combined With Plumas Subbasin 5

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project PLUMAS MOANA HYDROLOGY By SRD Date 8-11-88

Location PLUMAS WATERSHED SUBBASIN 1 Checked ____ Date ______

Circle one: Present [✓ Developed]

Circle one: [✓ T_c] T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

Segment ID		OVERLAND			
1. Surface description (table 3-1)		BRUSH			
2. Manning's roughness coeff., n (table 3-1)		0.20			
3. Flow length, L (total L $\leq$ 300 ft)	ft	300			
4. Two-yr 24-hr rainfall, P_2	in	1.2			
5. Land slope, s	ft/ft	0.20			
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t	hr	0.32	+		=

Shallow concentrated flow

Segment ID		COLLECTI			
7. Surface description (paved or unpaved)		UNPAVED			
8. Flow length, L	ft	2200			
9. Watercourse slope, s	ft/ft	0.20			
10. Average velocity, V (figure 3-1)	ft/s	7.2			
11. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr	0.08	+		=

Channel flow

Segment ID		MAIN			
12. Cross sectional flow area, a b:10 s:2:1 d:3	ft^2	48			
13. Wetted perimeter, p_w	ft	23.4			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft	2.05			
15. Channel slope, s	ft/ft	0.10			
16. Manning's roughness coeff., n		0.05			
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	15			
18. Flow length, L	ft	6000			
19. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr	0.11	+		= 0.51
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr				

LAG = 0.6 Tc

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project PLUMAS/MCANA HYDROLOGY By SRD Date 8-11-88

Location PLUMAS WATERSHED SUBBASIN 2 Checked ____ Date ____

Circle one: Present [✓ Developed]

Circle one: [✓ T_c] T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only) Segment ID		OVERLAND			
1. Surface description (table 3-1)		BRUSH			
2. Manning's roughness coeff., n (table 3-1) ..		0.20			
3. Flow length, L (total L ≤ 300 ft)	ft	300			
4. Two-yr 24-hr rainfall, P_2	in	7.2			
5. Land slope, s	ft/ft	0.20			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	.32	+		=
Shallow concentrated flow Segment ID		COLLECTOR			
7. Surface description (paved or unpaved)		1200			
8. Flow length, L	ft	0.20			
9. Watercourse slope, s	ft/ft	0.20			
10. Average velocity, V (figure 3-1)	ft/s	7.2			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.05	+		=
Channel flow Segment ID					
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, p_w	ft				
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft				
15. Channel slope, s	ft/ft	0.16			
16. Manning's roughness coeff., n		0.05			
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	15			
18. Flow length, L	ft	4000			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.07	+		= 0.44
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr				

LAG = 0.6 TC

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project PLUMAS/MANA HYDROLOGY By SRD Date 8-11-88

Location PLUMAS WATERSHED SUBBASIN 3 Checked ____ Date ____

Circle one: Present [✓ Developed]

Circle one: [✓ T_c] T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only) Segment ID		OVERLAND		
1. Surface description (table 3-1)		BRUSH		
2. Manning's roughness coeff., n (table 3-1) ..		0.20		
3. Flow length, L (total L $\leq$ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	1.2		
5. Land slope, s	ft/ft	0.15		
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	0.36	+	=

Shallow concentrated flow Segment ID		COLLECTOR		
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow length, L	ft	2200		
9. Watercourse slope, s	ft/ft	0.15		
10. Average velocity, V (figure 3-1)	ft/s	6.2		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.10	+	=

Channel flow Segment ID		MAIN		
12. Cross sectional flow area, a	ft^2	·48		
13. Wetted perimeter, p_w	ft	23.4		
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft	2.05		
15. Channel slope, s	ft/ft	0.064		
16. Manning's roughness coeff., n		0.05		
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	12		
18. Flow length, L	ft	2200		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.05	+	= 0.51
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr			

LAG = 0.6 TC

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project PLUMAS/MIRANA HYDROLOGY By SRD Date 8-11-88

Location PLUMAS WATERSHED SUBBASIN - 4 Checked ____ Date ____

Circle one: Present [✓ Developed]

Circle one: [✓ T_c] T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID	OVERLAND			
1. Surface description (table 3-1)		LAWN			
2. Manning's roughness coeff., n (table 3-1)		~~0.20~~ .24			
3. Flow length, L (total L $\leq$ 300 ft)	ft	200			
4. Two-yr 24-hr rainfall, P_2	in	1.2			
5. Land slope, s	ft/ft	0.02			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	~~0.58~~ 0.64	+		=
Shallow concentrated flow	Segment ID	COLLECTOR			
7. Surface description (paved or unpaved)		UNPAVED			
8. Flow length, L	ft	1500			
9. Watercourse slope, s	ft/ft	0.08			
10. Average velocity, V (figure 3-1)	ft/s	4.6			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.09	+		=
Channel flow	Segment ID	MAIN			
12. Cross sectional flow area, a b=10' s=2:1 d=4'	ft^2	56			
13. Wetted perimeter, p_w	ft	27.9			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft	2.01			
15. Channel slope, s	ft/ft	0.05			
16. Manning's roughness coeff., n		0.05			
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	10.6			
18. Flow length, L	ft	5600			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.15	+		= 0.92 ~~0.82~~
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr				

LAG = 0.6 Tc

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project PLUMAS/MUNA HYDROLOGY By SRD Date 8-11-88

Location PLUMAS WATERSHED SUBBASIN 5 Checked ____ Date ______

Circle one: Present [✓ Developed]

Circle one: [✓ T_c] T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

Segment ID		OVERLAND		
1. Surface description (table 3-1)		LAWN		
2. Manning's roughness coeff., n (table 3-1)		~~0.20~~ .24		
3. Flow length, L (total L $\leq$ 300 ft)	ft	200		
4. Two-yr 24-hr rainfall, P_2	in	1.2		
5. Land slope, s	ft/ft	~~0.05~~ 0.0[illegible]		
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	~~0.41~~ 0.68	+	=

Shallow concentrated flow

Segment ID		COLLECTOR		
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow length, L	ft	1500		
9. Watercourse slope, s	ft/ft	0.05		
10. Average velocity, V (figure 3-1)	ft/s	3.6		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.12	+	=

Channel flow

Segment ID				
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft	2.0		
15. Channel slope, s	ft/ft	0.03		
16. Manning's roughness coeff., n		0.04		
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	10.2		
18. Flow length, L	ft	4450		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.12	+	= 0.65 (0.92)
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr			

LAG = 0.6 Tc

.35 0.55

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project PLUMAS/MOANA HYDROLOGY By SRD Date 8-11-88

Location PLUMAS WATERSHED SUBBASIN 6 Checked ____ Date ____

Circle one: Present [✓ Developed]

Circle one: [✓ T_t] T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

	Segment ID		OVERLAND	
1.	Surface description (table 3-1)		LAWN	
2.	Manning's roughness coeff., n (table 3-1) ..		~~0.20~~ .24	
3.	Flow length, L (total L $\le$ 300 ft)	ft	200	
4.	Two-yr 24-hr rainfall, P_2	in	1.2	
5.	Land slope, s	ft/ft	0.02	
6.	$T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{\ 0.5}\ s^{0.4}}$ Compute T_t	hr	~~0.58~~ 0.66	+ ____ = ____

Shallow concentrated flow

	Segment ID		COLLECTOR	
7.	Surface description (paved or unpaved)		UNPAVED	
8.	Flow length, L	ft	1200	
9.	Watercourse slope, s	ft/ft	0.05	
10.	Average velocity, V (figure 3-1)	ft/s	3.6	
11.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.09	+ ____ = ____

Channel flow

	Segment ID		MAIN	
12.	Cross sectional flow area, a	ft^2	28	
13.	Wetted perimeter, p_w	ft	18.9	
14.	Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft	1.48	
15.	Channel slope, s	ft/ft	0.03	
16.	Manning's roughness coeff., n		0.04	
17.	$V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	8.4	
18.	Flow length, L	ft	3500	
19.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.12	+ ____ = ~~0.79~~ 0.99

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) .... hr ____

LAG = 0.6 Tc

= 0.47 hr 0.53

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project PLUMAS/MUNA HYDROLOGY By SRO Date 8-11-88

Location PLUMAS WATERSHED SUBBASIN 7 Checked ____ Date ____

Circle one: Present [✓ Developed]

Circle one: [✓ T_c] T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID	OVERLAND			
1. Surface description (table 3-1)		LAWN			
2. Manning's roughness coeff., n (table 3-1) ..		~~0.25~~ .24			
3. Flow length, L (total L $\leq$ 300 ft)	ft	200			
4. Two-yr 24-hr rainfall, P_2	in	1.2			
5. Land slope, s	ft/ft	~~0.03~~ .02			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	~~0.50~~ 0.18	+		=
Shallow concentrated flow	Segment ID	COLLECTOR			
7. Surface description (paved or unpaved)		UNPAVED			
8. Flow length, L	ft	1850			
9. Watercourse slope, s	ft/ft	0.04			
10. Average velocity, V (figure 3-1)	ft/s	3.2			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.16	+		=
Channel flow	Segment ID	MAIN			
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, p_w	ft				
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft	1.48			
15. Channel slope, s	ft/ft	0.02			
16. Manning's roughness coeff., n		0.04			
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	6.8			
18. Flow length, L	ft	1900			0,92
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.08	+		= ~~0.74~~
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr				

LAG= 0.6 Tc

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project PLUMAS/MOANA HYDROLOGY By SRD Date 8-11-88

Location MOANA/LAKESIDE SUBBASIN 1 Checked ____ Date ____

Circle one: Present [✓ Developed]

Circle one: [✓ T_c] T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID	OVERLAND			
1. Surface description (table 3-1)		LAWN			
2. Manning's roughness coeff., n (table 3-1) ..		~~0.20~~ .24			
3. Flow length, L (total L $\leq$ 300 ft)	ft	200			
4. Two-yr 24-hr rainfall, P_2	in	1.2			
5. Land slope, s	ft/ft	~~0.01~~ 0.02			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	~~0.79~~	+		= 0.69
Shallow concentrated flow	Segment ID	COLLECTOR			
7. Surface description (paved or unpaved)		UNPAVED			
8. Flow length, L	ft	1500			
9. Watercourse slope, s	ft/ft	0.035			
10. Average velocity, V (figure 3-1)	ft/s	3.0			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.14	+		=
Channel flow	Segment ID	MAIN			
16 12. Cross sectional flow area, a	ft^2	30			
12.9 13. Wetted perimeter, p_w	ft	17.4			
1.24 14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft	1.72			
15. Channel slope, s	ft/ft	0.032			
16. Manning's roughness coeff., n		0.04			
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	9.6			
18. Flow length, L	ft	3500			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.10	+		= ~~1.15~~ ~~1.03~~ 0.92
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr				

LAG = 0.6 Tc

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project PLUMAS/MOANA HYDROLOGY By SRO Date 8-11-88

Location MOANA/LAKESIDE SUBBASIN 2 Checked ____ Date ____

Circle one: Present [✓ Developed]

Circle one: [✓ T_c] T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

$(0.01)^{.4} = 0.16$

$(0.02)^{.4} = 0.2$

Sheet flow (Applicable to T_c only) Segment ID		OVERLAND		
1. Surface description (table 3-1)		LAWN		
2. Manning's roughness coeff., n (table 3-1) ..		0.24		
3. Flow length, L (total L $\leq$ 300 ft)	ft	200		
4. Two-yr 24-hr rainfall, P_2	in	1.2		
5. Land slope, s	ft/ft	~~.01~~ 0.02		
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{\ 0.5}\ s^{0.4}}$ Compute T_t	hr	~~0.79~~	+	= 0.68

Shallow concentrated flow Segment ID		COLLECTOR		
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow length, L	ft	1200		
9. Watercourse slope, s	ft/ft	0.01		
10. Average velocity, V (figure 3-1)	ft/s	1.6		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.21	+	=

Channel flow Segment ID				
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft	1.72		
15. Channel slope, s	ft/ft	0.015		
16. Manning's roughness coeff., n		0.04		
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	6.6		
18. Flow length, L	ft	2000		1.78
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.08	+	= ~~1.08~~
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr			0.97

LAG = 0.6 T_c

0.

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project PLUMAS/MOANA HYDROLOGY By SRD Date ______
Location GLENDA & LAKESIDE 3 Checked ____ Date ______
Circle one: Present [✓ Developed]
Circle one: [✓ T_c] T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

Segment ID		OVERLAND			
1. Surface description (table 3-1)		LAWN			
2. Manning's roughness coeff., n (table 3-1) ..		0.24			
3. Flow length, L (total L $\leq$ 300 ft)	ft	100			
4. Two-yr 24-hr rainfall, P_2	in	1.2			
5. Land slope, s	ft/ft	0.01			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	0.51	+		=

Shallow concentrated flow

Segment ID		COLLECT			
7. Surface description (paved or unpaved)		PAVED			
8. Flow length, L	ft	400			
9. Watercourse slope, s	ft/ft	0.01			
10. Average velocity, V (figure 3-1)	ft/s	2.0			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.06	+		=

Channel flow

Segment ID		CHANNEL			
12. Cross sectional flow area, a	ft^2	25			
13. Wetted perimeter, p_w	ft	15			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft	1.67			
15. Channel slope, s	ft/ft	0.015			
16. Manning's roughness coeff., n		0.015			
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	17			
18. Flow length, L	ft	1300			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.02	+		= 0.59
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr				

LAG = 0.6 Tc = 0.6X0.59

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project PLUMAS/MOANA HYDROLOGY By SRO Date ________

Location LAKESIDE & BRINKBY 4 Checked _____ Date ________

Circle one: Present Developed

Circle one: T_c T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only) Segment ID		OVERLAND				
1. Surface description (table 3-1)		LAWN				
2. Manning's roughness coeff., n (table 3-1) ..		0.24				
3. Flow length, L (total L $\leq$ 300 ft)	ft	100				
4. Two-yr 24-hr rainfall, P_2	in	1.2				
5. Land slope, s	ft/ft	0.01				
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.51	+		=	

Shallow concentrated flow Segment ID		COLLECT				
7. Surface description (paved or unpaved)		PAVED				
8. Flow length, L	ft	1200				
9. Watercourse slope, s	ft/ft	0.015				
10. Average velocity, V (figure 3-1)	ft/s	2.5				
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.13	+		=	

Channel flow Segment ID		CHANNEL				
12. Cross sectional flow area, a	ft^2					
13. Wetted perimeter, p_w	ft					
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft					
15. Channel slope, s	ft/ft					
16. Manning's roughness coeff., n						
17. $V = \frac{1.49\ r^{2/3} s^{1/2}}{n}$ Compute V	ft/s	15				
18. Flow length, L	ft	1100				
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.02	+		=	0.66
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr					

LAG = 0.6Tc

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project PLUMAS/MOANA HYDROLOGY By SRD Date 8·25·88

Location VIRGINIA LAKE (AREA=15.1 AC) Checked ____ Date ______

Circle one: Present [✓ Developed]

Circle one: [✓ T_c] T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only) Segment ID		OVERLAND				
1. Surface description (table 3-1)		LAWN				
2. Manning's roughness coeff., n (table 3-1) ..		0.24				
3. Flow length, L (total L $\leq$ 300 ft)	ft	100				
4. Two-yr 24-hr rainfall, P_2	in	1.2				
5. Land slope, s	ft/ft	0.01				
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	0.51	+		=	

Shallow concentrated flow Segment ID		COLLECTION				
7. Surface description (paved or unpaved)		PAVED				
8. Flow length, L	ft	400				
9. Watercourse slope, s	ft/ft	0.01				
10. Average velocity, V (figure 3-1)	ft/s	2.0				
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.06	+		=	

Channel flow Segment ID		CHANNEL				
12. Cross sectional flow area, a	ft^2					
13. Wetted perimeter, p_w	ft					
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft					
15. Channel slope, s	ft/ft					
16. Manning's roughness coeff., n						
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	10				
18. Flow length, L	ft	800				
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.02	+		=	0.59
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr					

LAG = 0.59 X 0.6

PC

RAINFALL TABLE 2

STANDARD SCS 24-HOUR, TYPE II DISTRIBUTION
CUMULATIVE RAINFALL TABLE
(REVISED MAY 1982)

```
    TABLE NO.          TIME INCREMENT
5 RAINFL 2                   0.2500

8               0.0        0.0020      0.0050      0.0080      0.0110
8               0.0140     0.0170      0.0200      0.0230      0.0260
8               0.0290     0.0320      0.0350      0.0380      0.0410
8               0.0440     0.0480      0.0520      0.0560      0.0600
8               0.0640     0.0680      0.0720      0.0760      0.0800
8               0.0850     0.0900      0.0950      0.1000      0.1050
8               0.1100     0.1150      0.1200      0.1260      0.1330
8               0.1400     0.1470      0.1550      0.1630      0.1720
8               0.1810     0.1910      0.2030      0.2180      0.2360
8               0.2570     0.2830      0.3870      0.6630      0.7070
8               0.7350     0.7580      0.7760      0.7910      0.8040
8               0.8150     0.8250      0.8340      0.8420      0.8490
8               0.8560     0.8630      0.8690      0.8750      0.8810
8               0.8870     0.8930      0.8980      0.9030      0.9080
8               0.9130     0.9180      0.9220      0.9260      0.9300
8               0.9340     0.9380      0.9420      0.9460      0.9500
8               0.9530     0.9560      0.9590      0.9620      0.9650
8               0.9680     0.9710      0.9740      0.9770      0.9800
8               0.9830     0.9860      0.9890      0.9920      0.9950
8               0.9980     1.0000      1.0000      1.0000      1.0000
9 ENDTBL
```

Note: On Executive Control use Rainfall Depth in inches and Rainfall Duration of 1.0.
The format for this table is Form #271, Page F-7.

APPENDIX B

GOLF COURSE HYDROLOGY AND RESERVOIR ROUTING

By Janet Carson Date 11/14/88 Subject Washoe Co. Golf Course drainage Job No. 877041.00
Checked By ______ Date ______ Sheet 1 of 3

Run 1: Southern fairway drainage (subbasins 6 + 7)

Assumed 18 AF detention dam near Plumas with 9' depth + 2 acres with 100' spillway at 8' + 24" outl pipe
100 yr 24 hr storm (same as Dant)

Peak inflow = 182 cfs
Total Inflow volume = ~~(not exactly determined~~) 25 AF
Peak outflow = 51 cfs
Max Storage volume = 10 af
Max pool elev = 5.1'

Peak flow from "Golf 6" = 135 cfs
Peak flow from "Golf 7" = 48 cfs

Est. subbasin 8 ≈ 30 cfs (same parameters as 7, but ~~less~~ only .6 × area)

Run 2: Same parameters as Run 1, but no low level outlet from detention basin (file = "GLF7.OUT"

Peak inflow = 182 cfs
Peak outflow = 34 cfs
Total volume in = 26 AF
Max storage = 16 AF (full)
Max pool elev = 8.23' (.23' over spillway)

By Jpc Date 11/14/88 Subject W.C. Golf Course Job No. 877041.00

Checked By ______ Date ______ Sheet 2 of 3

Run 3: Ø Subarea 8 (clubhouse through south-central part of course)
Area = .06 mi^2 (file = "GLF8.OUT"

Assumed 18 AF detention basin; no pipe outlet

Peak inflow = 31 cfs
Peak outflow = Ø cfs
Total vol in = 4 AF
Max storage = 4 AF
Max pool elev = 2.12'

11/~~14~~17/88

Run 4: All tributary areas from headwaters of Dant drainage through & including golf course tributaries.

Dant peak outflow = 98 cfs
Dant peak storage = 39 AF (stage = 4697.95')
☆ Glenda peak flow = 360 cfs
☆ Total volume = 130 AF
Total area = 1.77 mi^2

Plum 1 peak = 240 cfs
Plum 2 peak = 150 cfs
Plum 3 peak = 178 cfs
Plum 4 peak = 195 cfs
Plum 5 peak = 63 cfs
Plum 6 peak = 135 cfs
Plum 7 peak = 49 cfs
Plum 8 peak = 31 cfs

Peak flows of each individual subarea. Combined peaks are less than sum of tributary peaks due to time lag by routing


8
A=.06 mi²
7
A=.1mi²
6
A=.27 mi²
WESTWOOD DR
PALISADE
MARSH
SHARON
CIRCLE
LANE
SOUTH
PLUMB
LAKE
GLENMANOR DR
4523
4535
4455
Beck Sch
PINERIDGE
DR
ROSEWOOD DR
PLUMAS
BM 4472
395
Park
Trailer
Park
WEBSTER
22
23
CORP
BM 4524
RENO
County
Golf Course
Virginia
Lake
4466
COUNTY
GOLF COURSE
RENO
Drive-in
Theater
Anderson
4750
4700
4800
BLVD
4604
MOANA
4495
4540
LAKE
4522
26
Horsemans
Park
Fire
Station
SKYLINE
CORPORATE
MANZANITA
LANE
Lakeridge
Golf
Course
LAKESIDE
LAST
CHANCE
DITCH
4553
HASH
4900
4724
5232
5100
Wheeler
Reservoir
34
35
4900
4947
4800
5000
5256
4758

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project PLUMAS/MOANA HYDROLOGY By SRD/JRC Date 11-14-88

Location PLUMAS WATERSHED SUBBASIN 6 Checked JRC Date

Circle one: Present [✓ Developed]

Circle one: [✓ T_c] T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

Segment ID		OVERLAND		
1. Surface description (table 3-1)		LAWN		
2. Manning's roughness coeff., n (table 3-1) ..		~~0.20~~ .24		
3. Flow length, L (total L ≤ 300 ft)	ft	200		
4. Two-yr 24-hr rainfall, P_2	in	1.2		
5. Land slope, s	ft/ft	0.02		
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	~~0.58~~ 0.68	+	=

Shallow concentrated flow

Segment ID		COLLECTOR		
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow length, L	ft	1200		
9. Watercourse slope, s	ft/ft	0.05		
10. Average velocity, V (figure 3-1)	ft/s	3.6		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.09	+	=

Channel flow

Segment ID		MAIN		
12. Cross sectional flow area, a	ft^2	28		
13. Wetted perimeter, p_w	ft	18.9		
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft	1.48		
15. Channel slope, s	ft/ft	0.03		
16. Manning's roughness coeff., n		0.04		
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	8.4		
18. Flow length, L	ft	3500		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.12	+	= ~~0.79~~ 0.89

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) .... hr

LAG = 0.6 Tc

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project PLUMAS/MUANA HYDROLOGY By SRD/JRC Date 11/14/88

Location PLUMAS WATERSHED SUBBASIN 7 Checked ____ Date ____

Circle one: Present [✓ Developed]

Circle one: [✓ T_c] T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only) Segment ID		OVERLAND			
1. Surface description (table 3-1)		LAWN			
2. Manning's roughness coeff., n (table 3-1)		.24			
3. Flow length, L (total $L \leq 300$ ft)	ft	200			
4. Two-yr 24-hr rainfall, P_2	in	1.2			
5. Land slope, s	ft/ft	.02			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	.68	+		=

Shallow concentrated flow Segment ID		COLLECTOR			
7. Surface description (paved or unpaved)		UNPAVED			
8. Flow length, L	ft	1850			
9. Watercourse slope, s	ft/ft	0.04			
10. Average velocity, V (figure 3-1)	ft/s	3.2			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.16	+		=

Channel flow Segment ID		MAIN			
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, p_w	ft				
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft	1.48			
15. Channel slope, s	ft/ft	0.02			
16. Manning's roughness coeff., n		0.04			
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	6.8			
18. Flow length, L	ft	~~2100~~ 1900			.92
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	~~.09~~ .08	+		= ~~.93~~
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr				

LAG = 0.6 Tc

~~0.56~~ .55

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project PLUMAS/MUNA HYDROLOGY By SRD/JRC Date 11-14-88

Location PLUMAS WATERSHED SUBBASIN 8 Checked JRC Date

Circle one: Present [✓ Developed]

Circle one: [✓ T_c] T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

Segment ID		OVERLAND		
1. Surface description (table 3-1)		LAWN		
2. Manning's roughness coeff., n (table 3-1)		~~0.26~~ .24		
3. Flow length, L (total L $\le$ 300 ft)	ft	200		
4. Two-yr 24-hr rainfall, P_2	in	1.2		
5. Land slope, s	ft/ft	~~0.03~~ .02		
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{\ 0.5}\ s^{0.4}}$ Compute T_t	hr	~~0.50~~ 0.18	+	=

Shallow concentrated flow

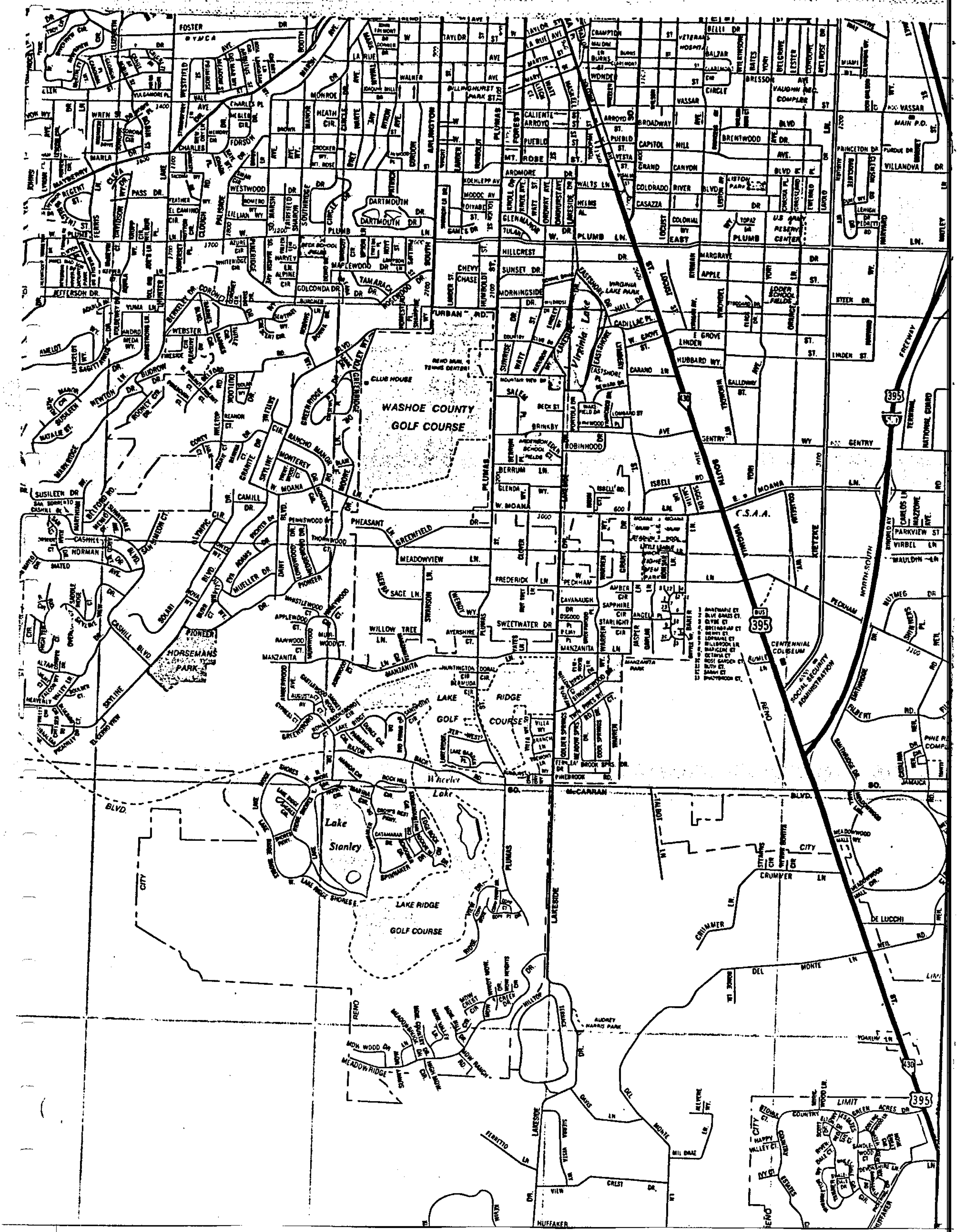
Segment ID		COLLECTOR		
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow length, L	ft	1320		
9. Watercourse slope, s	ft/ft	0.04		
10. Average velocity, V (figure 3-1)	ft/s	3.2		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	.11	+	=

Channel flow

Segment ID		MAIN		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, P_w	ft			
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft	1.48		
15. Channel slope, s	ft/ft	0.02		
16. Manning's roughness coeff., n		0.04		
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	6.8		
18. Flow length, L	ft			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	.05	+	= .84
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr			

LAG = 0.6 Tc

= ~~0.47~~ ~~[illegible]~~ = .51



FOSTER DR.
TAYLOR ST.
WALKER
BILLINGHURST PARK
MONROE
VASSAR ST.
VAUGHN REC. COMPLEX
VETERANS HOSPITAL
BROADWAY
CAPITOL HILL
BRENTWOOD DR.
MAIN P.O.
VILLANOVA DR.
MT. ROSE ST.
ARDMORE
GRAND CANYON
COLORADO RIVER BLVD.
CASAZZA DR.
DARTMOUTH DR.
WESTWOOD
PASS DR.
PLUMB LN.
EAST PLUMB
U.S. ARMY RESERVE CENTER
HILLCREST
SUNSET DR.
MORNINGSIDE DR.
VIRGINIA LAKE PARK
Virginia Lake
MARGRAVE DR.
APPLE ST.
LODER SCHOOL FIELDS
JEFFERSON DR.
YUMA LN.
WEBSTER
URBAN RD.
GROVE
LINDEN ST.
HUBBARD WY.
WASHOE COUNTY GOLF COURSE
CLUB HOUSE
RENO MUN. TENNIS CENTER
FREEWAY
395
430
BRINKBY AVE
ROBINHOOD DR.
GENTRY WY.
NATIONAL GUARD
TERMINAL
RANCHO MANOR
MONTEREY
W. MOANA
E. MOANA LN.
ISBELL RD.
C.S.A.A.
PHEASANT LN.
GREENFIELD DR.
MEADOWVIEW LN.
PARKVIEW ST
VIRBEL LN
WAULDIN LN
FREDERICK
PECHAM LN.
MUELLER DR.
PIONEER
SOLARI
SAGE LN.
WILLOW TREE LN.
SWEETWATER DR
MANZANITA LN.
CENTENNIAL COLISEUM
SOCIAL SECURITY ADMINISTRATION
NUTMEG DR
HORSEMANS PARK
CASHILL BLVD.
SKYLINE
LAKE RIDGE GOLF COURSE
BACK RD.
FILBERT RD.
SO. McCARRAN BLVD.
JAMAICA
Wheeler Lake
Lake Stanley
MEADOWOOD MALL WY.
CITY LIMIT
CRUMMER LN.
LAKE RIDGE GOLF COURSE
DE LUCCHI
NEIL RD.
DEL MONTE LN
AUDREY HARRIS PARK
YOARLW LN
MEADOWRIDGE
DAVIS LN
LAKESIDE DR.
HUFFAKER
GREEN ACRES DR.
HAPPY VALLEY CT.
RENO

4x4 Grid Sheet **Kennedy/Jenks/Chilton**

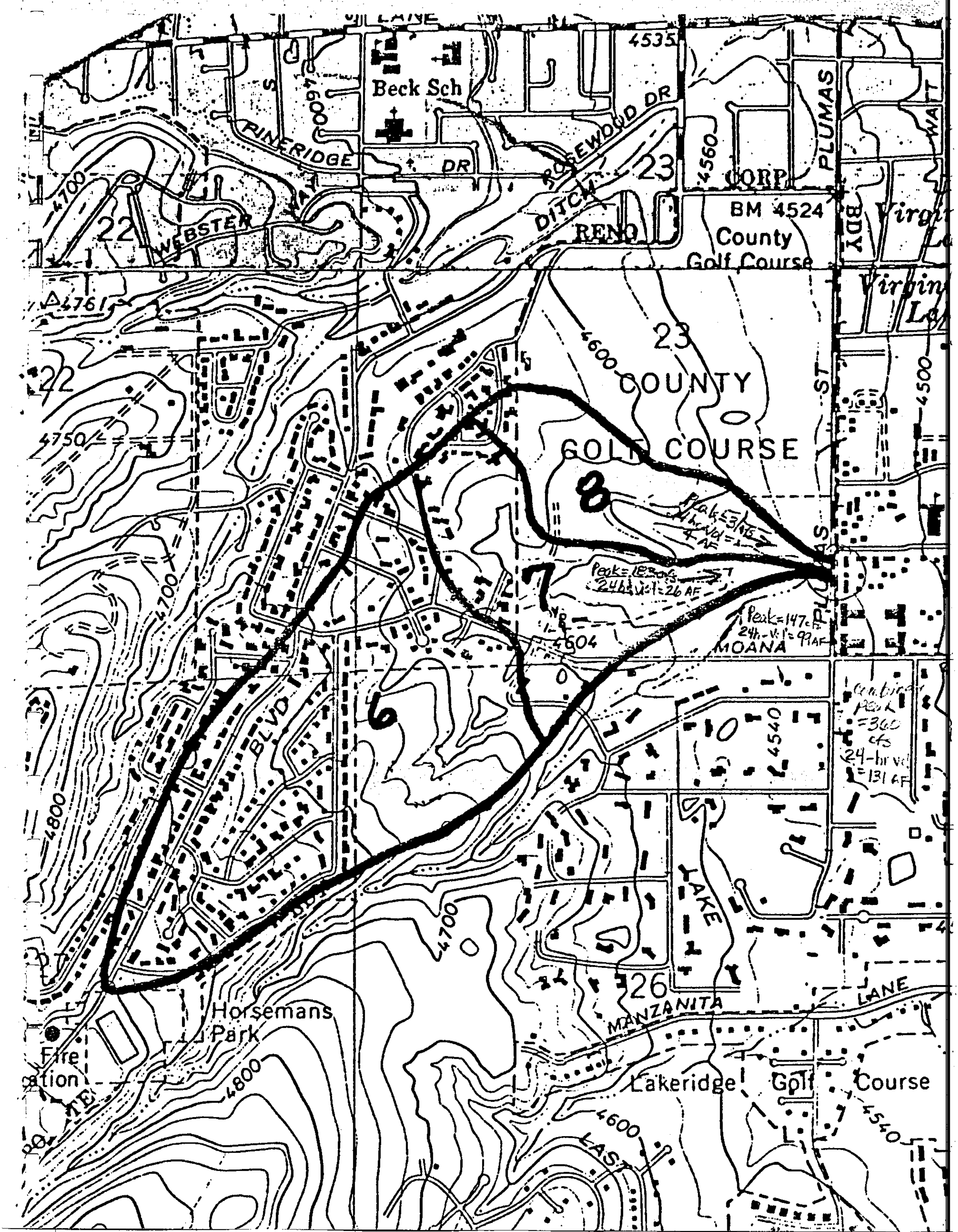
By Janet Carson Date 11/17/88 Subject ~~[illegible]~~ Plumas/Glenda Job No. 877041.00
Checked By ______ Date ______ Sheet 3 of 3

Run 5 : Dant Blvd Dam in place
2 detention dams (18 AF each) on golf course
pond in southern area (subbasin 7)
has 1' diam outlet 4' above bottom
plus 20' wide spillway at 8' depth.
Pond in center of course (subbasin 8) has
no low level outlet; same spillway as other.
Both ponds have a simple box shape —
2 acres × 9 ft deep

Results for detention pond in subarea 7;
Peak outflow = 22 cfs (compare to 183 inflow)
Total volume = 24 AF
Peak storage = 17 AF (.3' over spillway)

Results for detention pond in subarea 8:
Peak outflow = 0 cfs (compare to 31 inflow)
Peak Storage = 4 AF (2.12' deep)

Results of all flows to Plumas/Glenda
* Peak flow = 149 cfs (compare to 360 cfs without G.C. detention)

LANE
4535
Beck Sch
PINERIDGE DR
ROSEWOOD DR
23
4560
CORP
PLUMAS
WATT
BM 4524
BDY
Reno County Golf Course
Virginia Lake
4700
22
WEBSTER
DITCH
RENO
4761
22
23
4600
COUNTY GOLF COURSE
ST
4500
4750
4700
8
Peak=31cfs 24-hr vol=4 AF
7
Peak=182cfs 24hr vol=26 AF
Peak=147cfs 24hr-vol=99AF
4604
MOANA
PLUMAS
Combined peak =360 cfs 24-hr vol =131 AF
6
BLVD
10
4540
4800
LAKE
4700
26
MANZANITA LANE
Horsemans Park
Fire Station
4800
Lakeridge Golf Course
4600
4540
LAS

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

  1           ID        PLUMAS/GLENDA RUNOFF
  2           ID        FUTURE LAND USE CONDITIONS WITH DETENTION BASIN AT DANT ROAD ADDED
  3           ID        DRAINAGE AREA TRIBUTARY TO GLENDA AVENUE - USING SCS METHODOLOGY
  4           ID        100-YEAR,24-HOUR STORM, SCS EMERGENCY SPILLWAY DISTRIBUTION
  5           ID        FILE 100Y.INP      JANET CARSON      NOVEMBER 16, 1988
              *DIAGRAM
  6           IT       5       0       0     289
  7           IO       5       0
  8           IN      15       0       0
              *  *************************************************************************

  9           KK   PLUM1
 10           KM        PLUM1 SUBBASIN IS HIGHEST, WESTERNMOST, DUE SOUTH OF MT ROSE SUBSTN.
 11           BA    0.35
 12           PB    2.7
 13           PC    0.00    .002    .005    .008    .011    .014    .017    .020    .023    .026
 14           PC    .029    .032    .035    .038    .041    .044    .048    .052    .056    .060
 15           PC    .064    .068    .072    .076    .080    .085    .090    .095    .100    .105
 16           PC    .110    .115    .120    .126    .133    .140    .147    .155    .163    .172
 17           PC    .181    .191    .203    .218    .236    .257    .283    .387    .663    .707
 18           PC    .735    .758    .776    .791    .804    .815    .825    .834    .842    .849
 19           PC    .856    .863    .869    .875    .881    .887    .893    .898    .903    .908
 20           PC    .913    .918    .922    .926    .930    .934    .938    .942    .946    .950
 21           PC    .953    .956    .959    .962    .965    .968    .971    .974    .977    .980
 22           PC    .983    .986    .989    .992    .995    .998    1.00
 23           LS       0      85
 24           UD    0.31
              *  *************************************************************************

 25           KK   PLUM2
 26           KM        PLUM2 SUBBASIN PARALLELS PLUM1 TO THE EAST, EQUALLY HIGH IN WATERSHED
 27           BA    0.20
 28           LS       0      85
 29           UD    0.27
              *  ************************************************************************

 30           KK    COMB
 31           KM        COMBINE FLOWS FROM PLUM1 & PLUM2 SUBBASINS
 32           HC       2
              *  ***********************************************************************

 33           KK   ROUTE
 34           KM        ROUTE PLUM1 & PLUM2 COMBINED FLOWS THROUGH PLUM3 USING KINEMATIC WAVE
 35           RK    2200   0.064    0.05             TRAP     10.      2.
              *  ************************************************************************

 36           KK   PLUM3
 37           KM        PLUM3 SUBBASIN IS ON MAINSTEM BETWEEN TRANSMISSION LINE & MCCARRAN BLVD
 38           BA    0.26
 39           LS       0      85
 40           UD    0.31
              *  ************************************************************************
1                                         HEC-1 INPUT                                        PAGE  2

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


 41           KK    COMB
 42           KM        COMBINE PLUM3 LOCAL INFLOW WITH ROUTED FLOW FROM ABOVE AT MCCARRAN
 43           HC       2
              *  ************************************************************************
```

11/17/88
Run with al
tributaries to
Glenda/Plumas
intersection.
Dant Dam in u
but no detentio
basins on gol
course.
JRC

```
  45          KM       ROUTE ALL FLOWS FROM SUBBASINS 1,2,3 FROM MCCARRAN TO DANT BLVD.
  46          RK   5600   0.050    0.05            TRAP     10.      2.
              *  ***********************************************************************

  47          KK   PLUM4
  48          KM       PLUM4 IS SUBBASIN BETWEEN MCCARRAN AND DANT BLVD.
  49          BA    0.40
  50          LS       0      85
  51          UD    0.55
              *  **********************************************************************

  52          KK    COMB
  53          KM       COMBINE RUNOFF FROM PLUM4 WITH ROUTED FLOW FROM ABOVE AT DANT BLVD.
  54          HC       2
              *  **********************************************************************

  55          KK   DETEN
              *       ROUTE ALL COMBINED FLOWS THROUGH DETENTION BASIN WITH 24" OUTLET
              *       NOTE: SV IS RESERVOIR STORAGE DATA; SE IS CORRESPONDING ELEVATIONS;
              *       .      SS DESCRIBES SPILLWAY CHARACTERISTICS; SL IS LOW-LEVEL OUTLET.
  56          RS       1     STOR       0
  57          SV     0.0      .04      .28      .77     1.57     2.66      4.0      5.6     7.58     10.1
  58          SV    13.2     17.1     21.7     32.9     39.5     46.8     54.9     73.1     83.4     94.6
  59          SE    4668     4670     4672     4674     4676     4678     4680     4682     4684     4686
  60          SE    4688     4690     4692     4696     4698     4700     4702     4706     4708     4710
  61          SS    4700     23.3      3.1      1.5
  62          SL    4667     2.43      0.9      0.5
  63          KO       1        2
              *  ************************************************************************

  64          KK   ROUTE
  65          KM       ROUTE DANT DAM OUTFLOW THROUGH SUBBASIN PLUM5
  66          RK   4450    0.03    0.04            TRAP     10.      2.
              *  ***********************************************************************

  67          KK   PLUM5
  68          KM       PLUM5 IS NARROW AREA BETWEEN DANT DAM AND PLUMAS AVENUE
  69          BA    0.13
  70          LS       0      85
  71          UD    0.55
              *  ************************************************************************

  72          KK    COMB
  73          KM       COMBINE DANT DAM OUTFLOW WITH PLUM5 LOCAL INFLOW
  74          HC       2
              *  ************************************************************************
1                                         HEC-1 INPUT                                          PAGE  3

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


  75          KK   PLUM6
  76          KM       PLUM6 IS BETWEEN SKYLINE & DANT BLVDS, ABOVE GOLF COURSE
  77          BA    0.27
  78          LS       0      85
  79          UD    0.53
              *  ***********************************************************************

  80          KK   ROUTE
  81          KM       ROUTE PLUM6 FLOW THROUGH PLUM7, GOLF COURSE FAIRWAY.
  82          RK   1900    0.02    0.04            TRAP      10       2
              *  ***********************************************************************

  83          KK   PLUM7
```

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 86          LS      0      85
 87          UD    0.55
             *  *********************************************************************

 88          KK    COMB
 89          KM          COMBINE ROUTED PLUM6 FLOW WITH LOCAL PLUM7 INFLOW
 90          HC       2
             *  *********************************************************************

 91          KK    COMB
 92          KM         COMBINE DANT DRAINAGE (SUBBASINS 1-5) WITH SOUTH G.C. (SUBS 6-7)
 93          HC       2
             *  *********************************************************************

 94          KK   PLUM8
 95          KM         PLUM8 IS CENTER AREA OF GOLF COURSE, NORTH OF PLUM7.
 96          BA    0.06
 97          LS      0      85
 98          UD    0.51
             *  *********************************************************************

 99          KK    COMB
100          KM         COMBINE PLUM8 WITH ALL OTHER DRAINAGE (ALREADY COMBINED) AT GLENDA
101          HC       2
102          KO       1       2
103          ZZ
1
          SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

   9      PLUM1
            .
            .
  25        .       PLUM2
            .           .
            .           .
  30       COMB...........
            V
            V
  33      ROUTE
            .
            .
  36        .       PLUM3
            .           .
            .           .
  41       COMB...........
            V
            V
  44      ROUTE
            .
            .
  47        .       PLUM4
            .           .
            .           .
  52       COMB...........
            V
            V
  55      DETEN
            V
            V
```

```
                    .
 67                 .       PLUM5
                    .           .
                    .           .
 72             COMB............
                    .
                    .
 75                 .       PLUM6
                    .           V
                    .           V
 80                 .       ROUTE
                    .           .
                    .           .
 83                 .           .        PLUM7
                    .           .            .
                    .           .            .
 88                 .        COMB............
                    .           .
                    .           .
 91             COMB............
                    .
                    .
 94                 .       PLUM8
                    .           .
                    .           .
 99             COMB............

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1                                                   ****
                                FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
                  U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                                    ****




                              PLUMAS/GLENDA RUNOFF
                              FUTURE LAND USE CONDITIONS WITH DETENTION BASIN AT DANT ROAD ADDED
                              DRAINAGE AREA TRIBUTARY TO GLENDA AVENUE - USING SCS METHODOLOGY
                              100-YEAR,24-HOUR STORM, SCS EMERGENCY SPILLWAY DISTRIBUTION
                              FILE 100Y.INP      JANET CARSON      NOVEMBER 16, 1988

    7 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                        NMIN          5  MINUTES IN COMPUTATION INTERVAL
                       IDATE     1    0  STARTING DATE
                       ITIME       0000  STARTING TIME
                          NQ        289  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     2    0  ENDING DATE
                      NDTIME             ENDING TIME

                     COMPUTATION INTERVAL     .08 HOURS
                         TOTAL TIME BASE    24.00 HOURS

             ENGLISH UNITS

 WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG



 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
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              **************
              *            *
   55 KK      *    DETEN   *
              *            *
              **************

   63 KO          OUTPUT CONTROL VARIABLES
                        IPRNT          1  PRINT CONTROL
                        IPLOT          2  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE

                HYDROGRAPH ROUTING DATA

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

   57 SV            STORAGE         .0        .0        .3        .8       1.6       2.7       4.0       5.6       7.6      10.1
                                  13.2      17.1      21.7      32.9      39.5      46.8      54.9      73.1      83.4      94.6

   59 SE          ELEVATION    4668.00   4670.00   4672.00   4674.00   4676.00   4678.00   4680.00   4682.00   4684.00   4686.00
                               4688.00   4690.00   4692.00   4696.00   4698.00   4700.00   4702.00   4706.00   4708.00   4710.00

   62 SL          LOW-LEVEL OUTLET
                        ELEVL    4667.00  ELEVATION AT CENTER OF OUTLET
                        CAREA       2.43  CROSS-SECTIONAL AREA
                         COQL        .90  COEFFICIENT
                         EXPL        .50  EXPONENT OF HEAD

   61 SS          SPILLWAY
                         CREL    4700.00  SPILLWAY CREST ELEVATION
                        SPWID      23.30  SPILLWAY WIDTH
                         COQW       3.10  WEIR COEFFICIENT
                         EXPW       1.50  EXPONENT OF HEAD

                                                     ***

                                          COMPUTED OUTFLOW-ELEVATION DATA

          OUTFLOW       .00     19.31     21.48     24.20     27.71     32.41     39.03     49.05     65.98    100.76
        ELEVATION   4668.00   4668.21   4668.50   4668.90   4669.50   4670.41   4671.95   4674.82   4681.15   4700.00

          OUTFLOW    103.50    120.67    165.78    252.35    393.91    603.95    896.01   1283.44   1780.01   2399.13
        ELEVATION   4700.11   4700.41   4700.92   4701.62   4702.52   4703.62   4704.92   4706.41   4708.11   4710.00


                                      COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE       .00       .00       .01       .02       .03       .04       .09       .27       .28       .77
          OUTFLOW     17.54     19.31     21.48     24.20     27.71     30.38     32.41     39.03     39.22     46.41
        ELEVATION   4668.00   4668.21   4668.50   4668.90   4669.50   4670.00   4670.41   4671.95   4672.00   4674.00

          STORAGE      1.10      1.57      2.66      4.00      4.92      5.60      7.58     10.10     13.20     17.10
          OUTFLOW     49.05     52.62     58.17     63.24     65.98     67.93     72.32     76.45     80.38     84.12
        ELEVATION   4674.82   4676.00   4678.00   4680.00   4681.15   4682.00   4684.00   4686.00   4688.00   4690.00

          STORAGE     21.70     32.90     39.50     46.80     47.24     48.48     50.52     53.37     54.90     57.28
          OUTFLOW     87.70     94.45     97.66    100.76    105.50    120.67    165.78    252.35    308.06    393.91
        ELEVATION   4692.00   4696.00   4698.00   4700.00   4700.11   4700.41   4700.92   4701.62   4702.00   4702.52

          STORAGE     62.28     68.18     73.10     75.23     83.40     84.00     94.60
```

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*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN       18. TO       28.
                THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

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

                                                    HYDROGRAPH AT STATION    DETEN

*******************************************************************************************************************************
                                              *                                              *
 DA MON HRMN ORD   OUTFLOW  STORAGE    STAGE  * DA MON HRMN ORD   OUTFLOW  STORAGE    STAGE  * DA MON HRMN ORD   OUTFLOW  STORAGE    STAGE
                                              *                                              *
  1      0000   1     18.       .0  4668.0 *  1     98       7.       .0  4668.0 *  1    195       94.      32.2  4695.7
  1         2          7.       .0  4668.0 *  1     99       7.       .0  4668.0 *  1    196       94.      31.8  4695.6
  1         3          7.       .0  4668.0 *  1    100       7.       .0  4668.0 *  1    197       94.      31.4  4695.5
  1         4          7.       .0  4668.0 *  1    101       7.       .0  4668.0 *  1    198       93.      31.1  4695.3
  1         5          7.       .0  4668.0 *  1    102       7.       .0  4668.0 *  1    199       93.      30.7  4695.2
  1         6          7.       .0  4668.0 *  1    103       7.       .0  4668.0 *  1    200       93.      30.3  4695.1
  1         7          7.       .0  4668.0 *  1    104       7.       .0  4668.0 *  1    201       93.      30.0  4695.0
  1         8          7.       .0  4668.0 *  1    105       7.       .0  4668.0 *  1    202       92.      29.6  4694.8
  1         9          7.       .0  4668.0 *  1    106       7.       .0  4668.0 *  1    203       92.      29.2  4694.7
  1        10          7.       .0  4668.0 *  1    107       7.       .0  4668.0 *  1    204       92.      28.9  4694.6
  1        11          7.       .0  4668.0 *  1    108       7.       .0  4668.0 *  1    205       92.      28.5  4694.4
  1        12          7.       .0  4668.0 *  1    109       7.       .0  4668.0 *  1    206       92.      28.1  4694.3
  1        13          7.       .0  4668.0 *  1    110       7.       .0  4668.0 *  1    207       91.      27.8  4694.2
  1        14          7.       .0  4668.0 *  1    111       7.       .0  4668.0 *  1    208       91.      27.4  4694.0
  1        15          7.       .0  4668.0 *  1    112       7.       .0  4668.0 *  1    209       91.      27.0  4693.9
  1        16          7.       .0  4668.0 *  1    113       7.       .0  4668.0 *  1    210       91.      26.6  4693.8
  1        17          7.       .0  4668.0 *  1    114       7.       .0  4668.0 *  1    211       90.      26.2  4693.6
  1        18          7.       .0  4668.0 *  1    115       7.       .0  4668.0 *  1    212       90.      25.8  4693.5
  1        19          7.       .0  4668.0 *  1    116       7.       .0  4668.0 *  1    213       90.      25.4  4693.3
  1        20          7.       .0  4668.0 *  1    117       7.       .0  4668.0 *  1    214       90.      25.1  4693.2
  1        21          7.       .0  4668.0 *  1    118       7.       .0  4668.0 *  1    215       89.      24.7  4693.1
  1        22          7.       .0  4668.0 *  1    119       7.       .0  4668.0 *  1    216       89.      24.3  4692.9
  1        23          7.       .0  4668.0 *  1    120       7.       .0  4668.0 *  1    217       89.      23.9  4692.8
  1        24          7.       .0  4668.0 *  1    121       7.       .0  4668.0 *  1    218       89.      23.5  4692.7
  1        25          7.       .0  4668.0 *  1    122       7.       .0  4668.0 *  1    219       89.      23.1  4692.5
  1        26          7.       .0  4668.0 *  1    123       7.       .0  4668.0 *  1    220       88.      22.7  4692.4
  1        27          7.       .0  4668.0 *  1    124       7.       .0  4668.0 *  1    221       88.      22.4  4692.2
  1        28          7.       .0  4668.0 *  1    125       7.       .0  4668.0 *  1    222       88.      22.0  4692.1
  1        29          7.       .0  4668.0 *  1    126       7.       .0  4668.0 *  1    223       88.      21.6  4691.9
  1        30          7.       .0  4668.0 *  1    127       8.       .0  4668.0 *  1    224       87.      21.2  4691.8
  1        31          7.       .0  4668.0 *  1    128       9.       .0  4668.0 *  1    225       87.      20.8  4691.6
  1        32          7.       .0  4668.0 *  1    129      10.       .0  4668.0 *  1    226       87.      20.3  4691.4
  1        33          7.       .0  4668.0 *  1    130      11.       .0  4668.0 *  1    227       86.      19.9  4691.2
  1        34          7.       .0  4668.0 *  1    131      12.       .0  4668.0 *  1    228       86.      19.5  4691.1
  1        35          7.       .0  4668.0 *  1    132      14.       .0  4668.0 *  1    229       86.      19.1  4690.9
  1        36          7.       .0  4668.0 *  1    133      16.       .0  4668.0 *  1    230       85.      18.7  4690.7
  1        37          7.       .0  4668.0 *  1    134      18.       .0  4668.1 *  1    231       85.      18.3  4690.5
  1        38          7.       .0  4668.0 *  1    135      21.       .0  4668.4 *  1    232       85.      17.9  4690.4
  1        39          7.       .0  4668.0 *  1    136      23.       .0  4668.8 *  1    233       84.      17.5  4690.2
  1        40          7.       .0  4668.0 *  1    137      26.       .0  4669.2 *  1    234       84.      17.1  4690.0
  1        41          7.       .0  4668.0 *  1    138      29.       .0  4669.8 *  1    235       84.      16.8  4689.8
  1        42          7.       .0  4668.0 *  1    139      31.       .1  4670.1 *  1    236       83.      16.4  4689.6
  1        43          7.       .0  4668.0 *  1    140      33.       .1  4670.5 *  1    237       83.      16.0  4689.4
  1        44          7.       .0  4668.0 *  1    141      35.       .2  4671.1 *  1    238       83.      15.6  4689.2
  1        45          7.       .0  4668.0 *  1    142      39.       .3  4672.1 *  1    239       82.      15.2  4689.0
  1        46          7.       .0  4668.0 *  1    143      43.       .5  4673.0 *  1    240       82.      14.8  4688.8
  1        47          7.       .0  4668.0 *  1    144      48.      1.0  4674.6 *  1    241       82.      14.5  4688.6
  1        48          7.       .0  4668.0 *  1    145      55.      2.0  4676.7 *  1    242       81.      14.1  4688.4
  1        49          7.       .0  4668.0 *  1    146      63.      3.8  4679.7 *  1    243       81.      13.7  4688.3
  1        50          7.       .0  4668.0 *  1    147      71.      6.8  4683.2 *  1    244       80.      13.3  4688.1
  1        51          7.       .0  4668.0 *  1    148      77.     10.7  4686.4 *  1    245       80.      12.9  4687.8
```

```
  1      55      7.       .0  4668.0 *  1      152      90.      26.3  4693.6 *  1      249      78.      11.4  4686.8
  1      56      7.       .0  4668.0 *  1      153      92.      29.0  4694.6 *  1      250      78.      11.0  4686.6
  1      57      7.       .0  4668.0 *  1      154      93.      31.1  4695.4 *  1      251      77.      10.6  4686.3
  1      58      7.       .0  4668.0 *  1      155      94.      32.9  4696.0 *  1      252      77.      10.2  4686.1
  1      59      7.       .0  4668.0 *  1      156      95.      34.3  4696.4 *  1      253      76.       9.9  4685.8
  1      60      7.       .0  4668.0 *  1      157      96.      35.4  4696.8 *  1      254      75.       9.5  4685.5
  1      61      7.       .0  4668.0 *  1      158      96.      36.3  4697.0 *  1      255      75.       9.1  4685.2
  1      62      7.       .0  4668.0 *  1      159      96.      37.1  4697.3 *  1      256      74.       8.7  4684.9
  1      63      7.       .0  4668.0 *  1      160      97.      37.7  4697.5 *  1      257      74.       8.4  4684.6
  1      64      7.       .0  4668.0 *  1      161      97.      38.2  4697.6 *  1      258      73.       8.0  4684.3
  1      65      7.       .0  4668.0 *  1      162      97.      38.6  4697.7 *  1      259      72.       7.6  4684.0
  1      66      7.       .0  4668.0 *  1      163      97.      38.8  4697.8 *  1      260      72.       7.3  4683.7
  1      67      7.       .0  4668.0 *  1      164      97.      39.1  4697.9 *  1      261      71.       6.9  4683.3
  1      68      7.       .0  4668.0 *  1      165      98.      39.2  4697.9 *  1      262      70.       6.6  4683.0
  1      69      7.       .0  4668.0 *  1      166      98.      39.3  4697.9 *  1      263      69.       6.2  4682.7
  1      70      7.       .0  4668.0 *  1      167      98.      39.3  4698.0 *  1      264      69.       5.9  4682.3
  1      71      7.       .0  4668.0 *  1      168      98.      39.3  4698.0 *  1      265      68.       5.6  4682.0
  1      72      7.       .0  4668.0 *  1      169      98.      39.3  4697.9 *  1      266      67.       5.3  4681.6
  1      73      7.       .0  4668.0 *  1      170      98.      39.2  4697.9 *  1      267      66.       4.9  4681.2
  1      74      7.       .0  4668.0 *  1      171      97.      39.1  4697.9 *  1      268      65.       4.6  4680.8
  1      75      7.       .0  4668.0 *  1      172      97.      39.0  4697.8 *  1      269      64.       4.3  4680.4
  1      76      7.       .0  4668.0 *  1      173      97.      38.8  4697.8 *  1      270      63.       4.0  4680.0
  1      77      7.       .0  4668.0 *  1      174      97.      38.6  4697.7 *  1      271      62.       3.7  4679.6
  1      78      7.       .0  4668.0 *  1      175      97.      38.4  4697.7 *  1      272      61.       3.5  4679.2
  1      79      7.       .0  4668.0 *  1      176      97.      38.2  4697.6 *  1      273      60.       3.2  4678.8
  1      80      7.       .0  4668.0 *  1      177      97.      38.0  4697.5 *  1      274      59.       2.9  4678.4
  1      81      7.       .0  4668.0 *  1      178      97.      37.8  4697.5 *  1      275      58.       2.6  4678.0
  1      82      7.       .0  4668.0 *  1      179      97.      37.5  4697.4 *  1      276      57.       2.4  4677.5
  1      83      7.       .0  4668.0 *  1      180      97.      37.2  4697.3 *  1      277      56.       2.1  4677.1
  1      84      7.       .0  4668.0 *  1      181      96.      36.9  4697.2 *  1      278      54.       1.9  4676.6
  1      85      7.       .0  4668.0 *  1      182      96.      36.6  4697.1 *  1      279      53.       1.7  4676.2
  1      86      7.       .0  4668.0 *  1      183      96.      36.3  4697.0 *  1      280      52.       1.5  4675.7
  1      87      7.       .0  4668.0 *  1      184      96.      36.0  4696.9 *  1      281      50.       1.3  4675.2
  1      88      7.       .0  4668.0 *  1      185      96.      35.7  4696.8 *  1      282      49.       1.1  4674.7
  1      89      7.       .0  4668.0 *  1      186      96.      35.3  4696.7 *  1      283      47.        .9  4674.2
  1      90      7.       .0  4668.0 *  1      187      95.      35.0  4696.6 *  1      284      45.        .7  4673.7
  1      91      7.       .0  4668.0 *  1      188      95.      34.7  4696.5 *  1      285      43.        .5  4673.0
  1      92      7.       .0  4668.0 *  1      189      95.      34.3  4696.4 *  1      286      41.        .4  4672.4
  1      93      7.       .0  4668.0 *  1      190      95.      34.0  4696.3 *  1      287      38.        .3  4671.8
  1      94      7.       .0  4668.0 *  1      191      95.      33.6  4696.2 *  1      288      34.        .1  4670.9
  1      95      7.       .0  4668.0 *  1      192      95.      33.3  4696.1 *  2      289      31.        .1  4670.1
  1      96      7.       .0  4668.0 *  1      193      94.      32.9  4696.0 *
  1      97      7.       .0  4668.0 *  1      194      94.      32.5  4695.9 *
                                      *                                         *
*****************************************************************************************************************

    PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                           6-HR       24-HR       72-HR     24.00-HR
 +    (CFS)       (HR)
                               (CFS)
 +        98.     13.83                     94.         46.         46.          46.
                            (INCHES)       .722       1.410       1.410        1.410
                             (AC-FT)        47.         91.         91.          91.

   PEAK STORAGE   TIME                             MAXIMUM AVERAGE STORAGE
                                           6-HR       24-HR       72-HR     24.00-HR
 +   (AC-FT)      (HR)
          39.     13.83                     33.         11.         11.          11.

    PEAK STAGE    TIME                              MAXIMUM AVERAGE STAGE
                                           6-HR       24-HR       72-HR     24.00-HR
 +    (FEET)      (HR)
     4697.95      13.83                 4695.75     4679.02     4679.02      4679.02
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1                                                            STATION    DETEN

                                  (I) INFLOW,   (O) OUTFLOW
               0.        100.       200.       300.       400.       500.       600.       700.       800.         0.         0.         0.         0.
                                                                                                 (S) STORAGE
               0.          0.         0.         0.         0.         0.         0.        10.        20.        30.        40.         0.         0.
 DAHRMN PER
  10000  1I-O-------.----------.----------.----------.----------.----------S----------.----------.----------.----------.----------.----------.
   1  210          .          .          .          .          .          S          .          .          .          .          .          .
   1  310          .          .          .          .          .          S          .          .          .          .          .          .
   1  410          .          .          .          .          .          S          .          .          .          .          .          .
   1  510          .          .          .          .          .          S          .          .          .          .          .          .
   1  610          .          .          .          .          .          S          .          .          .          .          .          .
   1  710          .          .          .          .          .          S          .          .          .          .          .          .
   1  810          .          .          .          .          .          S          .          .          .          .          .          .
   1  910          .          .          .          .          .          S          .          .          .          .          .          .
   1 1010          .          .          .          .          .          S          .          .          .          .          .          .
   1 1110. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   1 1210          .          .          .          .          .          S          .          .          .          .          .          .
   1 1310          .          .          .          .          .          S          .          .          .          .          .          .
   1 1410          .          .          .          .          .          S          .          .          .          .          .          .
   1 1510          .          .          .          .          .          S          .          .          .          .          .          .
   1 1610          .          .          .          .          .          S          .          .          .          .          .          .
   1 1710          .          .          .          .          .          S          .          .          .          .          .          .
   1 1810          .          .          .          .          .          S          .          .          .          .          .          .
   1 1910          .          .          .          .          .          S          .          .          .          .          .          .
   1 2010          .          .          .          .          .          S          .          .          .          .          .          .
   1 2110. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   1 2210          .          .          .          .          .          S          .          .          .          .          .          .
   1 2310          .          .          .          .          .          S          .          .          .          .          .          .
   1 2410          .          .          .          .          .          S          .          .          .          .          .          .
   1 2510          .          .          .          .          .          S          .          .          .          .          .          .
   1 2610          .          .          .          .          .          S          .          .          .          .          .          .
   1 2710          .          .          .          .          .          S          .          .          .          .          .          .
   1 2810          .          .          .          .          .          S          .          .          .          .          .          .
   1 2910          .          .          .          .          .          S          .          .          .          .          .          .
   1 3010          .          .          .          .          .          S          .          .          .          .          .          .
   1 3110. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   1 3210          .          .          .          .          .          S          .          .          .          .          .          .
   1 3310          .          .          .          .          .          S          .          .          .          .          .          .
   1 3410          .          .          .          .          .          S          .          .          .          .          .          .
   1 3510          .          .          .          .          .          S          .          .          .          .          .          .
   1 3610          .          .          .          .          .          S          .          .          .          .          .          .
   1 3710          .          .          .          .          .          S          .          .          .          .          .          .
   1 3810          .          .          .          .          .          S          .          .          .          .          .          .
   1 3910          .          .          .          .          .          S          .          .          .          .          .          .
   1 4010          .          .          .          .          .          S          .          .          .          .          .          .
   1 4110. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   1 4210          .          .          .          .          .          S          .          .          .          .          .          .
   1 4310          .          .          .          .          .          S          .          .          .          .          .          .
   1 4410          .          .          .          .          .          S          .          .          .          .          .          .
   1 4510          .          .          .          .          .          S          .          .          .          .          .          .
   1 4610          .          .          .          .          .          S          .          .          .          .          .          .
   1 4710          .          .          .          .          .          S          .          .          .          .          .          .
   1 4810          .          .          .          .          .          S          .          .          .          .          .          .
   1 4910          .          .          .          .          .          S          .          .          .          .          .          .
   1 5010          .          .          .          .          .          S          .          .          .          .          .          .
   1 5110. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   1 5210          .          .          .          .          .          S          .          .          .          .          .          .
   1 5310          .          .          .          .          .          S          .          .          .          .          .          .
   1 5410          .          .          .          .          .          S          .          .          .          .          .          .
   1 5510          .          .          .          .          .          S          .          .          .          .          .          .
   1 5610          .          .          .          .          .          S          .          .          .          .          .          .
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1  59I0        .         .         .         .         .         S         .         .         .         .         .         .
1  60I0        .         .         .         .         .         S         .         .         .         .         .         .
1  61I0..........................................................S............................................................
1  62I0        .         .         .         .         .         S         .         .         .         .         .         .
1  63I0        .         .         .         .         .         S         .         .         .         .         .         .
1  64I0        .         .         .         .         .         S         .         .         .         .         .         .
1  65I0        .         .         .         .         .         S         .         .         .         .         .         .
1  66I0        .         .         .         .         .         S         .         .         .         .         .         .
1  67I0        .         .         .         .         .         S         .         .         .         .         .         .
1  68I0        .         .         .         .         .         S         .         .         .         .         .         .
1  69I0        .         .         .         .         .         S         .         .         .         .         .         .
1  70I0        .         .         .         .         .         S         .         .         .         .         .         .
1  71I0..........................................................S............................................................
1  72I0        .         .         .         .         .         S         .         .         .         .         .         .
1  73I0        .         .         .         .         .         S         .         .         .         .         .         .
1  74I0        .         .         .         .         .         S         .         .         .         .         .         .
1  75I0        .         .         .         .         .         S         .         .         .         .         .         .
1  76I0        .         .         .         .         .         S         .         .         .         .         .         .
1  77I0        .         .         .         .         .         S         .         .         .         .         .         .
1  78I0        .         .         .         .         .         S         .         .         .         .         .         .
1  79I0        .         .         .         .         .         S         .         .         .         .         .         .
1  80I0        .         .         .         .         .         S         .         .         .         .         .         .
1  81I0..........................................................S............................................................
1  82I0        .         .         .         .         .         S         .         .         .         .         .         .
1  83I0        .         .         .         .         .         S         .         .         .         .         .         .
1  84I0        .         .         .         .         .         S         .         .         .         .         .         .
1  85I0        .         .         .         .         .         S         .         .         .         .         .         .
1  86I0        .         .         .         .         .         S         .         .         .         .         .         .
1  87I0        .         .         .         .         .         S         .         .         .         .         .         .
1  88I0        .         .         .         .         .         S         .         .         .         .         .         .
1  89I0        .         .         .         .         .         S         .         .         .         .         .         .
1  90I0        .         .         .         .         .         S         .         .         .         .         .         .
1  91I0..........................................................S............................................................
1  92I0        .         .         .         .         .         S         .         .         .         .         .         .
1  93I0        .         .         .         .         .         S         .         .         .         .         .         .
1  94I0        .         .         .         .         .         S         .         .         .         .         .         .
1  95I0        .         .         .         .         .         S         .         .         .         .         .         .
1  96I0        .         .         .         .         .         S         .         .         .         .         .         .
1  97I0        .         .         .         .         .         S         .         .         .         .         .         .
1  98I0        .         .         .         .         .         S         .         .         .         .         .         .
1  99I0        .         .         .         .         .         S         .         .         .         .         .         .
1 100I0        .         .         .         .         .         S         .         .         .         .         .         .
1 101I0..........................................................S............................................................
1 102I0        .         .         .         .         .         S         .         .         .         .         .         .
1 103I0        .         .         .         .         .         S         .         .         .         .         .         .
1 104I0        .         .         .         .         .         S         .         .         .         .         .         .
1 105I0        .         .         .         .         .         S         .         .         .         .         .         .
1 106I0        .         .         .         .         .         S         .         .         .         .         .         .
1 107I0        .         .         .         .         .         S         .         .         .         .         .         .
1 108I0        .         .         .         .         .         S         .         .         .         .         .         .
1 109I0        .         .         .         .         .         S         .         .         .         .         .         .
1 110I0        .         .         .         .         .         S         .         .         .         .         .         .
1 111I0..........................................................S............................................................
1 112I0        .         .         .         .         .         S         .         .         .         .         .         .
1 113I0        .         .         .         .         .         S         .         .         .         .         .         .
1 114I0        .         .         .         .         .         S         .         .         .         .         .         .
1 115I0        .         .         .         .         .         S         .         .         .         .         .         .
1 116I0        .         .         .         .         .         S         .         .         .         .         .         .
1 117I0        .         .         .         .         .         S         .         .         .         .         .         .
1 118I0        .         .         .         .         .         S         .         .         .         .         .         .
1 119I0        .         .         .         .         .         S         .         .         .         .         .         .
1 120I0        .         .         .         .         .         S         .         .         .         .         .         .
1 121I0..........................................................S............................................................
1 122I0        .         .         .         .         .         S         .         .         .         .         .         .
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1 125.I        .         .         .         .         .         S         .         .         .         .         .         .
1 126.I        .         .         .         .         .         S         .         .         .         .         .         .
1 127.I        .         .         .         .         .         S         .         .         .         .         .         .
1 128.I        .         .         .         .         .         S         .         .         .         .         .         .
1 129.I        .         .         .         .         .         S         .         .         .         .         .         .
1 130.I        .         .         .         .         .         S         .         .         .         .         .         .
1 131.I. . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1 132.I        .         .         .         .         .         S         .         .         .         .         .         .
1 133. I       .         .         .         .         .         S         .         .         .         .         .         .
1 134. I       .         .         .         .         .         S         .         .         .         .         .         .
1 135. I       .         .         .         .         .         S         .         .         .         .         .         .
1 136. I       .         .         .         .         .         S         .         .         .         .         .         .
1 137.  I      .         .         .         .         .         S         .         .         .         .         .         .
1 138.  I      .         .         .         .         .         S         .         .         .         .         .         .
1 139.  0I     .         .         .         .         .         S         .         .         .         .         .         .
1 140.  0I     .         .         .         .         .         S         .         .         .         .         .         .
1 141. . 0I. . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1 142.   0 I   .         .         .         .         .         S         .         .         .         .         .         .
1 143.   0    I.         .         .         .         .         .S        .         .         .         .         .         .
1 144.    0    .   I     .         .         .         .         .S        .         .         .         .         .         .
1 145.    0    .         .   I     .         .         .         . S       .         .         .         .         .         .
1 146.     0   .         .         .         .I        .         .   S     .         .         .         .         .         .
1 147.      0  .         .         .         .         .        I.      S  .         .         .         .         .         .
1 148.       0 .         .         .         .         .         .         IS        .         .         .         .         .
1 149.       0 .         .         .         .         .         .         . I  S    .         .         .         .         .
1 150.        0.         .         .         .         .         .      I  .        S.         .         .         .         .
1 151. . . . .0. . . . . . . . . . . . . . . . . . . . . . . . . I . . . . . . . . . . .S. . . . . . . . . . . . . . . . . .
1 152.        0.         .         .         .         .I        .         .         .     S   .         .         .         .
1 153.        0.         .         .         .   I     .         .         .         .        S.         .         .         .
1 154.        0.         .         .       I .         .         .         .         .         .S        .         .         .
1 155.        0.         .         . I       .         .         .         .         .         .  S      .         .         .
1 156.         0         .       I .         .         .         .         .         .         .   S     .         .         .
1 157.         0         .   I     .         .         .         .         .         .         .    S    .         .         .
1 158.         0         . I       .         .         .         .         .         .         .     S   .         .         .
1 159.         0        I.         .         .         .         .         .         .         .      S  .         .         .
1 160.         0      I  .         .         .         .         .         .         .         .       S .         .         .
1 161. . . . . 0 . . I . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . .
1 162.         0    I    .         .         .         .         .         .         .         .        S.         .         .
1 163.         0  I      .         .         .         .         .         .         .         .        S.         .         .
1 164.         0 I       .         .         .         .         .         .         .         .        S.         .         .
1 165.         0I        .         .         .         .         .         .         .         .        S.         .         .
1 166.         0I        .         .         .         .         .         .         .         .        S.         .         .
1 167.         I         .         .         .         .         .         .         .         .        S.         .         .
1 168.        I0         .         .         .         .         .         .         .         .        S.         .         .
1 169.        I0         .         .         .         .         .         .         .         .        S.         .         .
1 170.       I 0         .         .         .         .         .         .         .         .        S.         .         .
1 171. . . . I 0 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . .
1 172.       I 0         .         .         .         .         .         .         .         .        S.         .         .
1 173.      I  0         .         .         .         .         .         .         .         .        S.         .         .
1 174.      I  0         .         .         .         .         .         .         .         .        S.         .         .
1 175.      I  0         .         .         .         .         .         .         .         .       S .         .         .
1 176.     I   0         .         .         .         .         .         .         .         .       S .         .         .
1 177.     I   0         .         .         .         .         .         .         .         .       S .         .         .
1 178.     I   0         .         .         .         .         .         .         .         .       S .         .         .
1 179.     I   0         .         .         .         .         .         .         .         .      S  .         .         .
1 180.     I   0         .         .         .         .         .         .         .         .      S  .         .         .
1 181. . . I . 0 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . .
1 182.    I    0         .         .         .         .         .         .         .         .      S  .         .         .
1 183.    I    0         .         .         .         .         .         .         .         .     S   .         .         .
1 184.    I    0         .         .         .         .         .         .         .         .     S   .         .         .
1 185.    I    0         .         .         .         .         .         .         .         .     S   .         .         .
1 186.    I    0         .         .         .         .         .         .         .         .    S    .         .         .
1 187.    I    0         .         .         .         .         .         .         .         .    S    .         .         .
1 188.    I    0         .         .         .         .         .         .         .         .    S    .         .         .
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1 191. . I . . 0. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . .
1 192.    I    0.         .         .         .         .         .         .         .         .  S      .         .         .
1 193.    I    0.         .         .         .         .         .         .         .         .  S      .         .         .
1 194.    I    0.         .         .         .         .         .         .         .         .  S      .         .         .
1 195.    I    0.         .         .         .         .         .         .         .         . S       .         .         .
1 196.    I    0.         .         .         .         .         .         .         .         . S       .         .         .
1 197.    I    0.         .         .         .         .         .         .         .         .S        .         .         .
1 198.    I    0.         .         .         .         .         .         .         .         .S        .         .         .
1 199.    I    0.         .         .         .         .         .         .         .         .S        .         .         .
1 200.    I    0.         .         .         .         .         .         .         .         S         .         .         .
1 201. . I . . 0. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . . . .
1 202.    I    0.         .         .         .         .         .         .         .         S         .         .         .
1 203.    I    0.         .         .         .         .         .         .         .        S.         .         .         .
1 204.    I    0.         .         .         .         .         .         .         .        S.         .         .         .
1 205.    I    0.         .         .         .         .         .         .         .        S.         .         .         .
1 206.    I    0.         .         .         .         .         .         .         .       S .         .         .         .
1 207.    I    0.         .         .         .         .         .         .         .       S .         .         .         .
1 208.    I    0.         .         .         .         .         .         .         .      S  .         .         .         .
1 209.   I     0.         .         .         .         .         .         .         .      S  .         .         .         .
1 210.   I     0.         .         .         .         .         .         .         .      S  .         .         .         .
1 211.  .I. . .0. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . . . . . .
1 212.   I     0.         .         .         .         .         .         .         .     S   .         .         .         .
1 213.   I     0.         .         .         .         .         .         .         .    S    .         .         .         .
1 214.   I     0.         .         .         .         .         .         .         .    S    .         .         .         .
1 215.   I     0.         .         .         .         .         .         .         .    S    .         .         .         .
1 216.   I     0.         .         .         .         .         .         .         .   S     .         .         .         .
1 217.   I     0.         .         .         .         .         .         .         .   S     .         .         .         .
1 218.   I     0.         .         .         .         .         .         .         .   S     .         .         .         .
1 219.   I     0.         .         .         .         .         .         .         .  S      .         .         .         .
1 220.   I     0.         .         .         .         .         .         .         .  S      .         .         .         .
1 221.  .I. . .0. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . . . . . . . .
1 222.   I     0.         .         .         .         .         .         .         . S       .         .         .         .
1 223.   I     0.         .         .         .         .         .         .         . S       .         .         .         .
1 224.   I     0.         .         .         .         .         .         .         .S        .         .         .         .
1 225.   I     0.         .         .         .         .         .         .         .S        .         .         .         .
1 226.   I     0.         .         .         .         .         .         .         S         .         .         .         .
1 227.   I     0.         .         .         .         .         .         .         S         .         .         .         .
1 228.   I     0.         .         .         .         .         .         .         S         .         .         .         .
1 229.   I     0.         .         .         .         .         .         .        S.         .         .         .         .
1 230.   I     0.         .         .         .         .         .         .        S.         .         .         .         .
1 231.  .I. . .0. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . . . . . . . . . .
1 232.   I   0 .          .         .         .         .         .         .       S .         .         .         .         .
1 233.   I   0 .          .         .         .         .         .         .       S .         .         .         .         .
1 234.   I   0 .          .         .         .         .         .         .      S  .         .         .         .         .
1 235.   I   0 .          .         .         .         .         .         .      S  .         .         .         .         .
1 236.   I   0 .          .         .         .         .         .         .     S   .         .         .         .         .
1 237.   I   0 .          .         .         .         .         .         .     S   .         .         .         .         .
1 238.   I   0 .          .         .         .         .         .         .     S   .         .         .         .         .
1 239.   I   0 .          .         .         .         .         .         .    S    .         .         .         .         .
1 240.   I   0 .          .         .         .         .         .         .    S    .         .         .         .         .
1 241.  .I. .0. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . S . . . . . . . . . . . . . . . . . . . . . . .
1 242.   I   0 .          .         .         .         .         .         .   S     .         .         .         .         .
1 243.   I   0 .          .         .         .         .         .         .   S     .         .         .         .         .
1 244.   I   0 .          .         .         .         .         .         .  S      .         .         .         .         .
1 245.  I    0 .          .         .         .         .         .         .  S      .         .         .         .         .
1 246.  I    0 .          .         .         .         .         .         .  S      .         .         .         .         .
1 247.  I    0 .          .         .         .         .         .         . S       .         .         .         .         .
1 248.  I    0 .          .         .         .         .         .         . S       .         .         .         .         .
1 249.  I    0 .          .         .         .         .         .         .S        .         .         .         .         .
1 250.  I    0 .          .         .         .         .         .         .S        .         .         .         .         .
1 251.  I . .0. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .S. . . . . . . . . . . . . . . . . . . . . . . .
1 252.  I    0 .          .         .         .         .         .         S         .         .         .         .         .
1 253.  I    0 .          .         .         .         .         .         S         .         .         .         .         .
1 254.  I    0 .          .         .         .         .         .        S.         .         .         .         .         .
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1 257. I    O  .         .         .         .         .         .       S .         .         .         .         .         .
1 258. I    O  .         .         .         .         .         .       S .         .         .         .         .         .
1 259. I    O  .         .         .         .         .         .       S .         .         .         .         .         .
1 260. I    O  .         .         .         .         .         .      S  .         .         .         .         .         .
1 261. I . .O...........................................................S.....................................................
1 262. I    O  .         .         .         .         .         .      S  .         .         .         .         .         .
1 263. I    O  .         .         .         .         .         .     S   .         .         .         .         .         .
1 264. I    O  .         .         .         .         .         .     S   .         .         .         .         .         .
1 265. I    O  .         .         .         .         .         .     S   .         .         .         .         .         .
1 266. I    O  .         .         .         .         .         .    S    .         .         .         .         .         .
1 267. I    O  .         .         .         .         .         .    S    .         .         .         .         .         .
1 268. I    O  .         .         .         .         .         .    S    .         .         .         .         .         .
1 269. I   O   .         .         .         .         .         .   S     .         .         .         .         .         .
1 270. I   O   .         .         .         .         .         .   S     .         .         .         .         .         .
1 271. I . O.........................................................S........................................................
1 272. I   O   .         .         .         .         .         .  S      .         .         .         .         .         .
1 273. I   O   .         .         .         .         .         .  S      .         .         .         .         .         .
1 274. I   O   .         .         .         .         .         .  S      .         .         .         .         .         .
1 275. I   O   .         .         .         .         .         .  S      .         .         .         .         .         .
1 276. I   O   .         .         .         .         .         . S       .         .         .         .         .         .
1 277. I   O   .         .         .         .         .         . S       .         .         .         .         .         .
1 278. I  O    .         .         .         .         .         . S       .         .         .         .         .         .
1 279. I  O    .         .         .         .         .         . S       .         .         .         .         .         .
1 280. I  O    .         .         .         .         .         .S        .         .         .         .         .         .
1 281. I .O.......................................................S...........................................................
1 282. I  O    .         .         .         .         .         .S        .         .         .         .         .         .
1 283. I  O    .         .         .         .         .         .S        .         .         .         .         .         .
1 284. I  O    .         .         .         .         .         .S        .         .         .         .         .         .
1 285. I O     .         .         .         .         .         .S        .         .         .         .         .         .
1 286. I O     .         .         .         .         .         S         .         .         .         .         .         .
1 287. I O     .         .         .         .         .         S         .         .         .         .         .         .
1 288. IO      .         .         .         .         .         S         .         .         .         .         .         .
2 289.-IO------.---------.---------.---------.---------.---------S---------.---------.---------.---------.---------.---------.



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


           **************
           *            *
 99 KK     *    COMB    *
           *            *
           **************

102 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           1  PRINT CONTROL
                      IPLOT           2  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

101 HC          HYDROGRAPH COMBINATION
                      ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                              ***

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

                                                       HYDROGRAPH AT STATION     COMB
                                                            SUM OF  2 HYDROGRAPHS

*******************************************************************************************************************************
                                  *                                *                                *
   DA MON HRMN  ORD        FLOW   *   DA MON HRMN  ORD        FLOW *   DA MON HRMN  ORD        FLOW *   DA MON HRMN  ORD        FLOW
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```
 1     2    17.  *  1     75    7.  *  1    148   287.  *  1    221   103.
 1     3    14.  *  1     76    7.  *  1    149   330.  *  1    222   102.
 1     4    12.  *  1     77    7.  *  1    150   354.  *  1    223   102.
 1     5    10.  *  1     78    7.  *  1    151   360.  *  1    224   101.
 1     6     9.  *  1     79    7.  *  1    152   351.  *  1    225   101.
 1     7     8.  *  1     80    7.  *  1    153   333.  *  1    226   100.
 1     8     8.  *  1     81    7.  *  1    154   308.  *  1    227   100.
 1     9     8.  *  1     82    7.  *  1    155   282.  *  1    228    99.
 1    10     7.  *  1     83    7.  *  1    156   258.  *  1    229    99.
 1    11     7.  *  1     84    7.  *  1    157   240.  *  1    230    98.
 1    12     7.  *  1     85    7.  *  1    158   224.  *  1    231    98.
 1    13     7.  *  1     86    7.  *  1    159   210.  *  1    232    98.
 1    14     7.  *  1     87    7.  *  1    160   199.  *  1    233    97.
 1    15     7.  *  1     88    7.  *  1    161   187.  *  1    234    97.
 1    16     7.  *  1     89    7.  *  1    162   178.  *  1    235    97.
 1    17     7.  *  1     90    7.  *  1    163   171.  *  1    236    96.
 1    18     7.  *  1     91    7.  *  1    164   165.  *  1    237    96.
 1    19     7.  *  1     92    7.  *  1    165   160.  *  1    238    96.
 1    20     7.  *  1     93    7.  *  1    166   155.  *  1    239    95.
 1    21     7.  *  1     94    7.  *  1    167   151.  *  1    240    95.
 1    22     7.  *  1     95    7.  *  1    168   147.  *  1    241    94.
 1    23     7.  *  1     96    7.  *  1    169   144.  *  1    242    94.
 1    24     7.  *  1     97    7.  *  1    170   141.  *  1    243    93.
 1    25     7.  *  1     98    7.  *  1    171   139.  *  1    244    93.
 1    26     7.  *  1     99    7.  *  1    172   137.  *  1    245    92.
 1    27     7.  *  1    100    7.  *  1    173   135.  *  1    246    91.
 1    28     7.  *  1    101    7.  *  1    174   133.  *  1    247    90.
 1    29     7.  *  1    102    7.  *  1    175   131.  *  1    248    90.
 1    30     7.  *  1    103    7.  *  1    176   129.  *  1    249    89.
 1    31     7.  *  1    104    7.  *  1    177   128.  *  1    250    88.
 1    32     7.  *  1    105    7.  *  1    178   126.  *  1    251    88.
 1    33     7.  *  1    106    7.  *  1    179   125.  *  1    252    87.
 1    34     7.  *  1    107    7.  *  1    180   124.  *  1    253    87.
 1    35     7.  *  1    108    7.  *  1    181   122.  *  1    254    86.
 1    36     7.  *  1    109    7.  *  1    182   121.  *  1    255    85.
 1    37     7.  *  1    110    7.  *  1    183   121.  *  1    256    85.
 1    38     7.  *  1    111    7.  *  1    184   120.  *  1    257    84.
 1    39     7.  *  1    112    7.  *  1    185   119.  *  1    258    83.
 1    40     7.  *  1    113    8.  *  1    186   118.  *  1    259    83.
 1    41     7.  *  1    114    8.  *  1    187   118.  *  1    260    82.
 1    42     7.  *  1    115    8.  *  1    188   117.  *  1    261    81.
 1    43     7.  *  1    116    8.  *  1    189   117.  *  1    262    81.
 1    44     7.  *  1    117    8.  *  1    190   116.  *  1    263    80.
 1    45     7.  *  1    118    8.  *  1    191   116.  *  1    264    79.
 1    46     7.  *  1    119    9.  *  1    192   115.  *  1    265    78.
 1    47     7.  *  1    120    9.  *  1    193   114.  *  1    266    78.
 1    48     7.  *  1    121    9.  *  1    194   114.  *  1    267    77.
 1    49     7.  *  1    122   10.  *  1    195   113.  *  1    268    76.
 1    50     7.  *  1    123   10.  *  1    196   113.  *  1    269    75.
 1    51     7.  *  1    124   10.  *  1    197   113.  *  1    270    74.
 1    52     7.  *  1    125   10.  *  1    198   112.  *  1    271    73.
 1    53     7.  *  1    126   11.  *  1    199   112.  *  1    272    72.
 1    54     7.  *  1    127   11.  *  1    200   112.  *  1    273    71.
 1    55     7.  *  1    128   12.  *  1    201   111.  *  1    274    70.
 1    56     7.  *  1    129   13.  *  1    202   111.  *  1    275    69.
 1    57     7.  *  1    130   14.  *  1    203   111.  *  1    276    68.
 1    58     7.  *  1    131   15.  *  1    204   110.  *  1    277    67.
 1    59     7.  *  1    132   17.  *  1    205   110.  *  1    278    66.
 1    60     7.  *  1    133   19.  *  1    206   109.  *  1    279    64.
 1    61     7.  *  1    134   22.  *  1    207   109.  *  1    280    63.
 1    62     7.  *  1    135   25.  *  1    208   108.  *  1    281    62.
 1    63     7.  *  1    136   28.  *  1    209   108.  *  1    282    61.
 1    64     7.  *  1    137   32.  *  1    210   107.  *  1    283    59.
 1    65     7.  *  1    138   37.  *  1    211   107.  *  1    284    58.
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   1      68      7.   *   1     141     52.   *   1     214    106.   *   1     287     52.
   1      69      7.   *   1     142     61.   *   1     215    105.   *   1     288     49.
   1      70      7.   *   1     143     75.   *   1     216    105.   *   2     289     46.
   1      71      7.   *   1     144     98.   *   1     217    105.   *
   1      72      7.   *   1     145    135.   *   1     218    104.   *
   1      73      7.   *   1     146    185.   *   1     219    104.   *
                                *                                *                                *
 ******************************************************************************************************************************

    PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR       72-HR     24.00-HR
 +   (CFS)        (HR)
                               (CFS)
 +     360.      12.50                   156.         66.         66.          66.
                            (INCHES)     .820       1.380       1.380        1.380
                             (AC-FT)      77.        130.        130.         130.

                            CUMULATIVE AREA =    1.77 SQ MI

 1                                                               STATION     COMB

                             (O) OUTFLOW
         0.       40.       80.      120.      160.      200.      240.      280.      320.      360.        0.        0.        0.
DAHRMN PER
 10000  1.---O-----.---------.---------.---------.---------.---------.---------.---------.---------.---------.---------.---------.
 1   2.   O     .         .         .         .         .         .         .         .         .         .         .         .
 1   3.   O     .         .         .         .         .         .         .         .         .         .         .         .
 1   4.  O      .         .         .         .         .         .         .         .         .         .         .         .
 1   5. O       .         .         .         .         .         .         .         .         .         .         .         .
 1   6. O       .         .         .         .         .         .         .         .         .         .         .         .
 1   7. O       .         .         .         .         .         .         .         .         .         .         .         .
 1   8. O       .         .         .         .         .         .         .         .         .         .         .         .
 1   9. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  10. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  11. O.....................................................................................................................
 1  12. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  13. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  14. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  15. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  16. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  17. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  18. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  19. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  20. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  21. O.....................................................................................................................
 1  22. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  23. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  24. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  25. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  26. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  27. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  28. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  29. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  30. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  31. O.....................................................................................................................
 1  32. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  33. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  34. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  35. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  36. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  37. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  38. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  39. O       .         .         .         .         .         .         .         .         .         .         .         .
 1  40. O       .         .         .         .         .         .         .         .         .         .         .         .
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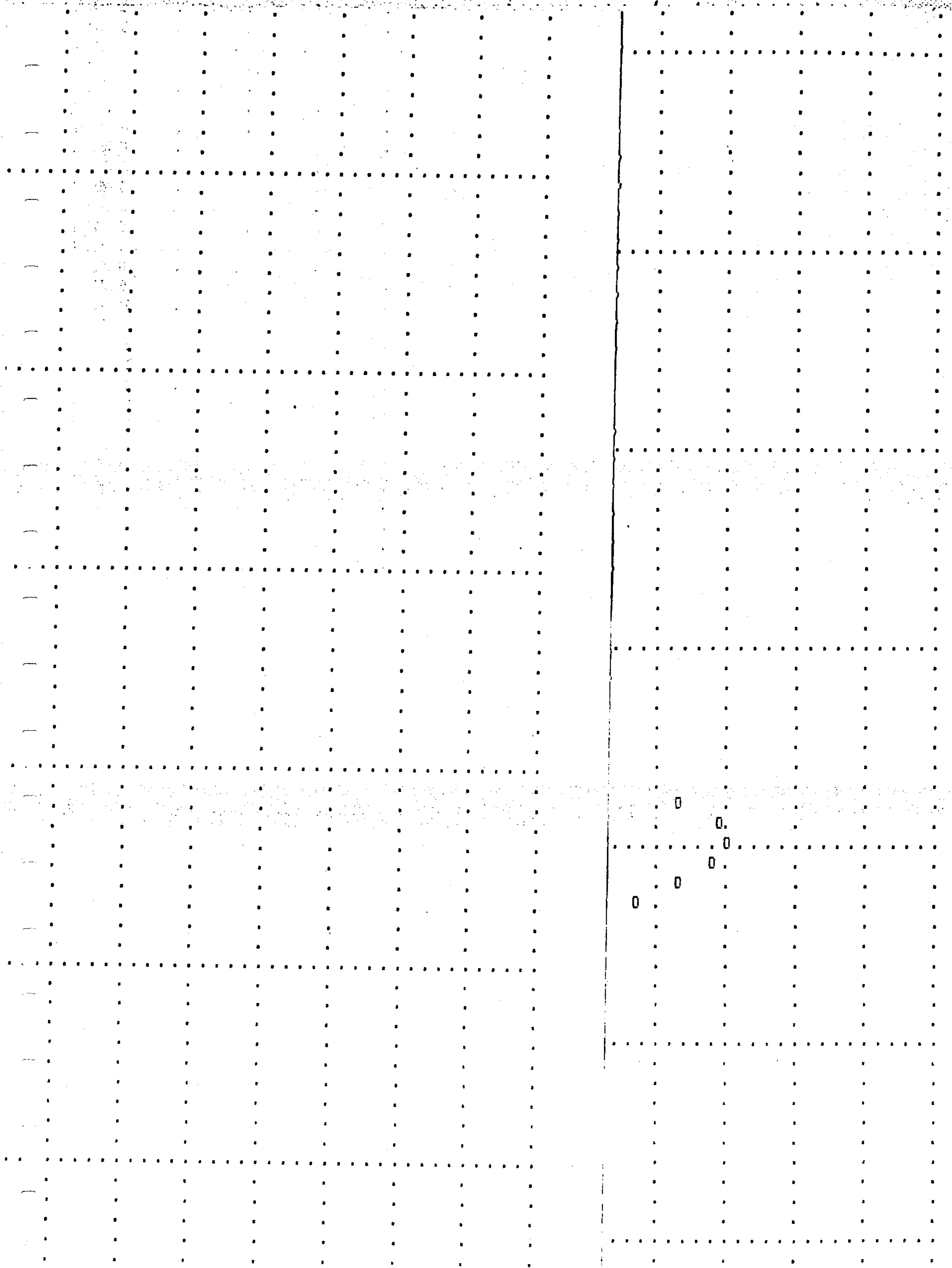

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1 175.          .         .         . 0       .         .         .         .         .         .         .         .         .
1 176.          .         .         . 0       .         .         .         .         .         .         .         .         .
1 177.          .         .         . 0       .         .         .         .         .         .         .         .         .
1 178.          .         .         . 0       .         .         .         .         .         .         .         .         .
1 179.          .         .         .0        .         .         .         .         .         .         .         .         .
1 180.          .         .         .0        .         .         .         .         .         .         .         .         .
1 181. . . . . . . . . . . . . . . .0. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1 182.          .         .         0         .         .         .         .         .         .         .         .         .
1 183.          .         .         0         .         .         .         .         .         .         .         .         .
1 184.          .         .         0         .         .         .         .         .         .         .         .         .
1 185.          .         .         0         .         .         .         .         .         .         .         .         .
1 186.          .         .         0         .         .         .         .         .         .         .         .         .
1 187.          .         .        0.         .         .         .         .         .         .         .         .         .
1 188.          .         .        0.         .         .         .         .         .         .         .         .         .
1 189.          .         .        0.         .         .         .         .         .         .         .         .         .
1 190.          .         .        0.         .         .         .         .         .         .         .         .         .
1 191. . . . . . . . . . . . . . .0. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
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                                                       RUNOFF SUMMARY
                                                FLOW IN CUBIC FEET PER SECOND
                                             TIME IN HOURS,  AREA IN SQUARE MILES


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


              HYDROGRAPH AT
+                              PLUM1    240.    12.17           41.         13.         13.          .35

              HYDROGRAPH AT
+                              PLUM2    150.    12.17           23.          7.          7.          .20
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+                      COMB      389.   12.17        64.        20.        20.        .55

          ROUTED TO
+                      ROUTE     382.   12.25        64.        20.        20.        .55

          HYDROGRAPH AT
+                      PLUM3     178.   12.17        30.         9.         9.        .26

          2 COMBINED AT
+                      COMB      558.   12.25        95.        29.        29.        .81

          ROUTED TO
+                      ROUTE     541.   12.25        95.        29.        29.        .81

          HYDROGRAPH AT
+                      PLUM4     195.   12.42        47.        14.        14.        .40

          2 COMBINED AT
+                      COMB      724.   12.33       142.        43.        43.       1.21

          ROUTED TO
+                      DETEN      98.   13.83        94.        46.        46.       1.21
+                                                                                              4697.95      13.83

          ROUTED TO
+                      ROUTE      98.   14.00        94.        46.        46.       1.21

          HYDROGRAPH AT
+                      PLUM5      63.   12.42        15.         5.         5.        .13

          2 COMBINED AT
+                      COMB      147.   12.58       107.        50.        50.       1.34

          HYDROGRAPH AT
+                      PLUM6     135.   12.42        32.        10.        10.        .27

          ROUTED TO
+                      ROUTE     134.   12.50        32.        10.        10.        .27

          HYDROGRAPH AT
+                      PLUM7      49.   12.42        12.         4.         4.        .10

          2 COMBINED AT
+                      COMB      183.   12.50        43.        13.        13.        .37

          2 COMBINED AT
+                      COMB      330.   12.50       149.        64.        64.       1.71

          HYDROGRAPH AT
+                      PLUM8      31.   12.42         7.         2.         2.        .06

          2 COMBINED AT
+                      COMB      360.   12.50       156.        66.        66.       1.77


*** NORMAL END OF HEC-1 ***
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APPENDIX C

COST ESTIMATES

TABLE E

ENGINEERS COST ESTIMATE KENNEDY/JENKS/CHILTON

CLIENT: City of Reno
PROJECT:Plumas/Moana Storm Drain OPTION 4 DATE: 22 Feb 89
ESTIMATE: Preliminary K/J/C Job # 877041.00

ITEM NO	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
1	Mobilization	1.00	L.S.	$10,000.00	$10,000.00
2	Traffic Control	1.00	L.S.	$50,000.00	$50,000.00
3	24 inch Dia. RCP, Cl III	1250.00	L.F.	$24.00	$30,000.00
4	36 inch Dia. RCP, Cl III	1420.00	L.F.	$44.00	$62,480.00
5	48 inch Dia. RCP, Cl III	300.00	L.F.	$76.00	$22,800.00
6	60 inch Dia. RCP, Cl III	740.00	L.F.	$100.00	$74,000.00
7	66 inch Dia. RCP, Cl III		L.F.	$130.00	$0.00
8	78 inch Dia. RCP, Cl II	480.00	L.F.	$210.00	$100,800.00
9	84 inch Dia. RCP, Cl II	650.00	L.F.	$230.00	$149,500.00
10	96 inch Dia. RCP, Cl II		L.F.	$280.00	$0.00
11	Standard S.D. Manholes	11.00	Each	$1,850.00	$20,350.00
12	Special S.D. Manholes	3.00	Each	$3,000.00	$9,000.00
13	Special Hydraulic Structures	3.00	Each	$15,000.00	$45,000.00
14	Drop Inlets, Type 2A	16.00	Each	$2,000.00	$32,000.00
15	Special Drop Inlets, 10' Openings	3.00	Each	$5,000.00	$15,000.00
16	Special Drop Inlets, 20' Openings	1.00	Each	$7,000.00	$7,000.00
17	Concrete Lined Ditch Concrete	250.00	C.Y.	$345.00	$86,250.00
18	Concrete Lined Ditch Exc. & Emb.	1000.00	C.Y.	$10.00	$10,000.00
19	Partial Removal of Conc. Lined Ditch	500.00	L.F.	$2.50	$1,250.00
20	10 inch Dia. PVC Sanitary Sewer	550.00	L.F.	$18.00	$9,900.00
21	12 inch Dia. PVC Sanitary Sewer	650.00	L.F.	$21.50	$13,975.00
22	Sanitary Sewer Manholes	5.00	Each	$1,500.00	$7,500.00
23	Trench Excavation	14500.00	C.Y.	$8.50	$123,250.00
24	Trench Shoring	4840.00	L.F.	$10.00	$48,400.00
25	Granular Backfill	7300.00	C.Y.	$12.50	$91,250.00
26	Native Backfill	4500.00	C.Y.	$6.00	$27,000.00
27	Sawcut Existing Pavement	11500.00	L.F.	$1.50	$17,250.00
28	Remove Existing Pavement	41000.00	S.F.	$0.50	$20,500.00
29	Pavement Patching, 4" A.C. on 6" A.B.	41000.00	S.F.	$1.20	$49,200.00
30	Remove Existing Storm Drain Manholes	5.00	Each	$500.00	$2,500.00
31	Remove Existing Drop Inlets	12.00	Each	$250.00	$3,000.00
32	Golf Course Exc. & Emb.	35000.00	C.Y.	$4.00	$140,000.00
33	Golf Course Fairway Sod	90000.00	S.F.	$0.40	$36,000.00
		COLUMN TOTALS			$1,315,155.00
		CONTINGENCY @ 20%			$263,031.00
		TOTAL PROJECT COST			$1,578,186.00

TABLE G

ENGINEERS COST ESTIMATE KENNEDY/JENKS/CHILTON

CLIENT: City of Reno
PROJECT:Plumas/Moana Storm Drain OPTION 6 DATE: 22 Feb 89
ESTIMATE: Preliminary K/J/C Job # 877041.00

ITEM NO	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
1	Mobilization	1.00	L.S.	$10,000.00	$10,000.00
2	Traffic Control	1.00	L.S.	$50,000.00	$50,000.00
3	24 inch Dia. RCP, Cl III	1250.00	L.F.	$24.00	$30,000.00
4	36 inch Dia. RCP, Cl III		L.F.	$44.00	$0.00
5	48 inch Dia. RCP, Cl III	300.00	L.F.	$76.00	$22,800.00
6	60 inch Dia. RCP, Cl III	1420.00	L.F.	$100.00	$142,000.00
7	66 inch Dia. RCP, Cl III	300.00	L.F.	$130.00	$39,000.00
8	78 inch Dia. RCP, Cl II		L.F.	$210.00	$0.00
9	84 inch Dia. RCP, Cl II		L.F.	$230.00	$0.00
10	96 inch Dia. RCP, Cl II	1130.00	L.F.	$280.00	$316,400.00
11	Standard S.D. Manholes	11.00	Each	$1,850.00	$20,350.00
12	Special S.D. Manholes	3.00	Each	$3,000.00	$9,000.00
13	Special Hydraulic Structures	3.00	Each	$15,000.00	$45,000.00
14	Drop Inlets, Type 2A	16.00	Each	$2,000.00	$32,000.00
15	Special Drop Inlets, 10' Openings	3.00	Each	$5,000.00	$15,000.00
16	Special Drop Inlets, 20' Openings	1.00	Each	$7,000.00	$7,000.00
17	Concrete Lined Ditch Concrete	250.00	C.Y.	$345.00	$86,250.00
18	Concrete Lined Ditch Exc. & Emb.	1000.00	C.Y.	$10.00	$10,000.00
19	Partial Removal of Conc. Lined Ditch	500.00	L.F.	$2.50	$1,250.00
20	10 inch Dia. PVC Sanitary Sewer	550.00	L.F.	$18.00	$9,900.00
21	12 inch Dia. PVC Sanitary Sewer	650.00	L.F.	$21.50	$13,975.00
22	Sanitary Sewer Manholes	5.00	Each	$1,500.00	$7,500.00
23	Trench Excavation	16300.00	C.Y.	$8.50	$138,550.00
24	Trench Shoring	4100.00	L.F.	$10.00	$41,000.00
25	Granular Backfill	8300.00	C.Y.	$12.50	$103,750.00
26	Native Backfill	4300.00	C.Y.	$6.00	$25,800.00
27	Sawcut Existing Pavement	11500.00	L.F.	$1.50	$17,250.00
28	Remove Existing Pavement	46000.00	S.F.	$0.50	$23,000.00
29	Pavement Patching, 4" A.C. on 6" A.B.	46000.00	S.F.	$1.20	$55,200.00
30	Remove Existing Storm Drain Manholes	5.00	Each	$500.00	$2,500.00
31	Remove Existing Drop Inlets	12.00	Each	$250.00	$3,000.00
32	Golf Course Exc. & Emb.		C.Y.	$4.00	$0.00
33	Golf Course Fairway Sod		S.F.	$0.40	$0.00

COLUMN TOTALS $1,277,475.00

CONTINGENCY @ 20% $255,495.00

TOTAL PROJECT COST $1,532,970.00

TABLE F

ENGINEERS COST ESTIMATE KENNEDY/JENKS/CHILTON

CLIENT: City of Reno
PROJECT:Plumas/Moana Storm Drain OPTION 5 DATE: 22 Feb 89
ESTIMATE: Preliminary K/J/C Job # 877041.00

ITEM NO	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
1	Mobilization	1.00	L.S.	$10,000.00	$10,000.00
2	Traffic Control	1.00	L.S.	$50,000.00	$50,000.00
3	24 inch Dia. RCP, Cl III	1250.00	L.F.	$24.00	$30,000.00
4	36 inch Dia. RCP, Cl III	1420.00	L.F.	$44.00	$62,480.00
5	48 inch Dia. RCP, Cl III	300.00	L.F.	$76.00	$22,800.00
6	60 inch Dia. RCP, Cl III	1180.00	L.F.	$100.00	$118,000.00
7	66 inch Dia. RCP, Cl III		L.F.	$130.00	$0.00
8	78 inch Dia. RCP, Cl II	480.00	L.F.	$210.00	$100,800.00
9	84 inch Dia. RCP, Cl II	650.00	L.F.	$230.00	$149,500.00
10	96 inch Dia. RCP, Cl II		L.F.	$280.00	$0.00
11	Standard S.D. Manholes	14.00	Each	$1,850.00	$25,900.00
12	Special S.D. Manholes	3.00	Each	$3,000.00	$9,000.00
13	Special Hydraulic Structures	3.00	Each	$15,000.00	$45,000.00
14	Drop Inlets, Type 2A	16.00	Each	$2,000.00	$32,000.00
15	Special Drop Inlets, 10' Openings	3.00	Each	$5,000.00	$15,000.00
16	Special Drop Inlets, 20' Openings	1.00	Each	$7,000.00	$7,000.00
17	Concrete Lined Ditch Concrete		C.Y.	$345.00	$0.00
18	Concrete Lined Ditch Exc. & Emb.		C.Y.	$10.00	$0.00
19	Partial Removal of Conc. Lined Ditch		L.F.	$2.50	$0.00
20	10 inch Dia. PVC Sanitary Sewer	550.00	L.F.	$18.00	$9,900.00
21	12 inch Dia. PVC Sanitary Sewer	1100.00	L.F.	$21.50	$23,650.00
22	Sanitary Sewer Manholes	6.00	Each	$1,500.00	$9,000.00
23	Trench Excavation	22200.00	C.Y.	$8.50	$188,700.00
24	Trench Shoring	5280.00	L.F.	$10.00	$52,800.00
25	Granular Backfill	10300.00	C.Y.	$12.50	$128,750.00
26	Native Backfill	8900.00	C.Y.	$6.00	$53,400.00
27	Sawcut Existing Pavement	12900.00	L.F.	$1.50	$19,350.00
28	Remove Existing Pavement	48000.00	S.F.	$0.50	$24,000.00
29	Pavement Patching, 4" A.C. on 6" A.B.	48000.00	S.F.	$1.20	$57,600.00
30	Remove Existing Storm Drain Manholes	5.00	Each	$500.00	$2,500.00
31	Remove Existing Drop Inlets	12.00	Each	$250.00	$3,000.00
32	Golf Course Exc. & Emb.	35000.00	C.Y.	$4.00	$140,000.00
33	Golf Course Fairway Sod	90000.00	S.F.	$0.40	$36,000.00

COLUMN TOTALS	$1,426,130.00
CONTINGENCY @ 20%	$285,226.00
TOTAL PROJECT COST	$1,711,356.00

APPENDIX D

PRELIMINARY ENGINEERING REPORT FOR PLUMAS/MOANA STORM DRAIN
DATED APRIL 1988
REVISED JUNE 1988

PRELIMINARY ENGINEERING REPORT
FOR
PLUMAS/MOANA STORM DRAIN

KENNEDY/JENKS/CHILTON
877041

APRIL 1988
Revised June 1988

** NOTE **

Due to the cost of the alternatives presented herein, it was determined that further study was required. Upstream storm water detention basins were to be studied along with HEC-1 hydrologic analysis of the storm runoff. The results of these studies are presented in the Supplemental Report prepared by Kennedy/Jenks/Chilton, dated March 1989.

PLUMAS/MOANA
STORM DRAIN PROJECT

FOR

CITY OF RENO
RENO, NEVADA

April 1988
Revised June 1988

KENNEDY/JENKS/CHILTON

877041.00

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EXECUTIVE SUMMARY

Kennedy/Jenks/Chilton analyzed several conceptual storm drain alternatives for the Plumas/Moana Storm Drain Project. The recommended alternative consists of a new 8'x6' box culvert connecting with the existing 7'x5' box culvert recently installed just west of Plumas Street at Glenda Way. This new box culvert will run east on Glenda to Lakeside Drive where it will then turn to the north and proceed down Lakeside in an 8'x6' box culvert to the outfall into Virginia Lake. This alternative is labeled as Option 2 in the text of this report.

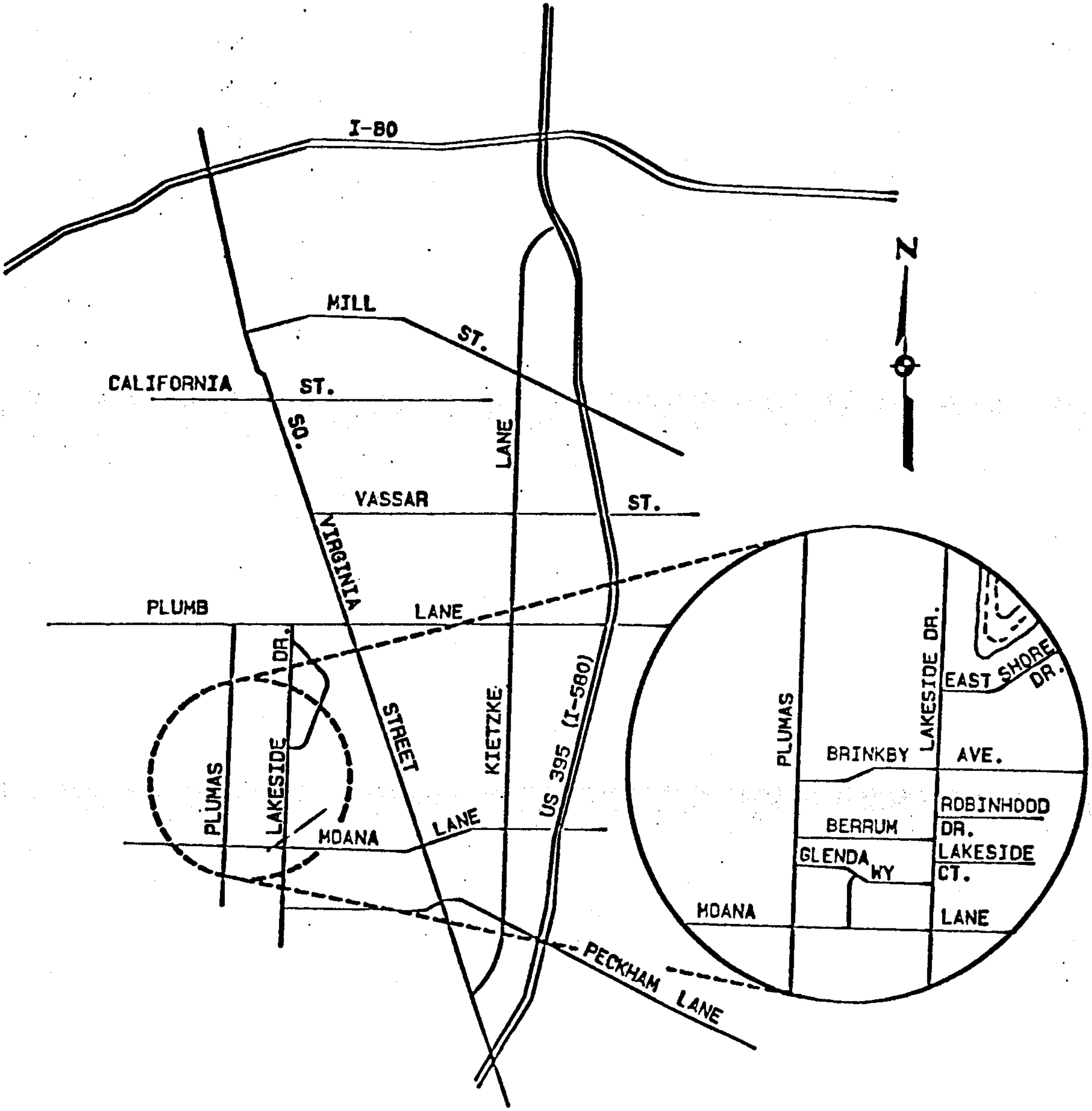
A 60-inch diameter pipe would be installed in Plumas Street to intercept runoff as it crosses Plumas approximately 700 feet south of Moana Lane. A defined drainage way exists at Plumas whereas runoff reaching Lakeside Drive will be widely dispersed and not as easily or conveniently intercepted. The 60-inch pipe will run to the north in Plumas Street and connect with the 8'x6' box culvert to be installed in Glenda Way. Runoff that travels onto Lakeside Drive and Moana Lane will be picked-up and conveyed north in Lakeside in a 42-inch diameter pipe and connected with the 8'x7' box culvert at the intersection of Glenda and Lakeside.

This alternative is recommended because of its superior hydraulic efficiencies, better runoff capture at Plumas Street and its lesser impact on existing underground utilities.

Localized runoff will be handled by installing collector mains off the major structure in Lakeside Drive. 24-inch diameter pipes will be installed in Berrum, Brinkby and Beck to intercept the local storm runoff. Combination inlet type (curb and gutter openings) catch basins will be located on the side streets to intercept the runoff without flooding adjacent street travel lanes. The local system would be designed to accommodate 100 year storm flows.

For planning purposes, the total costs for the recommended storm drain facilities will range between $2.5 and $3.0 million.

Kennedy/Jenks/Chilton



VICINITY MAP
NTS

FIGURE 1

CHAPTER 1

INTRODUCTION

The City of Reno contracted with Kennedy/Jenks/Chilton to provide hydrologic analyses and conceptual storm drainage designs for the project named "Plumas/ Moana Storm Drain", hereinafter referred to as the Project.

The scope of work entailed analyzing the Project site hydrology to determine peak runoff flows for the onsite collection system. Also based on peak runoff inflow values given by the City of Reno. Kennedy/Jenks/Chilton was required to provide conceptual designs of storm drainage systems to convey the offsite runoff through the Project area to an outfall into Virginia Lake. The following sections discuss Kennedy/Jenks/Chilton's hydrology studies conceptual designs, conclusions and recommendations.

CHAPTER 2

SITE LOCATION AND DESCRIPTION

The Project area is bordered south to north by Moana Lane and Mountain View Drive and west to east at Plumas Street and Lakeside Drive. The Project covers approximately 240 acres of highly developed land consisting primarily of multi-residential dwellings and commercial establishments with only a few single family residences. The Anderson Elementary School site and the pasture lying in the northeast corner of the Project (south of Mountain View Drive) are the largest "open" areas. The remainder of the Project area is predominated by apartment/condominium complexes with large paved parking areas and driveways and very little grassed or other vegetated open spaces.

The predominate slope is from west to east with generally about 30 feet of fall in the 1500 feet (2 percent average) between Plumas Street and Lakeside Drive. The ground continues to fall to the east of Lakeside Drive.

The grade on Lakeside Drive is rather flat, with only about 4 feet of elevation difference between Moana Lane and Eastshore Drive. The ground north of Eastshore Drive drops relatively steeply to Virginia Lake, about 20 feet of drop in 400 feet or 5 percent. The general slope of Lakeside Drive is a mild downward grade to the north with a maximum grade of approximately 0.5 percent and a small "hump" between Brinkby Avenue and Beck Court.

CHAPTER 3

EXISTING DRAINAGE SYSTEMS

The Project area does not have an extensive network of underground storm drainage facilities. Existing storm drains are located in Glenda Way, portions of Lakeside Drive, Brinkby Avenue, Beck Street and in Plumas Street. As depicted on Figure 2 "Existing Utility Map", an 18-inch diameter storm drain pipe system located in Plumas Street discharges into the Glenda Way 36-inch diameter system which then combines with the Lakeside system. The Lakeside Drive system collects runoff from the area south of Moana Lane and conveys it to the north, where it joins flows with the Glenda Way system. From the intersection at Glenda Way the Lakeside Drive storm drain runs north approximately 300 feet where it then turns to the east and crosses Lakeside Drive and eventually combines with the Lymberry Street system. The Lakeside Drive storm drain begins as an 18-inch diameter conduit south of Moana Lane increasing to 24-inches at Glenda Way. North of Glenda Way, the pipe is an oval shaped corrugated metal pipe, 22x36-inches in dimension. Another system is present in the northeast corner of the intersection of Moana Lane and Lakeside Drive. However, due to extensive silting the size and route of this system could not be determined. (Since the routing and capacity of this system was not critical to this study, the City was not asked to clean the lines.)

The Brinkby Avenue system picks up local runoff flows west of Lakeside Drive via a 12-inch diameter pipe. The collected runoff flows east and connects to a 60-inch diameter conduit at the intersection of Brinkby and Lakeside. The

60-inch pipe runs east on Brinkby approximately 300 feet to where it turns north and discharges into a concrete lined trapazoidal channel. The channel has a 4 foot wide bottom with 3/4 H. to 1 V. walls and a 4.5 foot depth. This open channel travels north and discharges into Virginia Lake after passing under Eastshore Drive via a triple barrel culvert of 42x27-inch oval pipes.

The Beck Street system collects runoff from the adjacent condominium complex through a series of drop inlets and catch basins. The runoff is directed to a sag portion of Beck Street approximately 200 feet west of Lakeside Drive. At this point, the run off is carried to the north a short distance and discharged onto the ground, presumably on private property. The route that this flow follows after discharge was not determined.

The other significant storm drainage facility within the Project is a 24-inch corrugated metal pipe which runs from Plumas Street just north of Glenda Way to a location northwest of Beck Street (the line could not be traced beyond this point). In between, the 24-inch pipe runs northeasterly from Plumas through the apartment complex situated between Glenda Way and Berrum Lane. At Berrum, the line turns and heads due north through the west side of the Anderson School yard to Brinkby Avenue. The line crosses Brinkby and continues northward to the open pasture south of Mountain View Drive. As stated above the alignment from this point on could not be determined. It is postulated that the 24-inch line eventually discharges into the existing underground storm drain line running in the City of Reno Soccer field and is carried to Virginia Lake via this system.

All onsite catch basins are of the City of Reno standard type 1 which are curb inlet types only (see Existing Utility Map).

CHAPTER 4

HYDROLOGY

A. DRAINAGE BASINS

There are two offsite drainage basins tributary to the Project area. The larger of the two basins enters the Project at the intersection of Plumas and Glenda (see Local Drainage Basins map) and is designated as the "Plumas Tributary Area". The Plumas basin encompasses a relatively large narrow area of approximately 1038 surface acres that extends to the southwest almost 4 miles.

As part of the Retirement Manor development just west of Plumas Street. (refer to Osgood Engineering Construction Plans for details), a 7 foot by 5 foot concrete box has been installed which conveys the Plumas Tributary Area runoff flows directly to Plumas Street. The new box culvert structure is approximately 440 feet in length and sloped at less than 1 percent.

Another smaller drainage basin, designated as the "Moana Tributary Area" lies to the south of the Project and encompasses approximately 183 acres and is about 1 mile long. This basin's drainage route crosses Plumas Street south of Moana Lane in a clearly defined area. East of Plumas, however, the flows do not travel in well defined routes. Eventually, the flows reach the intersection of Moana Lane and Lakeside Drive the southeast corner of the Project.

B. TRIBUTARY FLOWS

The incoming runoff flows were selected by the City of Reno from an unpublished 1985 Hydrologic Study prepared by Winzler and Kelly, a consulting firm. The Project lies within a "drainage deficiency area" designated as Number 4. Winzler and Kelly utilized the Rational Method for computing peak runoff values for various critical locations (nodes) within the deficiency area. The reported 100 year peak flows at Plumas and Glenda, the Plumas Tributary Area (Winzler and Kelly node f), is 575 cubic feet per second (cfs). The 100 year flow at Moana and Lakeside, (node m), Moana Tributary Area is 230 cfs. A third 100 year inflow was given by the City via a letter dated 9 February 1988. This flow was 27 cfs entering from the west side of Plumas adjacent to Brinkby Avenue.

To hydraulically size the storm drain facilities through the study area, the Winzler and Kelly results needed to be modified to reflect the "proposed" installation of underground storm drainage conduits. Also, the Project area hydrology needed to be specifically analyzed to locate and size the onsite collection facilities.

C. PROJECT AREA FLOWS

Kennedy/Jenks/Chilton utilized the Rational Method to estimate the 5 year and 100 year peak flows that would be collected and conveyed by a storm drain system onsite. Of prime interest were the routing of flows to the point of confluence between the two offsite tributary areas and the anticipated flows at the outfall into Virginia Lake.

Table 4-1 below shows the results of the computations for the Project site hydrology. The estimated 100 year peak flow at the confluence of the two tributary areas is estimated to be 710 cfs. The peak flow entering Virginia Lake is 720 cfs. These values are higher than the values contained in the Winzler and Kelly report for the same locations. The differences are explained by the fact that Winzler and Kelly had kept the Plumas flow and the Moana/Lakeside flow separate and they assumed a longer time of concentration due to total overland flow for their computations of the peak runoff values at the onsite nodes. Kennedy/Jenks/Chilton computed the onsite peaks by taking the inflow (Winzler and Kelly Nodes F and M) and calculating velocities representative of closed conduits rather than normal overland velocities. This reduces the time of concentration at the downstream onsite nodes and thus increases the given rainfall intensities (see City of Reno Rainfall Intensity - Duration - Frequency Curves, Public Works Design Manual). The net effect is that the peak quantities increase.

TABLE 4-1

ESTIMATED DESIGN FLOWS AT DRAINAGE NODES

Location Drainage Node	Drainage Area (Acres)	Runoff Factor	Rainfall 5yr (in/hr)	Intensities 100yr (in/hr)	Q5yr (cfs)	Q100yr (cfs)
1) Plumas & Glenda *	1052.3	0.33	0.68	1.68	235	585
2) Moana & Lakeside	182.5	0.46	1.14	3.11	95	260
3) Glenda & Lakeside	1254.9	0.35	0.67	1.62	295	710
4) Lakeside & Brinkby	1286.1	0.36	0.66	1.56	305	720
5) Eastshore @ Lake	1301.2	0.36	0.64	1.52	305	720

* Assumes that inflow (27 cfs) from Plumas at Brinkby included in Plumas and Glenda flows.

The Project area was divided into sub-drainage basins "A" through "T" and the onsite 5 year and 100 year storm flows computed using the Rational Method. The sub-basin boundaries were based on existing drainage patterns and existing storm drain facilities. The point of concentration of each sub-basin is located at the low point. The peak flows of the onsite sub-basins are listed in Table 4-2. An isopleth number of 1.5 has been included for wet season runoff. The sub-basins are shown delineated on Figure 3, Local Drainage Basins Map.

TABLE 4-2

ONSITE HYDROLOGY

ESTIMATED SUB-BASIN DESIGN FLOWS

Area	Drainage Area (Acres) "a"	Runoff Factor "c"	TC* tc (min)	Rainfall 5yr (in/hr) "i"	Intensities 100yr (in/hr) "i"	Q5yr (cfs)	Q5yr (wet) (cfs)	Q100yr (cfs)	Q100yr (wet) (cfs)
A	8.1	0.70	18	0.98	2.70	5.6	8.4	15.3	23.0
B	0.2	0.95	12.5	1.35	3.40	0.3	0.5	0.6	0.9
C	5.5	0.70	15.5	1.10	2.90	4.2	6.3	11.2	16.8
D	1.3	0.85	14.7	1.15	3.00	1.3	2.0	3.3	5.0
E	1.0	0.95	17.8	0.98	2.70	0.9	1.4	2.6	3.8
F	5.2	0.70	20.5	0.88	2.45	3.2	4.8	8.9	13.4
G	1.5	0.70	13.4	1.15	3.15	1.2	1.8	3.3	5.0
H	6.7	0.70	16.5	1.05	2.80	4.9	7.4	13.1	19.7
I	0.4	0.95	17.9	0.98	2.70	0.4	0.6	1.1	1.7
J	7.3	0.70	18.4	0.96	2.55	4.9	7.4	13.0	19.5
K	2.0	0.30	12.0	1.25	3.40	0.8	1.2	2.1	3.2
L	1.6	0.55	13.9	1.15	3.10	1.0	1.5	2.7	4.1
M	4.5	0.60	15.2	1.10	2.90	3.0	4.5	7.8	11.7
N	1.2	0.70	13.7	1.15	3.15	1.0	1.5	2.6	3.9
O	0.5	0.95	20.3	0.88	2.45	0.4	0.6	1.2	1.8
P	10.3	0.70	19.0	0.94	2.50	6.8	10.2	18.1	27.2
Q	5.4	0.70	12.4	1.35	3.40	5.1	7.7	12.9	19.4
R	0.8	0.70	11.3	1.30	3.55	0.8	1.2	2.0	3.0
S	0.6	0.95	18.6	0.96	2.55	0.6	0.9	1.5	2.3
T	1.5	0.25	11.9	1.25	3.40	0.5	0.8	1.3	2.0

CHAPTER 5

STORM DRAIN CONCEPTUAL DESIGNS

A. APPROACH

Kennedy/Jenks/Chilton analyzed the existing storm drainage systems and found them to be substantially undersized to adequately convey the selected design flows for the two tributary areas. Therefore, Kennedy/Jenks/Chilton identified conceptual design options which provided for all new storm drainage facilities and combination systems. The combination systems looked at new drainage facilities coupled with and augmented by the existing systems.

B. ALTERNATIVES

After reviewing many different options and routes, Kennedy/Jenks/Chilton narrowed the analysis to three alternatives. Each of the three final alternatives consisted of all new facilities. The existing facilities proved to be much too small to carry enough flow to substantially reduce the size of the new system carrying the remaining storm waters. Coupled with the complex structures required to split the large design flows, Kennedy/Jenks/Chilton dropped the consideration of utilizing existing storm drain facilities to convey the 100 year storm flows. All three options connect to the new 7'x5' box culvert west of the Plumas and Glenda intersection. The existing 7'x5' box culvert does not have the capacity required to carry the expected 100 year flow. Therefore, all options will have a special hydraulic structure designed to carry the flows from the existing 7'x5' box culvert and intercept overland flows.

Extensive preliminary designs of the inlet, outfall and special hydraulic (benos, etc.) structures were not performed. The intake structure at Glenda and Plumas requires that the quantity of flow carried in the box and the overland flow be determined. The outfall structure configuration depends on the alternative selected.

The given inflows represent future flow conditions. The conduit sizes recommended herein will convey these future flows. No attempt was made to provide structural design for the addition of future conduits as the manner and sequence of future development in unknown at this time.

The three alternatives analyzed in depth are depicted on Figures 4, 5 and 6 and are briefly described below:

1. Option 1

Option 1 connects a new 6'x6' box culvert with the recently placed 7'x5' box culvert located west of the Plumas and Glenda intersection. The new 6'x6' box culvert conveys flows down Glenda Way to the intersection Lakeside. At this point, the 6'x6' box culvert turns to the north via a special hydraulic structure which makes the turn in two 45 degree bends. Also at this intersection. the Plumas tributary area flows are combined with the flows from the Moana tributary area carried via a 6'x4' box culvert. After combining. the flows are carried north down Lakeside in an 8'x7' box culvert which continues to Virginia Lake. As with the following two alternatives, the local runoff is collected and discharged into the main trunk line. (See onsite collection Section 5C.)

2. Option 2

Option 2 is the same basic layout as Option 1 from the intersection of Glenda and Lakeside north. However, the Moana tributary flows are picked up on Plumas Street and conveyed to the north via a 60-inch diameter pipe. The 60-inch pipe discharges into an 8'x6' box culvert that runs down Glenda to Lakeside. The remaining runoff that collects at Moana and Lakeside is collected and carried north in a 42-inch diameter pipe to convey with the Plumas/Glenda flows. From Glenda north, the storm flows are conveyed in an 8'x7' box culvert to Virginia Lake, as in Option 1.

3. Option 3

This alternative is a variation of Option 2 in that the initial collection and conveyance system is the same. However, from the intersection of Glenda Way and Lakeside Drive north, the system is different. From the confluence of the two offsite tributary storm runoff flows at Glenda Way, the system is carried north down Lakeside via a 9'x6' box culvert to Brinkby Avenue. At Brinkby, the storm drain line turns to the east through a special structure which makes the transition by two 45 degree bends. The facility runs east on Brinkby Avenue approximately 300 feet in a 10'x6' box culvert to where the existing open channel lies. The flow will once again be turned to the north via a special hydraulic structure (two 45 degree bends) and directed towards Virginia Lake. The open channel will be replaced by a 12'x6' box culvert to provide discharge directly into Virginia Lake. The existing triple barrel at culvert will be removed and the profile of East Shore Drive will be raised adjacent to the new box culvert.

C. ONSITE COLLECTION

The onsite runoff is collected by a series of catch basins located in the several streets of the Project. Berrum, Brinkby and Beck will have 24-inch storm drain conduits installed to connect the catch basin flows to the major storm drainage facility in Lakeside Drive. The 24-inch lines will extend up Berrum and Brinkby to allow connection with the existing 24-inch facility. This will convey flow carried by the existing facility to the new Lakeside box culvert.

The catch basins will be combination inlets. City of Reno Type 2A and sized to capture the 100 year local runoff flows, thus offering the most protection against localized flooding. The catch basin locations and sizes will prevent overtopping the curb during the 100 year event, or flooding more than 6 feet of a travel lane during the 5 year event.

Specific criteria used for the catch basins was weir and orifice flow with a 50 percent clogging factor for the horizontal grate and 0 percent clogging for the curb opening. The catch basins are located so that 70 percent of the 100 year flood flows are captured without overtopping the sidewalk.

At this time there are no substantial flows to intercept on the east side of Lakeside Drive between Moana and Brinkby. During the final design phase, it may be advisable to place several inlets along the east gutter line of Lakeside as a precaution against flooding of the residential/commercial structures.

The local system is the same for all three options. (See Figure 4. 5. 6, Options 1, 2 and 3. Table A in the Appendix lists the curb opening length for the proposed catch basins.)

D. PRELIMINARY COSTS

Preliminary cost estimates for three alternatives were generated. These costs were developed based on very preliminary, conceptual designs. The cost estimates are shown in Tables B, C and D contained in the Appendix.

Unit costs were derived from City of Reno development costs, Nevada Department of Transportation Bid Tabulations, Manufacturer Quotes and in-house cost estimating guides. Not included in these estimates are utility relocation costs. After preliminary reviews by Sierra Pacific Power Company and Westpac. it appears that utility adjustments will be paid by the affected utility company. Construction quality control and project administration costs are not included.

It should also be noted that all three options will require that a parallel sanitary line be installed in Lakeside Drive between Glenda Way and Beck. The invert of the new storm drain will preclude connecting sanitary flows from the east with the existing sanitary sewer line running west of the Lakeside Drive centerline. The cost generated for each alternative include the installation of this parallel collector sanitary sewer.

In summary, the preliminary costs of the three options are:

	Option 1	Option 2	Option 3
Removals	$ 15,100	$ 15,100	$ 31,000
New Construction	$1,849,645	$1,936,415	$1,967,678
Subtotal	$1,864,745	$1,951,515	$1,998.678
Contingency (20%)	$ 372,949	$ 390,303	$ 399.736
Engineering (15%)	$ 335,654	$ 351,273	$ 359.762
	===========	===========	===========
Total	$2,573,348	$2,693,091	$2,758,175
Use Total	$2,600,000	$2,700,000	$2,800,000

Note: Engineering costs include preliminary design, final design and construction engineering.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

1. General

The storm drainage options studied for the Plumas/Moana Storm Drain Project represent conservative designs that will adequately convey the 100 year storm flows through the Project area. The Rational Method of hydrology yields conservative peak flow values particularly for drainage areas greater than one square mile. Thus, facilities designed utilizing these peak flows are likewise conservative.

2. Utilities

The underground utility conflicts anticipated by the construction of the storm drain will be most pronounced in the intersection of Moana and Lakeside. Two large water mains run east-west through the intersection as well as gas mains and a trunk sanitary sewer line. Lakeside Drive north of Moana has a full range of underground utilities. However, sufficient clearance between the various underground utilities appears to be available to install the proposed storm drain facility in Lakeside Drive without major relocating. Trench shoring will be required in Lakeside due to the depth of trench and the proximity of the utility lines.

The major inflow at Glenda and Plumas will be carried down Glenda Way to Lakeside. Glenda was selected because of its utility configuration and the "straight shot" available between Plumas and Lakeside. The underground utilities in Glenda consist of gas and water in a common trench and the existing 36-inch diameter storm drain. There is no sanitary sewer in Glenda. Thus, utilizing the same basic alignment as the existing storm drain, there will be fewer utility adjustments than on any of the other east-west roads between Plumas and Lakeside. Glenda also offers the opportunity of convey flows with only one 90 degree bend, (two 45 degree bends) at the intersection of Glenda and Lakeside. Any other route would require a minimum of three 90 degree bends.

3. Existing Storm Drains

As stated above, the utilization of the existing storm drainage facilities does not offer many cost or hydraulic advantages. These systems are so small that appreciable flows cannot be diverted through them. The size of the facilities to convey the remaining flows will be large and will still be expensive to install. Also, the hydraulic efficiencies are difficult to assess and may not perform as anticipated. Kennedy/Jenks/Chilton concluded that only new facilities designed to accommodate the full peak flows should be considered.

4. Costs

The preliminary cost estimates of the three conceptual design alternatives yielded only about a ten percent difference between the three. It is Kennedy/Jenks/Chilton's preliminary estimate that a storm drain system to convey the 100 year storm flows will cost between $2.5 million to $3.0 million to construct.

B. RECOMMENDATIONS

As stated above, the preliminary cost estimates are within ten percent of each other. The construction cost estimates of the three alternatives do not yield a clear economical choice. Therefore, other criteria such as hydraulic efficiency, utility conflicts and traffic interuption became the primary parameters for the selection of the recommended storm drain alternative.

Kennedy/Jenks/Chilton recommends that Option 2 be the alternative selected as the design basis for the Plumas/Moana Storm Drain Project. It is our conclusion that Option 2 offers the most efficient hydraulic design due to fewer bends and pipe size transitions. Sharp 90 degree bends in a structure of this size should be avoided if at all possible from the hydraulic and maintenance standpoints. This is the primary reason that Option 2 is recommended over Option 3. Option 3 has three 90 degree bends along with four changes of conduit sizes in the main trunk line. By collecting the majority of the Moana tributary area runoff on Plumas Street, the potential severe utility conflicts in the Moana/Lakeside intersection can be reduced. The 42-inch diameter pipe offers more flexibility crossing the intersection than does a 6'x4' box culvert. Any work that can be avoided or hastened in the Moana/Lakeside intersection will save money and inconvenience to the public. Also, Plumas Street has a sag vertical curve, which provides a sump condition. This is ideal for intercepting flows of this magnitude (200 cfs).

The effects of the Plumas/Moana Storm Drain Project flows on the flood storage capacity of Virginia Lake have not been analyzed. The Project flows coupled with other inflows into Virginia Lake could exceed the flood storage volume and the discharge capabilities of the outlet structures. Kennedy/Jenks/Chilton recommends that a reservoir routing analysis be conducted on Virginia Lake to assure that storm runoff volumes do not jeopardize the structural integrity of the reservoir and dam.

APPENDIX A

TABLE A

ONSITE COLLECTION SYSTEM

PROPOSED CATCH BASINS

Catch Basin Number	Type	Curb Opening Length (Ft.)	Q 100 (cfs)	Q 5 (cfs)
DI-1	2A	60	105.0	39.9
DI-2	2A	60	105.0	39.9
DI-3	2A	10	5.0	1.9
DI-4	2A	10	5.0	1.9
DI-5	2A	10	7.6	2.9
DI-6	2A	10	7.6	2.9
DI-7	2A	15	4.0	1.5
Option 1, DI-8	2A	80	115.0	43.7
Option 2, DI-8	2A	25	27.5	10.5
Option 3, DI-8 (3)	2A	25	27.5	10.5
Option 1, DI-9	2A	80	115.0	43.7
Option 2, DI-9	2A	25	27.5	10.5
Option 3, DI-9 (3)	2A	25	27.5	10.5
DI-10	2A	20	10.0	3.8
DI-11	2A	20	10.0	3.8
DI-12	2A	20	10.0	3.8
DI-13	2A	20	10.0	3.8
DI-14	2A	20	6.8	2.6
DI-15	2A	20	5.0	1.9
DI-16	2A	15	6.5	2.5
DI-17	2A	25	6.5	2.5
DI-18	2A	20	6.5	2.5
DI-19	2A	20	6.6	2.5
DI-20	2A	20	2.0	0.8
DI-20	2A	20	9.0	3.4
DI-22	2A	20	9.0	3.4
DI-23	2A	10	3.9	1.5
DI-24	2A	10	3.9	1.5
DI-25	2A	10	2.0	0.8
DI-26	2A	10	6.5	2.5
DI-27	2A	10	6.5	2.5

PRELIMINARY COST ESTIMATE

T A B L E B

KENNEDY/JENKS/CHILTON

CLIENT: City of Reno

PROJECT: Plumas/Moana Storm Drain
OPTION 1

CURRENT COSTS
ESCALATE @ % / MONTH
ESCALATE COSTS FOR MONTHS

DATE:
K/J/C # 877041
REV DATE 03/14/89
EST. BY:

TYPE OF ESTIMATE : CONCEPTUAL TAKEOFF (W/PLANS)

ITEM NO	DESCRIPTION	QUANTITY	UNIT	MATERIAL		LABOR & EQUIPMENT		MATERIAL, LABOR, OH, PROFIT		TOTAL COST	
				UNIT COST	EXTENSION	UNIT COST	EXTENSION	UNIT COST	EXTENSION	UNIT COST	EXTENSION
1	Special Hydraulic Structure	3	LS	0.00	$0	0.00	$0	20,000.00	$60,000	20000.00	$60,000
2	6'x 4' Reinforced Concrete Box	1,030	LF	0.00	$0	0.00	$0	166.00	$170,980	166.00	$170,980
3	6'x 6' Reinforced Concrete Box	1,500	LF	0.00	$0	0.00	$0	187.00	$280,500	187.00	$280,500
4	8'x 6' Reinforced Concrete Box	0	LF	0.00	$0	0.00	$0	216.00	$0	216.00	$0
5	8'x 7' Reinforced Concrete Box	2,390	LF	0.00	$0	0.00	$0	216.00	$516,240	216.00	$516,240
6	9'x 6' Reinforced Concrete Box	0	LF	0.00	$0	0.00	$0	244.00	$0	244.00	$0
7	10'x 6' Reinforced Concrete Box	0	LF	0.00	$0	0.00	$0	272.00	$0	272.00	$0
8	12'x 6' Reinforced Concrete Box	0	LF	0.00	$0	0.00	$0	321.00	$0	321.00	$0
9	24" Reinforced Concrete Pipe	2,600	LF	0.00	$0	0.00	$0	22.00	$57,200	22.00	$57,200
10	42" Reinforced Concrete Pipe	0	LF	0.00	$0	0.00	$0	50.00	$0	50.00	$0
11	60" Reinforced Concrete Pipe	0	LF	0.00	$0	0.00	$0	75.00	$0	75.00	$0
12	RCB Manhole Access	11	EA	0.00	$0	0.00	$0	1,200.00	$13,200	1200.00	$13,200
13	Storm Drain Manholes, Type 1	6	EA	0.00	$0	0.00	$0	1,200.00	$7,200	1200.00	$7,200
14	Catch Basins, Type 2A	27	EA	0.00	$0	0.00	$0	2,500.00	$67,500	2500.00	$67,500
15	10" P.V.C. Sanitary Sewer	550	LF	0.00	$0	0.00	$0	16.00	$8,800	16.00	$8,800
16	12" P.V.C. Sanitary Sewer	1,100	LF	0.00	$0	0.00	$0	18.75	$20,625	18.75	$20,625
17	Sanitary Sewer Manholes, Type 1	6	EA	0.00	$0	0.00	$0	1,200.00	$7,200	1200.00	$7,200
18	Sawcut Existing Pavement	15,000	LF	0.00	$0	0.00	$0	1.00	$15,000	1.00	$15,000
19	Trench Excavation	34,000	CY	0.00	$0	0.00	$0	8.00	$272,000	8.00	$272,000
20	Trench Shoring	5,000	LF	0.00	$0	0.00	$0	10.00	$50,000	10.00	$50,000
21	Granular Backfill	12,400	CY	0.00	$0	0.00	$0	8.00	$99,200	8.00	$99,200
22	Pavement Patching 4"A.C., 6" A.B.	80,000	SF	0.00	$0	0.00	$0	1.20	$96,000	1.20	$96,000
23	Remove 36" Pipe	1,400	LF	0.00	$0	0.00	$0	2.00	$2,800	2.00	$2,800
24	Remove 24" Pipe	900	LF	0.00	$0	0.00	$0	2.00	$1,800	2.00	$1,800
25	Remove Existing S.D. Manholes	9	EA	0.00	$0	0.00	$0	500.00	$4,500	500.00	$4,500
26	Remove 60" Pipe	0	LF	0.00	$0	0.00	$0	3.00	$0	3.00	$0
27	Remove Existing Catch Basins	12	LF	0.00	$0	0.00	$0	500.00	$6,000	500.00	$6,000
28	Remove Concrete Lined Ditch and Culvert crossing	0	LS	0.00	$0	0.00	$0	15,000.00	$0	15000.00	$0
29	Gas Main Relocation at Moana And Lakeside	1	LS	0.00	$0	0.00	$0	0.00	$0	0.00	$0
30	Water Main Relocation at Moana And Lakeside	1	LF	0.00	$0	0.00	$0	0.00	$0	0.00	$0
31	Water Service Relocation	21	EA	0.00	$0	0.00	$0	0.00	$0	0.00	$0
32	Gas Service Relocation	8	EA	0.00	$0	0.00	$0	0.00	$0	0.00	$0
33	Traffic Control	1	EA	0.00	$0	0.00	$0	50,000.00	$50,000	50000.00	$50,000
34	Native Backfill	11,500	CY	0.00	$0	0.00	$0	4.00	$46,000	4.00	$46,000
35	A.C. Removal	80,000	SF	0.00	$0	0.00	$0	0.15	$12,000	0.15	$12,000

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=================================================================================================================
                                          COLUMN TOTALS              $0              $0      $1,864,745      $1,864,745
                                          CONTINGENCY %  20.00       $0              $0        $372,949        $372,949
-----------------------------------------------------------------------------------------------------------------
                                          SUBTOTAL                   $0              $0      $2,237,694      $2,237,694
                                          OH & PROFIT %   0.00       $0              $0              $0              $0
*****************************************************************************************************************
                                          TOTAL MARKED UP COST       $0              $0      $2,237,694      $2,237,694
                                                                                         USE TOTAL -->       $2,230,000
```

PRELIMINARY COST ESTIMATE   T A B L E   C   KENNEDY/JENKS/CHILTON

CLIENT: City of Reno

PROJECT: Plumas/Moana Storm Drain
OPTION 2
(RECOMENDED OPTION)

CURRENT COSTS
ESCALATE @ % / MONTH
ESCALATE COSTS FOR MONTHS

DATE:
K/J/C # 877041
REV DATE 03/14/89
EST. BY:

TYPE OF ESTIMATE : CONCEPTUAL TAKEOFF (W/PLANS)

ITEM NO	DESCRIPTION	QUANTITY	UNIT	MATERIAL UNIT COST	MATERIAL EXTENSION	LABOR & EQUIPMENT UNIT COST	LABOR & EQUIPMENT EXTENSION	MATERIAL, LABOR, OH, PROFIT UNIT COST	MATERIAL, LABOR, OH, PROFIT EXTENSION	TOTAL COST UNIT COST	TOTAL COST EXTENSION
1	Special Hydraulic Structure	3	LS	0.00	$0	0.00	$0	20,000.00	$60,000	20000.00	$60,000
2	6'x 4' Reinforced Concrete Box		LF	0.00	$0	0.00	$0	166.00	$0	166.00	$0
3	6'x 6' Reinforced Concrete Box		LF	0.00	$0	0.00	$0	187.00	$0	187.00	$0
4	8'x 6' Reinforced Concrete Box	1,500	LF	0.00	$0	0.00	$0	216.00	$324,000	216.00	$324,000
5	8'x 7' Reinforced Concrete Box	2,390	LF	0.00	$0	0.00	$0	216.00	$516,240	216.00	$516,240
6	9'x 6' Reinforced Concrete Box		LF	0.00	$0	0.00	$0	244.00	$0	244.00	$0
7	10'x 6' Reinforced Concrete Box		LF	0.00	$0	0.00	$0	272.00	$0	272.00	$0
8	12'x 6' Reinforced Concrete Box		LF	0.00	$0	0.00	$0	321.00	$0	321.00	$0
9	24" Reinforced Concrete Pipe	2,600	LF	0.00	$0	0.00	$0	22.00	$57,200	22.00	$57,200
10	42" Reinforced Concrete Pipe	962	LF	0.00	$0	0.00	$0	50.00	$48,100	50.00	$48,100
11	60" Reinforced Concrete Pipe	1,250	LF	0.00	$0	0.00	$0	75.00	$93,750	75.00	$93,750
12	RCB Manhole Access	9	EA	0.00	$0	0.00	$0	1,200.00	$10,800	1200.00	$10,800
13	Storm Drain Manholes, Type 1	13	EA	0.00	$0	0.00	$0	1,200.00	$15,600	1200.00	$15,600
14	Catch Basins, Type 2A	27	EA	0.00	$0	0.00	$0	2,500.00	$67,500	2500.00	$67,500
15	10" P.V.C. Sanitary Sewer	550	LF	0.00	$0	0.00	$0	16.00	$8,800	16.00	$8,800
16	12" P.V.C. Sanitary Sewer	1,100	LF	0.00	$0	0.00	$0	18.75	$20,625	18.75	$20,625
17	Sanitary Sewer Manholes, Type 1	6	EA	0.00	$0	0.00	$0	1,200.00	$7,200	1200.00	$7,200
18	Sawcut Existing Pavement	16,500	LF	0.00	$0	0.00	$0	1.00	$16,500	1.00	$16,500
19	Trench Excavation	39,600	CY	0.00	$0	0.00	$0	8.00	$316,800	8.00	$316,800
20	Trench Shoring	3,900	LF	0.00	$0	0.00	$0	10.00	$39,000	10.00	$39,000
21	Granular Backfill	11,200	CY	0.00	$0	0.00	$0	8.00	$89,600	8.00	$89,600
22	Pavement Patching 4"A.C., 6" A.B.	98,000	SF	0.00	$0	0.00	$0	1.20	$117,600	1.20	$117,600
23	Remove 36" Pipe	1,400	LF	0.00	$0	0.00	$0	2.00	$2,800	2.00	$2,800
24	Remove 24" Pipe	900	LF	0.00	$0	0.00	$0	2.00	$1,800	2.00	$1,800
25	Remove Existing S.D. Manholes	9	EA	0.00	$0	0.00	$0	500.00	$4,500	500.00	$4,500
26	Remove 60" Pipe		LF	0.00	$0	0.00	$0	3.00	$0	3.00	$0
27	Remove Existing Catch Basins	12	LF	0.00	$0	0.00	$0	500.00	$6,000	500.00	$6,000
28	Remove Concrete Lined Ditch and Culvert crossing		LS	0.00	$0	0.00	$0	15,000.00	$0	15000.00	$0
29	Gas Main Relocation at Moana And Lakeside		LS	0.00	$0	0.00	$0	0.00	$0	0.00	$0
30	Water Main Relocation at Moana And Lakeside		LF	0.00	$0	0.00	$0	0.00	$0	0.00	$0
31	Water Service Relocation		EA	0.00	$0	0.00	$0	0.00	$0	0.00	$0
32	Gas Service Relocation		EA	0.00	$0	0.00	$0	0.00	$0	0.00	$0
33	Traffic Control	1	EA	0.00	$0	0.00	$0	50,000.00	$50,000	50000.00	$50,000
34	Native Backfill	15,600	CY	0.00	$0	0.00	$0	4.00	$62,400	4.00	$62,400
35	A.C. Removal	98,000	SF	0.00	$0	0.00	$0	0.15	$14,700	0.15	$14,700

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                                  COLUMN TOTALS                 $0           $0        $1,951,515    $1,951,515
                                  CONTINGENCY %  20.00          $0           $0          $390,303      $390,303
---------------------------------------------------------------------------------------------------------------
                                  SUBTOTAL                      $0           $0        $2,341,818    $2,341,818
                                  OH & PROFIT %   0.00          $0           $0                $0            $0
***************************************************************************************************************
                                  TOTAL MARKED UP COST          $0           $0        $2,341,818    $2,341,818
                                                                                  USE TOTAL -->      $2,350,000
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PRELIMINARY COST ESTIMATE

T A B L E D

KENNEDY/JENKS/CHILTON

CLIENT: City of Reno

PROJECT: Plumas/Moana Storm Drain
OPTION 3

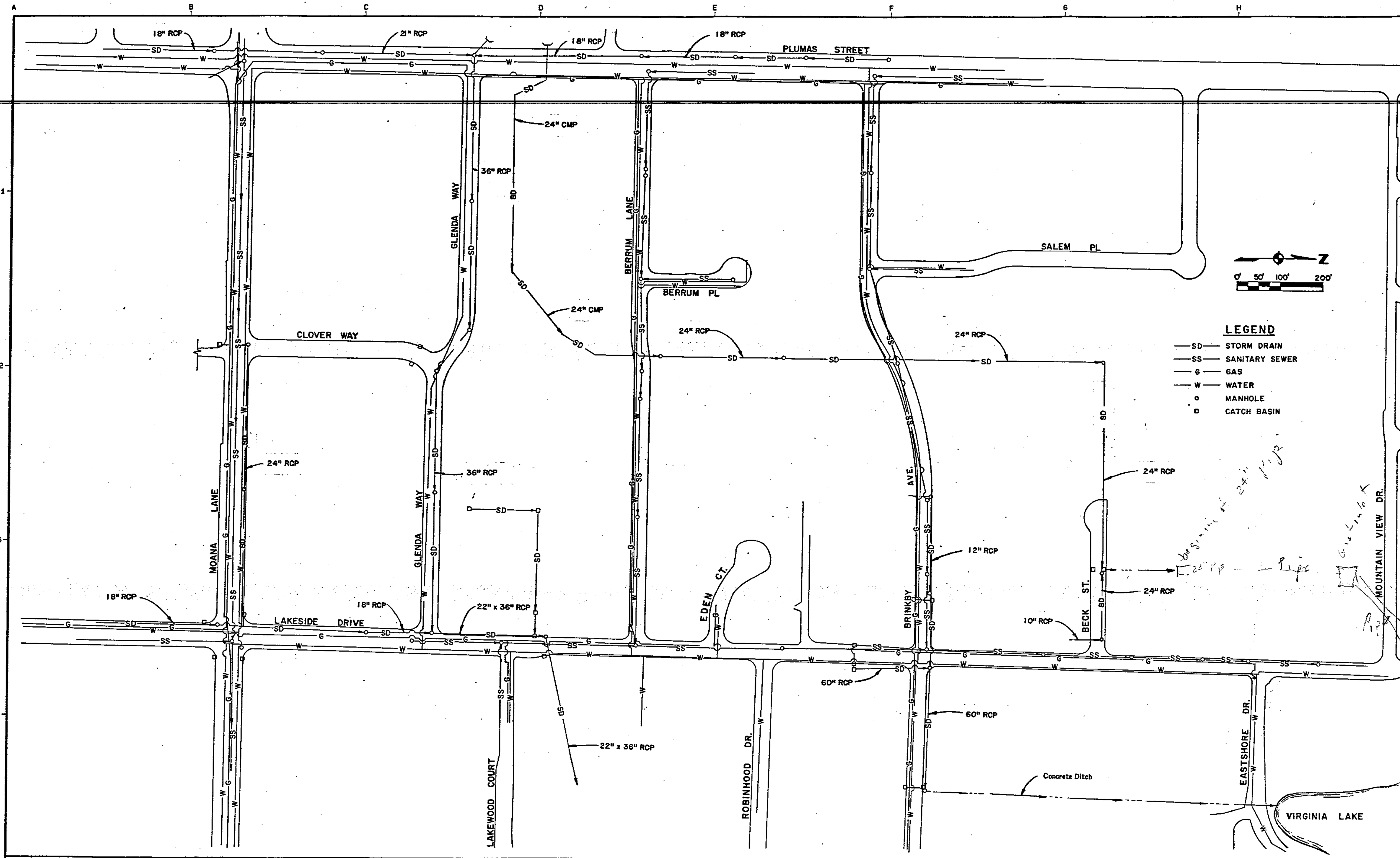
CURRENT COSTS
ESCALATE @ % / MONTH
ESCALATE COSTS FOR MONTHS

DATE: ______
K/J/C # 877041
REV DATE 03/14/89
EST. BY: ______

TYPE OF ESTIMATE : CONCEPTUAL TAKEOFF (W/PLANS)

				MATERIAL		LABOR & EQUIPMENT		MATERIAL, LABOR, OH, PROFIT		TOTAL COST	
ITEM NO	DESCRIPTION	QUANTITY	UNIT	UNIT COST	EXTENSION	UNIT COST	EXTENSION	UNIT COST	EXTENSION	UNIT COST	EXTENSION
1	Special Hydraulic Structure	4	LS	0.00	$0	0.00	$0	20,000.00	$80,000	20000.00	$80,000
2	6'x 4' Reinforced Concrete Box		LF	0.00	$0	0.00	$0	166.00	$0	166.00	$0
3	6'x 6' Reinforced Concrete Box		LF	0.00	$0	0.00	$0	187.00	$0	187.00	$0
4	8'x 6' Reinforced Concrete Box	2,615	LF	0.00	$0	0.00	$0	216.00	$564,840	216.00	$564,840
5	8'x 7' Reinforced Concrete Box	0	LF	0.00	$0	0.00	$0	216.00	$0	216.00	$0
6	9'x 6' Reinforced Concrete Box		LF	0.00	$0	0.00	$0	244.00	$0	244.00	$0
7	10'x 6' Reinforced Concrete Box	300	LF	0.00	$0	0.00	$0	272.00	$81,600	272.00	$81,600
8	12'x 6' Reinforced Concrete Box	900	LF	0.00	$0	0.00	$0	321.00	$288,900	321.00	$288,900
9	24" Reinforced Concrete Pipe	3,450	LF	0.00	$0	0.00	$0	22.00	$75,900	22.00	$75,900
10	42" Reinforced Concrete Pipe	962	LF	0.00	$0	0.00	$0	50.00	$48,100	50.00	$48,100
11	60" Reinforced Concrete Pipe	1,250	LF	0.00	$0	0.00	$0	75.00	$93,750	75.00	$93,750
12	RCB Manhole Access	11	EA	0.00	$0	0.00	$0	1,200.00	$13,200	1200.00	$13,200
13	Storm Drain Manholes, Type 1	16	EA	0.00	$0	0.00	$0	1,200.00	$19,200	1200.00	$19,200
14	Catch Basins, Type 2A	27	EA	0.00	$0	0.00	$0	2,500.00	$67,500	2500.00	$67,500
15	10" P.V.C. Sanitary Sewer	550	LF	0.00	$0	0.00	$0	16.00	$8,800	16.00	$8,800
16	12" P.V.C. Sanitary Sewer	650	LF	0.00	$0	0.00	$0	18.75	$12,188	18.75	$12,188
17	Sanitary Sewer Manholes, Type 1	5	EA	0.00	$0	0.00	$0	1,200.00	$6,000	1200.00	$6,000
18	Sawcut Existing Pavement	18,000	LF	0.00	$0	0.00	$0	1.00	$18,000	1.00	$18,000
19	Trench Excavation	31,400	CY	0.00	$0	0.00	$0	8.00	$251,200	8.00	$251,200
20	Trench Shoring	2,950	LF	0.00	$0	0.00	$0	10.00	$29,500	10.00	$29,500
21	Granular Backfill	11,000	CY	0.00	$0	0.00	$0	8.00	$88,000	8.00	$88,000
22	Pavement Patching 4"A.C., 6" A.B.	92,000	SF	0.00	$0	0.00	$0	1.20	$110,400	1.20	$110,400
23	Remove 36" Pipe	1,400	LF	0.00	$0	0.00	$0	2.00	$2,800	2.00	$2,800
24	Remove 24" Pipe	900	LF	0.00	$0	0.00	$0	2.00	$1,800	2.00	$1,800
25	Remove Existing S.D. Manholes	9	EA	0.00	$0	0.00	$0	500.00	$4,500	500.00	$4,500
26	Remove 60" Pipe	300	LF	0.00	$0	0.00	$0	3.00	$900	3.00	$900
27	Remove Existing Catch Basins	12	LF	0.00	$0	0.00	$0	500.00	$6,000	500.00	$6,000
28	Remove Concrete Lined Ditch and Culvert crossing	1	LS	0.00	$0	0.00	$0	15,000.00	$15,000	15000.00	$15,000
29	Gas Main Relocation at Moana And Lakeside		LS	0.00	$0	0.00	$0	0.00	$0	0.00	$0
30	Water Main Relocation at Moana And Lakeside		LF	0.00	$0	0.00	$0	0.00	$0	0.00	$0
31	Water Service Relocation		EA	0.00	$0	0.00	$0	0.00	$0	0.00	$0
32	Gas Service Relocation		EA	0.00	$0	0.00	$0	0.00	$0	0.00	$0
33	Traffic Control	1	EA	0.00	$0	0.00	$0	50,000.00	$50,000	50000.00	$50,000
34	Native Backfill	11,700	CY	0.00	$0	0.00	$0	4.00	$46,800	4.00	$46,800
35	A.C. Removal	92,000	SF	0.00	$0	0.00	$0	0.15	$13,800	0.15	$13,800

COLUMN TOTALS		$0	$0	$1,998,678	$1,998,678
CONTINGENCY %	20.00	$0	$0	$399,736	$399,736
SUBTOTAL		$0	$0	$2,398,413	$2,398,413
OH & PROFIT %	0.00	$0	$0	$0	$0
TOTAL MARKED UP COST		$0	$0	$2,398,413	$2,398,413



Revised	Description	Submit.	Appr'd.	Date
	Refer to Tracing for Latest Revision			

Reference Information and Notes:

Designed
Drawn
Checked
Date

CITY OF RENO

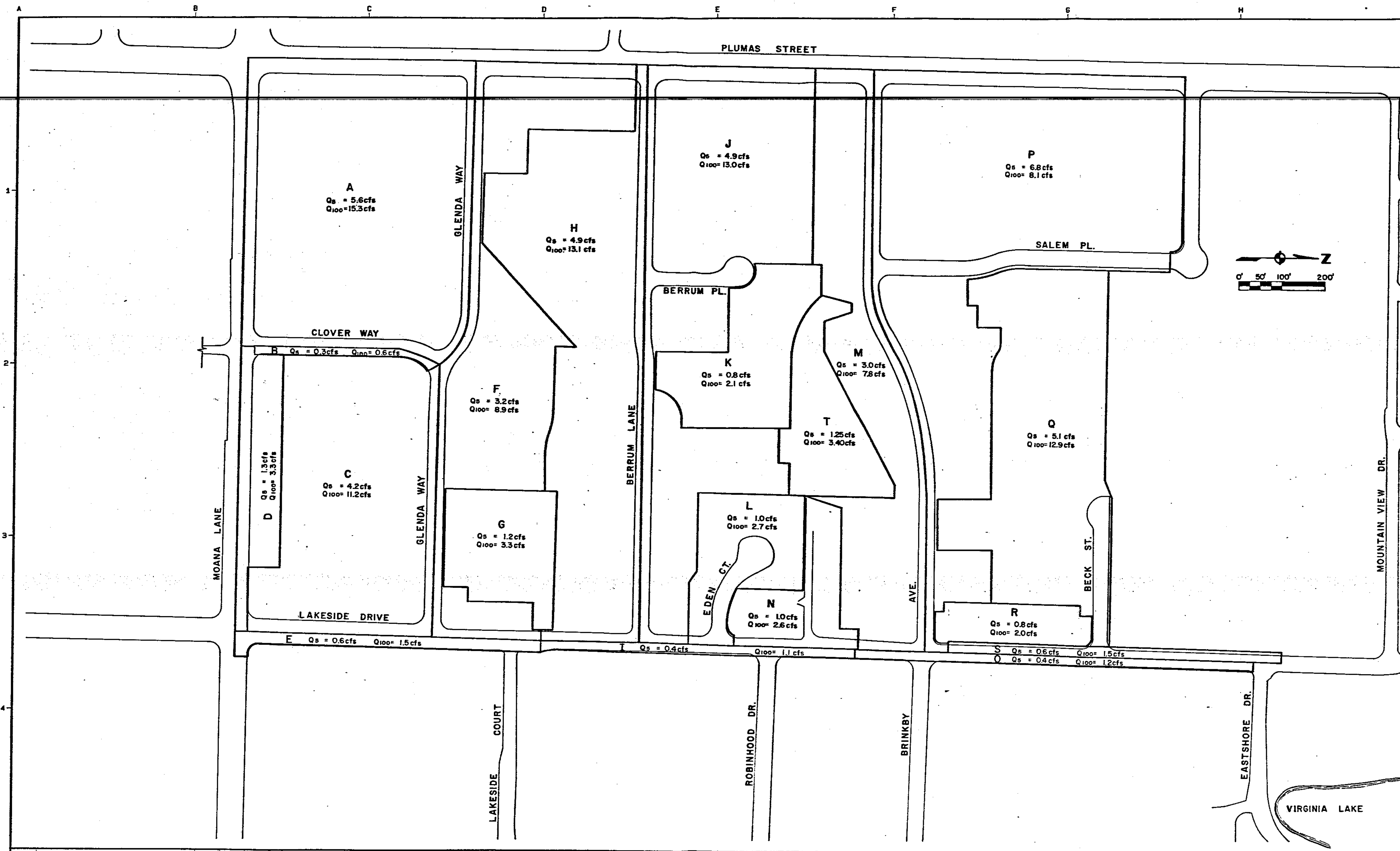
Kennedy/Jenks/Chilton Reno, Nevada

Submitted: Approved:

PLUMAS MOANA STORM DRAIN

EXISTING UTILITIES

Scale 1"=100'
Job No. 877041
Figure 2
of



Revised	Description	Submit.	Appr'd.	Date
	Refer to Tracing for Latest Revision			

Reference Information and Notes:

Designed
Drawn
Checked
Date

CITY OF RENO

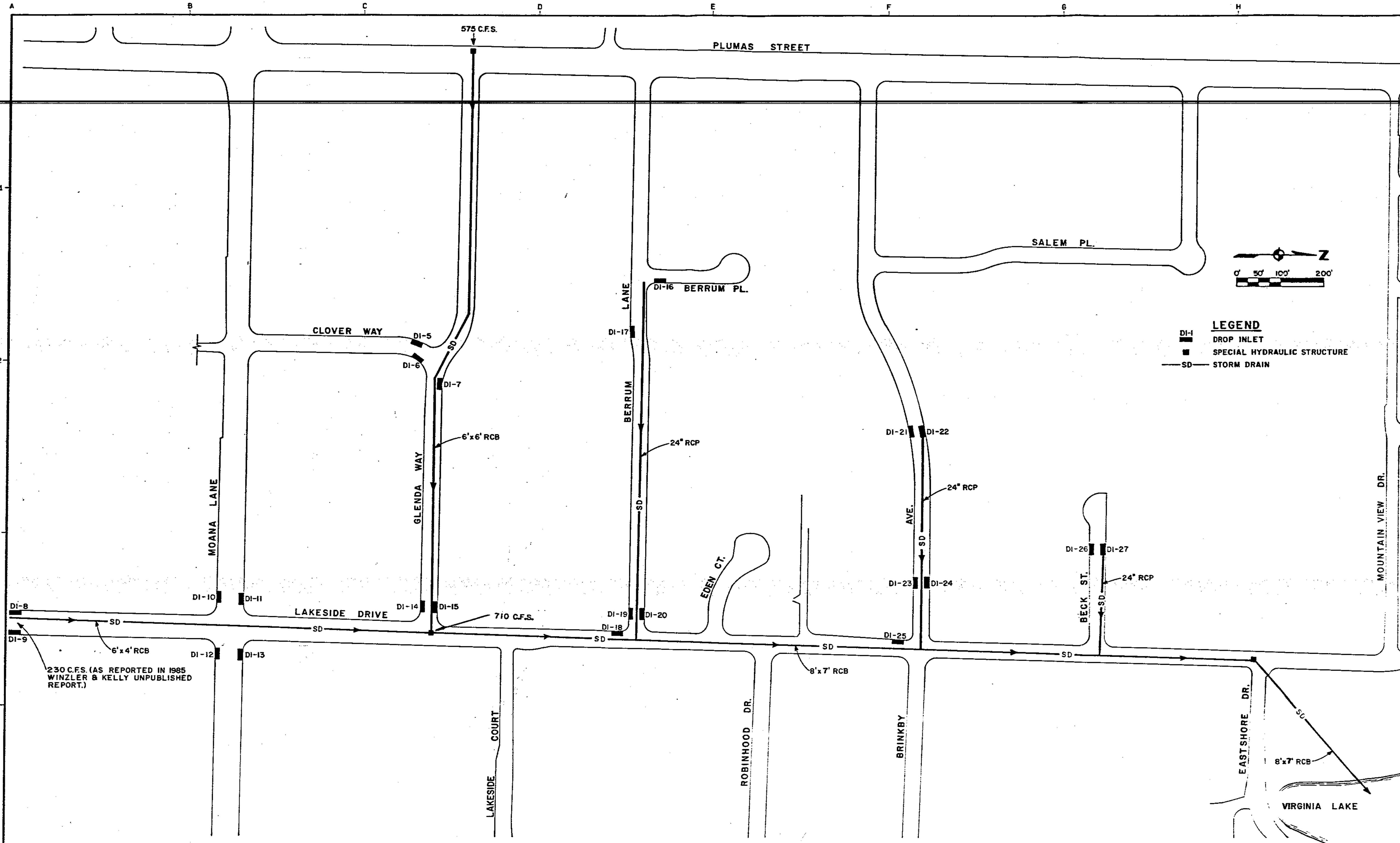
Kennedy/Jenks/Chilton Reno, Nevada

Submitted: Approved:

PLUMAS MOANA STORM DRAIN

LOCAL DRAINAGE BASINS

Scale 1"=100'
Job No. 877041
Figure 3
of



Revised	Description	Submit.	Appr'd.	Date

Refer to Tracing for Latest Revision

Reference Information and Notes:

Designed
Drawn
Checked
Date

CITY OF RENO

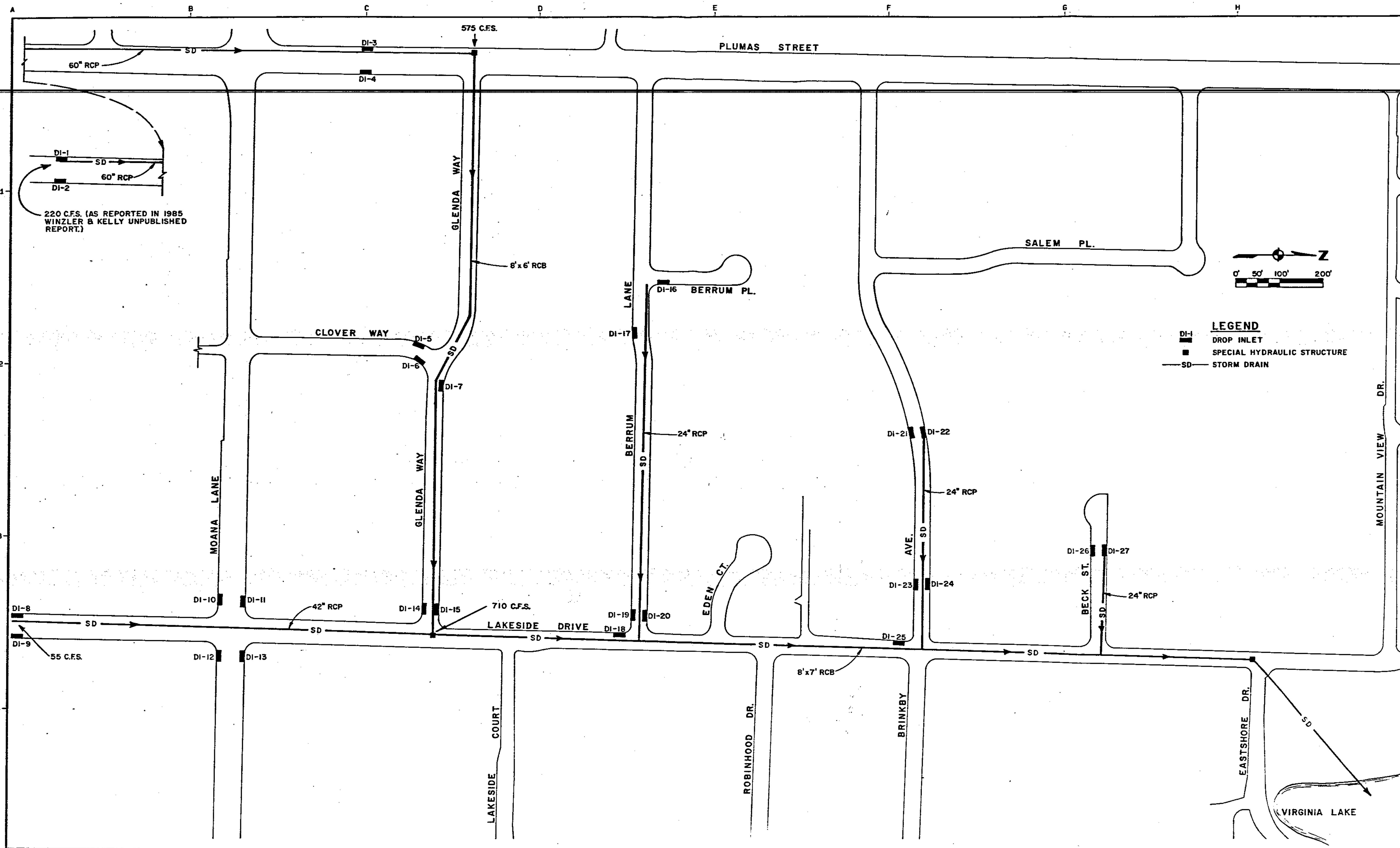
Kennedy/Jenks/Chilton Reno, Nevada

Submitted: Approved:

PLUMAS MOANA STORM DRAIN

OPTION 1

Scale 1"=100'
Job No. 67704
Figure 4



Revised	Description	Submit.	Appr'd.	Date
Refer to Tracing for Latest Revision				

Reference Information and Notes:

Designed
Drawn
Checked
Date

CITY OF RENO

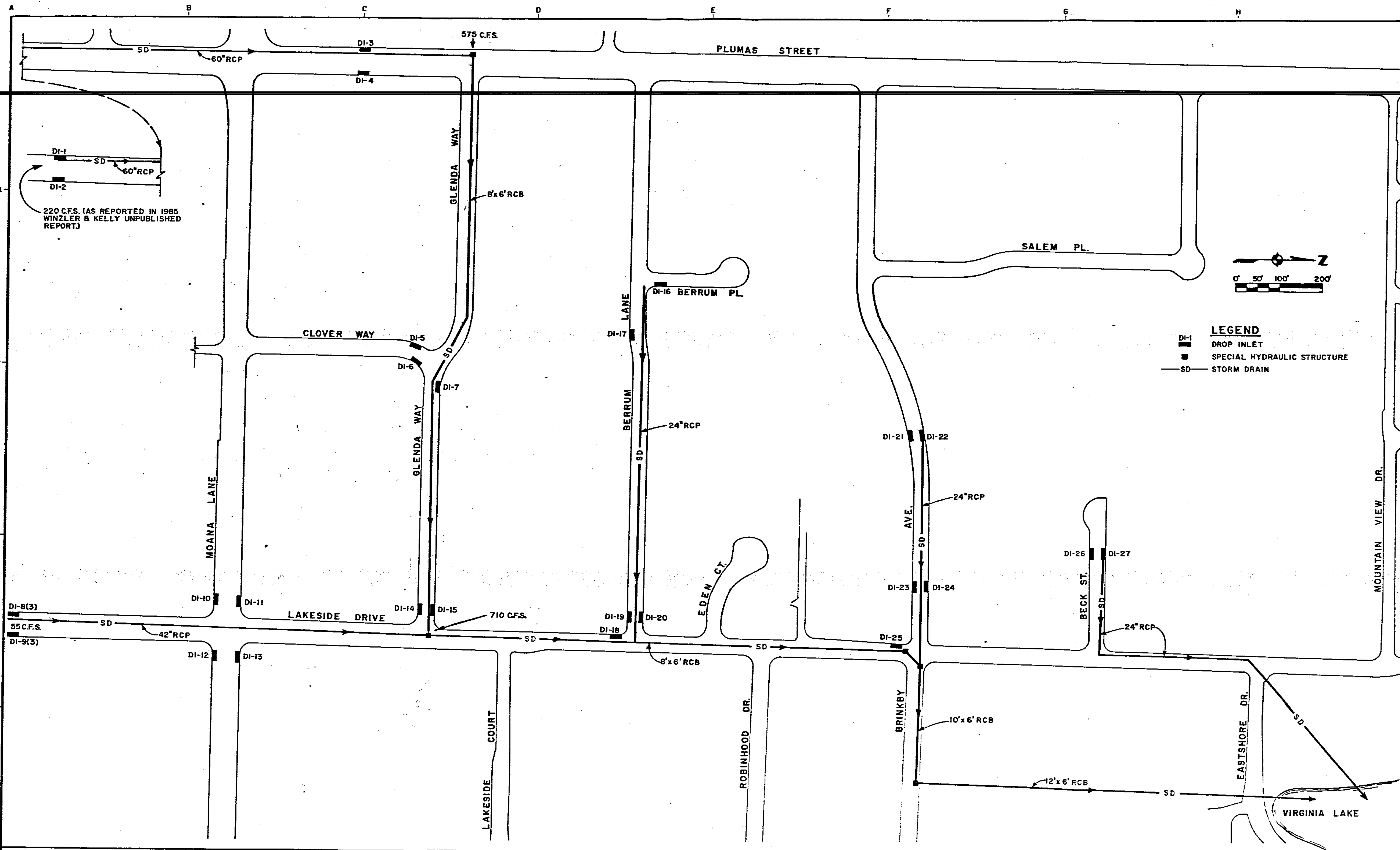
Kennedy/Jenks/Chilton Reno, Nevada

Submitted: Approved:

PLUMAS MOANA STORM DRAIN

OPTION 2

Scale 1"=100'
Job No. B77041
Figure 5



Revised	Description	Submit.	Appr'd.	Date
	Refer to Tracing for Latest Revision			

Reference-Information and Notes:

Designed
Drawn
Checked
Date

CITY OF RENO

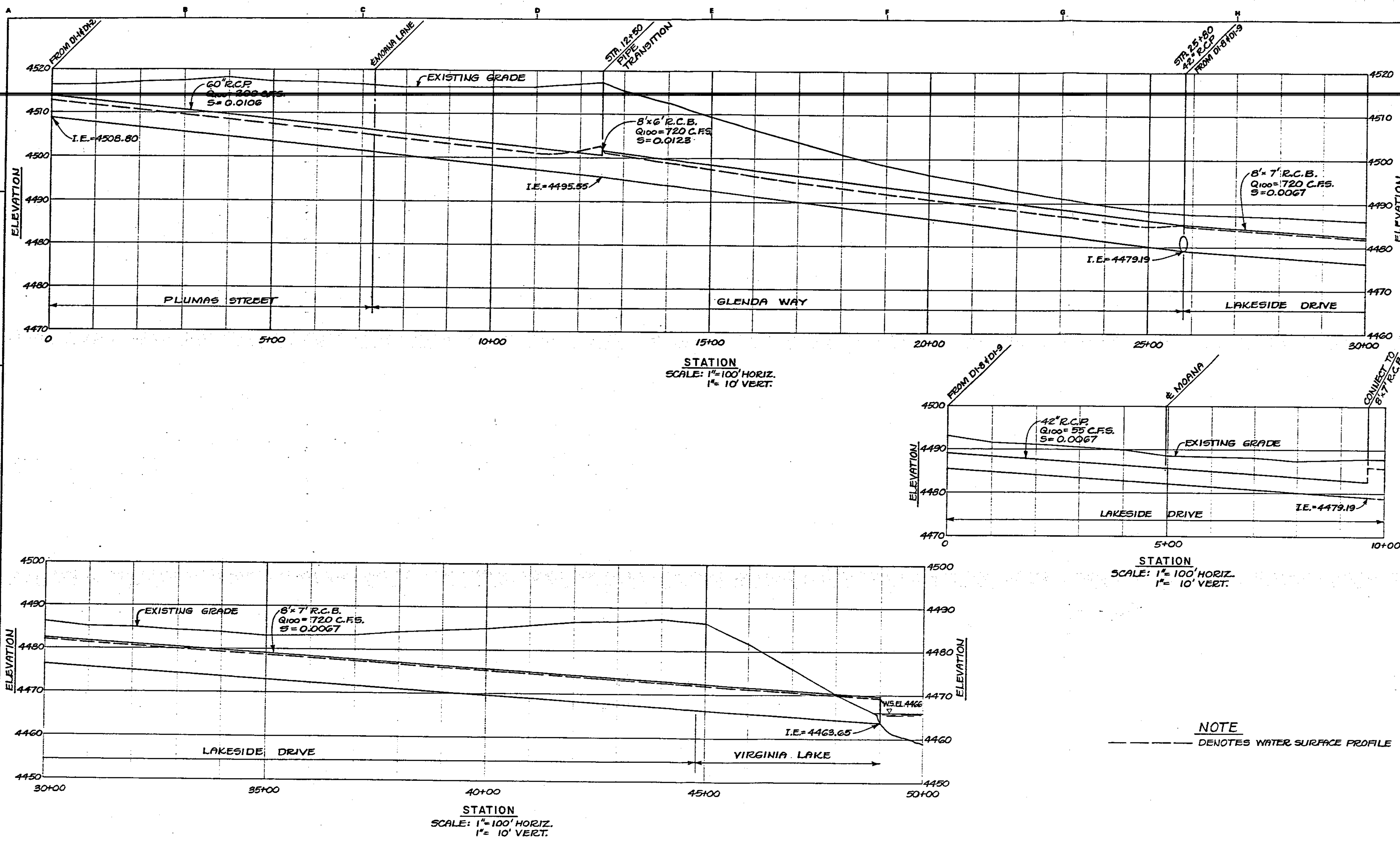
Kennedy/Jenks/Chilton Reno, Nevada

Submitted: Approved:

PLUMAS MOANA STORM DRAIN

OPTION 3

Scale 1"=100'
Job No. 877041
Figure 6
of



Revised	Description	Submit.	Appr'd.	Date
	Refer to Tracing for Latest Revision			

Reference Information and Notes:

Designed
Drawn
Checked
Date

CITY OF RENO

Kennedy/Jenks/Chilton Reno, Nevada
Submitted:
Approved:

PLUMAS MOANA STORM DRAIN

OPTION 2
STORM DRAIN PROFILE

Scale 1"=100'
Job No. 877041
Figure 7
of