SUN VALLEY PARKWAY CORRESPONDENCE

FLOOD CONTROL DISTRICT
of
Maricopa County

3335 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 262-1501

D. E. Sagramoso, P.E., Chief Engineer and General Manager

MEMO TO: Dorwin C. Black, Special Assistant to the County Engineer
Maricopa County Highway Department

ATTN; Thomas J. Phelan III, P.E., Project Engineer

FROM: Nicholas P. Karan, Chief, Engineering Division

SUBJECT: Sun Valley Parkway

This memo is to restate the comments that the Flood Control District addressed to Tom Phelan, dated August 23, 1988. Per your request, we have made a field investigation of the damage of the drainage channel for the above referenced project. The investigation was concentrated on the reach between stations 845+00 and 1024+53 of the Phase II-B of the project (Figure 1).

As you are aware, the August 20 storm caused substantial damages throughout the whole project reach. A field inspection was made August 23; additional comments will be provided later.

The watershed areas which affect this reach of parkway naturally flow northwesterly; the flow will be cut off and diverted by the constructed side channel (South Channel) along the south side of the parkway. Small incised channels with shallow overbank sheet flow are the general flow patterns of the areas. The soil characteristics in this area are highly erodible as a general nature of the desert.

EROSION

The damage to the drainage channel are basically caused by the erosion. Two types of erosion are encountered in this area; one by the incised channel and the other by the sheet overflow.

Photos 1, 2 and 8 show the damage caused by the erosion of a incised tributary flow. There were no treatments given to the inlet in order to safely convey the tributary flow into the South Channel at a defined logical point; the flow will run unpredictably because of the non-existence of the soil erosion resistance. Any obstruction, man-made (grouted rip-rap, Photo 1) or natural (tree, Photo 1), will cause sudden avulsion of the tributary channel. It appears that locating a drop structure right at the natural channel inlet (for example, Sta. 890+00 and 970+16) is an unsound design. Large amounts of sediment are brought into the drainage channel from the tributary (see Photos 1, 8 and 9) in association with this type of erosion.

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MEMO TO: Dorwin C. Black, Special Assistant to the County Engineer
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ATTN: Thomas J. Phelan III, P.E., Project Engineer

FROM: Nicholas P. Karan, Chief, Engineering Division NPK 9-8-88

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On August 20, 1988, a flood generated by a thunderstorm caused considerable damage to the roadway drainage structures of the above referenced project. A total of 3.11 inches of precipitation was recorded in a 9 hour period at White Tank Mountain (Sensor #1615). The flood is estimated at a frequency between 5 and 25 year, depending on what duration is used. Field inspection was performed on August 23. This memo summarizes my comments.

The project area is located within the alluvial fans of the White Tank Mountain. Alluvial fans are deposits of sediment with surface resembling a segment of a cone, fan-shaped in plan, and having a relatively uniform slope from apex to toe. Channels on alluvial fans are typically braided and shallow. They shift frequently on fans, so that stream locations are transitory. They are subjected to lateral migration and sudden relocations (avulsions). Such characteristics of alluvial fans should be kept in mind when performing an engineering design.

It was found that the damages were basically caused by the soil erosion; severe bank erosion occurred at areas where tributaries or overland sheet flows enter the side drainage channel and at areas where water overtopped the unprotected (under construction) detention basin berm. In addition to the soil erosion, flow exceeded the design capacity at two box culverts (Sta. 473+68.5 and Sta. 476+88.5) and overtopped one side of the roadway pavement. Also, tributary flows splashed over the shoulder and deposited the sediment on the pavement at several locations (Sta. 662+00, 655+00 and 12+50).

Discussions and suggestions addressed here are to express our opinions and are very general. The final specific recommendation and design should be provided by the design engineer (Collar, Williams and White Engineering, Inc.) after analyzing all the possible solutions, including their cost and effectiveness.

intercepted by the roadway in an approximately 500 foot reach with a very flat grade, with several shallow channels scattered in between. It is difficult to select a definite concentration point. In this flood event, flow was concentrated at the south side of the watershed (near 662+00) instead of the culvert at the north. Similar situations existed around stations 655+00 (Figure 3) and 12+50 (Figure 4, Phase I-A). Large amounts of sediment found in the side channel between stations 518+00 and 523+00 (Figure 5) reveal the same condition.

All the tributaries enter the side channel at an almost 90 degree angle. The momentum of the water carried the water over the side channel bank and roadway shoulder and splashed on the pavement. Consequently, the debris and sediment transported with the water were left on the pavement (Photo 8).

Side channels with adequate capacity should be designed to collect the tributary flows and to divert the flows to the nearest culvert. Proper design should be given so that the flow will not overtop the side channel bank because of the 90 degree turn. A safety factor should be applied to the design because of the possibility of a channel avulsion.

It is also very important to verify the existing topographic information in the field. For example, from the construction plan, the proposed grade of the roadway pavement at the curb between stations 662+00 and 655+00 is at least 2 feet higher than the existing ground. Photo 7, however, shows that the surrounding ground is almost at the same elevation as the roadway.

5. CONFLUENCE OF WAGNER WASH AND SOUTH CHANNEL

Photo 9 shows 3 feet of scour at the outlet of the confluence, and the downstream channel shows a trend of degradation. It is amazing the magnitude of the channel response in an event of one single flood. Does the design take into account the effect of the channel degradation? What are the equilibrium channel conditions? What is the local scour depth due to the drop?

The grouted rip-rap at the outlet may be damaged by either excessive local scour induced by the drop or simply by the excessive channel degradation. Therefore, placement of dumped rip-rap with proper size rock at this location is suggested. A gabion mattress may be necessary if no suitable size rock is available.

Note that only 4 cells of box are visible in the picture. A total of six cell RCBC was designed under the parkway. It can be seen from Figure 6 that the transition from the outlet of the culvert to the natural channel is too short. The two cells of box on the west will not function properly because of the channel contraction; they will be clogged with sediment eventually. The upstream headwater should be re-derived, using only 4 cells of box. If the headwater height is found to be unacceptable, the confluence should be redesigned.

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The second type of erosion is found on the earthen channel bank. As the overland sheet flow flows over the slope, a small incised gully is first formed and the size grows as time progresses, and finally a large amount of soil on the bank is sloughing away (Photo 3). This type of erosion is less severe in magnitude compared to the first type, however, it will generate severe damage if no maintenance is given.

CONCERNS

For some designs of the project, although no apparent damage was found at this time, we would like to express our concerns.

1. Station 849+40

Only about 3 feet of bank protection was provided on the west bank of the confluence of South Channel and Wagner Wash (Photo 5,6). This bank is almost perpendicular to the south channel and, with design discharge of 3,790 cfs, the water wave may splash over and damage the unprotected bank.

2. Station 850+050

There will be a maximum of 3 feet of water ponded in the energy dissipater basin (Photo 6). This will create a health hazard as well as a liability issue if someone is drowned. Generally, there is a required drain time for a detention basin design, which may also be applicable in this case.

3. Station 983+13

Photo 7 shows that the grouted rip-rap on the south bank for the drop structure ended right near the channel bottom and no protection was given to the channel bank. The flow will scour the toe of the channel and subsequently damage the structure.

RECOMMENDATIONS

1. Every incised tributary should be identified by examining the topographic map and performing a field investigation. An inlet structure with grouted rip-rap should be designed (Figure 2 shows a schematic sketch of the design). It should be noted that this figure is only a schematic sketch, the actual dimensions; length L, width B, angle θ, and invert elevation d, are dependent on the existing topography and design discharge. Channel side slope protection was provided at some locations (Photo 10), however no protection was given on the overbank area. Without protection on the overbank, a scour hole will be formed at the toe of the slope protection (Photo 4).

2. Some kind of slope protection, perhaps hydro seeding, is necessary to control the erosion on the earth channel bank due to the sheet overflow. The possibility of providing a small collector ditch with lined overchute is worth investigating.

3. The bank protection on the west bank of the South Channel and Wagner Wash confluence (Sta. 849+40) should be raised to the full channel bank height, or at least to the full energy grade line at this location.

4. A method to drain the ponded water in the energy dissipater basin (Sta. 850+050) should be provided.

5. Grouted rip-rap of the drop structure on the south bank should be raised to full channel bank height.

PHOTOS

1. Damage on the south bank of Sta. 890+00 drop structure. The tributary channel inlet is right at the drop structure.

2. Erosion on the south bank of Sta. 970+16 drop structure. Again, the tributary channel inlet is right at the drop structure.

3. Typical bank erosion on the earth channel bank due to the sheet overflow. Small gullies were formed first and grew as time progressed and finally a large portion of bank is sloughing away.

4. An approximately 2 foot deep scour hole was found at the downstream end of Sta. 893+70 drop structure. It demonstrated the power of the water.

5. Confluence of the South Channel and Wagner Wash. Photo 5.b shows the west bank protection is provided only to about half of the channel bank height. This bank is about perpendicular to the flow direction of the South Channel. The channel design discharge is 3,790 cfs.

6. Water ponded in the energy dissipater basin (Sta. 850+050).

7. Drop structure at Sta. 983+13. Note that the top of the grouted rip-rap is at the toe of the channel bank.

8. Tributary inlet near Sta. 876+00, about 30 feet downstream from the access ramp box culvert. Note that large amounts of sediment deposit are in the low flow channel.

9. Approximately a 100 foot reach of low flow channel was filled with sediment at the downstream of the Sta. 890+00 drop structure where the structure was damaged by the tributary inflow. The low flow channel is about 20 feet wide and 2 feet deep.

10. Channel slope protection at (a) Sta 937+00, and (b) Sta. 948+00. Note that the overbank flow area (toe of the slope) was not protected.

Nicholas P. Karan, P.E.

L. C. Huang

L. C. Huang, PhD., P.E.
Civil Engineer II

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On August 20, 1988, a flood generated by a thunderstorm caused considerable damage to the roadway drainage structures of the above referenced project. A total of 3.11 inches of precipitation was recorded in a 9 hour period at White Tank Mountain (Sensor #1615). The flood is estimated at a frequency between 5 and 25 year, depending on what duration is used. Field inspection was performed on August 23. This memo summarizes my comments.

The project area is located within the alluvial fans of the White Tank Mountain. Alluvial fans are deposits of sediment with surface resembling a segment of a cone, fan-shaped in plan, and having a relatively uniform slope from apex to toe. Channels on alluvial fans are typically braided and shallow. They shift frequently on fans, so that stream locations are transitory. They are subjected to lateral migration and sudden relocations (avulsions). Such characteristics of alluvial fans should be kept in mind when performing an engineering design.

It was found that the damages were basically caused by the soil erosion; severe bank erosion occurred at areas where tributaries or overland sheet flows enter the side drainage channel and at areas where water overtopped the unprotected (under construction) detention basin berm. In addition to the soil erosion, flow exceeded the design capacity at two box culverts (Sta. 473+68.5 and Sta. 476+88.5) and overtopped one side of the roadway pavement. Also, tributary flows splashed over the shoulder and deposited the sediment on the pavement at several locations (Sta. 662+00, 655+00 and 12+50).

Discussions and suggestions addressed here are to express our opinions and are very general. The final specific recommendation and design should be provided by the design engineer (Collar, Williams and White Engineering, Inc.) after analyzing all the possible solutions, including their cost and effectiveness.

1. CHANNEL BANK EROSION

Erosion caused either by incised tributaries or overland sheet flow are commented in my previous memo dated August 23 and are still valid. This erosion problem is spread over the whole project area. Photo 1 shows the typical channel bank erosion in Phase III reach. Soil in this Phase III reach contains some gravel and small cobbles. Natural armoring may retard (to some degree) the erosion process.

Some channel bank protection for the side tributaries were provided (see Photos 2 and 3). However, its function will increase if the length of the apron on the top of the bank and the depth of the depression increases. Also, the toe of the bank (overbank area) should be protected. It should be noted that no weep holes were provided to relieve the hydrostatic pressure behind the gunite low flow channel bank which can be damaged very easily once a scour hole is formed or seepage flows behind it (Photo 4).

It is relatively easier to protect a defined incised tributary inlet (see previous comment for conceptual design). On the contrary, it will be difficult and tricky to protect the earth side channel bank from overland sheet flow erosion and to control the channel avulsion, and they may be very costly. As we discussed during our August 28 meeting, the possible measures include but are not limited to:

i. Install about 2 foot high earth berm on the channel bank to divert water to a define inlet.
ii. Design a small lined channel parallel to the side channel to collect and divert the overland flows.
iii. Provide a cutoff wall along side channel bank to control the existing grades.
iv. Combination of the above.

Any single scheme may not be able to control the erosion problem effectively. A combination of these based on the field conditions is more desirable. Hydro seeding is still needed, especially on the south channel bank in Phase II-B Reach.

2. STA. 129+55 3-10'x3' RCBC (PHASE III)

The South Channel bank at the inlet of the box culvert should be protected (see sta. 136+90 RCBC inlet) to reduce the possible bank erosion caused by flow impingement.

3. STA. 473+68.52 1-8'x3' RCBC (a)
STA. 476+88.50 1-6'x3' RCBC (b)

Apparently the flow at these two box culverts exceeded their design capacity; the headwater overtopped the shoulder and flooded the northbound lane (Photos 5 and 6). It is estimated that the area of the culvert is less than 10 percent of the natural channel area for both box culverts (sheet 9/35 of phase II-A). It appears that the wash may carry more water under natural conditions than the design discharge.

Culvert a (sta. 473+68.52) was designed to collect the water for watersheds 9 and 10 (see Figure 1) with a total area of 72 acres. Because of the nature of the alluvial fans, channels will shift frequently and are prone to sudden relocations; part of the discharge generated in watershed 8 (and possibly watershed 7) may cross the watershed boundary (designated by the hydrology report) and flow into watershed 9 or 10. By the same token, discharge from watershed 12 may flow into watershed 11 and eventually concentrate at culvert b (sta. 476+88.50). As a result of breakout, the discharge at the designated concentration point is increased and therefore exceeds the design capacity of the corresponding box culvert.

Assuming the headwater elevation was at the pavement grade at median curb and the inlet control was governed, the discharge was estimated at 180 cfs (design is 126 cfs) for culvert a and 220 cfs (design is 164 cfs) for culvert b. Increases of the discharge prove the possible channel avulsion in the upstream watershed. It should be understood that these discharges were estimated, based on the performance of the box culvert only. The actual discharge in the wash may be higher because of the breakout. A portion of the ponded water of culvert b was diverted through the side channel to the box culvert at Sta. 480+10; 4 feet of headcut was observed at the south bank of the culvert inlet (see Photo 7).

It should also be noticed that the roadway profile is at its lowest point near culvert a. Part of the discharge causing the ponding for this culvert may be the result of the breakout of culvert b.

Several remedial measures are listed here:

i. Install a dike along the designated watershed boundary to prevent breakout.
ii. Install extra culvert(s) to increase capacity.
iii. Install a floodwall.
iv. Design a channel parallel to the roadway to divert the excessive water to other drainage structure.

Methods i and ii are the optimum solution, but are very costly. Method iii may not be acceptable aesthetically and economically. On the other hand, method iv may be less expensive, but the major challenge is to derive a proper design discharge for the channel and to reduce the energy loss when the water makes a 90 degree turn, therefore, the effectiveness of this alternative may not be as satisfactory as the others. A further study is needed in order to evaluate the cost and effectiveness of all the possible solutions.

4. SIDE COLLECTOR CHANNEL

Again, due to the nature of the alluvial fans, there is a possibility that the flow was not concentrated at its design location. For example, the 1-10'x3' RCBC at sta. 665+02 is designed to convey the discharge of watershed 42 (Figure 1). However, it can be seen from Figure 2 that the watershed is

intercepted by the roadway in an approximately 500 foot reach with a very flat grade, with several shallow channels scattered in between. It is difficult to select a definite concentration point. In this flood event, flow was concentrated at the south side of the watershed (near 662+00) instead of the culvert at the north. Similar situations existed around stations 655+00 (Figure 3) and 12+50 (Figure 4, Phase I-A). Large amounts of sediment found in the side channel between stations 518+00 and 523+00 (Figure 5) reveal the same condition.

All the tributaries enter the side channel at an almost 90 degree angle. The momentum of the water carried the water over the side channel bank and roadway shoulder and splashed on the pavement. Consequently, the debris and sediment transported with the water were left on the pavement (Photo 8).

Side channels with adequate capacity should be designed to collect the tributary flows and to divert the flows to the nearest culvert. Proper design should be given so that the flow will not overtop the side channel bank because of the 90 degree turn. A safety factor should be applied to the design because of the possibility of a channel avulsion.

It is also very important to verify the existing topographic information in the field. For example, from the construction plan, the proposed grade of the roadway pavement at the curb between stations 662+00 and 655+00 is at least 2 feet higher than the existing ground. Photo 7, however, shows that the surrounding ground is almost at the same elevation as the roadway.

5. CONFLUENCE OF WAGNER WASH AND SOUTH CHANNEL

Photo 9 shows 3 feet of scour at the outlet of the confluence, and the downstream channel shows a trend of degradation. It is amazing the magnitude of the channel response in an event of one single flood. Does the design take into account the effect of the channel degradation? What are the equilibrium channel conditions? What is the local scour depth due to the drop?

The grouted rip-rap at the outlet may be damaged by either excessive local scour induced by the drop or simply by the excessive channel degradation. Therefore, placement of dumped rip-rap with proper size rock at this location is suggested. A gabion mattress may be necessary if no suitable size rock is available.

Note that only 4 cells of box are visible in the picture. A total of six cell RCBC was designed under the parkway. It can be seen from Figure 6 that the transition from the outlet of the culvert to the natural channel is too short. The two cells of box on the west will not function properly because of the channel contraction; they will be clogged with sediment eventually. The upstream headwater should be re-derived, using only 4 cells of box. If the headwater height is found to be unacceptable, the confluence should be redesigned.

6. DETENTION BASINS (PHASE I-A)

A series of detention basins were designed in Phase I-A Reach. Damages to these detention basins were mainly caused by erosion. Similar measures as discussed in item 1 will protect the side slope at the channel entrance and the damage due to overtopping of the berm will be resolved (to some degree) once the construction of the grouted rip-rap is completed. However, after reviewing the construction plan, we found that the grouted rip-rap protection is a little short of satisfactory. Figure 7 shows the typical grouted rip-rap design in the detention basin. Several concerns are listed as follows:

i. No slope protection on the embankment (Figure 7a, 7b). Water flows with a given depth; the protection should at least extend above the water depth.

ii. The downstream apron should extend across the whole bottom width of the basin (Figure 7b).

iii. The 2 foot cutoff wall at the apron is not adequate. The drop height of the berm is up to 6 feet; scour depth at the downstream end of the apron is expected to be greater than 2 feet.

iv. Headwater of the box culvert at sta. 73+77 (Figure 7c) was calculated at elevation 1635. The top of the berm in the west is at 1634. Will water flow into the detention basin? Note that no slope protection is provided on the basin side. Also, the top of the east berm is at 1635, therefore, overflow will occur because of the backwater. The slope should be protected and an apron should be provided.

In conclusion, we would like to reiterate the difficulty of the design on the alluvial fans area. It needs more engineering and the cost may be higher than other design projects. However, we feel that the integrity of the design should take precedence over the cost. Without proper remedial actions, the County may inherit a project with a life-time maintenance burden. Also, it may be too late, but we would like to raise an issue concerning the accuracy of the watershed delineations using a 15 minute quadrangle map (scale 1:62500) with 40 foot contour interval. Smaller scale topographic mapping in needed to determine more accurately the watershed boundaries, especially in the alluvial fans area where channels are braided.

Nicholas P. Karan, P.E.

L.C. Huang

L.C. Huang
Civil Engineer II

LCWT 1.5.1

Greiner

SUN VALLEY PARKWAY

GES JOB NO. E121063

Minutes of the Meeting held Wednesday, February 11, 1987 at 8:30AM at the offices of the Flood Control District of Maricopa County.

In attendance were:

Tom Phelan, Maricopa County Highway Department
Bill Horne, Maricopa County Highway Department
Dick Perreault, Flood Control District of Maricopa County
Joe Tram, Flood Control District of Maricopa County
Dave Johnson, Flood Control District of Maricopa County
Tim Sutko, Flood Control District of Maricopa County
Erik Collett, Greiner Engineering Sciences, Inc.
Shi-En Shiau, Greiner Engineering Sciences, Inc.
Michael Shapiro, Greiner Engineering Sciences, Inc.

This meeting was held as a follow-up to the drainage design criteria meeting held on February 4, 1987. The Flood Control District (FCD) and the Maricopa County Highway Department (MCHD) expressed their concerns about some of the drainage approaches taken by Collar, Williams and White (CW & W) on this project as follows:

- The drainage form the roadway impacting the Buckeye Watershed Project should be designed to be compatible with the methods and criteria that the Soil Conservation Services (SCS) used to design this structure.

- The drainage report for the highway should not be used as a master plan report for the overall development.

- The duration used for the design storm should be dependent on the lag time for the subareas; i.e., if the lag time is over one (1) hour but under two (2) hours a duration of two (2) hours should be used.

- When using the rational method for smaller subareas adjacent to the highway, there should be justification that there will not be any runoff entering the smaller subareas from over bank flows from their adjacent subareas.

- Slope easements, drainage easements and ponding easements should be dedicated for the highway. Ponding areas for all culverts should be mapped as part of the drainage report.

- Culverts should be designed to take into account aggredation degradation and siltation accumulation. If the structures are design at the natural slopes of the stream beds there should be no problems.

- Erosion protection including detailed calculations should be performed on the outlets of culverts.

- Where detention basins are being employed, calculations are necessary to ensure that situations are not worsened because of improper design.

- All earthen channels should function so that they will have a rigid boundary. Permissible velocity calculations are required.

- All the drainage criteria used for the highway design should be documented in the reports.

- From the MCHD's maintenance experience, wherever a multibarrel concrete box culvert exceeds four (4) barrels a bridge is usually designed. The MCHD requested Greiner to count up how many numbers of four (4), five (5) and six (6) barrel culverts are proposed on the entire job.

The FCD asked if a bi-weekly meeting could be scheduled for every Thursday for the duration of the project.

Greiner

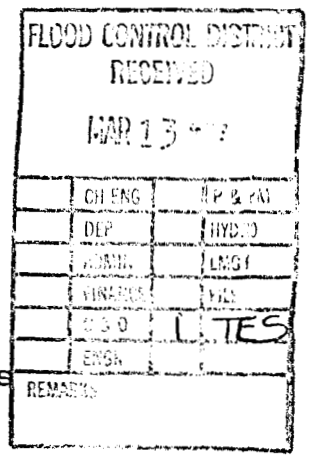
SUN VALLEY PARKWAY

GES JOB NO. E121063

Minutes of the Meeting held Wednesday, March 4, 1987 at 9:00AM at the offices of the Maricopa County Highway Department (MCHD).

In attendance were:

Thomas J. Phelan, MCHD Engineering
Harry R. Keller, MCHD Engineering
Jay Davis, MCHD Real Estate Supervisor
Troy Shobe, MCHD Real Estate
Amedee Gregoire, MCHD Real Estate
Tony Vallance, Hanscomb Associates
Ronnie Redland, Pima Savings
Mark Ratermann, Morrison-Knudsen Engineers
Ron Holmes, Morrison-Knudsen Engineers
Fred Fleet, CW& W Engineering
Paul Kelley, Gust, Rosenfeld, Divelbess and Henderson
Fred Rosenfeld, Gust, Rosenfeld, Divelbess and Henderson
Don Ferris, Adams Group, Inc.
Bob Williams, Adams Group, Inc.
Andy Hendricks, Gaston, Snow, Moya, Bailey, Bowers and Jones
Dick Perreault, Flood Control District
Tim Sutko, Flood Control District
Kay Stevens, Flood Control District
James C. Blosser, Flood Control District
Ronald Weinstein, Loeb and Loeb
Glenn Carter, Greiner Engineering
Erik Collett, Greiner Engineering
Phil Turner, Greiner Engineering



1. The County's requirements for the filing of the ROW requirements have been discussed. The plans must be 1"=200' scale. The parkway centerline will be tied to section corners, etc. The permanent ROW will generally be 75 feet on each side. Permanent slope, drainage and ponding easements will be added where required.

   The ROW will be conveyed to the County with a title policy. A second filing will be prepared with the required permanent easements.

2. The Maricopa County Flood Control District (MCFCD) owns parcel in fee along the proposed parkway and has flowage easements in several locations. A discussion followed regarding the need to advertise and sell the land and the easement by auction. This question was not totally resolved. It is anticipated that the MCHD can be granted easements by paying the required fee.

3. The McMicken Dam stability question has been resolved. The parkway crossing does not create any danger to the dam.

   The Buckeye dyke is classified as a dam. The dam is located on ADOT ROW. A permit application must be filed for the work in the area.

4. Schedule.

   Authorization to proceed with the project will be granted by the County's Board of Supervisors during the March 23, 1987 Board Meeting.

   By March 31, 1987 the bond issue will be closed. All required information must reach the County by March 21, 1987.

5. The construction documents will not be ready by march 21, 1987. (The revised advertisement date was later moved to April 8, 1987.) On a question regarding who seals and signs the specifications and special provisions, it was established that the County will provide the bid documents while the design engineer will prepare the specification and special provisions. He will seal and sign these.

6. Bond Surety.

   The bid documents should include a rating clause.

   In bid evaluation, the State law gives in-state firms a five (5%) percent preference. The requirement is to pay State tax in any amount during the last tax year.

7. The question regarding authority for and on the project was resolved as follows:

   The ENGINEER has the authority on the construction project. The MAG specifications defines the ENGINEER as the County Engineer. He will delegate his authority for the day to day supervision to the Independent Engineer (Greiner) by means of a Letter of Instruction. The agreement between the County and the Corporation will delineate their respective duties and the authority each has on the project.

Greiner will approve the contractor's invoice(s) and submit these to the Corporation's agent for payment. The County will have full control over all Change Orders (CO's) that affect the County's standards. The CO's will usually be initiated by the Independent Engineer. CO request(s) from the Corporation and others that adds work to the contract will be allowed only if additional funding is made available.

Approval procedures will be developed to assure that the project will not stop or create a claim situation.

8. Schedule.

The bonds will be delivered on March 31, 1987.

The project will be advertised on April 8, 1987 and bids received on May 6, 1987.

Items that may delay the schedule include:

- Agreement with ADOT. This process is currently on schedule.
- Environmental study by ADOT is apparently an in-house formality and should not delay the project.

Greiner Engineering Sciences, Inc.
7310 N. 16th Street, Suite 160
Phoenix, Arizona 85020-5223
(602) 275-5400

Greiner

A Greiner Engineering, Inc. Company

GES Job No. E-121-063

April 3, 1987

Mr. Tom Phelan
Project Manager
Maricopa County Highway Department
3325 West Durango Street
Phoenix, Arizona 85009

Re: Sun Valley Parkway
Drainage Review

Dear Mr. Phelan:

Greiner understands about the time pressures involved in completing this project and has, therefore, reviewed the second submittal from Collar, Williams and White Engineering, Inc. (CW & W) in as short a time period as possible. The second submittals from CW & W for drainage was received by Greiner Engineering as follows:

Phase III,	March 20, 1987
Phase IIA,	March 27, 1987
Phase IIB,	March 27, 1987
Phase I,	March 31, 1987

Due to the time constraints, CW & W could not meet all of the Maricopa County Highway Department's (MCHD) minimum design criteria for drainage to complete the above mentioned project. Greiner has reviewed the above mentioned phases and has compiled a detailed list based on CW & W's response to drainage review comments specifying which items have been accepted, which items need to be resolved prior to construction and which items can be resolved during construction. Greiner has estimated the following:

Phase III

- 81% is acceptable.
- 3% needs to be resolved prior to construction unless an agreement is reached between CW & W and MCHD.
- 16% can be resolved by CW & W during construction.

Phase II

- 50% is acceptable.
- 5% needs to be resolved prior to construction unless an agreement is reached between CW & W and MCHD.

- 45% can be resolved by CW & W during construction.

Phase I

- 40% is acceptable.
- 10% needs to be resolved prior to construction unless an agreement is reached between CW & W and MCHD.
- 50% can be resolved by CW & W during construction.

Some of Greiner's major concerns are as follows:

Phase III, II and I

- No calculations for inlet erosion and bank protection have been provided by CW & W for Greiner's review.
- Greiner has concerns about CW & W not providing scour protection downstream of the proposed culverts at this time and the recommendation for future inspection even though the calculation provided show that protection is needed.
- Greiner does not feel confident with the proposed drainage facilities based on CW & W's analysis of split flows and some of their assumptions made in developing their hydrology.
- CW & W did not revise the invert elevations of the culverts to be a maximum of one (1') foot below the existing streambed as recommended or make an attempt to satisfy Greiner that these structures will function to be maintenance free.
- Greiner can not approve the plans until we receive, review and approve the plans for drainage easements, temporary construction easements, slope easements and ponding areas being prepared by the Adams Group.
- CW & W did respond to the MCHD's and Greiner's recommendations regarding Design Memorandum No. 5 evaluating the use of multicell concrete box culverts.

Phases III and II

- The constructability of a cutoff wall using wire welded fabric and pneumatically placed mortar is questionable for channels, spillways, etc. This application seems inappropriate.

Phase III

- Greiner can not approve the drainage concepts for the southern portion until given the opportunity to review CW & W's supporting data showing how the proposed drainage facilities will not adversely impact the existing Buckeye Watershed Protection Project and the ADOT interchange at Interstate 10 and Palo Verde Road.

- Greiner feels that four (4") inches of pneumatically placed mortar with a wire welded fabric will not provide the structural requirements necessary to hold on a 1/2:1 side slope. We suggest designing a six (6") inch concrete channel lining with steel reinforcing for this application.

- Where drop structures are proposed it will be necessary to show that the aprons are long enough to provide enough erosion protection downstream. The joint at the apex of the drop structure should be eliminated. Change of materials should not take place in areas of critical flow.

Phase II

- The lack of documentation between the plans and the HEC-2 (water surface profile) analysis make it impossible to completely verify and for Greiner to feel confident with CW & W's designs for Wagner Wash and the south side channel.

Phase I

- CW & W did not provide back up calculations or documentation to ensure that there is no ponding along the south side of the roadway or breakouts over the roadway between sta. 394+00 to 492+50 as requested by Greiner.

- Greiner can not approve the drainage concepts until given the opportunity to review CW & W's supporting data or documentation from the Arizona Department of Water Resources (ADWR) and the Flood Control District (FCD) for the McMicken Dam.

- Proper access for McMicken Dam as per the FCD's request and sketch has not been incorporated into the construction documents.

- No borrow plans for Tribley Wash Basin have been incorporated into the construction documents as requested by the FCD.

- No back up documentation has been provided indicating the agreements reached between CW & W and the State Land Department regarding the criteria for detention basins and outlet culvert velocities.

- CW & W did not provide any documentation regarding approval from the FCD for their design addressing the conflict between the roadway alignment and the embankment outlet drains for the McMicken Dam.

- CW & W did not provide enough back up information for the proposed detention basin for Greiner to feel confident that the roadway will be protected and that the drainage scheme will work.

- CW & W did not provide any calculations to show that the aprons are long enough downstream of the drop structures or spillways to provide enough erosion protection and to show that they are stable.

- It was never addressed by CW & W how the detention basins were designed and how the runoff will drain into the basins.

- No calculations have been provided to ensure that percent of split flow shown at the outlet of the detention basin discharging into either the culvert or a basin.

- Not enough calculations have been provided for the detention basins to assure that they will function properly.

- CW & W did not verify that removing the existing ditch and dike systems crossing the roadway will not adversely impact the roadway or property upstream or downstream.

Greiner

- CW & W did not address the need for slope paving to protect the roadway embankment within the floodplain of the Tribley Wash Basin.

- CW & W did not show us any evident that the 404 permitting process has been started.

- Greiner is not sure what CW & W is proposing for the Beardsley Canal; i.e. concrete lining?

Greiner sees no reason why these issues cannot be resolved prior to the completion of construction of this project and sees no reason to delay the proposed schedule. Greiner suggests that CW & W be available to make all the necessary revisions during the construction phase of this project. Greiner will make themselves completely available to you to go through the above list documenting our major concerns and to help you in resolving these issues.

Enclosed is the list as mentioned above based on CW & W's response to Greiner's previous drainage review comments. If you should have any questions or need any additional information, do not hesitate to contact me.

Sincerely,

GREINER ENGINEERING SCIENCES, INC.

Shi-En Shiau

Shi-En Shiau, P.E.
Project Director
Water Resources

Enclosures

cc: Fred Fleet, Collar, Williams and White
Dick Perreault, Flood Control District of Maricopa County
Dave Johnson, Flood Control District of Maricopa County
Timothy Sutko, Flood Control District of Maricopa County
Joe Tam, Flood Control District of Maricopa County
Erik Collett, Greiner Engineering
Michael Shapiro, Greiner Engineering
Gary Sun, Greiner Engineering
Dale Crane, Greiner Engineering

DATE IN MAR 20 1987

RESPONSE TO DRAINAGE REVIEW COMMENTS
PHASE III

ACTION TAKEN:

1. Drainage Report General Comments:

OK a. Done - Appendix
OK b. Done - Appendix
OK c. Done - Appendix
* d. To be addressed in a separate analysis.
* e. To be addressed in a separate analysis.
OK f. Done Narrative
OK g. Done Narrative
OK h. Done Narrative
OK i. Done Appendix, Ponding investigation by Adams Group.
OK j. Done - Appendix
* k. Done
OK l. Done - Appendix
OK m. Done - Narrative
OK n. Done - Narrative
OK o. Done - Narrative
OK p. Done
OK q. Done - See attached revised Exhibit Two written response.
OK r. Exhibit Two in Drainage Report updated to include all pertinent information.

OK 2. Drainage Report, Page Two:

a. Narrative changed to clarify.
b. Economy and improved hydraulics.

OK 3. Drainage Report Page Three:

Done in narrative and summary hydrologic data sheet added to appendix.

OK 4. Drainage Report Page Three:

Done

OK 5. Drainage Report Page Three:

Different designers worked on the two contracts, the slight differencein precipitation values has no significant difference in the design of drainage structures.

OK 6. Drainage Report Page Four:

Done

* To be resolved prior to the construction.

** Can be resolved during the construction.

OK 7. Drainage Report Page Four, Last Paragraph:

Limited available R/W on west side.

OK 8. Appendix A Table II:

a. Done
b. 300 is correct.
c. Done
d. Yes
e. Done
f. Done

9. Appendix A Table III:

0.015 a. 0.15
** b. Done
OK c. No, discharges intercepted too small.
OK d. Done - see paving plans.

10. Appendix A Table IV:

OK a. Done - see paving plans.
0.80 b. 0.80 ft.
OK c. Not necessary.

OK 11. Appendix A Table V:

a, b, and c. Table V replaced with corrections and additional information requested.

OK 12. Appendix B Figures:

a. Done - see narrative.
b. Figure 3-47 was removed, its not applicable.

OK 13. Appendix C Rational Design Forms:

a. Yes, velocity in parenthesis indicates Figure 2-8. See Figure 2-8 for assumed conditions.
b. Done
c. Done

OK 14. Appendix D Culvert Design Forms:

a-f. Done
g. Slope is 0.48% not 0.80%.
h-j. Done see Design Forms.
k. Corrected See Table II
l. Done
m. An added safety factor for split flow conditions.
n. Done - See footnote Table II
o. Corrections made where needed.

15. Appendix E HEC-1 Runoff Summaries:

OK a. Lag equals .6TC
OK b. Standard Table for "N" values for natural channels and overland flow.
OK c. Done - See new printouts.
OK d. See HEC-1 input data.
e. Exhibit 2
* 1. Explained in Narrative Page Four.
OK 2. Corrected
** 3. 28B doesn't split.
OK f. Area 24B splits into 28B.
OK g. Corrected.
OK h. Standard of one (1) hour duration used as per ADOT procedures in effect when project began.

OK 16. Drainage Report vs. Paving Plans, General Comments:

a. Corrected
b. Done
c. Done
d. Corrected in Narrative - Spacing varies as per slope.
e. Done

OK 17. Appendix A Table II:

a. Corrected
b. Checked and ok.
c. Corrected

OK 18. Appendix A Table III:

Done

OK 19. Appendix A Table IV

They weren't. Add the transition-length.

OK 20. Appendix A Table V:

a. Done - see plans and new Table V.
b. Design discharges have been modified in several reaches and freeboard added. See Summary Sheet of Table V calculations.
c. Done - See new Table V.
d. Changed - See new Table V.

OK 21. Appendix D Culvert Design Forms:

a. Done
b. No, 31 cfs each, plans corrected.

22. Paving Plans, Drainage General Comments:

a. OK 1. Six inch hump removed as per MCHD instructions.
** 2. Yes
OK 3. See culvert design forms.
** b. Inverts raised as per MCHD recommended maximum depth below the natural grade.
OK c. Done - See detail on plans.
** d. Done
OK e. Done - See plans.
OK f. Due to different amount of cover.
** g. Done
* h. See Exhibit being prepared by Adams Group.
OK i. Done - See Table V.
OK j. Done - See Culvert Design Forms.
** k-l. For all basins, elevations specified on plans.
OK m. Done - See new Table V.
OK n-q. Done - See plans.
OK r-s. Done
** t-u. See k. & L.
OK v. Problem coordinated with AT&T.
OK w. To avoid leaky joints.
OK x. Angles set to fit natural terrain, are not required by MCHD standard ADOT wingwall angles.
OK y. This is not a modification, but an option which must be called out.
OK z. See Table V and Table VI.
OK aa. Done
OK bb. Done
** cc. No, it is not necessary.
* dd. Being done by Adams Group.
OK ee. Corrected.
OK ff. Changed - See plans.
OK gg. Done
OK hh. Done

OK 23. Paving Plans Drainage, Sheet Two (2):
a. Done. See revised detail.
b. See revised detail.
c. Changed now using 4 inch.
d. Done
e. 550 doesn't fit our conditions, see detail 7/2.
f. 1. See Revised Detail (S.R.D.)
2. All changed to 4".
3. S.R.D.
4. See new Section C-C.
5. Revised.
6. Revised

24. Sheet 3
OK a. Done
OK b. Done
** c. Done
** d. Changed to 6".
OK e. See revised detail.

OK 25. a. Plans for roadway south of station 15 to 4.3 will be provided.
b. & c. Temporary channel designs provided.

OK 26. a. Corrected
b. Done

27. OK a. Corrected
OK b. Corrected
OK c. No
OK d. Done
OK e. Done
** f. See Chow.
OK g. Corrected.
OK h. Done

OK 28. Done

OK 29. a. Changed
b. Changed

30. OK a. No
OK b. Done
OK c. No don't agree.
** d. Corrected

OK 31. a. Not necessary
b. Done
c. Done

OK 32. a. Not necessary
b. Checked.O.K.
c. Changed
d. Changed
e. Done
f. Done
g. Corrected

33. ** a. Changed
** b. Will grade to daylight
OK c. Catch basin

34. OK a. No not needed.
** b. To match natural grade of incoming washes.
** c. Fifteen
OK d. It has end section called for.

35. **Corrected

36. **a. Done
**b. Don't believe its a problem.
OK 37. {c. Not recommended according to ADOT criteria.
d. Done

OK 37. a. Done
b. Done
** 38. ?
39. OKa. Collars eliminated
OKb. Not necessary
**c. Not necessary
OKd. Corrected
**e. Not necessary
OKf. Done

** 40. a. Done
b. Done

OK 41. a. Corrected
b. Changed
c. Changed
d. Done
e. Yes, added.
f. Revised

** 42. a. Not necessary.
b. Doesn't make sense.

43. **a. Not necessary.
**b. Not necessary.
OKc. Done
OKd. Not necessary

44. **a. Not necessary
OKb. Corrected.
OKc. Not necessary
OKd. O.K.

45. **a. Not necessary
**b. Done
OKc. Changed
OKd. Corrected

46. OKa. Corrected
**b. Not necessary

47. OKa. Done
**b. Not necessary
OKc. Done

** 48. Not necessary

** 49. Corrected

OK 50. a. Done
b. Revised

OK 51. a. Changed
b. Done
c. For Cover

OK 52. Done

OK 53. Yes, added

OK 54. a. Done
b. Changed

OK 55. a. Changed to 15"
b. Added catch basin.
c. Changed

OK 56. Yes

OK 57. a. There are no modifications.
b. Catch basin moved to 380 + 69.74.

OK 58. a. Done
b. Done
c. Done
d. Corrected

OK 59. a. Done
b. Grade breaks called out.

DATE IN MAR 2 6 1984

RESPONSE TO PHASE II DRAINAGE REVIEW COMMENTS

1.OK A-E. Done
** F. Report is organized. A conclusion or recommendation section doesn't seem approrpriate for a design project, this isn't a reasearch study or an an alternatives analysis.

** G-N. Done
* O. Exhibit has been corrected.
** P. Not necessary, the drainage Exhibit #2 can be correlated to the plans by using the station I.D.'s on the Exhibit and the section corner I.D.'s on the plans.

OK 2. Corrected

3.OK A. Done
OK b. See narrative
* C. Derivation of curve numbers are explained in narrative.
** D. The statement does not say that HEC-1 was "only" used on area larger than 100 acres. The important point is that the rational formula was not used on areas over 100 acres in size. HEC-1 was used on all areas over 100 acres, however, this doesn't mean HEC-1 was not also used on some areas less than 100 acres in size as you discovered.

4.OK A. Done
** B. Figure 3-1 or the estimated travel time was used.
OK C. Yes, See Table I
** D. Added
OK E. Corrected
F.OK 1. Changed
OK 2. True
OK 3. They drain naturally into Wagner Wash
** 4. Ground configuration; areas 47 to 49 drain into Wagner Wash anyway. See HEC-1 run for calculations.

OK 5. A-E. See new ADOT format basin worksheets (Table IV) requested.

** 6. A-B. See new pavement and median worksheets Tables III and IV provided.

7.OK A. Yes, but the benefits outweight the costs.
** B. An energy dissapator will be provided.
** C. Don't understand the question.

OK 8. See new worksheets provided in Table III.

* To be resolved prior to the construction.

** Can be resolved during the construction.

9 OK A. Done
OK B. Done
** C. Done
OK D. Done

10 ** A. 710 + 00
** B. 1-7. Corrected.
OK C. Two subareas within 12 (See HEC-1 as noted)
OK D. O.K. Done

11 ** A. See Culvert Calculations Sheets.
OK B. O.K. Corrected.
** C. Yes
** D. 1. Done
2. Done
** E. See Culvert Calculation Sheet.
** F. See Culvert Calculation Sheet.

** 12. A. Not necessary, all necessary data is contained in the HEC-1 printouts in the appendix.
B. Either Figure 3.1 or actual estimated time of travel was used.
C. 1. Done
2. Done
3. Done
D. Done

13. ** A.
* B. See narrative.
** C. Not necessary, locate elevation 2000 feet if needed.
** D. Not necessary, major error was corrected on Exhibit II between areas 16 and 25.
OK E. Done

14. ** A. Done
OK B. These areas are minor contributors, although, our approach was on the conservative side.
** C. TLAG = 0.6 T_c
OK D. Standard tables.
** E. See HEC-1 printouts.
OK F. Not applicable, County approved standard for this project is 100 year, 1 hour.
OK G. Corrected.

OK 15. Changed, See revised drainage report.

OK 16. See Plans.

** 17. A-D. See revised report and plans.

** 18. A. Done
B. Not necessary for call out of Station on calculation or summary sheet in the report to agree exactly with the centerline call out on the plans, unless you can't recognize which culvert it is referring to.
C. These are all split flow situations, see revised Table II.
D. Done
E. Done

19. **A. Done
OK B. Done
OK C. Done
** D. Done
** E. Done
OK F. Done
OK G. Done
** H. Done
** F. Done
OK J. Done
** K. Done
** L. Done
** M. Done
** N. Not necessary.
OK O. Done
** P. Not necessary
* Q. Adams Group is doing.
** R-U. Done
** V. See Channel Design Summary in Appendix
** W-Z. Done

20. OK A. 1. Done
2. There are some V-Ditches see new detail.
3. Revised typical section.
OK B. 1-2. Done
3. Can't on detail, see plans.

OK 21. A. Done
B. Dike added.
C. Not necessary per County Bridge Department.
D. Checked O.K.

OK 22. Done

OK 23. A-C. Done

24. **A-B. Done
OK C. Checking
** D-F. Done

OK 25-26. Done

OK 27. A. Done
B. Not Necessary (N.N.)
C. Done

DATE IN MAR 2 7 1987

RESPONSE TO PHASE II-B
DRAINAGE COMMENTS #49 THRU 67

OK 49. A. 1. No see plans.
No see plans.
B. Done
C. Changed, used 4 ft.

OK 50. Done

51. OK A. Done
** B. Detail number changed.
OK C. Done

52. OK A. Done
OK B. Done, 336 is correct.
** C. Not necessary.
OK E-G. Done

** 53. A-C. Done

54. ** A. No.
OK B-D. Done
** E. Unresolved
** F. Don't understand question.

55. ** A-B. Why, the area is nearly level?
** C. No
OK D-F. Done
OK G. Negligible flow.

56. ** A. Done
** B-C. No
** D-F. Done
OK G. Not necessary
** H-K. Done

** 57. A-B. Done

OK 58. Done

OK 59. A. Done
B. Changed configuration.

** 60-65. Changed configuration.

OK 66. Done

67. ** A. Changed detail.
OK B.. Done

42 OK	A.	Done
OK	B.	Done
OK	C.	Done
OK	D.	Corrected
**	E.	Done
OK	F.	Done
** 43.		Done
44 OK	A.	Done
**	B.	Done
OK	C.	Done
** 45-55.		Done

PHASE I - B

** 56.		Done
** 57-64.	A-E.	Done
**	F.	Done, see detention basin summary table.
** 65.	A-B.	Done
	C.	Changed to 4:1
	D.	Will be carried to reservoir area in roadside channel.
OK 66.	A.	Done
67. OK	A.	Done
*	B.	Done
**	C.	Permit has been filed
**	D.	Under
**	E-G.	Done
68. **	A.	Will be carried to reservoir in channel
OK	D.	Done
**	C-E.	Done
** 69.	A.	What information?
	B.	Done
	C.	This is part of the bridge plans for the Beardsley Canal.
	D.	See Bell Road Design, Town of Surprise

* To be resolved prior to the construction.

** Can be resolved during the construction.

** 28-30. Done

OK 31. A. Done
B. Removed
C-F. Done

** 32-43. Done

44 OK A. Done
** B. "
OK C. Not Possible
** D. Done

OK 45. A. Revised
** 46 ? B-C. Done

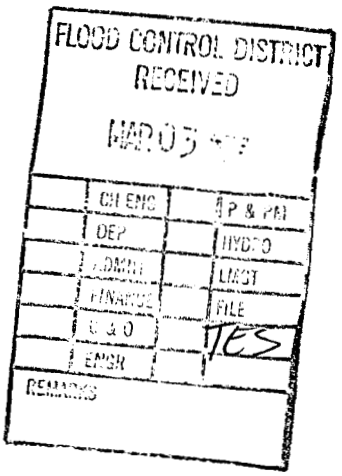
~~46.~~ ** A-B. See report and channel design calculations and road side ditch calculations.
47 OK C-H. Done
OK I. N.N.
OK J. Changed
OK K. Done
** L. Rip-rap is to be constructe per proposed contour lines.

~~47.~~ OK A. Done. See new median calculations.
48 OK B. Done
** C. Done

Greiner

Greiner Engineering Sciences, Inc.
7310 N. 16th Street, Suite 160
Phoenix, Arizona 85020-5223
(602) 275-5400

A Greiner Engineering, Inc. Company



GES Job No. E121063

February 27, 1987

Mr. Fred E. Fleet, P.E.
Project Manager
Collar, Williams & White Engineering, Inc.
2702 N. 44th Street
Suite 205-B
Phoenix, Arizona 85008

Re: Sun Valley Parkway
Drainage Review

Dear Fred:

Enclosed are the drainage design criteria addendum and our drainage review comments on Phase II for the above referenced project. Our review is based on the January 30th submittal of: (1) drainage report for section 9 of Sun Valley Parkway, December 1986 (not bound); (2) paving plans for Sun Valley Parkway Phase II-A and II-B (not dated); and (3) paving plans for Sun Valley Parkway Phase II-B and II-C (not dated). These comments do not cover the supporting documentation that Greiner requested at our meeting of February 9, 1987.

The review comments are prepared for three parts: (1) drainage report review, (2) consistency between drainage report and paving plan, and (3) paving plan drainage review. General review comments are included in each of these parts. The detail review comments as page-to-page, item-by-item or sheet-to-sheet are provided for parts (1), (2) and (3), respectively. Due to the limited information provided in the drainage report, the review of consistency between the drainage report and the paving plan cannot be completed. The review comments are numbered in sequence; please address each item accordingly.

Sincerely,

GREINER ENGINEERING SCIENCES, INC.

Shi-En Shiau, P.E.
Project Director
Water Resources

SES/jsa

Enclosures

cc: Tom Phelan, Maricopa County Highway Department
Dave Johnson, Flood Control District of Maricopa County
Dick Perreault, Flood Control District of Maricopa County
Timothy Sutko, Flood Control District of Maricopa County
Joe Tram, Flood Control District of Maricopa County
Erik Collett, Greiner Engineering
Mick Mathieu, Greiner Engineering
Michael Shapiro, Greiner Engineering
Gary Sun, Greiner Engineering

Greiner

SUN VALLEY PARKWAY

GES JOB NO. E121063

Addendum

Drainage Design Criteria

February 27, 1987

	Maricopa County Instructions
I. HYDROLOGY	
o Design Frequencies	Highway-100 year, 1-hour storm FCD (McMicken & Buckeye Structures) Peak Q_{100} flood event Note: Highway design is not to adversely effect these Flood Control structures based on FCD criteria.
II. HEC-1 PROGRAM	
o Lag Time	M.C. used SCS methodology and in certain circumstances will allow use of TR-55.
III. OPEN CHANNELS	
o Freeboards	Supercritical .25d Supercritical .2(d+v2/2g) OR HGL + 1.0' Channels HGL + 0.5' Ditches *FCD only
o Scour and Bank Protection	HEC 15 (COE procedure for FCD structures)
o Permissible Velocity	HEC 15 or SCS (SCS for FCD structures)
IV. CULVERTS	
o Erosion Protection	HEC 14 or approved simplified method. (FCD structures FHWA or HEC 14)

Addendum

Drainage Design Criteria

February 27, 1987

	Maricopa County Instructions
V. DETENTION BASINS	
o Design Frequency and Freeboards	Detention basins shall meet State requirements.
o Maximum Depth	Detention basins are to be drained within 60 hours. Maximum fill height for detention basins berms shall be six (6) feet.
VI. DRAINAGE EASEMENTS	
	A. DHW for the peak 100 year frequency flow and corresponding DHW elevation shall be computed for all culvert crossing. DHW elevation for maximum Q_{100} which would overtop the roadway or adjacent dike may be calculated based upon a fill height available to contain the flow. B. Drainage easements sufficient to contain and control peak Q_{100} frequency flow shall be mapped and conveyed to Maricopa County. Modifications to these easements will be made based on information presented and verified in Master Drainage Studies for site developments.

Greiner

SUN VALLEY PARKWAY

GES JOB NO. E121063

Drainage Review Comments

Phase II

Action Taken

(1) Drainage Report, General Comments

A. Please provide the culvert calculation sheets.

B. Please include Arizona Highway Department Median Drainage worksheets for the design of median catch basins.

C. Please provide Arizona Highway Department Storm Sewer System Design Data Sheets with each inlet design. These sheets are Runoff Calculation Sheets, Inlet Calculation Sheets and Storm Sewer Calculation Sheets.

D. On all channel calculations, compute the actual water depth and average velocity based on the actual design discharge value.

E. Report should be bound, sealed and signed by a registered Professional Civil Engineer.

F. Please organize the report and at least provide a conclusion or recommendation section.

G. Describe the effect the proposed construction might be expected to have upon drainage flows and flood levels.

H. Discuss the project and estimate how future development in the project area might affect the characteristics of future drainage flows, and ultimately, the performance of the hydraulic structures on the project.

I. In the procedures section, describe briefly the methods used in delineating the drainage areas, the program used for catch basin and curb opening calculations and all the drainage design criteria used in the study.

Greiner

SUN VALLEY PARKWAY

GES JOB NO. E121063

Drainage Review Comments

Phase II

Action Taken

J. Provide hydraulic data sheets, which are to include the natural channel velocities, outlet protection (type) and ponding beyond the Right-of-Way.

K. Need to show all your calculations for inlet and outlet erosion protection and bank protection.

L. Need to demonstrate that all earthen channels will function so that they will have a rigid boundary (permissible velocity calculations).

M. Need to specify that this report is only for the roadway improvements and is not intended to be used as a master drainage study for future development. It is the future development's responsibility to not adversely impact the highway.

N. Justify that when using the rational method, there will not be any runoff entering these smaller areas from over bank flows from their adjacent areas and address what kind of precaution was made in culvert design.

O. There are a number of drainage area delineations that are unclear. Please submit a clean exhibit so that it can be redlined.

P. Please provide a strip map approximately 11 inches wide of the roadway alignment at a scale no less than 1" = 400', depicting contours at no less than five (5') foot intervals, stationing, drainage area delineations, drainage area numbers, proposed cross structures, median inlets and dikes, curb opening inlets, channel alignments and delineation of ponding areas.

Q. Our comments do not include any type-errors.

Drainage Review Comments

Phase II

Action Taken

(2) Drainage Report, Page 1

"This report is for the section of parkway Station 409+94 through Station 1024+52...as Contract 9."

The stations contradict with the title of this report which shows Stations 409+95 and 1024+53, respectively.

(3) Drainage Report, Page 2

A. "Project area lies between White Tank Mountain to the east and the Hassayampa River to the west (southerly section), White Tank Mountain and Wagner Wash to the southeast and the river to the northwest (center section) and finally White Tank Mountain to the south and CAP to the north (easterly section)."

It seems that this paragraph is unclear, please describe the boundaries for southerly, center and easterly sections of the project area.

B. What happened to the flows discharging from two overchutes through the CAP shown on the Drainage Area Map?

C. "The drainage areas on the slopes of the White Tank Mountains, were assumed to have curve numbers of 93. The flatter desert areas were assumed to have a curve number of 83 in present conditions, however, a curve number of 86 was used in the calculations to account for a potential increase in runoff due to future development. (Neglect a possibility of required retentions of generated runoff in future developments.)"

Drainage Review Comments

Phase II

Action Taken

This is a design project. Please address land use pattern, vegetation cover, treatment or practice, hydrologic condition, and hydrologic soil group. Then a curve number can be determined. Since this is not a master drainage study for future development, it is based on the result of future development to decide whether retentions are needed.

D. "Peak discharges for the watershed areas were determined using the rational formula for areas up to 100 acres, and using Corps of Engineers HEC-1 computer program for areas in excess of 100 acres."

This statement contradicts with the hydrology summary. Several watershed areas less than 100 acres were using the HEC-1 computer model to compute peak discharges.

(4) Drainage Report, Page 3

A. "Likewise a runoff coefficient of 0.5 was used in the rational method calculations instead of the undeveloped desert runoff coefficient 0.35 to account for future development (See figure 2-21.)"

Please address how the runoff coefficient of 0.35 was determined.

B. "Time of concentration for each area was determined using figure 3-1."

It appears that figure 3-1 was used to compute time of concentration only for the areas using the rational method to calculate the runoff.

C. "Precipitation values for 100 year one hour were determined using nearest station-Buckeye. See figure .)"

Action Taken

Please assign a figure number to the precipitation values for Buckeye station.

D. There is no description of procedure used to obtain time of concentration and direct runoff for the areas using the HEC-1 model.

E. "MEDIAN DRAINAGE - SEE NEXT CHAPTER"

It appears that the drainage report was not organized in chapters.

F. "Station 710+00 - 1024+52 Area drained to Wagner Wash (Areas A-Z)"

1. Station 1023+52 should be 1024+53.

2. There are no drainage areas Q and W.

3. Address where the drainage areas B_1, D_1, E_1, F_1, I_1, J_1 and K_1 will drain.

4. Address why the drainage from areas 47-49 was routed to the Wagner Wash stated in Summary Runoff and Culverts. Please provide the calculations for the above changes.

(5) Drainage Report, Page 4, MEDIAN DRAINAGE CALCULATIONS

A. Address why the Manning's equation is used instead of the modified Manning's equation to compute runoff for median.

B. Address how the time of concentration is calculated and it appears to be in minutes.

C. Address what the I100 is and how its value was determined.

D. Show how the second Q's were calculated.

Action Taken

E. Address why a length of 3,500 feet was recommended.

(6) Drainage Report, Pages 4-6, CATCH BASINS AND OUTLETS

A. The procedure used to design catch basins was unclear. Please address all variables used and correct all type-errors in the calculations. The following are some general questions for the calculations:

1. Address why the modified Manning's equation was not used to compute Tc. Was the minimum of Tc of 10 minutes be used.

2. How were the rainfall intensities determined.

3. What type of catch basin was proposed. For example, Grade Inlet in a sag as per ADOT Standard Drawing C-15.30 and C-15.50 Type LW-1.2 Grate with 2 inches gutter depression.

4. What is the Manning's roughness coefficient used.

5. Address what is the gutter depression for the grate inlet in sag. What is the depth used for the grate bar. Is it 0.27' and 0.29'.

B. Due to the above mentioned problems, the review of the catch basin cannot be completed at this point.

Drainage Review Comments

Phase II

Action Taken

(7) "More economical solution is recommended for this section: collect a runoff from area A-K in a new channel along south of parkway draining towards west into Wagner Wash just south of crossing with parkway. This solution will not only save 11 culverts underneath the parkway and minimize the runoff at crossing Wagner Wash, but it will make it easier to develop the area northerly of parkway (areas B1-K1)."

A. This solution will also create a situation, which involves substantial earthwork, drop structures design, channel erosion protection and extensive maintenance problem.

B. The concentrated flow for the drainage area like this size may be create an extensive erosion problem at the inlet to the Wagner Wash.

C. Please address why a 58" x 36" CMP shown in the summary runoff and culverts was designed to divert flow in area K crossing parkway into area K.

(8) Drainage Report, Pages 7-9, PAVEMENT DRAINAGE CALCULATIONS

Due to the same reasons as stated in 6(A) of these review comments, the calculations cannot be reviewed for pavement drainage.

(9) Drainage Report, Page 9-10, CHANNEL DESIGN CALCULATIONS

A. Please show the channel slopes in feet per foot for all reaches.

B. Please calculate the water depth based on the design discharge and check for the minimum freeboard requirement of 0.5 foot.

Action Taken

C. Please submit the permissible velocity calculations to decide whether channel/bank erosion protection is needed.

D. Please provide the hydraulic analysis and erosion protection calculations for all drop structures.

(10) Drainage Report, HYDROLOGY SUMMARY

A. Please indicate what is the correct station of the boundaries of two parts for this section 9. It showed Station 715+00 in the hydrology summary and Station 710+00 was shown in the text, page 3.

B. Please verify the following discrepancies with the Hydrologic Design Data Sheets:

1. Slope for area 1 may be 2.9%.

2. Area for area 12 may be 2.84 square miles.

3. Parkway elevation for area 15 may be 1,422 feet.

4. Area for area 18 may be 22.9 acres.

5. Parkway elevation for area 19 may be 1,428 feet.

6. Top elevation for area 44 may be 1,900 feet.

7. Area for the watershed area P may be 0.27 square miles.

C. Please address why two sets of parameters were used for the area 12.

Drainage Review Comments

Phase II

Action Taken

D. It appears that the letters 'Q' and 'W' were not designated as watershed areas, please ensure there is no drainage areas missed.

(11) Drainage Report, SUMMARY RUNOFF AND CULVERTS

A. Please address how the discharge splits were accessed for the culvert design.

B. Please use the standard call outs for the box culverts.

C. What happens to the area 'Z'. Is discharge of 9,679 cfs including the peak flows for areas 'Z' and 48-49.

D. Please address the following discrepancies with the HEC-1 results:

1. Check discharges for culvert locations at Station 784+61, Station 849+39 and Station 1015+84.

2. Verify the watershed acreage and discharge for drainage area A-Y. Please show calculations for the 149 cfs flow route to Station 716+43.

E. Please specify the design discharge for each culvert in the section.

F. Please verify the adequacies for the proposed culverts which have the note "REQ'D BY GROUND CONFIG.".

(12) Drainage Report, HYDROLOGIC DESIGN DATA SHEETS

A. Please provide hydrologic design data sheets for watershed areas L-P, R-V, X-Z, B_1, D_1-F_1 and I_1-K_1.

Drainage Review Comments

Phase II

Action Taken

B. It is unclear that the procedure used to compute times of concentration for areas less than 0.1 square miles and/or for areas which average drainage area slopes were flatter than one (1) percent.

C. Please verify the design data for the following items:

1. Drainage areas for areas V, X, Z, 8-10, 18, 20, 24, 27-29, 35, 37 and 39.

2. Drainage length for area 4.

3. Top elevation of area 44.

D. All data sheets should be signed, checked and dated.

(13) Drainage Report, DRAINAGE AREA MAP

A. The tile of "15 MINUTE SERIES DRAINAGE AREA MAP..." is misleading. It stated that the drainage area map was a combination of blown up 15 minute quadrangle with 40' interval contours and aerial photography.

B. Please verify if soil group B used in most watershed areas is correct. It appears that approximately 50% of the section drainage area was group D soil based on the Soil Conservation Service Soil Survey.

C. Please indicate the drainage area boundary between area 12A and area 12B.

D. There are a number of drainage area delineations that are unclear. The potential split flows are not identified, please verify.

E. Please indicate the boundaries for areas I and 15.

Drainage Review Comments

Phase II

Action Taken

(14) Drainage Report, HEC-1 RESULTS

A. It appears that area of 0.49 square miles should be used in the HEC-1 input for area U instead of 0.44 square miles shown. This was based on the hydrology summary in the drainage report.

B. Please address the rationale of developing runoff hydrographs for the areas, which will discharge into the Wagner Wash, without considering the Parkway crossing. For example, areas such as T, U, Y and Z.

C. How was the lag for HEC-1 input calculated. Is the empirical relation (L=0.6Tc) used. Please verify the lag for areas 11 and 13.

D. What criteria were used to determine roughness values.

E. Need hydrologic data to check the kinematic wave routing.

F. Most of the Tp>1.5 hours, 100-year, 2-hour hypothetical storm should be used to generate 100-year peak discharges.

G. No BA card was assigned to area 12B. The HEC-1 will default to last given area 2.84 square miles instead of 1.65 square miles.

(15) Drainage Report vs. Paving Plans, General Comments

Due to the limited information provided in the drainage report, the review of consistency between the drainage report and the paving plan cannot be completed.

Drainage Review Comments

Phase II

Action Taken

(16) Catch Basins and Outlets

According to Detail of Mounted Curb and Gutter on plans, the ADOT standard grate catch basin is to be used in conjunction with the gutter width of 24 inches. Please address how the design procedure was used in the report and make modifications to the plans for the proposed 15-inch gutter width.

(17) Channel Design

The review cannot proceed for the following reasons:

A. None of the calculations were using the actual design discharges to compute the water depth and velocity.

B. Stations of reaches were unclear.

C. No calculations were performed for the various channel bottom width with the actual discharge.

D. There are no calculations for the design of drop structures.

(18) Summary Runoff and Culverts

A. There are several discrepancies on the design discharges between the report and the paving plans. Please verify these discharges, which have "SPLIT" in Summary Notes, with the paving plans.

B. Cross culvert station shall be called by intersection with the roadway centerline. Please address why the station at the inlet or outlet side was used in this summary instead of station crossing roadway centerline shown in the profile of the paving plans.

Action Taken

C. Please verify the discharges for the culverts at drainage areas 1, 8, 9, 10, 14, 29, 32 and 34 on Phase II Plans with the report.

D. Please identify the structure at Station 719+89 (inlet side) on Sheet 33 of 35 in Phase II-A and II-B Plans.

E. Please verify the discharges of the culverts for drainage areas Y and K in the HEC-1 output with Phase II-B and II-C Plans.

(19) Paving Plans, Drainage General Comments

A. Please explain why a gutter width of 15 inches was proposed instead of 2 feet. How the ADOT standard grate catch basins can be installed without modifications. Please investigate the possibility of using concrete gutter transition to protect grate catch basins.

B. Please ensure that the length of culvert meets the requirements that minimum 30 feet normal to the centerline of roadway each side from edge of pavement to the back of the headwall.

C. Please ensure that the proposed channels are shown on plans and profiles. Channel slopes, elevations and stations for grade break point and match points should be included.

D. Please ensure that call outs for median catch basins include the 'H' values. Address how the 'H' values were calculated.

E. Please ensure that the notes for grate catch basins include the 'H' values, grate type, grate elevation and in sag or on grade. Address how the 'H' values were determined. Notes should be clear and understandable, a contractor should be able to tell what is (W=2") or what is (15").

Drainage Review Comments

Phase II

Action Taken

F. Please include the station in the notes for all culverts. Cross culvert stations shall be called by intersection with the roadway centerline.

G. Please explain why the stations and inverts of inlet/outlet were used to plot the culvert in profile at the offset of 48 feet left and right. Please address why this will not apply to the connector pipes.

H. Please address how the contractor shall perform the proposed grading work for roadside channels and the inlet/outlet of culverts to ensure proper functioning of drainage schemes.

I. Since ADOT Standard No. CW6 series wingwalls with modified length bends and were proposed on Phase II-A and II-B Plans, address how the transition between 6 to 1 and 4 to 1 and provide details to show how to grade from the edge of the shoulder to the back of wingwalls.

J. Make sure that stations and invert elevations are called out at all culverts in profile.

K. Please ensure that all catch basins are shown in profile with the call outs including stations, invert elevations and grate elevations..

L. Please specify what type of the level wingwalls are proposed as per ADOT Standard No. CWL-1. It appears that type B level wingwall was proposed.

M. Since each grouted rip-rap at the inlet/outlet of culverts has the different geometry, please provide details for each side of culverts and ensure that they will function hydraulically.

Greiner

SUN VALLEY PARKWAY

GES JOB NO. E121063

Drainage Review Comments

Phase II

Action Taken

N. Please address why the headwall as per MAG Detail No. 501-3 was modified and proposed for the multiple pipe culverts at Station 424+87, Station 437+17.25, Station 463+30, Station 504+51.50, Station 590+65, Station 601+81, Station 605+53, Station 611+51, Station 624+33, Station 627+75, Station 638+09, Station 656+81, Station 658+96 and Station 698+15. If the modification is a must, structure details should be provided for each modification.

O. Please provide calculations, hydraulic performance data, sedimentation and scour anaylsis for culvert design adequacy review.

P. Wherever earthen channels are shown, call out by note, on each sheet to construct these earthen channels.

Q. Please secure and show temporary constructional slope easement where grading outside the right-of-way.

R. Since the proposed channels are not consistently offset from the roadway centerline, the horizontal alignment should be calculated and provided. Without this information, how can the channel be staked and constructed.

S. Please call out the beginning station and the ending station of channel transitions on the plans.

T. Please provide channel stability analysis at a minimum, bank stability and channel degradation analysis should be performed.

U. Detail should be provided for the grouted rip-rap at the outlet of the catch basin pipe.

Drainage Review Comments

Phase II

Action Taken

V. The discharges of the south earthen channel in Phase II-C were not able to be verified at this time, due to limited documentation. Greiner will try to verify and provide comments at later date.

W. Please address the stability of the drop structure per detail 12, and provide documentation that erosion from either side of the upstream end will not occur.

X. Please ensure the quantities called for every drop structure at the south channel in Phase II-C are correct. Detail 12 should be quantified in cubic yards not in square yards. It appears that quantities for the two foot cutoff wall in all edges was not included.

Y. Please verify to adequacy of the side spillway type structures per detail 11. The quantities called in each note appears not including the two foot cutoff wall in all edges. Plans verify and quantified in cubic-yard.

Z. Please indicate why you are using RGRCP and not RCP/CSP.

(20) Phase II-A and II-B, Sheet 2

A. Details 1 and 2

1. There is no slope arrow for the right shoulder in Detail 1.

2. The bottom width of the roadside channel should be 5' typ. There are several reaches that have the V-shape ditch per plan.

Action Taken

3. Please address how it can be matched existing ground at the right-of-way line with the typical sections shown. What if the existing ground is lower than the roadway at the right-hand side. What will the contractor do if the existing ground is higher than the existing ground shown at the left-hand side.

B. Detail 12, Typical Section Box Culvert

1. Please show the flow direction.

2. Please include end treatment for inlet and outlet.

3. Please indicate how to match the existing ground.

(21) Phase II-A and II-B, Sheet 3

A. Please show the median catch basin at Station 413+86 in profile.

B. Please address why the dike was not proposed at the downstream of median catch basin at Station 413+86.

C. Call out for ADOT Standard Detail CW 6-5 Wingwall, length = 16' does not conform to Standard Detail. If mod. bends are to be used, provide a detail and reference it in the call out.

D. It might not have enough cover over 3-10'x3' RCBC at Station 412+74.

(22) Phase II-A and II-B, Sheet 4

Please identify the flow direction for the proposed ditch (west side) at approximate Station 427+00 and Station 427+40.

Drainage Review Comments

Phase II

Action Taken

(23) Phase II-A and II-B, Sheet 5

A. Flow line elevations of the proposed ditch are not consistent from plan to profile.

B. Please verify the flow direction of the proposed west ditch in profile at approximate Station 436+30.

C. Is the flow direction shown for median drainage correct at approximate Station 439+60. Please call out the grade break at approximate Station 436+60.

(24) Phase II-A and II-B, Sheet 6

A. Please verify the length of level wingwall at the south of the outlet of the 8'x3' RCBC at Station 443+31.

B. Please show the double grate catch basin at Station 445+64.08 in profile. The grate elevations and invert elevations of 18-inch RGRCP are different between median catch basin and double grate catch basin.

C. Please verify the clearance from the grouted rip-rap to the transmission tower to meet the requirements as per Special Notes 3-2 in Sheet 1. Need a structural detail to construct this grouted rip-rap structure. For example, the transition of side slopes and elevations of top of banks should be included.

D. Check the length of the wingwall on 8'x3' CBC at Station 443+31 on the downstream south side.

E. Please show the cross slopes for the median on this sheet.

Action Taken

F. Check the flow line of the proposed ditch in profile.

(25) Phase II-A and II-B, Sheet 7

A. The label for the 5' channel bottom width at approximate Station 458+30 left is misplaced.

B. Check the flow line of the proposed ditch in profile.

(26) Phase II-A and II-B, Sheet 8

A. The label of the 5' channel bottom width at approximate Station 467+00 left is misplaced.

B. Please verify the length and slope for the double 36"x22" CMP.

C. Please call out the station of grade break for the median drainage.

D. Please include the design discharges and headwater elevations for culverts at Station 460+55 and Station 463+30.

(27) Phase II-A and II-B, Sheet 9

A. Check the flow line of the proposed ditch in profile. Please address why the flow line elevations are the same from Station 475+63 right to Station 476+80 right.

B. Please include calculations to ensure the HGL elevation for the median catch basin at Station 473+69.09 is not higher than the grate elevation. Provide a detail to show 1'x1' opening in top RCBC slab.

Action Taken

C. The south wingwall at the outlet of the 6-10'x4' RCBC at Station 480+10.5 shall be ADOT Standard CW6-3 and not CW6-1.

(28) Phase II-A and II-B, Sheet 10

A. The south wingwall at the inlet of the 6-10'x4' RCBC at Station 482+23 shall be ADOT Standard No. CW 6-5 and Not CW 6-1.

B. Show the station of grade break for median drainage.

C. Need a call out for the proposed east ditch at Station 490+00 including station, offset and flow line elevation on plan.

D. Please verify the 36"x22" CMP shown in profile.

E. Please include the design discharge for each of three sets of 6-10'x4' RCBC.

F. Please address why the dike was not proposed at the downstream median catch basin at Station 482+87.

(29) Phase II-A and II-B, Sheet 11

A. Please plot the median catch basin and the grate catch basin at Station 490+07.91 in profile.

B. Please verify the invert elevation shown in profile at Station 490+16 and Station 492+71.

C. Please show the 18-inch RGRCP in profile at the proposed grade at back of curb left.

D. ADOT Standard No. CW6-3 shall be used at the outlet of the 10'x3' RCBC at Station 492+71.

Action Taken

E. Need a call out for the proposed right ditch Station 500+00 including station, offset and flow line elevation on plan.

F. Please include the design discharges and headwater elevations for the culverts at Station 490+16 and Station 496+86.

(30) Phase II-A and II-B, Sheet 12

Need a call out for the proposed right ditch at Station 500+00 including station, offset and flow line elevation on plan.

(31) Phase II-A and II-B, Sheet 13

A. Please show the station of grade break for median drainage.

B. What is "C=24.00" shown at the inlet of the 4-10'x3' RCBC.

C. Please show the proposed west ditch from Station 514+34 to Station 516+45 in profile.

D. Please show the flow direction for the proposed east ditch in profile.

E. Need a call out for the proposed east ditch at Station 520+00 as shown in Sheet 14.

F. Please verify the invert elevation shown in profile at Station 518+31.

(32) Phase II-A and II-B, Sheet 14

A. Please show the proposed west ditch in profile.

Drainage Review Comments

Phase II

Action Taken

B. Please show the 58"x36" CMP at approximate Station 529+95 in profile. Verify the invert of this pipe shown in profile at back of curb left.

C. Need a call out for the proposed ditch at Station 540+00 right.

(33) Phase II-A and II-B, Sheet 15

A. Please show the proposed west ditch in profile.

B. Need a call out for the proposed ditch at Station 540+00 right.

(34) Phase II-A and II-B, Sheet 16

A. Need a call out for the proposed ditch at Station 540+00 right.

B. Please verify the median catch basin at Station 544+29 in profile. Check the grate elevation in the call out.

C. Please address why the dike was not proposed at the downstream of the median catch basin at Station 544+29.

(35) Phase II-A and II-B, Sheet 17

A. Please include the design discharges and headwater elevations for the culverts at Station 550+50, Station 552+64 and Station 555+51.

B. Please show the station of grade break for median drainage.

Drainage Review Comments

Phase II

Action Taken

C. Please verify the invert elevations for the pipes shown in profile at Station 550+50, Station 552+64 and Station 557+56.

(36) Phase II-A and II-B, Sheet 19

A. Please show the station of grade break for median drainage.

B. Show the flow line in profile for the proposed ditch at approximate Station 578+95 left.

(37) Phase II-A and II-B, Sheet 21

A. Need a call out for the proposed ditch at Station 590+00 right as shown on Sheet 20. Verify the flow line in profile.

B. Please include the design discharge and headwater elevation for the 29"x18" CMP at Station 594+88.

C. Need a call out for the proposed ditch at Station 600+00 right.

(38) Phase II-A and II-B, Sheet 22

A. Need a call out for the proposed ditch at Station 600+00 right. Plot the proposed ditch in profile.

B. Please show the proposed ditch in profile from Station 603+95 to Station 602+73.

(39) Phase II-A and II-B, Sheet 23

A. Please include the design discharge and headwater elevation for the 29"x18" CMP at Station 614+49.

Action Taken

B. Please identify the station of grade break for median drainage.

(40) Phase II-A and II-B, Sheet 24

A. Please address why the dike was not proposed at the downstream of median catch basins at Station 621+71.16 and Station 629+42.12.

B. In profile, the station of median catch basin shall be Station 621+71.16 and not Station 621+71.68.

C. Please include the design discharges and headwater elevations for the culverts at Station 620+54 and Station 624+33.

D. Please verify the inlet station of 628+00 for the double 36"x22" CMP.

(41) Phase II-A and II-B, Sheet 25

A. Please call out the flow line elevation for the proposed east channel at Station 630+00.

B. Need notes to construct two wingwalls at the inlet side of the two sets of 4-10'x3' RCBC at approximately Station 631+70.

C. Please verify the note which states wingwall per ADOT Standard CW 6-5, for the north wingwall at the east side of the 4-10'x3' RCBC at approximately Station 632+25.

D. Please call out the station of grade break for median drainage.

E. Check the flow line of the proposed east channel in profile.

Drainage Review Comments

Phase II

Action Taken

(42) Phase II-A and II-B, Sheet 27

A. Please call out the station of grade break for median drainage.

B. Please verify the flow direction shown on plan and profile for the proposed west ditch from Station 653+94 to Station 655+73.

C. Please show the 15" RGRCP in profile.

(43) Phase II-A and II-B, Sheet 29

A. Need notes for the proposed east channel in this sheet.

B. Please call out the station of grade break for median drainage. Address what you propose for the median drainage from this grade break station to Station 677+78.84.

C. Please verify the invert elevation shown in profile for the 3-10'x3' at Station 676+30.

(44) Phase II-A and II-B, Sheet 30

A. Please verify the outlet elevation for the 15" RGRCP at Station 683+12 on plan and profile.

B. Please ensure that the proposed inlets will pick up the east bound pavement drainage. The transition of cross slopes is not clear.

C. Please address why the connector pipes for catch basins at Station 683+12 and Station 684+96 were not proposed to drain into the west side of the road. Instead, a very expensive scheme of storm drain was proposed. The proposed solution will drain water into the proposed east channel, then drain west through the 4-10'x3' RCBC.

Action Taken

D. Check the flow line for the proposed east channel on profile sheet.

(45) Phase II-A and II-B, Sheet 31

A. Notes for the 58"x36" CMP called out per ADOT Standard C-13.25 end section for both ends, but the drawing shows headwalls with grouted rip-rap structures. Please verify.

B. Need a note for the proposed east channel at Station 690+00. Please check the flow line in profile on this sheet.

C. Please verify the channel bottom width at the reach near Station 700+00.

(46) Phase II-A and II-B, Sheet 32

A. Please specify the design discharges for the earthen channel reaches.

B. Please address the stability of the proposed earthen channel and its inlet configurations.

C. The note for the proposed east channel at Station 710+00 was called out as Station 709+00.

(47) Phase II-A and II-B, Sheet 33-34

A. Please verify the design discharge for the proposed east earthen channel.

B. Please address the stability of the proposed earthen channel.

C. Please verify the grate elevation for the median catch basin at Station 713+41.61 in the note.

Drainage Review Comments

Phase II

Action Taken

D. Please call out the name of wash crossing the road.

E. Please show the design discharges for all the box culverts on Sheets 33-34.

F. Please verify the station shown on the note for the inlet of the 3-10'x4' RCBC at Station 718+02.

G. Need a note for the south wingwall of the inlet side of the 3-10'x4' RCBC at Station 718+02.

H. Please include the centerline station on profile sheet for the 3-12'x6' RCBC at approximate Station 720+20.

I. Please provide structural details for the proposed 3-12'x6' RCBC.

J. Most of the inlet wingwalls and outlet wingwalls designed for the three sets of the 3-12'x6' RCBC on sheet 33 and 34 are modified ADOT CW 6-6 or CW 2-6. The ADOT CW 6-6 and CW 2-6 are used for culvert heights more than eight foot. Please check other ADOT standard and provide structural details for the modified version.

K. Please show grading slopes between the shoulder and top of the bank at each end for every RCBC on sheet 33 and 34.

L. Please verify earthwork at both ends of the proposed three sets of the 3-12'x6' RCBC. If the earthwork is correct, should the contractor construct sloping rip-rap aprons or should he construct flat rip-rap aprons then cover with sloping earthwork.

Drainage Review Comments

Phase II

Action Taken

(48) Phase II-A and II-B, Sheet 35

A. Please address why the dike was not proposed at the downstream of the median catch basin at Station 738+00. Address what you propose for the median drainage from this catch basin to Station 734+64.92.

B. Please call out the cross slopes for the median at approximate Station 739+00.

C. Check the location of the grate catch basin and the median catch basin at Station 738+00 on plan.

(49) Paving Plans Drainage, Phase II-B, Sheet 2

A. Details 1, 2, 3 and 4

1. Is it correct that the proposed channel excavation will match existing ground at R/W line.

2. Is it correct that the proposed south channel will be constructed that north toe of the bank is located at R/W line. If not, a general note might be necessary.

B. Detail 11

Please specify side slope, length and rock size for the grouted rip-rap.

C. Detail 12

The cutoff wall depth at the downstream end of the proposed channel drop structure shall be verified. The exposure of the cutoff wall, due to the long term or short term degradation, shall not exceed half the cutoff wall depth. Structural concrete shall be used if the cutoff wall depth exceeds 6 feet.

Drainage Review Comments

Phase II

Action Taken

(50) Phase II-B, Sheet 3

Note for catch basin pipe at Station 741+61 is not complete. Please make proper revision.

(51) Phase II-B, Sheet 6

A. Please include design discharge and head water elevation for the proposed 2-36"x22" CLCMP.

B. Please include structural detail sheets for the modified MAG 501-3 head walls for the proposed 2-36"x22" CLCMP.

C. Please provide a note for the rip-rap construction at the inlet and outlet for the proposed 2-36"x22" CLCMP.

(52) Phase II-B, Sheet 7

A. Please include design discharge and headwater elevation for the proposed 2-29"x18" CLCMP.

B. Please include design headwater elevation for the proposed 10'x3' RCBC and verify the design discharge. (Q_{100}=236 cfs on plan, 336 cfs as in report.)

C. Please include structural detail for the modified MAG 501-3 headwalls for the proposed 2-29"x18" CLCMP.

D. Please provide structural details for each of the modified ADOT CW 6-7 wingwalls for the proposed 10'x3' RCBC.

E. The southwest wingwall for the proposed 10'x3' RCBC called a length of 32 feet. Please verify against the drawing which shows 22 feet.

Drainage Review Comments

Phase II

Action Taken

F. Please verify the quantities of the proposed rip-rap per detail 11 for the proposed 10'x3' RCBC. (Detail 11 should be quantified as cubic yard not square yard.)

G. Please address the fill slope for the area between shoulder and top of the bank at both ends of the proposed 10'x3' RCBC.

(53) Plan II-B, Sheet 9 and 10

A. The west earthen channel plans do not match from Sheet 9 to Sheet 10.

B. The earthen channel profiles do not match from Sheet 9 to Sheet 10. This is a 0.5 foot difference at west channel and a foot difference at east channel.

C. The flow direction of the east channel profile at approximately Station 819+80 is not correct. Please check.

(54) Plan II-B, Sheet 11

A. Please provide structural details for each of the modified ADOT CW 6-5 wingwalls for the proposed 2-10'x3' RCBC.

B. The proposed fill at upstream of the 2-10'x3' RCBC is not clear. Please provide detail instructions in the notes.

C. The culvert station called 829+20 at Station 825+20 may be a drafting error. Please check it.

D. The proposed south channel has a different drainage scheme. The plan provides a channel draining westerly, however, the profile shows a easterly flow direction. Please verify the drainage scheme.

Drainage Review Comments

Phase II

Action Taken

E. Please address why there is no cutoff wall provided for the 6" rip-rap apron for the 2-10'x3' RCBC.

F. Please address the fill slope for the area between shoulder and the top of the bank at both ends of the proposed 2-10'x3' RCBC.

(55) Plan II-B, Sheet 12

A. The proposed drainage grading at upstream and downstream of the proposed 2-10'x3' RCBC are not clear, please provide detail instruction in the notes.

B. It is unclear how the earthwork should be done from the shoulder to the top of the channel bank at the downstream end of the proposed 2-10'x3' RCBC.

C. Please provide structural details for each of the modified ADOT CW 6-1 and modified ADOT CW 6-3 wingwalls for the proposed 2-10'x3' RCBC.

D. Please verify the quantities of the proposed rip-rap per detail 11 for the proposed 2-10'x3' RCBC. (Detail 11 should be quantified as cubic yard, not square yard.)

E. Please verify the earthwork at the north end of the 2-10'x3' RCBC. It appears that a partial exposed culvert is proposed.

F. Please include the catch basin and pipe at Station 834+35 on profile sheet.

G. Please address how a sump condition can be achieved at median catch basin Station 834+35 and what you propose for the median drainage Station 834+40 to Station 836+10.

Drainage Review Comments

Phase II

Action Taken

(56) Phase II-C, Sheet 13.

A. Please include the proposed catch basin located at Station 845+20 on profile sheet.

B. Please include the structural detail for the proposed 6-12'x4' RCBC.

C. Please include the structural details for each of the modified ADOT CW 6-1 and modified ADOT CW 6-3 wingwalls for the proposed 6-12'x4' RCBC.

D. Please ensure the proposed earthworks at the west side of both ends of the 6-12'x4' RCBC are correct. If it is, please ensure that sloping aprons can be constructed and this type of construction will not reduce the design capacity.

E. Please verify the quantities of the proposed rip-rap per detail 11 for the proposed 6-12'x4' RCBC. (Detail 11 should be quantified in cubic yard, not square yard.)

F. Please address why channel drop structure as detail 12 is not proposed for the 80 foot channel at downstream of the 6-10'x4' RCBC.

G. Please address how the contractor should taper the channel sloping rip-rap to a flat rip-rap apron at the downstream of the 6-12'x6' RCBC.

H. Please address the fill slope for the area between shoulder and the top of the channel bank at the south end of the proposed 6-12'x4' RCBC.

I. Please verify the earthwork at the north end of the 6-12'x4' RCBC between shoulder and the top of the channel bank.

Drainage Review Comments

Phase II

Action Taken

J. Please include catch basin and outlet pipe at Station 840+87 and Station 845+20 on profile sheet.

K. Please ensure that the contractor will understand the drawing and the notes at approximately Station 849+80 as to construct 120 L.F. grouted rip-rap per detail 11.

(57) Phase II-C, Sheet 14

A. Please address how the water can drain from elevation 97.8 to elevation 99.2 as proposed in the north channel at approximately Station 852+80.

B. Please ensure the proposed 18" RGRCP at downstream of a drop structure will not be washed out during a high flow.

(58) Phase II-C, Sheet 15

Please address why median dike is not proposed at downstream end of the catch basin located at Station 863+60.

(59) Phase II-C, Sheet 16

A. There are no rip-rap protections provided at the outfalls of the north channel. Please ensure the head cut will not migrate into the roadway embankment.

B. There is no bank protection provided at the north bank of the south channel at Station 875+50, where a wash jointed the channel from the south. Please ensure the stability of the roadway embankment under the impinging flow from the south.

Drainage Review Comments

Phase II

Action Taken

(60) Phase II-C, Sheet 17

A. The north channel at Station 880+00 does not match with Station 880+00 on Sheet 16, please verify.

B. The south channel at Station 880+00, plan notes and profile has a one foot elevation difference, please verify.

C. Plan notes and profile have a half foot elevation difference at the south channel at Station 890+00, please verify.

(61) Phase II-C, Sheet 19

Plan notes and profile has a half foot elevation difference at the south channel at Station 910+00, please verify.

(62) Phase II-C, Sheet 23

Please assess the potential of channel breakout and failure at Station 941+00.

(63) Phase II-C, Sheet 25

Please correct every note called for rip-rap construction per detail 10 on this sheet. It appears should be detail 11 or detail 12.

(64) Phase II-C, Sheet 26

Notes called for drop structures per detail 11 on this sheet are not correct. It should be detail 12.

Drainage Review Comments

Phase II

Action Taken

(65) Phase II-C, Sheet 27

The south channel at Station 980+00 is at elevation 43.0, while it shows 43.1 on Sheet 26. Please verify.

(66) Phase II-C, Sheet 28

There is no protection provided at the outfall of the north channel. Please ensure the head cut will not migrate into roadway embankment.

(67) Phase II-C, Sheet 30

A. Please include structural detail for the modified MAG 501-3 headwalls.

B. Please provide notes for rip-rap apron construction.

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(602) 275-5400

Greiner

A Greiner Engineering, Inc. Company

Job No. E-121-063

February 20, 1987

Mr. Fred E. Fleet, P.E.
Project Manager
Collar, Williams & White Engineering, Inc.
2702 N. 44th St., Suite 205-B
Phoenix, AZ 85008

Re: Sun Valley Parkway Drainage Review

Dear Fred:

Enclosed are the drainage design criteria and our drainage review comments on Phase III for the above referenced project. Our review is based on the January 30th submittal of: (1) drainage report for 291st Avenue from I-10 to Northern Avenue, January 1987, and (2) paving plans for 291st Avenue from I-10 to Northern Avenue (43 sheets). These comments do not cover the supporting documentation that Greiner requested at our meeting of February 9, 1987.

The review comments are prepared for three parts: (1) drainage report review, (2) consistency between drainage report and paving plan, and (3) paving plan drainage review. General review comments are included in each of these parts. The detail review comments as page-to-page, item by item or sheet-to-sheet are provided for parts (1), (2) and (3), respectively. The review comments are numbered in sequence; please address each item accordingly.

Sincerely,

GREINER ENGINEERING SCIENCES, INC.

Shi-En Shiau

Shi-En Shiau, P.E.
Project Director
Water Resources

SES/smm
Enclosures

cc: Tom Phelan, Maricopa County Highway Department
Dave Johnson, Flood Control District of Maricopa County
Dick Perreault, Flood Control District of Maricopa County
Timothy Sutko, Flood Control District of Maricopa County
Joe Tram, Flood Control District of Maricopa County
Erik Collett, Greiner Engineering
Mick Mathieu, Greiner Engineering
Michael Shapiro, Greiner Engineering
Gary Sun, Greiner Engineering

Greiner

GES Job No. E-121-063

DRAINAGE REVIEW COMMENTS
SUN VALLEY PARKWAY - PHASE III
291ST AVENUE, FROM I-10 TO NORTHERN AVENUE

Action Taken

(1) Drainage Report, General Comments

A. Please include hydrologic design data summary table and calculation sheets for the HEC-1 modeling.

B. Please include median catch basin hydraulic calculations.

C. Please indicate the type of culvert used in the culvert calculation sheets.

D. Please provide supporting data that shows how the proposed drainage facilities will not adversely impact the existing Buckeye Watershed Protection Project.

E. Please provide supporting data that shows how the proposed drainage facilities will not adversely impact the ADOT Interchange at Interstate 10 and Palo Verde Road.

F. Describe the effect the proposed construction might be expected to have, upon drainage flows and flood levels.

G. Discuss the project and estimate how future development in the project area might affect the characteristics of future drainage flows, and ultimately, the performance of the hydraulic structures on the project.

H. In the procedures section, describe briefly the methods used in delineating the drainage areas, how split flows were identified and calculated, the program used for catch basin and curb opening calculations and all the drainage design criteria used in the study.

I. Provide hydraulic data sheets, which are to include the natural channel velocities, outlet protection (type) and ponding beyond the Right-of-Way.

Action Taken

J. On all channel calculations, calculate the actual water depth and average velocity based on the actual calculated design peak discharge value.

K. Need to show all your calculations for inlet and outlet erosion protection and bank protection.

L. Need to demonstrate that all earthen channels will function so that they will have a rigid boundary (permissible velocity calculations).

M. Need to specify that this report is only for the roadway improvements and is not intended to be used as a master drainage study for future development. It is the future development's responsibility to not adversely impact the highway.

N. Specify what duration storm you are using in the text and the total depth in inches.

O. Please submit split flow calculations used in HEC-1 modeling. Justify assumptions used and address what kind of precaution was made in culvert design.

P. Justify that when using the rational method, there will not be any runoff entering these smaller areas from over bank flows from their adjacent areas and address what kind of precaution was made in culvert design.

Q. There are a number of drainage area delineations and additional split flows that are unclear. Please submit a clean exhibit so that it can be redlined.

R. Please provide a strip map approximately 11 inches wide of the roadway alignment at a scale no less than 1" = 400', depicting contours at no less than five (5') foot intervals, stationing, drainage area delineations, drainage area numbers, proposed cross structures, median inlets and dikes, curb opening inlets, channel alignments and delineation of ponding areas.

Greiner

Action Taken

(2) Drainage Report, Page 2

A. "III. Proposed Development and Drainage System... ...The Maricopa County Highway Department has stipulated that ...all runoff from a 100-year storm be carried under the road through the drainage system."

This contradicts with drainage areas 32-37. All drainage in these areas were directed into the Buckeye Watershed Project retention basin.

B. Site the reason why concrete-lined CMP's are used when the cover is greater than two (2') feet.

(3) Drainage Report, Page 3

"IV. Procedures. . .
...The drainage areas on the slopes of the White Tank Mountains were assumed to have curve numbers of 93. The flatter desert areas were assumed to have a curve number of 83 in an undeveloped condition, however, a curve number of 86 was used in the calculations to account for a potential increase in runoff due to future development. . ."

This is a design project. Please address land use pattern, vegetation cover, treatment or practice, hydrologic condition, and hydrologic soil group. Then, a curve number can be determined.

(4) Drainage Report, Page 3

"IV. Procedures. . .
...Likewise, a runoff coefficient of 0.42 was used in the rational method calculations. . ."

Please address the condition as how the runoff coefficients of 0.42 and 0.35 were determined.

(5) Drainage Report, Page 3

"IV. Procedures. . .
...Precipitation values for the 100-year, 1-hour storm were determined using A.D.O.T. drainage manual. . ."

Please address why the information available from the Buckeye Station records was not used on Contract 1.

Action Taken

(6) Drainage Report, Page 4

". . .Q = CIA = 0.35 x 6.6. . ."

Please address how C = 0.35 was determined.

(7) Drainage Report, Page 4, Last Paragraph

"...A series of catch basins and collector pipes were placed along the west side of the road to collect street runoff and carry it to the roadside drainage channel on the east side of the road. Curb openings were placed on the east side of the road to allow street runoff to enter directly into the drainage channel."

Please address why curb openings were not proposed along the west side of the road. Instead, a very expansive scheme of storm drain was proposed. The proposed solution will collect water from the west side to the east side, then drain west again.

(8) Appendix A Table II

A. Please use standard terms for RCBC (number of barrels-span (ft.) x height (ft.).

B. At Station 329+20, Q_{100} is 300 c.f.s. as shown in the culvert design sheet and in Table II, 660 c.f.s., which is correct?

C. Station 327+20, 2 - 8' x 4' RCBC, Q_{100} = 360 as shown in the culvert design sheet is missing in the table.

D. Station 312+00 should be 6' x 3' RCBC.

E. Station 289+20 should be 289+30.

F. Please address how the Q_{100} values were determined for Station 306+00, 336+40, and 271+20.

(9) Appendix A Table III

A. What is the Manning's n value used for pavement?

B. A clogging factor of 0.8 should apply to the intercepted Q calculated.

Action Taken

C. Did all 15" R.G.R.C.P. meet the minimum design velocity of 3 f.p.s. for lateral design policy? Please include all the pipe velocity calculations in the table.

D. Please address where the west half of street flow between Station 19+00 and Station 15+04.30 including carryover flow of 5.2 c.f.s. will drain.

(10) Appendix A Table IV

A. Please address where the carryover flow of 5.4 c.f.s. will drain at Stations 16+00 and 19+00.

B. Specify what clogging factor was used in the catch basin calculations.

C. Show calculations for connector pipes.

(11) Appendix A Table V

A. The design discharges do not agree for the reach between Station 61+00 and Station 81+00, see first line and the last line.

B. An n value of 0.15 should be 0.015 for the reach between Station 15+00 and Station 50+00.

C. Need velocities and energy grade line calculations to check for freeboard requirements based on calculated design flows.

(12) Appendix B Figures

A. Specify the drainage area numbers which were used in Figure 2-8 to compute Tc.

B. Specify which basin design was used in Figure 3-47.

(13) Appendix C Rational Method Design Forms

A. Does area #1 use Figure 2-8 to compute Tc? What assumptions were made to obtain the velocity of 2.3 f.p.s.?

B. Check the drainage area (in acres) for area #12.

C. All calculations should be checked and dated.

Action Taken

(14) Appendix D Culvert Design Forms

A. Please include outlet velocity calculations for all culvert design sheets.

B. Please include calculations for the recommended 2 - 24" pipes at Station 404+40 and calculations for 1 - 8' x 4' CBC at Station 386+00.

C. Provide pipe slope and outlet invert elevation for the structure at Station 382+80.

D. Please verify the outlet invert elevation at Station 374+70.

E. Need culvert design calculations for the structure at Station 363+00. Show shoulder elevation for structure at Station 300+30. What is the slope for structure at Station 137+00?

F. All calculations should be checked and dated. Pages within this appendix should be numbered.

G. Need new calculations at Station 336+40 with a slope of 0.8%.

H. What are the recommended structures for Station 300+30, Station 292+10, Station 289+30, and Station 243+75?

I. Provide stationing for the structure of 3 - 10' x 3' RCBC in the last calculation sheet.

J. Change the size of RCBC to span x height instead of height x span.

K. Explain why the structure at Station 327+20 is not shown in Table II.

L. Check the stationing of 10' x 3' RCBC at D.B. 13 vs. Table II.

M. Explain why higher design flows for structures were used in D.B. 21, Station 230+30, Station 227+80, and Station 225+15 than were shown in Table II.

N. Need to use peak flows of combined hydrographs for structures at Station 386+00, Station 336+40, and Station 271+20.

Action Taken

O. The following is a list of locations of structures where the headwater elevations may be higher than the shoulder elevations.

Station 386+00, Station 382+80, Station 316+70, Station 292+10, Station 142+50.

(15) Appendix E HEC-1 Runoff Summaries

A. How was the lag for HEC-1 input calculated?

B. What criteria were used to determine roughness values?

C. Provide HEC-1 output with IO=3 option, which provides intermediate and master summaries including schematic diagram of stream network.

D. Need hydrologic data to check the kinematic wave routing.

E. Exhibit 2:

1. Show the area of soil group D.

2. No drainage basin 6C.

3. No spilt shown for D.B. 28B.

F. How did the spilt occur at the middle of the D.B. 28B?

G. No calculation for D.B. 32.

H. Most of the Tp > 1.5 hours, 100-year, 2-hour hypothetical storm should be used to generate 100-year Qp.

(16) Drainage Report vs. Paving Plans, General Comments

A. The stationing values shown in Table II cannot be checked on plans.

B. Please provide the type of pipe used (R.C.P. or C.M.P.) on all culvert calculation sheets for checking on plans.

Action Taken

C. Please provide new calculations for structures which have been modified per the design data on the plans. The data includes length, slope, and invert elevations.

D. The maximum median catch basin spacing is 2,400 feet as the drainage report stated. This is not in agreement with the paving plans.

E. Please ensure that the top elevation of dikes for median catch basins are 0.8 feet above the top of grate on the plans as per the drainage report.

(17) Appendix A Table II

A. The discharge shown for Drainage Basin 11 was divided into two structures on plan Sheet No. 35. The 2 - 10' x 4' RCBC was not shown in Table II.

B. The discharges shown for Drainage Basin 21 were changed on the plans, Sheet No. 25 and 26.

C. The discharge shown as 756 cfs for Drainage Basin 23 was reduced on the plans to 720 cfs Sheet No. 22 at Station 198+04.

(18) Appendix A Table III

A. Please identify the station of catch basin no. 9 with plan Sheet No. 7.

(19) Appendix A Table IV

A. Please address why the curb opening width was reduced on the plans.

(20) Appendix A Table V

A. The concrete channel does not meet the minimum freeboard requirements of 0.5 foot.

B. The use of design discharges for the concrete channel is somewhat questionable. The off-site drainage is all sheet flows in these reaches. We feel that the design discharges are low and should stay conservative to avoid creating a dirt ditch parallel to the concrete channel.

Action Taken

C. Please include a summary of calculations for channel slope of 0.80% shown on sheet no. 9 and 10. Is the channel design adequate here?

D. What is the design discharge for the 3 - 10' x 3' RCBC at Station 38+82 on sheet no. 6? If it is 658 c.f.s., address why the upstream approaching channel is designed with the capacity of 881 c.f.s. in the drainage report.

(21) Appendix D Culvert Design Forms

A. Need calculations for the 2 - 10' x 4' RCBC on plan Sheet No. 35.

B. Is the design discharge of 62 c.f.s. used for each 30-inch CMP? This contradicts with the culvert design at Station 397+60 in the drainage report. Need a separate culvert design form for each structure.

(22) Paving Plans, Drainage General Comments

A. Since the standard culvert outlet design and practice was not used for every culvert design, please submit calculations and hydraulic performance data for design adequacy review. For example:

1. What can a six (6) inch high hump do hydraulically to a three (3') feet or higher opening RCBC?

2. Is a four (4) feet cut off wall adequate for scour protection?

3. What is the outlet velocity and impact to downstream property?

B. Most of the proposed culverts are somewhat below the existing wash flow line elevation. Limited excavation such as pocket type is proposed. Please address and submitback up data to ensure that the culvert will not be silted during small storm events.

C. Dikes are proposed to ensure proper functioning of drainage schemes. Details of the dike should be presented to avoid a sugar dike situation.

Action Taken

D. Symbols used for grouted rip-rap are different from inlet to outlet, please verify.

E. Show in profile the flow line and the slope of the proposed drainage channels.

F. Please address why Class III and IV are specified for 15-inch RGRCP at different locations.

G. Please call out the beginning and the ending of channel transitions on the plans.

H. Please ensure all drainage easements are shown (dike, headwall, inlet grading, outlet protection, etc.).

I. Please specify the design discharges for all improved channel reaches.

J. Please include outlet velocity for each culvert.

K. Please address how the V depth of catch basins was determined.

L. Please address how the H values were calculated for median catch basins.

M. Provide the calculations for the unlined roadway drainage channel.

N. Explain why the grouted rip-rap at RCBC inlets were not shown graphically as per Detail 3 of Sheet No. 3.

O. Please re-calculate the grading slopes at the inlet or outlet of culverts to reflect the grouted rip-rap proposed on Sheet No. 3.

P. Cross culvert station shall be called by intersection with the roadway centerline. The angle of skew shall also be provided.

Q. Lateral culvert station shall be called by midpoint of the culvert relative to roadway centerline and offset from that.

R. A legend should be included on Sheet No. 1.

Action Taken

S. Special note for notation should be provided, such as "C = 00.86", what does "C" stand for?

T. On the ADOT Standard C-15.80 catch basin, the "H" is from the bottom of the grate to the floor of the catch basin, please make corrections on every "H" called on the plans.

U. On the MAG Standard 531 Type B curb opening catch basin, the "V" is from invert of the pipe to the top of the curb, please make corrections on every "V" called on the plans.

V. Please ensure that all cross drainage 15" RGRCP have no conflict with the existing telephone line.

W. Please indicate why you are using RGRCP and not RCP/CSP.

X. Please address how the wing wall angels were determined, i.e. 138°, 122°30', etc. Can standard ADOT wingwall angles be used?

Y. On median catch basins, ADOT Standard C-15.80 are used, please delete "W/4' Concrete Apron". Otherwise, show details if it is modified.

Z. Please confirm the stability of the proposed earthen channel and its inlet configurations.

AA. Please ensure that all pipe inlets entering the open channels match the proposed flow line elevations as specified by outlet stations and offsets.

BB. Please identify in the legend what "D.E." is.

CC. Where earthen channels are shown, call out, by note, on each sheet to construct these earthen channels.

DD. Please secure and show temporary construction/ slope easements where grading outside of the Right-of-Way.

EE. Check call outs for the concrete box culverts, they should be identified by the standard no. not the plan no., i.e. CB-3, CWL-1, etc.

Action Taken

FF. Please address why the 2:1 slope wings instead of the 6:1 slope wings are being used for the box culvert when the fill slope is 4:1.

GG. Please specify gage and corrugation and call out as "CSP" instead of "CMP" for all corrugated steel pipes or provide a table for all of them. A general note in lieu of changing all the notes can be used to specify the use of steel pipe.

HH. Make sure that stations, offsets and elevations are called out at all match lines for all open channels.

(23) Paving Plans Drainage, Sheet 2

A. Detail 2

At the concrete-lined channel, it is specified as "Match Existing Ground" at the top of the east bank. Since the existing ground elevation varies with a 3:1 side slope and the width is fixed how do you propose to match the existing ground? What shall the contractor do if the existing ground is below or above the top of the bank? Shall it be backfill to drain or just let it be? What should the contractor do if it is outside of the specified Right-Of-Way?

B. Details 5 and 6

Please address, submitting back up data, why three (3) inches of pneumatically placed mortar was proposed instead of a four (4) inch thickness for lining and one (1) foot thickness for cutoff walls.

C. Details 5 and 6

Please address how the proposed three (3) inch pneumatically placed mortar lined channel can be economically constructed, per MAG, Specification Section 525.

D. Detail 6

Show where the three (3) foot cutoff wall transitions back to the two (2) foot cutoff wall.

D. To construct the eastern collector system to function as designed, more information is needed on the plans.

E. A median catch basin may be required on this sheet.

F. What is "C" elevation for the grouted rip-rap at Station 198+04?

(42) Sheet 23

A. Notes for the earthen channel construction are not provided.

B. Show stations for slope changes, i.e. where is 0%, where is the transition?

(43) Sheet 24

A. Notes for earthen channel construction are not provided.

B. Show the channel transitions from trapezoidal to V-shape and from the five (5) foot bottom width to the two (2) foot bottom width.

C. Call out the stations for channel grade break.

D. A median catch basin may be required on this sheet.

(44) Sheet 25

A. Notes for earthen channel construction are not included.

B. The proposed 3 - 10' x 3' RCBC and 2 - 10' x 3' RCBC appear not to have enough cover at both ends.

C. A median catch basin is not provided for about 5,000 feet, please investigate.

D. Detail 3 of Sheet 3 was called out twice for the grouted rip-rap at Station 228+23.

(45) Sheet 26

A. Notes for earthen channel construction are not included.

Action Taken

B. the proposed 2 - 10' x 3' RCBC appear not to have enough cover at both ends.

C. Please address if the western earthen channel has the capacity to meet the roadway design standard.

D. The 67 S.Y. of grouted rip-rap at Station 230+85 was somewhat high in elevation, please verify.

(46) Sheet 27

A. The median section from Station 240+00 to 243+40 does not appear to drain, please investigate.

B. Notes for earthen channel construction are not included.

(47) Sheet 28

A. Please address the slope varies at the shoulder from Station 253+75, 56' RT to 255+07.93, 56' RT.

B. Notes for earthen channel construction are not included.

C. Please investigate the possibility of using a MAG Detail No. 545 or an ADOT Standard Drawing No. C-13.20 for the metal end section at Station 254+46.

(48) Sheet 29

Notes for earthen channel construction are not included.

(49) Sheet 31

Address why the outlet pipe of 18 inch RCP was used for the median catch basin at Station 280+62.

(50) Sheet 32

A. Please investigate the possibility of using a MAG Detail No. 545 or an ADOT Standard Drawing No. C-13.20 for the metal end sections for the 42 inch RGRCP.

B. What is "C" elevation for the grouted rip-rap at Station 292+62?

Action Taken

(51) Sheet 33

fA. What is "C" elevation for the grouted rip-rap at Station 301+00? This "C" elevation is higher than the roadway drainage channel invert as per Detail 2 of Sheet No. 3.

B. Please show the direction of flow for the median drainage.

C. Address why the 20 to 1 shoulder slope was used for the east side of the roadway instead of 10 to 1.

(52) Sheet 35

Check the call out for 30 inch CLCMP, the "End End" should be "Each End".

(53) Sheet 36

A median catch basin may be required on this sheet.

(54) Sheet 38

A. Please indicate the flow direction for the median drainage.

B. Please investigate the possibility of using a MAG Detail No. 545 or an ADOT Standard Drawing No. C-13.20 for the metal end section for the 36 inch RGRCP at Station 350+68.

(55) Sheet 39

A. Address why the outlet pipe of 18 inch RGRCP was proposed for the median catch basin at Station 365+80.

B. Indicate how the median drains between Station 362+00 and Station 357+50. Please call out the station of the high point at the median near Station 362+00.

C. Please investigate the possibility of using a MAG Detail No. 545 or an ADOT Standard Drawing No. C-13.20 for the metal end section for the 18 inch RGRCP at Station 365+80.

Action Taken

(56) Sheet 40

Is the 20 to 1 shoulder slope correct near Station 380+00 RT?

(57) Sheet 41

A. Please indicate any modifications made to Detail 3 on Sheet No. 3 for the 8' x 4' RCBC at Station 386+53.

B. Indicate how the median drains between Station 377+00 and Station 382+45. It is suggested that the median catch basin at Station 382+60 may have to shift to Station 380+75 and the dike may be eliminated.

(58) Sheet 42

A. Please investigate the possibility of using a MAG Detail No. 545 or an ADOT Standard Drawing No. C-13.20 for the metal end section for the 30 inch RGRCP at Station 397+92.

B. Please show the direction of flow for the median drainage.

C. Please check the skew angle for the 143 L.F. of 30 inch CLCMP. It appears to be 15°30'.

C. Please check the Q_{100} for culverts at Station 397+92 and at Station 398+70.

(59) Sheet 43

A. Please show the direction of flow for the median drainage.

B. It appears that the roadway drainage channel has grade breaks. Please check the channel slopes.

SUN VALLEY PARKWAY
DRAINAGE DESIGN CRITERIA

	A.D.O.T./M.C. Requirements	City of Phoenix Requirements	Collar, Williams & White Used	Greiner's Recommendation	Maricopa County Instructions
I. HYDROLOGY					
1. Design Frequencies	50-year, 1-hour storm for bridges, culverts, underpasses, and depressed roadways. Not worsen the effects upstream and downstream for the 100-year storm event.	N/A	100-year, 1-hour storm.	Accept	100-year, 1-hour storm except where the lag time exceeds one hour a 2-hour duration should be used.
2. Precipitation Values	Addendum[a]	Technical Memorandum WBTRM WR-44 "Phoenix WBO Records"	Contract 1-Addendum[a] Contracts 6&9-Buckeye Station Records	To be decided by Maricopa County[i]	Collar, Williams & White to justify.
3. Rational Method					
A. Drainage Area Sizes	Less than 1 square mile[a] Less than 160 ac.[b]	N/A	Contracts 1&9-less than 100 ac. Contract 6- less than 375 ac.	Accept	As Greiner recommends.
B. Runoff Coefficients	Figure 3-3[a]	N/A	Varies	Figure 3-3[a]	As Greiner recommends.

SUN VALLEY PARKWAY
DRAINAGE DESIGN CRITERIA

	A.D.O.T./M.C. Requirements	City of Phoenix Requirements	Collar, Williams & White Used	Greiner's Recommendation	Maricopa County Instructions
C. Time of Concentration	Figure 2-5 or Figure 3.1[a]	N/A	Figure 2-5 or Figure 3-1[a]	Accept	As Greiner recommends.
D. Rainfall Intensities	Figure 3-2[a]	P.24[i]	Figure 3-2[a]	Accept	As Greiner recommends.
4. HEC-1 Program					
A. Drainage Area Sizes	Larger than 1 sq. mi.[a] Larger than 160 ac.[b]	N/A	Contracts 1&9- exceed 100 ac. Contract 6- exceed 375 ac.	Accept	As Greiner recommends.
B. Hydro-graphs	SCS method Part I[a] SCS runoff CN & unit hydrograph[b]	N/A	SCS runoff CN & unit [a/b] hydro-graph	Accept	As Greiner recommends.
C. Components Used					
1. Runoff	N/A	N/A	(Hypothetical Storm)	Accept	As Greiner recommends.
2. Stream Routing	N/A	N/A	The Kinematic Wave Method	Accept	As Greiner recommends.
3. Lag Time	N/A	N/A	Unkown	Need to Decide	Collar, Williams & White to document in the report.

Action Taken

E. Detail 7

Please address why the MAG Standard Detail 550 curb opening and spillway inlet and spillway is not used. Justification for the proposed curb opening structures shall be provided and a detail should be included.

F. Detail 7

Please address the following discrepancies:

1. A curb opening of 4'-8" is used and the footnote specifies that it is to be varied per plan.

2. A three (3) inch thick pneumatically placed mortar is shown on the main detail while a two (2) inch is shown on Section A-A and B-B.

3. 8'-3" is called out on one side of section A-A, and 8' gravel width (typ.) on the other side.

4. On section A-A, what are the side slopes and how is the spillway transitioned to the gutter and to the channel?

5. On section B-B where ten (10%) percent is shown, this should actually be less.

6. Why is a double or single cutoff wall necessary at the bottom of the spillway as shown on Section B-B?

(24) Sheet 3

A. The rock size for grouted rip-rap should be specified.

B. Detail 1; show the joint detail for the metal end section for CMP and RCP.

C. Details 1, 2 and 3; please indicate how the inlet structure and existing ground will be tapered.

D. Please substantiate that the eight (8") inch thick grouted rip-rap is thick enough.

Action Taken

E. How will the joint between the concrete cutoff wall and the grouted rip-rap be constructed to ensure that water will not intrude?

(25) Sheet 4

A. Please provide correspondence from the roadway designer (south of station 15+04.30) that roadway drainage and channel drainage carry over to their project are accepted as CW & W proposed.

B. Please make a provision for the channel construction at Station 15+04.30 if the south segment is not constructed.

C. Please make a provision for roadway and median drainage if the ADOT segment to the south is not constructed.

(26) Sheet 5

A. Catch basin at 23+50 is shown at 22+50.

B. Please show the offset and flow line elevation of the channel at Station 30+00.00

(27) Sheet 6

A. Station 33+50, 62.5' RT, should be 63.5' RT.

B. The drawing for the west end wing wall and channel for the 3 - 10' x 3' RCBC cannot be constructed, please revise as indicated on the east end.

C. Typical 130° wing wall should be 135°.

D. The profile of the 3 - 10' x 3' RCBC and 24 inch RGRCP need to be plotted. It appears there is not enough cover on top.

E. Please ensure the proposed 24 inch RGRCP is better than other alternatives, such as grade to drain.

F. Please provide back up calculation or documents to ensure that the channel linings are structurally able to hold on 1/2 to 1 side slopes.

Action Taken

G. It appears that the 3 - 10' x 3' RCBC may not be functioning hydraulically as designed. Please check the calculations and make any adjustments, if necessary.

H. Please indicate the design discharge for the 3 - 10' x 3' RCBC.

(28) Sheet 7

At Station 47+80 the catch basin should be labeled, Station 47+50. Please revise in profile also.

(29) Sheet 8

A. Channel centerline Station 50+00, 61' RT, should be 67' RT.

B. Centerline Station 51+72, 62' RT, should be 51+75.

(30) Sheet 9

A. The pipe outlet data is missing for the catch basin at Station 61+50.

B. Note 2; relocation of the fence should not impede flows into the drainage channel.

C. It appears that the channel opening at approximate Station 68+10 might be shifted to the north approximately eight (8') feet.

D. The catch basin at Station 68+50 appears to not have enough cover over the top of pipe and the joint below the curb because of the "V" depth. Please check.

(31) Sheet 10

A. It appears that the channel opening at approximate Station 74+00 may function more efficiently if shifted to the south approximately 25 feet.

B. Please indicate the type of fence that is being relocated to ensure that flows into the channel will not be impeded.

C. Same situation as on Sheet 9, item (29) D., with the catch basin at Station 74+00.

Action Taken

(32) Sheet 11

A. Investigate the possibility of adding another channel opening at approximate Station 82+60.

B. Same situation as on Sheet 9, item (29) D., with the catch basin at Station 83+00 and 88+00.

C. Show the channel slope to the north of the grade break at Station 89+50.

D. Station 81+00, 60' RT, should be 65' RT.

E. Same comment as on Sheet 10, item (30) B., with the fence.

F. It is suggested that the AT & T cables under the channel alignment be investigated at this time to assure that there is not a conflict problem.

G. The label for the 25' D.E. is pointing to the channel bank and not the easement.

(33) Sheet 12

A. Change the "Construct 350 L.F. 20' Wide Concrete Lined Channel" to "212 L.F." and add another note to "Construct 138 L.F. ___ Wide Channel...".

B. What happens to the street runoff at the west end of the intersection of McDowell Road? (ponding)

C. Indicate how the median drains north of McDowell Road.

(34) Sheet 14

A. Please investigate the possibility of a cross drainage structure at Station 114+50 taking runoff to the southwest.

B. Please advise why is the open channel to the right changing grade so often.

C. At Station 119+00 is the pipe a 15 inch or an 18 inch diameter?

Action Taken

D. Please investigate the possibility of using a MAG Detail No. 545 or an ADOT Standard Drawing No. C-13.20 for the metal end section at Station 119+00.

(35) Sheet 15

It appears that the box culvert at approximate Station 129+50 does not have enough cover.

(36) Sheet 16

A. It appears that the box culvert at approximate Station 137+00 does not have enough cover.

B. Please evaluate if there is a split flow just upstream of the culvert entrance at Station 130+13 and the approach that should be taken. Possibly a major portion of that flow should head south in an open channel along the east Right-of-Way and discharge through another culvert at Station 114+50. It appears that there is no defined drainage way at the outlet of the proposed culvert at Station 130+13.

(37) Sheet 17

A. Check the cover beneath the right curb over the culvert at Station 143+08.

B. Is the pipe at approximate Station 148+50 a 15 inch or an 18 inch diameter. Please check. Please check the cover if the pipe is an 18 inch diameter.

C. Address why the grouted rip-rap was not proposed for the 48 inch RGRCP at Station 141+90.

D. Please investigate the possibility of using a MAG Detail No. 545 or an ADOT Standard Drawing No. C-13.20 for the metal end sections at Station 141+90, Station 143+08 and Station 148+50.

(38) Sheet 19

A. Centerline Station 170+00, 56' RT, should be 61.9' RT.

Action Taken

B. Indicate "Centerline station, offset right, and flowline elevation" for the channel at approximate Station 162+60.

(39) Sheet 20

A. Please check to see if there is enough cover over the proposed concrete collar at approximate Station 171+40.

B. Please indicate how the 15 inch RCP is connected into the double 8' x 3' box culvert. A detail may be necessary.

C. Show the offset and flowline elevation for the channel at Station 174+50.

D. Address why the containment dike was not proposed for the median catch basin at Station 172+65.

E. Address why grouted rip-rap is not proposed at each end of the 30-inch RGRCP at approximate Station 171+20.

F. Please investigate the possibility of using a MAG Detail 545 or an ADOT Standard Drawing No. C-13.20 for the metal end section at Station 171+62.

(40) Sheet 21

A. Please check the offset right at Stations 185+50 and Station 190+00.

B. Please check the longitudinal slope of the channel between Stations 180+00 and 184+25.

(41) Sheet 22

A. The proposed 6 - 10' x 4' RCBC and 4 - 10' x 3' RCBC appear not to have enough cover at the west ends.

B. Show the station and the design discharge for the curb opening catch basin near 196+00.

C. Need a detail for the median curb opening and drainage way.

Action Taken

SUN VALLEY PARKWAY
DRAINAGE DESIGN CRITERIA

	A.D.O.T./M.C. Requirements	City of Phoenix Requirements	Collar, Williams & White Used	Greiner's Recommendation	Maricopa County Instructions
II. ROADWAY DRAINAGE					
1. General Equations					
A. Manning's Equation	$Q=\frac{1.486}{n} S^{1/2}AR^{2/3}$	$Q=\frac{1.486}{n} S^{1/2}AR^{2/3}$	$Q=\frac{1.486}{n} S^{1/2}AR^{2/3}$	Accept	As Greiner recommends.
B. Modified Manning's Equation for Gutter Flow	$Q=\frac{.56(Z)}{n}S^{1/2}d^{8/3}$	$Q=\frac{.56(Z)}{n}S^{1/2}d^{8/3}$	$Q=\frac{.56(Z)}{n}S^{1/2}d^{8/3}$	Accept	As Greiner recommends.
C. Manning's n	$n=.016(\text{pavement})_{a/b}$	$n=.015(\text{pavement})^{i}$	Unknown	n=0.016	As Greiner recommends.
2. Pavement Drainage					
A. Design Frequencies	10-year storm 50-year storm in depressed freeways[a]	10-year storm	100-year storm	Accept	As Greiner recommends.
B. Design Discharges	Rational Method	Rational Method	Rational Method	Accept	As Greiner recommends.
C. Time of Concentraion	Minimum 10 min.[a]	Minimum 5 min.	Minimum 10 min.	Accept	As Greiner recommends.

SUN VALLEY PARKWAY
DRAINAGE DESIGN CRITERIA

	A.D.O.T./M.C. Requirements	City of Phoenix Requirements	Collar, Williams & White Used	Greiner's Recommendation	Maricopa County Instructions
D. Spread Calc.	F.H.W.A. HEC No. 12[d]	$T=d/S_x$ (P.3)[i]	Unknown	FHWA HEC No. 12	As Greiner recommends.
E. Allowable Pavement Flooding	Gutter width plus shoulder width.	One dry lane (12' wide), in each direction.	Two dry lanes (min. 23' wide), in each direction.	Accept	As Greiner recommends.
F. Inlet, Catch Basin Clogging Factors					
1. Grate Inlets					
a. Sump b. On Grade	50% of actual[c] area, perimeter, or width	50% of actual[i] area, perimeter, or width	None specified	As per ADOT requirements	As Greiner recommends.
2. Curb Opening Inlets					
a. Sump b. On Grade	80% of actual[c] length	80% of actual[i] length	None specified	As per ADOT requirements	As Greiner recommends.
3. Median Drainage					
A. Design Frequencies	10-year storm[a/b]	10-year storm	100-year storm	Accept as CW & W.	As Greiner recommends.

SUN VALLEY PARKWAY
DRAINAGE DESIGN CRITERIA

	A.D.O.T./M.C. Requirements	City of Phoenix Requirements	Collar, Williams & White Used	Greiner's Recommendation	Maricopa County Instructions
B. Design Discharges	Rational Method[c]	Rational Method	Rational Method	Accept as CW & W.	As Greiner recommends.
C. Allowable Ponding Depths	Less than the elevation of subbase[c].	N/A	Top of curb	To be decided.	Top of curb for 10-year storm.
D. Median Dikes	0.5' higher than the design high-water elevation of the inlet[c].	N/A	N/A	0.5' higher than the design high-water elevation of the inlet.	No criteria.
E. Clogging Factors	50%	N/A	None	50%	As Greiner recommends.
4. Storm Sewer Design					
A. Design Frequencies	10-year storm[a/b]	2-year storm[c]	100-year storm	Accept as CW & W.	As Greiner recommends.
B. Design Discharges	Rational Method[c]	Rational Method[c]	Rational Method	Accept as CW & W.	As Greiner recommends.
C. Minimum Velocities	3 fps[c]	5 fps[c]	N/A	To de decided by Maricopa County.	3 fps
D. Minimum Pipe Size	18" laterals 24" trunk lines	15"[c]	15"	To be decided by Maricopa County.	15"

	A.D.O.T./M.C. Requirements	City of Phoenix Requirements	Collar, Williams & White Used	Greiner's Recommendation	Maricopa County Instructions
E. Manhole Intervals	300'[c] under 36" - 400' 36" - 60" - 500' Over 60" - 1000'	30" or less - 330' 33" to 45" - 440' 48" & greater - 660'	N/A	N/A	N/A
F. Inlet Design	The 50-year HGL elevation is at an elevation 0.5' below the elevation. The HGL elevation must be maintained below ground level[b].	HGL elevation is at 0.5' below the elevation[c].	N/A	Design flow HGL elevation is 0.5' below the elevation.	At grate elevation.
5. Open Channels					
A. Minimum Velocities	A velocity of 2 fps is achieved when d = 2'.	N/A	N/A	To be decided by Maricopa County.	2 fps
B. Minimum Slopes	0.2%	N/A	N/A	To be decided by Maricopa County.	0.15%
C. Side Slopes	Unlined 3:1 or flatter[b].	N/A	Unknown	Unlined-3:1 or flatter.	Unlined 2:1 if velocities are not high.
D. Freeboards	Min. 1' to 2' Section J[c] min. 1' For improved channel : .25d (supercritical) $.20(d+\frac{V^2}{2g})$ (subcritical).	N/A	None	Min. 1'	Min. 0.5'

	A.D.O.T./M.C. Requirements	City of Phoenix Requirements	Collar, Williams & White Used	Greiner's Recommendation	Maricopa County Instructions
F. Scour & Bank Protection	HEC No. 15	N/A	Unknown	To be decided by Maricopa County.	HEC No. 15
G. Permisible Velocity	HEC No. 15	N/A	Unknown	To be decided by Maricopa County.	SCS Std. Dwg. No. 7-N-20104
6. Culverts					
A. Design Frequencies	100-year storm[b] 50-year storm	N/A	100-year storm	Accept	As Greiner recommends.
B. Capacity Calc's	FHWA HEC-5	FHWA HEC-5	FHWA HEC-5	Accept	As Greiner recommends.
C. Freeboards	Headwater 1' below shoulder elevation.	N/A	Unknown	Headwater 1' below shoulder elevation.	To the top of the shoulder.
D. Min. Length	30' from the edge of pavement each side (Mariocpa County Highway Dept.'s requirement for this project).	N/A	Various	30' from the edge of pavement each side to the back of the headwall.	As Greiner recommends.
E. Erosion Protection	By ratio of outlet[c] velocity to natural stream velocity.	N/A	Unknown	To be decided by Maricopa County.	ADOT Method

SUN VALLEY PARKWAY
DRAINAGE DESIGN CRITERIA

	A.D.O.T./M.C. Requirements	City of Phoenix Requirements	Collar, Williams & White Used	Greiner's Recommendation	Maricopa County Instructions
7. Detention Basins					
A. Design Frequency	N/A	N/A	Unknown	100-year (1- or 2-hour storm)	Decision is still pending.
B. Freeboards	Min. 1 foot	Min. 1 foot	Unknown	Min. 1 foot	Decision is still pending.
C. Maximum Depth	N/A	N/A	Various	To be decided by Maricopa County.	Decision is still pending.

Special Criteria For This Project Only

A sketch will be necessary to show the ponding areas upstream of the roadway as part of the drainage report.

FOOTNOTES

a. "Hydrologic Design for Highway Drainage in Arizona."

b. "Uniform Drainage Policies and Standards for Maricopa County, Arizona," 1986 draft.

c. "Hydrologic and Hydraulic Training Session," Arizona Highway Department Structures Section, Hydraulics Branch, October 1972.

d. "Drainage of Highway Pavements," Hydraulic Engineering Circular No. 12, U.S. Department of Transportation Federal Highway Administration, March 1984.

e. "Design of Urban Highway Drainage the State-of-the-Art," U.S. Department of Transportation, Federal Highway Administration, August 1979.

f. "Office Memo: Allowable Flooded Width Used in the Design of Curbed Roadway Drainage," Arizona Highway Department, August 24, 1970.

g. "Office Memo: Catch Basin Design Effective Areas," Arizona Highway Department, February 1, 1972.

h. "Storm Drainage Design Manual - Storm Drains With Paving of Major Streets," City of Phoenix, August 1975.

i. Precipitation value of Buckeye Station records is higher than the value from the Arizona Department of Transportation drainage manual procedures.

Greiner

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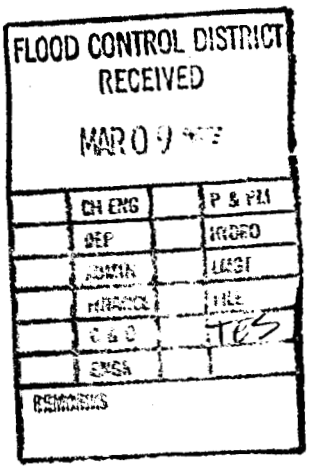

GES Job No. E121063

March 6, 1987

Mr. Fred E. Fleet, P.E.
Project Manager
Collar, Williams & White Engineering, Inc.
2702 N. 44th Street
Suite 205-B
Phoenix, Arizona 85008

Re: Sun Valley Parkway
Drainage Review Phase I

Dear Fred:

Enclosed are the drainage design review comments on Phase I for the above referenced project. Our review is based on the January 30th submittal of: (1) drainage report for section 6 of Sun Valley Parkway, December 1986 (not bound); (2) paving plans for Sun Valley Parkway Phase I-A (not dated); and (3) paving plans for Sun Valley Parkway Phase I-B (not dated). These comments do not cover the supporting documentation that Greiner requested at our meeting of February 9, 1987.

The review comments are prepared for three parts: (1) drainage report review, (2) consistency between drainage report and paving plan, and (3) paving plan drainage review. General review comments are included in each of these parts. The detail review comments as page-to-page, item-by-item or sheet-to-sheet are provided for parts (1), (2) and (3), respectively. Due to the limited information provided in the drainage report, the review of consistency between the drainage report and the paving plan cannot be completed. The review comments are numbered in sequence; please address each item accordingly.

Greiner

Sincerely,

GREINER ENGINEERING SCIENCES, INC.

Shi-En Shiau

Shi-En Shiau, P.E.
Project Director
Water Resources

SES/jsa

Enclosures

cc: Tom Phelan, Maricopa County Highway Department
Dave Johnson, Flood Control District of Maricopa County
Dick Perreault, Flood Control District of Maricopa County
Timothy Sutko, Flood Control District of Maricopa County
Joe Tram, Flood Control District of Maricopa County
Erik Collett, Greiner Engineering
Dale Crane, Greiner Engineering
Michael Shapiro, Greiner Engineering
Gary Sun, Greiner Engineering
Randall Beck, Greiner Engineering

SUN VALLEY PARKWAY

Greiner

GES JOB NO. E121063

Drainage Review Comments

Phase I

Action Taken

(1) Drainage Report, General Comments.

A. Please provide the culvert calculation sheets.

B. Please include Arizona Highway Department Median Drainage worksheets for the design of median catch basins.

C. Please provide Arizona Highway Department Storm Sewer System Design Data Sheets with each inlet design. These sheets are Runoff Calculation Sheets, Inlet Calculation Sheets and Storm Sewer Calculation Sheets.

D. Please provide calculations for detention basins.

E. Report should be bound, sealed and signed by a registered Professional Civil Engineer.

F. Please organize the report and as a minimum provide a conclusion or recommendation section.

G. Describe the effect the proposed construction might be expected to have, upon drainage flows and flood levels.

H. Discuss how the project might affect the characteristics of future drainage flows and the performance of the hydraulic structures on the project for future conditions.

I. In the procedures section, describe briefly the methods used in delineating the drainage areas, the program used for catch basin calculations and all the drainage design criteria used in the study.

J. Provide hydraulic data sheets, which are to include the natural channel velocities, outlet protection (type) and indicate if there will be ponding beyond the Right-of-Way.

Drainage Review Comments

Phase I

Action Taken

K. Need to show all calculations for culvert inlet and outlet erosion protection and bank protection.

L. Need to demonstrate that all earthen channels will function so that they will have a rigid boundary (permissible velocity calculations).

M. Justify that when using the rational method there will not be any runoff entering these smaller areas from over bank flows from their adjacent areas and address what kind of precaution was made in culvert design.

N. There are a number of drainage area delineations that are unclear. Please submit a clean exhibit so that it can be redlined.

O. Please provide a strip map approximately 11 inches wide of the roadway alignment at a scale no less than 1" = 400', depicting contours at no less than five (5') foot intervals, stationing, drainage area delineations, drainage area numbers, proposed cross structures, median inlets and dikes, curb opening inlets, channel alignments and delineation of ponding areas.

P. Our comments do not include any type-errors.

(2) Drainage Report, Pages 2 - 3.

A. "Peak discharge for the watershed areas were determined using the rational formula for smaller areas and Corps of Engineers HEC-1 computer program for areas larger, with different soils groups."

Please address what criteria was used to determine whether the watershed area is small or large.

Drainage Review Comments

Phase I

Action Taken

B. "The drainage areas on the slopes of White Tank Mountains were assumed to be Group "D" and curve Number 92. The flatter desert area were assumed to be Group "B" and curve number 83."

This is a design project. Please address land use patterns, vegetation cover, hydrologic condition, and hydrologic soil group. Then a curve number can be determined.

C. "Times of concentration for each area were determined using Fig. 3-1."

It appears that Fig. 3-1 was used to compute time of concentration only for the areas using the rational method to calculate the runoff.

D. "Precipitation values for 100-year one-hour were determined using nearest station - Buckeye (see Fig. 1)."

Please assign a figure number to the precipitation values for Buckeye station.

E. There is not a description of the procedure used to obtain time of concentration and direct runoff for the areas using the HEC-1 model.

F. "MEDIAN DRAINAGE - SEE NEXT CHAPTER"

It appears that the drainage report was not organized in chapters.

(3) Drainage Report, Page 4.

Please address why the CMP arch pipes were proposed instead of RCP pipes.

Drainage Review Comments

Phase I

Action Taken

(4) Drainage Report, Page 5, MEDIAN DRAINAGE CALCULATIONS.

A. Address what procedure was used to compute runoff for the median.

B. Address how the time of concentration is calculated and it appears to be in minutes.

C. Address what the I100 is and how its value was determined.

D. Address why a length of 3,500 feet was recommended for median catch basin spacing.

(5) Drainage Report, Pages 5 - 6, CATCH BASINS AND OUTLETS.

A. The procedure used to design the catch basins was unclear. Please address all variables used and correct all type-errors in the calculations. The following are some general questions for the calculations:

1. Identify the procedure used to compute Tc. Was the minimum Tc of 10 minutes used?

2. How were the rainfall intensities determined?

3. What type of catch basin was proposed? For example, Grade Inlet on-grade or in sag as per ADOT Standard Drawing C-15.30 and C-15.50 Type LW-1.2 Grate with 2 inches gutter depression, etc.

4. What is the Manning's roughness coefficient used?

5. What is the gutter depression for the grate inlet in sag? What is the depth used for the grate bar?

Drainage Review Comments

Phase I

Action Taken

B. Due to the above missing information, the review of the catch basin design cannot be completed at this point.

(6) Drainage Report, Page 7.

A. "Sta 394+00 - 492+50 - Roadway on relatively flat ground with centerline perpendicular to the contours of existing ground."

Please provide the back-up calculations or documentation to ensure that there is no ponding water to jeopardize the roadway.

B. Please address how the design considerations for the 2-10'x10' RCBC and the new bridge.

(7) Drainage Report, FIGURES.

A. Please identify which is figure 2-21 mentioned on page 3. Verify the abscissa expression for precipitation.

B. Please identify which is figure 1 mentioned on page 3.

(8) Drainage Report, CULVERTS AND DETENTIONS.

A. Please include the drainage areas in this summary so that the drainage scheme can be identified versus the hydrologic calculations.

B. Please use the standard callouts for the box culverts.

C. Please address how the design discharge was obtained for each culvert.

D. Please specify the design discharges and verify the adequacies for the proposed culverts which have the note "CULVERTS DICTATED MOSTLY BY GROUND CONFIGURATION - SIZES ESTABLISHED IN FIELD".

Drainage Review Comments

Phase I

Action Taken

E. Please justify the split flow for area 1 and address what kind of precaution was made in culvert design.

(9) Drainage Report, HYDROLOGIC DESIGN DATA SHEETS.

A. Please provide hydrologic data for the areas using the SCS method part I.

B. Please designate a letter or number for every drainage area in addition to stationing.

C. What is the note "(C#84)" on data sheet for area Sta 1+20. It appears to be the curve number of 84. If it is correct, explain why it is not 83. What curve number was used to obtain the runoff coefficient of 0.43?

D. Please verify the design data for the following items:

1. Drainage area of area Sta 47+60 - 51+76.

2. Drainage length for areas Sta 110+99, Sta 114+09, Sta 116+05, Sta 197+74 and Sta 261+00.

3. Top elevations for areas Sta 95+00, Sta 110+99, Sta 116+05, Sta 124+23 - 127+67 and Sta 197+74.

4. A data sheet is missing for the area between area Sta 136+16 and area Sta 146+50.

5. Please verify soil groups used for areas Sta 146+50, Sta 204+00, Sta 236+72, Sta 247+00, Sta 261+00, Sta 272+00, Sta 368+00 and Sta 379+00.

6. The runoff coefficient for the area Sta 171+00 may be 0.43.

Drainage Review Comments

Phase I

Action Taken

7. How was the peak discharge of 474 cfs computed for area Sta 368+00?

8. Please include the design discharges and headwater elevations for the structures at Station 473+10 and Station 491+68.

E. Please submit split flow calculations used in area 1.

F. All data sheets should be signed, checked and dated.

(10) Drainage Report, DRAINAGE AREA MAP.

A. Please verify if the boundary of soil groups B and D shown is correct. It appears that the area of group D soil is less than what has been shown on the drainage area map. This is based on the Soil Conservation Service Soil Survey.

B. There are a number of drainage area delineations, such as areas 1 - 8, that are unclear. Address where the drainage for the contributing area between Station 394+00 and Station 410+00 will drain.

C. Some potential split flows may not be identified, please verify.

D. How did the split occur at the middle of the drainage area 1B?

E. Please label all the sub-areas on this map.

(11) Drainage Report, HEC-1 RESULTS.

A. How was the lag for HEC-1 input calculated.

B. What criteria were used to determine roughness values.

Drainage Review Comments

Phase I

Action Taken

C. Need hydrologic data to check the kinematic wave routing.

D. Please verify the input error messages for areas 1 and 2.

E. Please verify the areas used for the drainage areas 4A and 4B.

F. What is 88 on the KK card in the filename WT88R? If it is the drainage area 8, then address why the curve number of 92 was used for the whole area.

(12) Drainage Report vs. Paving Plans, General Comments

Due to the limited information provided in the drainage report, the review of consistency between the drainage report and the paving plans cannot be completed.

(13) Catch Basins and Outlets.

A. According to the Detail of Mountable Curb and Gutter on Phase I-B plans, the ADOT standard grate catch basin is to be used in conjunction with the gutter width of 24 inches. Please address how the design procedure was used in the report and make modifications to the plans for the proposed 15-inch gutter width.

B. Grate catch basin at Station 415+50 was shown on plan at Station 414+50.

C. There are no design calculations for the median catch basins.

D. No median catch basin was proposed from Station 132+65 to Station 184+48. This contradicts with the spacing of 3,500 feet stated in the report. Please explain.

Drainage Review Comments

Phase I

Action Taken

(14) Channel and Detention Basin Design

The review cannot proceed for the following reasons:

A. There are no calculations for the proposed channels.

B. There are no calculations for the design of the detention basins.

C. There are no calculations for the design of spillways and drop structures.

(15) Culverts and Detentions

There are several discrepancies between the report and the paving plans. Please verify the following:

A. The culvert stations shown in the report at Station 16+17.50, 99+09.50, 116+05.50, 129+83, 307+78.30, 336+58, 341+76, 357+36, 369+17, 370+80, 373+10, 379+00, 379+80 and 473+10.

B. The size of culverts at Stations 30+35.50, 38+84.50, 110+99, 124+83, 146+50.50, 210+68.50, 264+99.50, 279+17, 304+13 and 347+26.

C. Most of the discharges and headwater elevations for the culverts were changed.

(16) Paving Plans, Drainage General Comments

A. Please explain why a gutter width of 15 inches was proposed instead of 2 feet. How can the ADOT standard grate catch basins be installed without modifications? Please investigate the possibility of using concrete gutter transition to protect grate catch basins which were proposed in Phase I-B plans.

Drainage Review Comments

Phase I

Action Taken

B. Please ensure that the length of culvert meets the requirement of minimum 30 feet normal to the centerline of roadway each side from edge of pavement to the back of the headwall in Phase I-A plans.

C. Please ensure that the proposed channels are shown on plans and profiles. Channel slopes, elevations and stations for grade break points and match points should be included.

D. Please ensure that callouts for median catch basins include the 'H' values and grate elevations. Address how the 'H' values were calculated.

E. Please ensure that the notes for grate catch basins include the 'H' values, grate type, grate elevation and in sag or on grade. Address how the 'H' values were determined. Notes should be clear and understandable, a contractor should be able to tell what W=2" is on Phase I-B plans.

F. Please include the station in the notes for all culverts in Phase I-B. Cross culvert stations shall be called out by intersection with the roadway centerline.

G. Please address why the stations and inverts of inlet/outlet were used when plotting the culvert in profile at the back of curb left and right. Please verify that this will also apply to the connector pipes.

H. Please address how the contractor will perform the proposed grading work for roadside channels and the inlet/outlet of culverts to ensure proper functioning of drainage schemes.

Drainage Review Comments

Phase I

Action Taken

I. Since ADOT Standard No. CW6 series wingwalls with modified length/bends were proposed for the inlet of box culverts, address how the transition between 6 to 1 and 4 to 1 will be handled and provide details to show how to grade from the edge of the shoulder to the back of wingwalls.

J. Since ADOT Standard No. CW2 series wingwalls with modified length/bends and were proposed for the outlet of box culverts, address how the transition between 2 to 1 and 3 to 1 will be handled and provide details to show how to grade from the edge of the shoulder to the back of wingwalls.

K. Make sure that stations and invert elevations are called out at all culverts in profile.

L. Please ensure that all catch basins are shown in profile with the call outs including stations, invert elevations and grate elevations.

M. Please specify what type of level wingwalls are proposed as per ADOT Standard No. CWL-1 and CWL-2. It appears that type B level wingwall was proposed.

N. Since each grouted rip-rap structure at the inlet/outlet of culverts has different geometry, please provide details for each side of culverts and ensure that they will function hydraulically.

O. Please address why the headwall as per MAG Detail No. 501-3 was modified and proposed for the multiple pipe culverts. If the modification is a must, structure details should be provided for each modification.

P. Please provide calculations, hydraulic performance data, sedimentation and scour analysis for culvert design adequacy review.

Drainage Review Comments

Phase I

Action Taken

Q. Where earthen channels are shown, call out by note, on each sheet to construct these earthen channels.

R. Please secure and show temporary construction/slope easements where grading outside the right-of-way.

S. Since the proposed channels and detention basins are not consistently offset from the roadway centerline, the horizontal alignment and offsets should be calculated and provided. Without this information, how can the channel or basin be staked and constructed.

T. Please call out the beginning station and the ending station of channel transitions on the plans.

U. Please provide channel stability analysis. At a minimum, bank stability and channel degradation analysis should be performed.

V. A detail should be provided for the grouted rip-rap at the outlet of the catch basin pipe.

W. The discharges at the detention basins in Phase I-A could not be verified at this time, due to limited documentation. Greiner will try to verify and provide comments at a later date.

X. Please address the stability of the drop structure per detail Section A-A on Sheet 9 in Phase I-A and provide documentation that erosion will not occur.

Drainage Review Comments

Phase I

Action Taken

Y. Please ensure the quantities called for every grouted rip-rap structure are correct. Grouted rip-rap should be quantified in cubic yards not in square yards as per grouted rip-rap detail. It appears that quantities for the two foot cutoff wall in all edges was not included.

Z. Please verify the adequacy of the side spillway type structures per grouted rip-rap detail. The quantities called in each note appears to not include the two foot cutoff wall in all edges. Please verify and quantify in cubic-yard.

AA. Please indicate why you are using RGRCP and not RCP/CSP.

BB. Please address why a concrete apron was proposed for the inlet/outlet of the multiple pipe culverts, while a grouted rip-rap apron was used for box culverts and connector pipes.

CC. Please include the cross slopes for the median on Phase I-A plans.

DD. Please ensure the notes for all culverts include station, length type, size, slope, skew angle, discharge, headwater elevation and outlet velocity.

EE. Please address why five (5) different types of pipes were proposed in Phase I. They were concrete-line CMP, CMP, RGRCP, RCP and CP. Please verify the proposed type of pipe sheet by sheet.

FF. Please verify the volume of every detention basin in Phase I-A plans.

Drainage Review Comments

Phase I

Action Taken

GG. Please address how the detention basins were designed. What kind of precautions were made to ensure that the water can drain into the basins.

HH. Please ensure that the class of 15" pipe is included in the callouts.

II. Most of the proposed culverts are somewhat below the existing wash flow line elevation. Please address and submit back-up data to ensure that the culvert will not be silted in during small storm events.

JJ. Please address how the wingwall angles were determined. Can standard ADOT wingwall angles be used?

KK. A legend should be included on Sheet No. 1.

LL. Ensure that the roadway is not in conflict with embankment drains on McMicken Dam.

MM. Investigate placing the fence behind the headwalls of the drainage structures instead of placing the fence across the wash where it could be washed out.

NN. Verify that the side channels draining to the culverts will function adequately when the ponding behind the culverts in some cases higher than the further invert of the channel.

(17) Phase I-A, Sheet 2.

A. Please assign a number for each detail as per the notes on plans. For example, grouted rip-rap detail will be Detail 4.

Drainage Review Comments

Phase I

Action Taken

B. Typical Roadway Sections

1. The bottom width of the roadside channel should be 5' typical. There are several reaches that have the V-shape ditch per plan.

2. Please address how the existing ground can be matched at the Right-of-Way line with the typical section shown. What if the existing ground is lower than the roadway at the right-hand side? What will the contractor do if the existing ground is higher than the existing ground shown at the left-hand side?

3. Please address why the side slope of 4 to 1 was proposed from the edge of the left shoulder to the channel bottom and then a side slope of 3 to 1 was proposed to match the existing ground.

4. Please ensure that the minimum 1 foot of channel depth was provided throughout the plans.

(18) Phase I-A, Sheet 2 (continued)

A. Typical section box culvert.

1. Please include end treatment for inlet and outlet.

2. Please indicate how to match the existing ground.

B. Grate Opening Detail

1. Please use the standard callouts for the 10'x8' RCBC.

2. Please verify the station of 316+36 for the grate opening on Sheet 34.

Drainage Review Comments

Phase I

Action Taken

3. Please verify the size of box culvert for the grate opening at Station 207+57.50 on Sheet 23. Please address what is the note "IN 4TH FIELD'.

4. Please address what is the note "#4 Every 3rd From Top Slab".

5. Possibly need to show additional details and/or information in the sections.

(19) Phase I-A, Sheet 3.

A. Flow line elevations of the proposed ditch are not consistent from plan to profile.

B. Please callout the station where high point occurs for the median drainage.

(20) Phase I-A, Sheet 4.

A. Please verify the side slope adjacent to the shoulder for the proposed north ditch. It appears to be 4 to 1 and not 3 to 1.

B. Check the flow line of the proposed south ditch in profile.

C. Please verify the flow line elevation shown in profile at Station 16+19.50 for the 3-50"x31" CMP.

(21) Phase I-A, Sheet 5.

A. Please show the median catch basin and the connector pipe on plan and profile.

B. Check the flow line of the proposed south ditch in profile.

C. ADOT Standard No. CW2-3 wingwalls should be used at the outlet of the 10'x3' RCBC at Station 26+06.25, please verify

Drainage Review Comments

Phase I

Action Taken

D. Please verify with Sheet 6 that there is no proposed south ditch discharging into the 2-50"x30" CMP.

(22) Phase I-A, Sheet 6.

A. Need a note at Station 30+00 for the proposed south ditch. Please check the flow line in profile for the ditch on this sheet.

B. Please show the side slopes for the proposed north ditch.

C. ADOT Standard No. CW2-3 wingwalls should be used at the outlet of the 2-10'x3' RCBC at Station 38+84.50, please verify.

D. ADOT Standard No. CW6-1 wingwalls should be used at the inlet of 2-10'x3' RCBC at Station 38+84.50, please verify.

(23) Phase I-A, Sheet 7.

A. Please show the grate opening for the cattle crossing in the profile. Please include calculations to ensure that the HGL elevation will not be higher than the grate elevation.

B. Please include the headwater elevation in the note for the 10'x8' RCBC. Verify the Q100 for this culvert.

C. Please specify the side slopes of the proposed north ditch.

(24) Phase I-A, Sheet 8.

A. Please show the detention area in profile. Please verify the volume.

B. Please show the catch basin at Station 38+20 in profile.

Drainage Review Comments

Phase I

Action Taken

C. A median dike should be installed behind the on-grade catch basin at Station 58+20.

D. Check the invert elevation for the 15" RGRCP in profile.

(25) Phase I-A, Sheet 9.

A. Please show the 12" outlet pipes for detention areas in the profile.

B. Check the inlet flow line for the box culvert at Station 64+87.50. The grading work is unclear.

C. Check to ensure that no flows will enter the detention area from the existing wash. The dike elevation should be higher than the culvert high water elevation. Please ensure that the dikes will not wash out during the high flow.

D. The box Culvert at Station 67+33 does not conform to ADOT CB-5. Structural details should be provided.

E. Please specify the grading slope for the north side of the roadway.

F. Please verify the volume of the detention basin at approximate Station 66+00.

G. Show the detention basin at approximate Station 69+00 in profile.

(26) Phase I-A, Sheet 10.

A. Check the inlet station for the 4-10'x3'.

B. Indicate the skew angle on the box culvert at Station 79+21.50.

Drainage Review Comments

Phase I

Action Taken

C. Please verify that the existing wash at approximate Station 79+20 will not flow into the detention area. Check the channel flow width between the detention structures to be sure that it will not cause a restriction or cause excessive velocities.

D. Please indicate the bottom of the detention basin elevation at Station 80+00.

E. Show the outlet pipes of the detention basins on the profile.

F. Please ensure that the dikes at approximate Stations 74+00 and 79+10 will not wash out during the high flow.

G. Please verify the grading slopes adjacent to the shoulder from Station 70+00 to the 4-10'x3' RCBC.

(27) Phase I-A, Sheet 11.

A. Please indicate bottom of pond elevation at Station 80+00.00

B. Show the detention pond outlets in profile.

C. Show how the median drainage between Stations 83+40 and 87+04 will be handled.

D. Elevation 1622 in bottom right corner of profile should be 1626.

E. Verify the 15" RGRCP in profile.

F. Please address why a median dike was not proposed downstream of the median catch basin at Station 83+40.

Drainage Review Comments

Phase I

Action Taken

(28) Phase I-A, Sheet 12.

A. Please provide a detail of the grouted rip-rap inlet structures. Please include design calculations for these structures.

B. Check the slope and invert elevations on RCBC at Station 99+09.75.

C. Show the outlet pipe for the detention basin in profile.

(29) Phase I-A, Sheet 13.

A. Check the detail on the 5-12'x3' RCBC at Station 102+11 and Station 106+89.50. ADOT CB-5 does not apply to 12'x3' boxes. Need to supply structural details.

B. Check the stationing of the detention area near Station 107+32.

C. Check to ensure that no main channel flows spill into the detention area at Station 102+11.

D. Please ensure that the upstream dikes of the detention basins will not wash out during the high flow.

E. Show the outlet pipes for the detention basins in profile.

F. Please include the volume of the detention basin adjacent to Station 100+00.

(30) Phase I-A, Sheet 14.

A. Check the length of the 5-12'x4' RCBC at Station 110+99. Need structural details for this RCBC.

B. Show the channel located at 62' right Station 120+00 in the profile.

Drainage Review Comments

Phase I

Action Taken

C. Show the 12" CP outlet for the detention area in the profile.

D. Show the median grate in the profile at the cattle crossing at Station 116+05.50. Include calculations to ensure that the HGL elevation at the cattle crossing is not higher than the grate elevation.

E. Please include the headwater elevation in the note for the 10'x8' RCBC. Verify the Q100 in the note also.

(31) Phase I-A, Sheet 15.

A. Check elevations and offsets for the south drainage channel.

B. Check the upstream, downstream and centerline flow line elevations of the CMP at Station 127+67.

C. Check the flow line elevation of the drainage ditch at Stations 128+28 right and 130+00 right.

D. Please verify the size of the structure at Station 124+23.

E. Please verify the callout for the south ditch at Station 122+00.

F. The callouts for the south ditch at Station 120+00 are different from Sheet 14 to Sheet 15.

(32) Phase I-A, Sheet 16.

A. Show how the median drainage will be handled from Station 116+00 to Station 131+72.58.

B. Please indicate the flow direction in the median.

Drainage Review Comments

Phase I

Action Taken

C. Check the flowline of the drainage channel right.

(33) Phase I-A, Sheet 17.

A. Check the flow line for the south drainage channel.

B. Show the detention area outlet pipe in the profile.

C. Please include the design calculations for the grouted rip-rap spillways. Please ensure that the contractor can construct these spillways as shown on the plans.

D. The station for the 3-8'x3' RCBC is different from plan to profile.

(34) Phase I-A, Sheet 18.

A. Show the median flow direction.

B. Please check the length of the 4-36"x22" CMP at centerline Station 154+43.50.

C. Show how the median drainage will be handled on this sheet.

(35) Phase I-A, Sheet 19.

A. Show the north drainage channel in the profile.

B. Show the south drainage channel in the profile from Station 169+00 to 170+00.

C. Please show the flow direction in the median.

D. Please specify the design discharges for the south channel.

Drainage Review Comments

Phase I

Action Taken

(36) Phase I-A, Sheet 20.

A Check the left drainage channel flow line this sheet.

B. Please show the flow direction in the median.

C. Please callout the beginning station and the ending station of the south channel transition.

D. Please specify the design discharges for the south channel reaches. Address the stability of this channel.

(37) Phase I-A, Sheet 21.

A. Please indicate the flow direction in the median.

B. Please explain how the median drainage will be handled from Station 132+65 to Station 184+48.

C. Show the bottom of the detention area in the profile.

D. Check the flow line of the drainage channel at Station 185+90. The plan and profile do not agree.

E. Please specify the design discharge for the proposed south channel. Address the stability of this channel.

F. Please show the design calculations for the grouted rip-rap spillways. Please ensure that the contractor can construct these spillways as shown on the plan.

(38) Phase I-A, Sheet 22.

A. Please verify the detention area stationing at 191+20.

Drainage Review Comments

Phase I

Action Taken

B. Show the detention area outlet pipes in the profile.

C. The upstream flow line of the RCBC at Station 197+74.50 should be 1530.00 in profile.

D. Please callout the centerline flow line for the RCBC at Station 197+74.50 in the profile.

E. Wingwall standard CW6-1 and CW2-1 are called out for the RCBC at 197+74.50. CW6-1 is for right angle culverts and the box is shown as skewed. CW2-1 wingwalls are not for the outlet.

F. A median dike should be installed behind the on-grade catch basin at Station 199+50.

G. Show the detention area in the profile from Station 198+43 to 200+00.

H. Provide a detail for any modifications to ADOT CB-6.

I. Specify the slope of the RCBC at Station 197+74.50.

J. Show the flow direction in the median.

K. Provide the design calculations for the grouted rip-rap spillways. Please ensure that the contractor can construct these spillways as shown on the plans.

(39) Phase I-A, Sheet 23.

A. Show the flow direction in the median.

B. Please include the grate elevation for the cattle crossing.

Drainage Review Comments

Phase I

Action Taken

C. Show the grate opening for the cattle crossing in the profile. Include calculations to ensure that the HGL elevation at the cattle crossing is not higher than the grate elevation.

D. Need a detail for the cattle crossing for the wall thickness of 12 inches with 10'-15' of fill for the 6-12'x8' RCBC.

E. Please callout the centerline station flow line in the profile for the cattle crossing.

F. Show the detention area outlets in the profile.

G. Please verify the volume of 16.87 ac-ft for the detention basin.

H. Show the design calculations for the grouted rip-rap spillways. Please ensure that the contractor can construct these spillways as shown on the plans.

(40) Phase I-A, Sheet 24.

A. Please show the flow direction for the median drainage.

B. Need a callout for the north ditch at Station 220+00 as per Sheet 25. Please show this ditch in profile.

C. Please specify the bottom width of the proposed north and south ditch.

(41) Phase I-A, Sheet 25.

A. Please show the flow direction of the median drainage.

B. Please specify the south side slope for the proposed north ditch. Check the flow line in profile.

Drainage Review Comments

Phase I

Action Taken

C. Please specify the design discharge for the proposed south channel.

D. Need a callout for the north ditch at Station 230+00 as per Sheet 26.

(42) Phase I-A, Sheet 26.

A. Please show the flow direction for the median drainage.

B. Please verify the side slopes of 4 to 1 shown on the plans for the north ditch at approximate Station 232+20 and Station 234+50. Show this ditch in profile.

C. Please show the south ditch in profile.

D. Please address why the dike was not proposed downstream of the median catch basin at Station 238+50. Show the pipe slope for the 15" connector pipe.

E. Please verify "Q100=528'" in the note for the 3-8'x3' RCBC at Station 236+72.50.

F. Please verify the drawing for the 3-8'x3' RCBC on the plan. Also, verify the box culvert shown in profile at Station 236+72.50. The length for this box culvert may be 186 L.F.

(43) Phase I-A, Sheet 27.

A. Please show the flow direction for the median drainage.

B. Please callout the beginning station and the ending station of channel bottom transitions in this sheet.

C. Please specify the design discharges for the proposed channel reaches.

Drainage Review Comments

Phase I

Action Taken

D. Please provide design calculations for the grouted rip-rap spillway.

E. Please show the detention basin in profile.

F. Please address the design for the median drainage from Station 238+50 to Station 241+00.

(44) Phase I-A, Sheet 28.

A. Please show the flow direction for the median drainage.

B. There is no bank protection provided at the upstream side of the detention basin where a 4-10'x4' RCBC is proposed. Please ensure the dike will not be washed out during a high flow.

C. Please callout the centerline station flow line of the RCBC at Station 254+82.50.

(45) Phase I-A, Sheet 29.

A. Please provide the structural details for the 6-12'x6' RCBC at Station 260+98.50.

B. Please show the flow direction for the median drainage.

C. Please address why the dike was not proposed downstream of the median catch basin at Station 269+65.

D. Please include the pipe slope in the note for the 15" connector pipe.

E. Please specify the bottom width for the proposed ditch.

Drainage Review Comments

Phase I

Action Taken

(46) Phase I-A, Sheet 30.

A. Please verify the grading slope of 4 to 1 shown on the plans at the north side of the roadway.

B. Please specify the design discharges for the proposed channel reaches. Address the stability of this channel.

C. Please include the design calculations of the grouted rip-rap protection for the earthen channel at approximate Station 273+35. Provide notes to ensure that the grouted rip-rap protection can be constructed.

D. The offsets for the proposed ditch at Station 270+00 were different from Sheet 29 to Sheet 30, please verify.

E. Please callout the beginning station and the ending station of channel transition on this sheet.

(47) Phase I-A, Sheet 31.

A. Please callout the bottom width for the proposed ditch.

B. Please show how the ditch ties into existing ground at approximate Station 287+80 RT.

(48) Phase I-A, Sheet 32.

A. Please specify the bottom width for the proposed north ditch. Verify cross slopes of this ditch on the plan.

B. Please specify the design discharges for the proposed south channel reaches. Address the stability of this channel.

Drainage Review Comments

Phase I

Action Taken

C. Please address what is proposed for the median drainage between Station 270+00 and Station 291+68.

D. Please callout the beginning station and the ending station of channel on this sheet.

E. Please specify for the contractor to "grade to drain" for the channel at approximate Station 297+00 LT.

(49) Phase I-A, Sheet 33.

A. Please verify the cross slope of pavement on the plan at approximate Station 302+30.

B. Please specify the design discharge for the proposed south earthen channel. Address the stability of the proposed channel.

(50) Phase I-A, Sheet 34.

A. Please show the grate opening at Station 316+36.50 in profile. Include calculations to ensure that the HGL elevation at the cattle crossing is not higher than the grate elevation.

B. Please specify the side slopes and bottom width for the proposed south ditch.

C. Please show the grading slopes for the proposed south channel between Station 318+00 and Station 319+50.

(51) Phase I-A, Sheet 35.

A. Show the proposed north ditch in profile. Please specify the side slopes and bottom width of this ditch.

B. Show the bottom width of the proposed south ditch.

Drainage Review Comments

Phase I

Action Taken

C. Please address why the dike was not proposed downstream of the median catch basin at Station 326+35.

D. Please verify the station of the 29"x18" CMP shown in profile.

(52) Phase I-A, Sheet 36.

A. Please show the flow direction for the median drainage.

B. Check the flow line for the proposed ditch in profile.

C. Please specify the side slopes of the proposed north ditch. Callout the bottom width of the ditch.

D. Please include the bottom width of the south ditch.

(53) Phase I-A, Sheet 37.

A. Please show the flow direction and the station of high point for the median drainage.

B. Please verify the length of the east wingwall at the outlet of the 2-10'x8' RCBC.

C. Check the flow line for the proposed ditch in profile.

D. Please verify the pipe length for the 2-43"x27" CMP.

(54) Phase I-A, Sheet 38.

A. Please show the flow direction for the median drainage. Address the design for the median drainage between approximate Station 343+00 and Station 354+51.

Action Taken

B. Please verify all notes for the 2-50"x31" CMP on the plans. For example, the length and skew angle shown cannot obtain the stationing values for the inlet and the outlet.

C. Please verify the note for the south ditch at Station 360+00 with Sheet 39.

D. Please check the flow line for the proposed ditch in profile.

(55) Phase I-A, Sheet 39.

A. Please show the flow direction for the median drainage.

B. Please address why a side slope of 2 to 1 was proposed for the south ditch from Station 356+00 to Station 363+50. Show the side slope transition between 2 to 1 and 4 to 1. Also, provide the bank stability analysis at the side slope of 2 to 1.

C. Please include a detail for the modified ADOT Standard No. PH-15 headwalls at each end of the 72" CMP. Please include pipe slope in the note for this pipe. Show and verify the invert elevations in profile.

D. Check the flow line for the proposed south ditch in profile.

(56) Phase I-B, Sheet 2.

A. Detail 1

1. Please ensure that the contractor will know to construct the left drainage channel from approximate Station 421+37.62 to Station 453+17.

2. Please ensure that the minimum depth of one (1') foot for the drainage channel is achieved.

Drainage Review Comments

Phase I

Action Taken

B. Detail 2

1. Please address what is the grading slope the contractor will use for the left of the roadway, while there is no channel proposed.

2. Please ensure that the contractor will know how to construct the right drainage channel. (No channel shown.)

(57) Phase I-B, Sheet 3.

A. Please check the slope on the pipe at Station 379+85.

B. Please check the station callout at the inlet of the 29"x18" CMP at Station 374+88.

C. Please include the station, discharge and headwater elevation in the note for each culvert.

D. Verify the shoulder slope direction shown at Station 370+10 RT.

(58) Phase I-B, Sheet 4.

A. Please check the callout at Station 385+00 for an ADOT C-15.30 with a concrete apron. Is the concrete apron correct?

B. Please specify the bottom width for the proposed channel.

C. Please address why the dike was not proposed downstream of the median catch basin at Station 381+43.

D. Need a callout for the proposed channel at Station 390+00 RT.

Drainage Review Comments

Phase I

Action Taken

(59) Phase I-B, Sheet 5.

A. Please reference detail 10 of Sheet 2 for grouted rip-rap on the 15" RGRCP at Station 392+60.

B. Please specify the side slopes for the proposed north and south channels.

C. Need a callout for the proposed channel at Station 390+00 RT.

(60) Phase I-B, Sheet 6.

A. The callout for rip-rap at 68.5' LT Station 400+20 is not consistent with the callout for the rip-rap elsewhere in the plans. This needs to be revised.

B. Please check the pipe slope for the 18" RGRCP at Station 407+80.

C. Please address why the dike was not proposed downstream of the median catch basin at Station 407+80.

D. Please show the median catch basin and the 18" RGRCP in profile.

E. Please specify the bottom width for the proposed north channel.

F. Please specify the grading slope for the embankment at the south side of the roadway.

G. Please ensure the water will not break out and inundate the roadway at approximate Station 408+20 RT.

(61) Phase I-B, Sheet 7.

A. Need callouts at Station 420+00 for the north and south channels.

Drainage Review Comments

Phase I

Action Taken

B. Please address why the dike was not proposed downstream of the median catch basin at Station 419+26.47.

C. Please show the median catch basin and the 18" RGRCP in profile.

(62) Phase I-B, Sheet 8.

A. Need callouts at Station 420+00 for the north and south channels.

B. Please specify the side slopes of the south channel.

(63) Phase I-B, Sheet 9.

A. Please callout the channel side slopes.

B. Please specify the bottom width of the south channel.

C. Please verify that removing the ditch and dike at approximate Station 437+00 will not adversely impact the roadway or property upstream or downstream

(64) Phase I-B, Sheet 10.

A. The channel elevations at Station 450+00 are not consistent between the plans and the profile.

B. Please callout the channel side slopes.

C. Please address why the dike was not proposed downstream of the median catch basin at Station 442+39.03.

D. Please show the median catch basin in profile.

Drainage Review Comments

Phase I

Action Taken

E. Please address the design for the median drainage from Station 442+40 to Station 443+85.

F. Please ensure that the design of the proposed channels in the cut areas, which cover most of Sheets 8-10, are adequate to prevent any break-outs into the roadway.

(65) Phase I-B, Sheet 11.

A. Please verify the flow line elevations at Station 450+00 for the north and south channels on Sheet 10.

B. Please specify the bottom width for the north and south channels.

C. Please address why the north side slope of 3 to 1 was proposed for the north channel.

D. Please verify that removing the ditch and dike at approximate Station 450+50 will not adversely impact the roadway or property upstream or downstream.

(66) Phase I-B, Sheet 12.

Please show the median catch basin and the 15" RGRCP in profile.

(67) Phase I-B, Sheet 13.

A. The southwest wingwall on the double 10'x10' RCBC is not drawn to the dimension in the callout.

B. Delineate the 100-year floodplain and investigate the need for slope paving to protect the roadway embankment near the box culvert.

Drainage Review Comments

Phase I

Action Taken

C. 404 permitting will be required for construction in this area.

D. Please show that an equal amount of borrow is being excavated from the basin to compensate for the placement of the roadway fill.

E. Please label McMicken Dam and Trilby Wash.

F. Please include the station, discharge and headwater elevation in the callout for the 2-10'10' RCBC.

G. Please callout the station of high point for the median drainage.

(68) Phase I-B, Sheet 14.

A. Please verify that removing the ditch and dike at approximate Station 489+20 will not adversely impact the roadway or property upstream or downstream.

B. Please address why the dike was not proposed downstream of the median catch basin at Station 485+24.

C. Please show the median catch basin in profile.

D. Please address the design for the median drainage from Station 485+24 to Station 486+71.

E. Please callout the stations and offsets for the transition of grading slopes at the north and south of the roadway.

(69) Phase I-B, Sheet 15.

A. Need additional information on canal crossing.

Drainage Review Comments

Phase I

Action Taken

B. Verify the detail numbers in all callouts for single curb, ribbon curb and curb transitions.

C. Please specify the grading works adjacent to the shoulders.

D. Please address the design for the pavement drainage heading east at the end of this project.