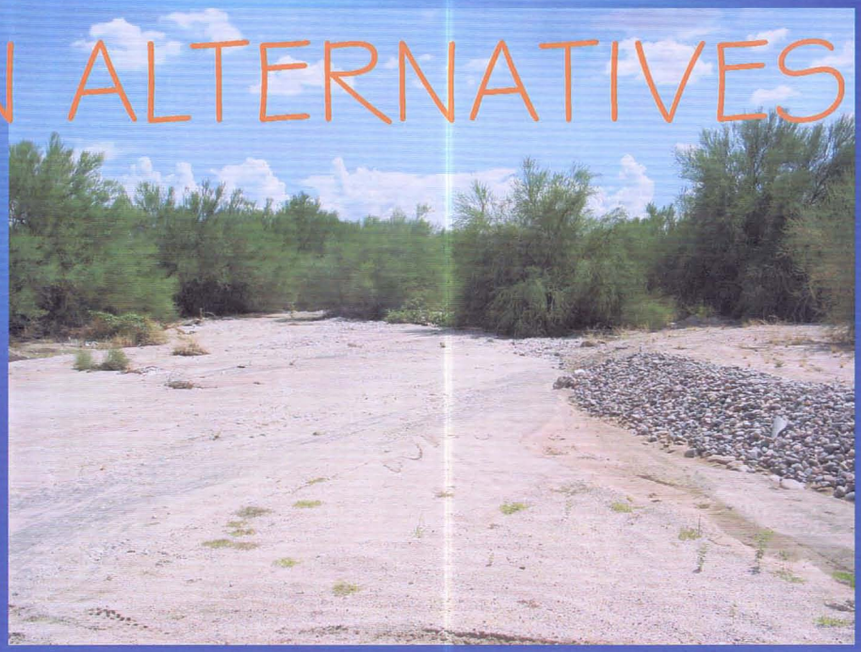
WATERFALL WASH and NORTH INLET CHANNEL DESIGN ALTERNATIVES



Prepared for the
Flood Control District
of Maricopa County

Flood Control District of Maricopa County
www.fcd.maricopa.gov

Prepared by
Stantec Consulting Inc.

Stantec

McMicken Dam Fissure Risk Zone Remediation Project

Waterfall Wash and North Inlet Channel Design Alternatives

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1.0 BACKGROUND AND PURPOSE

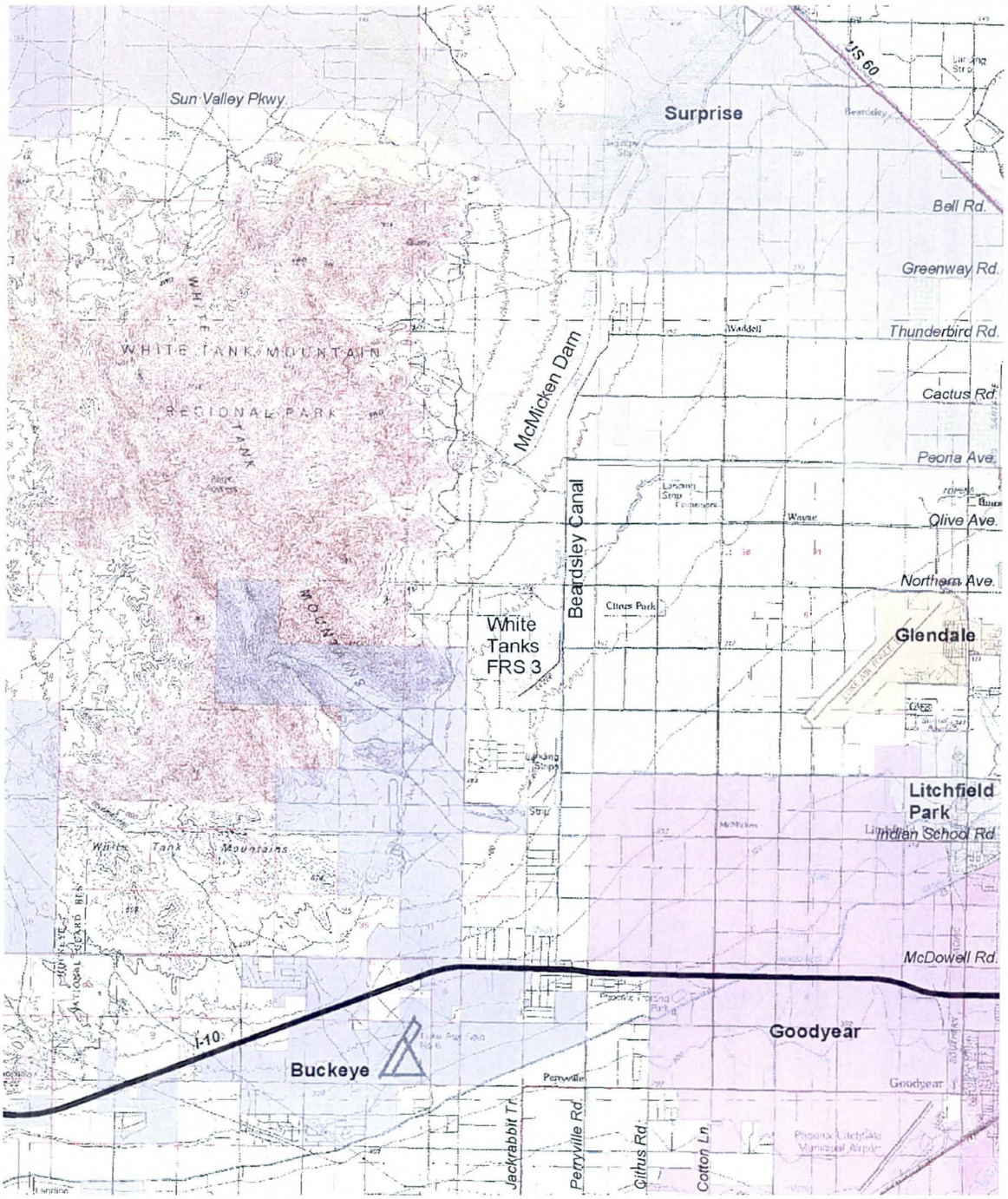
Runoff draining from the eastern flanks of the White Tank Mountains is intercepted by the Beardsley Canal and conveyed south along the canal alignment to the White Tanks Flood Retarding Structure No. 3. The wash formed by the canal, referred to as Beardsley Canal Wash is crossed by two roadways, Olive Avenue and Northern Avenue. The location of these roadways in relation to the White Tank Mountains and other features are shown in Figure 1. During the 100-year flood event the culvert capacity at both the Olive and Northern Avenue crossings are insufficient to convey the entire flow which results in flow breaking out over the canal.

The flooding issues along the Beardsley Canal were addressed in the White Tanks FRS # 3 North Inlet Channel Pre-Design Study, herein referred to as the Pre-Design Study. The purpose of that study was to investigate alternative solutions for the breakout along the Beardsley Canal Wash. The result of that study was the selection of a preferred alternative. The preferred alternative will involve the construction of a parallel channel on the east side of the canal as well as improvements of the culvert crossings. Runoff in excess of the culvert capacity at Olive Avenue will be conveyed via a culvert under the canal to the new "east side" channel. That flow will then be conveyed back into the existing channel on the west side of the canal via a second culvert under the canal just upstream of Northern Avenue. The estimated cost for those improvements is approximately $4,500,000.

Through the McMicken Dam Fissure Risk Zone Remediation Project, FCD 2002C011, a separate work assignment was initiated to investigate an additional alternative to the flooding problems along the Beardsley Canal during the 100-year event. This work assignment, identified as Work Assignment 2A, Waterfall Wash Diversion Design and Investigation, was intended to take advantage of the facilities associated with the improvements for McMicken Dam, thus providing a more cost effective solution than the preferred alternative from the Pre-Design Study. One result of that work assignment was the discovery of errors in the existing watershed model for the area. Correction of the errors, in combination with other refinements resulted in a reduction of the peak discharge at Olive Avenue. The reduction in the peak discharge was deemed significant enough to warrant investigation of a second alternative. The purpose of this second alternative, identified as Work Assignment 2C, North Inlet Channel Investigation Project, was to eliminate the flooding problems along the Beardsley Canal by improving the conveyance capacity of the existing channel

downstream of Olive Avenue. The purpose of this report is to document the hydrologic modeling that has been conducted for this watershed and to discuss the impacts of the various results in regard to the flooding problems and the selection of a preferred alternative.

Figure 1
Location Map



2.0 DATA COLLECTION

Several data sets were collected and utilized in the analyses for Work Assignments 2A and 2C. The following is a listing and brief description of each of those data sets.

Design Memorandum No. 1, Hydrology and Hydraulic Design for Trilby Wash Detention Basin and Outlet Channel (Corps of Engineers, U.S. Army, Los Angeles District, November 1953).

Design Memorandum No. 2, Design Analysis for Trilby Wash Detention Basin and outlet Channel (Corps of Engineers, U.S. Army, Sacramento District, March 1954).

Surface Water Hydrology Report, McMicken Dam Restoration Study, Maricopa County, Arizona (SHB, February, 1983) – A hydrology model to route the PMF through the spillway.

Report on A Hydrologic Analysis of the McMicken Dam Watershed (Flood Control District of Maricopa County, Rumann & Sutko, March 1987). – A revision of the SHB model that addresses comments by the Arizona Department of Water Resources.

Hydrologic Analysis for McMicken Dam, (Flood Control District of Maricopa County, Cruff, March 2000) – Adjusts the stage storage rating curve to account for effects of subsidence in the area.

White Tanks/Agua Fria ADMS (WLB, Oct. 1991) – The White Tanks/Agua Fria ADMS included the development of an existing condition 100-year, 24-hour watershed model for an area of approximately 180 square miles. The study also involved floodplain and floodway delineations for numerous watercourses within the study area, including Beardsley Canal Wash, Cholla Wash and Waterfall Wash.

Loop 303 Corridor/White Tanks ADMP Update (URS, Sept. 2002) – The Loop 303 Corridor/White Tanks ADMP Update HEC-1 model, herein referred to as the White Tanks Update model, is the most current watershed model of the study area. That model is based on the watershed model prepared for the White Tanks/Agua Fria ADMS (WLB, Oct. 1991.

White Tanks FRS # 3 North Inlet Channel Pre-Design Study Report (Wood, Patel & Associates, July 2002) - The purpose of that study was to develop alternatives for the North Inlet Channel (Beardsley Canal Wash) from Peoria Avenue to White Tanks FRS #3 and to study alternative solutions to the flow break outs conditions along the Beardsley Canal. Five alternatives were presented in the report and Alternative 4 was selected which includes an additional channel on the east side of the canal to convey those flows which breakout over the Canal. Hydrologic data used in this study was taken from the Loop 303 Corridor/White Tanks ADMP Update (URS, Sept. 2002).

Sonoran Ridge Estates – A development currently under construction that has the Beardsley Canal as the eastern boundary and extends from Northern Avenue to Olive Avenue. Two of the five units have an approved plat. As of the time of this report, the remaining units are still at a preliminary Plat stage. Based on the plats, there are numerous lots immediately adjacent to the existing R.O.W. that the Beardsley Canal Wash occupies. In addition to the plats, an HEC-RAS model was prepared. Cross sectional geometry used in the model is based on current detailed topographic mapping.

3.0 Work Assignment 2A - Waterfall Wash Diversion

3.1 General

A draft report for this work assignment was prepared and submitted to the District for review. That report presented the results of the hydrologic modeling performed as part of the analysis for the diversion structure as well as cost estimates and 10 percent design drawings. That report is provided for reference as Appendix A. The following is a brief discussion of the hydrologic conditions present in the watershed. The modeling results presented in this report reflect changes to the draft report requested by the District.

3.2 Existing Conditions

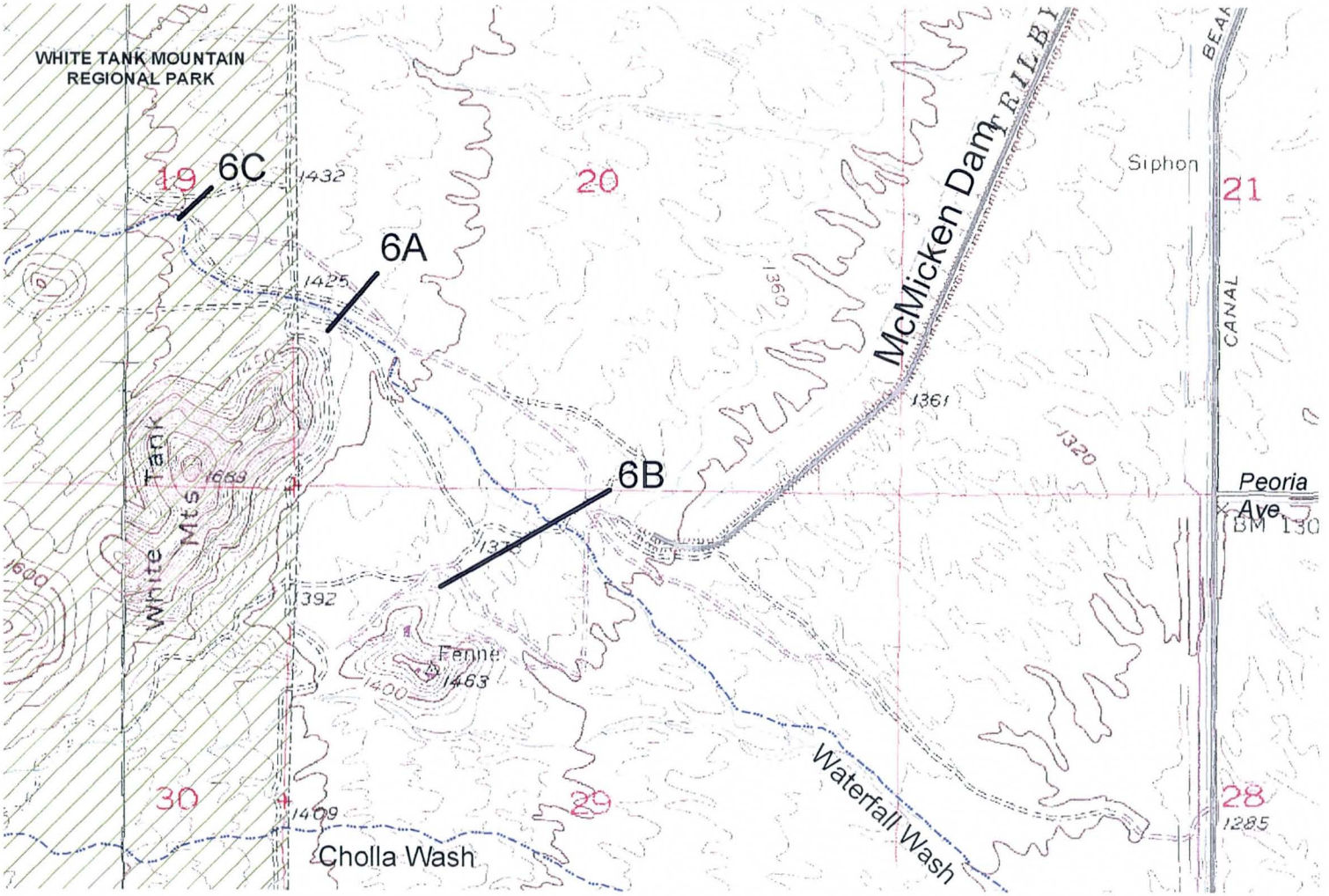
3.2.1 General

Runoff from the White Tank Mountains is concentrated along the Beardsley Canal where it is diverted from the natural flow paths. For high flows, the canal is overtopped at Olive Avenue and

Northern Avenues. The purpose of the Waterfall Wash diversion is to reduce the peak flow reaching the Beardsley Canal and to reduce the occurrence of breakout of those flows over the canal. Currently, the Beardsley Canal is overtopped during the 100-year event. The diversion structure is designed to divert runoff up to the 100-year event. Runoff in excess of the 100-year event will overtop the structure and continue downstream. The structure is also designed to allow a small volume of runoff to continue downstream for all events up to the 100-year for environmental considerations. In addition to the 100-year event, the performance of the structure is also evaluated for the Probable Maximum Flood (PMF). The PMF is considered in the analysis for potential impacts to the operation of McMicken Dam.

Three locations are considered for the proposed diversion. The alternative locations are shown in Figure 2 and are in general located west of McMicken Dam at approximately the Peoria Avenue alignment. One proposed location is within the limits of the White Tanks Mountain County Regional Park.

Figure 2
Diversion Locations



3.2.2 Hydrology

The study watershed is composed of physiographic characteristics that are highly varied. The majority of the watershed area lies within the rugged mountainous terrain of the White Tank Mountain County Regional Park. Elevations within the park range from 1,600 to over 4,000 feet. The watercourses in this area are generally steep, well defined and flow from west to east in long narrow valleys. Near the park boundary, the terrain changes abruptly to a relatively steep piedmont terrace with fairly well defined channels. Further down the piedmont terrace, near the Beardsley Canal, the watercourses begin to loose containment and the channels become braided and distributary in nature. The study watershed is drained by two main watercourses, Waterfall Wash and Cholla Wash. Waterfall wash is located in the northern portion of the watershed very near the southern terminus of McMicken Dam. Waterfall Wash is intercepted by the Beardsley Canal at Olive Avenue where it is diverted to the south, flowing along the canal alignment. The drainage area at this point is approximately 5 square miles. Cholla Wash drains the southern portion of the study watershed. Cholla Wash is intercepted by the Beardsley Canal midway between Olive and Northern Avenues where it combines with runoff from Waterfall wash, then continues flowing south along the canal alignment.

Soils in the mountainous portion of the watershed can be characterized as a gravelly loam or sandy loam with significant areas of rock outcroppings. On the piedmont, the soils progressively transition to a finer grained matrix moving in an easterly direction away from the base of the mountains. These soils can generally be characterized as sandy or silty clay. Under present conditions, the study watershed is essentially undeveloped except for the Sonoran Ridge Estates development.

The watershed models used to evaluate the proposed diversion structure are based on the White Tanks Update model. The study area represented by that model is approximately 180 square miles. The contributing drainage area considered for this study is approximately 11 square miles which comprises the majority of the White Tanks FRS 3 North Inlet Channel drainage area. This area is generally bounded on the south by Northern Avenue, on the east by the Beardsley Canal, on the west by the White Tank Mountains and on the north by McMicken Dam. Figure 3 shows the location of the watershed in relation to McMicken Dam and the Beardsley Canal.

All three of the proposed diversion locations lie within the limits of subbasin 2 as defined in the White Tanks Update model. One of these (Alternative 6A) is located at the northern point of a rock outcropping, just east of the park boundary. Because of the hydrologic and physiographic characteristics of that subbasin, the general proximity of the alternative locations to one another and for the purposes of this analysis, Alternative 6A is considered typical of the hydrologic conditions to be considered for modeling of a diversion and its impacts downstream. In other words, the magnitude of the runoff volume diverted to McMicken Dam and the resulting peak discharge along the Beardsley Canal will not significantly differ for the three proposed diversion sites. Runoff magnitudes at the proposed diversion location for Alternative 6A were determined by subdividing subbasin 2 as defined in the White Tanks Update model. The new subbasins are identified as 2A and 2 and are shown in Figure 3. New subbasin parameters were estimated for subbasins 2A and 2 per the methods employed in the White Tanks Update model and the procedures set forth in the Drainage Design Manual of Maricopa County; Volume I, Hydrology (Manual). Hydrologic channel routing data associated with the new subbasin delineation was prepared accordingly from the most recent topographic mapping. All other watershed parameters from the White Tanks Update model were reviewed for reasonableness. During the review, five issues were identified that impact the estimation of the peak discharge and runoff volumes.

- The point precipitation depth estimated for the entire White Tanks Update model of 4.03 inches is considered low for analysis of just the Waterfall Wash model watershed.
- Errant flow path slope for subbasin 1.
- The Phoenix Mountain S-graph was used for subbasins more characteristic of the Desert/Rangeland S-graph (note that the Desert/Rangeland S-graph was probably not available for use at the time of the White Tanks/Agua Fria ADMS).
- Areal reduction factors for estimating the peak discharge and runoff volumes are not representative of the size of the study watershed.
- The diversion rating curve at Olive Avenue was not current and was commented out such that all flow was modeled to continue flowing down Beardsley Canal Wash.

A more detailed discussion of these issues along with a presentation of the data used to develop the new and revised HEC-1 input parameters is provided as a separate memo. That memo is included for reference as Appendix B. The revised model, herein referred to as the Waterfall Wash Model

was run for the 100-year, 24-hour storm for comparison to the White Tanks Update Model. The results from those two models are shown in Table 1.

Figure 3
Watershed Map

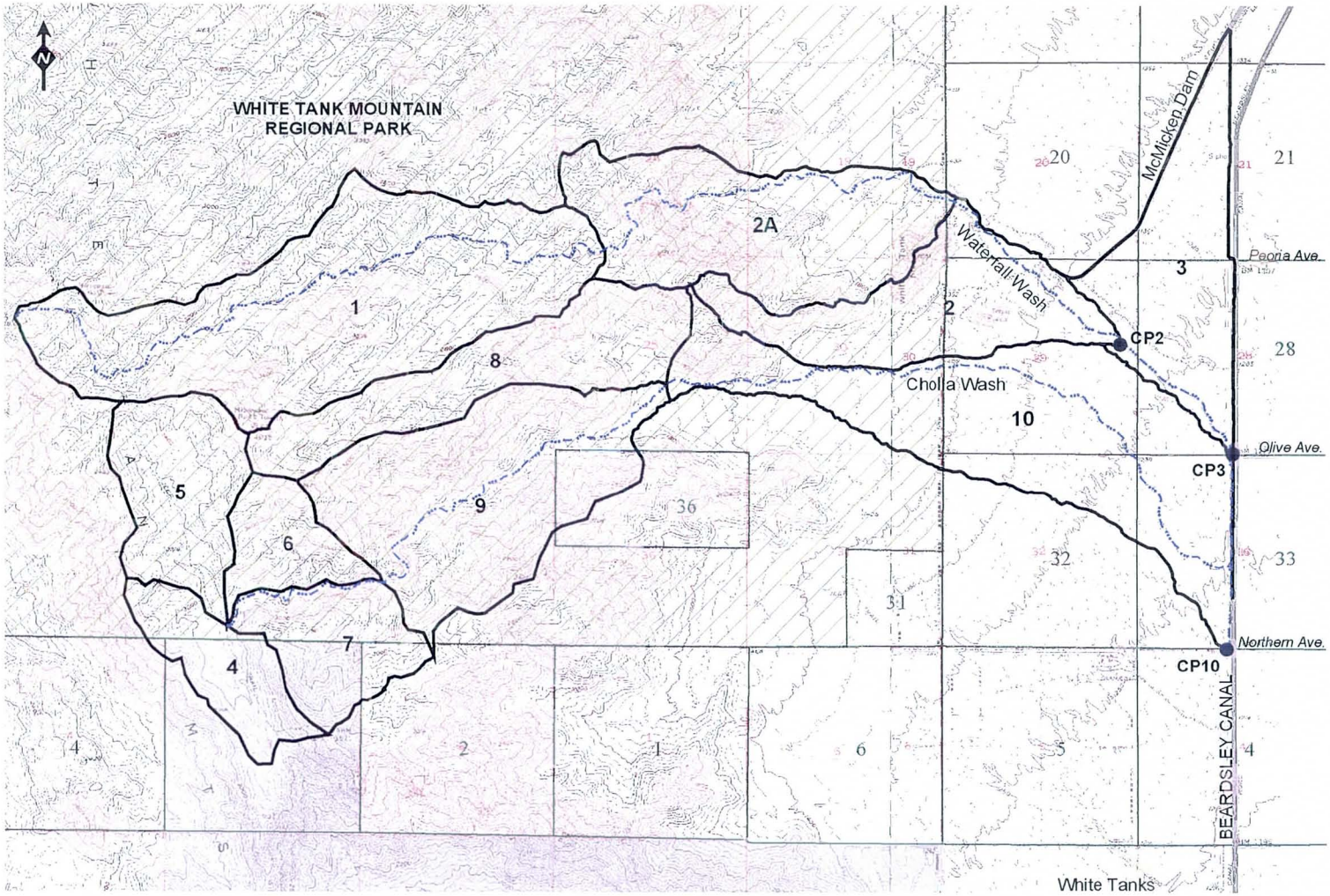


Table 1
Comparison of 100-year, 24-hour Model Results

	Waterfall Wash Model				White Tanks Update Model			
HEC-1 ID	Drainage Area sq. miles	Peak Discharge cfs	Runoff Volume acre-ft	Time to Peak hours	Drainage Area sq. miles	Peak Discharge cfs	Runoff Volume acre-ft	Time to Peak hours
1	1.99	1,505	137	12.42	1.94	1,719	122	12.42
CP2	4.01	2,376	322	12.67	3.76	2,821	250	12.75
3	0.88	1,235	56	12.17	1.10	1,048	59	12.42
CP3	4.89	2,405	376	12.75	4.86	2,823	308	12.83
DI189	4.89	435	29	12.75	4.86	629	30	12.83
D3	4.89	1,970	347	12.75	4.86	2,194	278	12.83
CP10	10.90	6,950	723	12.75	10.87	6,619	639	12.75

Notes:

HEC-1 ID 3 (subbasin 3) in the Waterfall Wash Model is equivalent to HEC-1 ID I1CP3 in the White Tanks Update Model.

As can be seen from the results in Table 1, the runoff volumes for the Waterfall Wash Model are greater than those in the White Tanks Update Model. This is due to the increase in the point rainfall value from 4.03 inches to 4.15 inches and the addition of an areal reduction factor for an area of 5 square miles. As can also be seen from the results in Table 1, the peak discharge for subbasin 1 in the Waterfall Wash Model is lower than that of the White Tanks Update Model. This is to be anticipated given the reduction in the flow path slope and thus an increase in the basin lag. The reduction in the peak discharge at HEC-1 ID CP2 for the Waterfall Wash Model from the White Tanks Update Model is a result of several different elements all related to hydrograph timing. In the White Tanks Update Model, the routed hydrograph from subbasin 1 peaks at 12.75 hours and combines directly with the runoff from subbasin 2. In the Waterfall Wash Model, subbasin 2 was split into subbasins 2A and 2 and new unit hydrograph parameters were determined. The flow path slopes for these two subbasins are 405.6 and 567.7 feet/mile, respectively. The flow path slope used for subbasin 2 in the White Tanks Update Model is 162.4 feet/mile. The significantly steeper slopes used in the Waterfall Wash Model result in much shorter time to peaks for those subbasins, consequently the peaks are not coincident with the routed peak from subbasin 1. Inspection of the topography suggests that the flow path slope of 162.4 feet/mile used in the White Tanks Update Model is an error. The peak discharge at HEC-1 ID 3 in the Waterfall Wash model is greater than that in the White Tanks Update Model due to the change in S-graph, specifically the use of a lower

value for K_n associated with the roughness characteristics of a desert/rangeland area compared to those of a mountainous area. The result of these changes yields a peak discharge at Olive Avenue (CP3) that is lower in the Waterfall Wash Model than in the White Tanks Update Model.

Although these changes appear to be significant in regard to the relative magnitudes, from a hydrologic perspective the differences in the results are well within the realm of accuracy. However, due to the errors in the White Tanks Update Model, the Waterfall Wash Model is the model used for the evaluation of the proposed diversion. A print out of the Waterfall Wash Model input and output is provided in Appendix C. Input and output files are also provided digitally on CD-Rom as Appendix G.

3.3 Proposed Conditions

3.3.1 100-Year

Given the size of the study watershed it cannot be determined whether the 6-hour local storm or the 24-hour general storm will produce the greatest runoff magnitudes. Therefore, the Waterfall Wash Model is run for both the 6 and 24-hour storms. The dimensions of the diversion structure are based on the critical flood producing storm. The critical flood producing storm at the proposed diversion locations is the 6-hour storm for peak discharge and the 24-hour storm for runoff volume. A summary of the peak discharge and runoff volume at key locations for both the 6- and 24-hour storms for both existing and proposed conditions is provided in Table 2. The HEC-1 operation MCMICK represents the flow that is diverted to McMicken Dam. Correspondingly, the HEC-1 operation WFW represents the flow that is allowed to continue downstream in Waterfall Wash. Highlighted in Table 2 are the results for the critical storm at each location. The controlling peak discharge and runoff volume at the diversion location for Alternative 6A (HEC-1 operation CP2A) is 2,106 cfs and 248 acre-feet, respectively. Of that, 1,966 cfs is diverted to McMicken Dam with 140 cfs continuing downstream. A print out of the proposed conditions HEC-1 models are provided in Appendix D. Input and output files are also provided digitally on cd as Appendix G.

The values listed in Table 2 for the proposed condition represent the hydraulics of the diversion for Alternative 6A. The peak discharges used to size the diversion structure for Alternatives 6B and 6C are based on the existing condition unit discharge at HEC-1 operations CP2 and CP2A, respectively. At CP2, the unit discharge is approximately 600 cfs/sq. mile. The drainage area for the diversion at

Alternative 6B is 3.7 square miles. At a unit discharge of 600 cfs/sq. mile, the peak inflow to the diversion structure for Alternative 6B is 2,220 cfs. Assuming the same diversion rating curve as for Alternative 6A, 2,080 cfs would be diverted into McMicken Dam with 140 cfs continuing downstream. At CP2A, the unit discharge is approximately 660 cfs/square mile. The drainage area for the diversion at Alternative 6C is 3.17 square miles. At a unit discharge of 660 cfs/sq. mile, the peak inflow to the diversion structure for Alternative 6C is 2,092 cfs. Again, assuming the same diversion rating curve as for Alternative 6A, 1,958 cfs would be diverted into McMicken Dam with 134 cfs continuing downstream.

Table 2

Comparison of Existing and Proposed Condition HEC-1 Model Results

	Existing Condition				Proposed Condition			
	6-Hour		24-Hour		6-Hour		24-Hour	
HEC-1 ID	Discharge cfs	Volume acre-ft	Discharge cfs	Volume acre-ft	Discharge cfs	Volume acre-ft	Discharge cfs	Volume acre-ft
CP2A	2,106	233	2,091	248	2,106	233	2,091	248
MCMICK	---	---	---	---	1,966	187	1,951	174
WFW	---	---	---	---	140	46	140	74
2	1,209	82	971	75	1,209	82	971	75
CP2	2,397	296	2,376	322	938	117	1,101	148
3	1,459	72	1,197	56	1,459	75	1,197	56
CP3	2,454	345	2,405	376	1,578	172	1,826	203
DI189	457	30	435	29	88	2	176	4
D3	1,997	315	1,970	347	1,490	170	1,650	199
CP10	5,457	609	6,950	723	4,857	478	6,253	580

3.3.2 Probable Maximum Flood

The proposed diversion is designed to divert flows up to the 100-year event to McMicken Dam. Flows in excess of the 100-year event are to continue downstream of the structure in the natural flow paths. However, it is likely that some portion of the runoff from more severe events, such as the Probable Maximum Flood (PMF) will be diverted to McMicken Dam. Runoff magnitudes for the PMF were estimated using the Waterfall Wash Model and the 6-hour Probable Maximum Precipitation (PMP). The PMP for the study area was estimated using the procedures set forth in the Hydrometeorological Report No. 49. The temporal distribution of the PMP is from the Hydrometeorological Report No. 5. The PMP discharge and runoff volume at the proposed diversion alternative 6A is 14,475 cfs and 1,592 acre-feet, respectively. Discharge and runoff volumes and the amount of the PMF diverted into the dam were not estimated for alternatives 6B and 6C, but would be similar. A print out of the HEC-1 model for the PMP is provided in Appendix E. Input and output files are also provided digitally on CD-Rom as Appendix G.

Estimation of the amount of the PMF runoff volume that will end up in the McMicken Dam impoundment area is difficult and requires estimation of the weir coefficients for both the diversion weir and the overflow of the dike, estimation of the breach rate of the fuseplug and calculation of the outflow hydrograph through the breach. Diversion of flows in excess of the 100-year event will continue in the diversion channel until the channel is overtopped or until the diversion dike is completely breached and flow returns to the natural channel. The maximum capacity of the diversion channel (including freeboard) is approximately 3,100 cfs. Assuming that the diversion channel could convey flow to McMicken Dam at the maximum capacity for the duration of the PMF, the corresponding volume of runoff would be approximately 540 acre-feet.

3.4 Conclusions

The performance of the diversion must be evaluated from two different perspectives. First, the diversion must be evaluated for the effectiveness at reducing the breakout of flows along the Beardsley Canal during the 100-year event. Second, the potential impacts of diverting runoff into McMicken Dam must be evaluated. In the Pre-Design Study, the 100-year, 24-hour existing condition peak discharge at Olive Avenue is 2,823 cfs with 629 cfs overtopping the canal. With the revisions to the model input parameters, the controlling peak discharge at Olive Avenue is 2,454 cfs

with 457 cfs overtopping the canal. By diverting the 100-year runoff from Waterfall Wash into McMicken Dam, the controlling peak discharge at Olive Avenue is 1,826 cfs with 176 cfs overtopping the canal. Part of the recommended improvements for the preferred alternative of the Pre-Design Study was the construction of a larger culvert crossing at Olive Avenue. Although a hydraulic analysis of the revised peak discharges along the Beardsley Canal Wash was not performed as part of this analysis, it is likely that reduction in the peak discharge along with the increased conveyance capacity of the proposed culvert would eliminate overtopping of the canal during the 100-year event. At Northern Avenue, the 100-year, 24-hour existing condition peak discharge from the White Tanks Update model is 6,619 cfs. With the revisions to the model input parameters, the controlling peak discharge increased to 6,950 cfs. Part of the recommended improvements for the preferred alternative of the Pre-Design Study was the construction of a larger culvert crossing at Northern Avenue. With the diversion on Waterfall Wash the peak discharge at Northern Avenue is approximately 6,300 cfs. Based on these results, construction of a diversion on Waterfall Wash would eliminate the need for a parallel channel on the east side of the canal. From the Pre-Design Study report, the estimated construction cost of the parallel channel and connecting culverts is approximately $2,800,000. The estimated cost of the diversion structure and related facilities ranges from approximately $932,000 to $2,971,000 depending on the various options considered (see the Draft Report in Appendix A for a complete discussion of the options).

The preferred alternative selected for the McMicken Dam Fissure Risk Zone Remediation Project is dam segmentation. For this alternative the high fissure risk zone is isolated from the rest of McMicken Dam. Because of the location of the segmented portion of the dam in relation to the diversion structure, diverted flows from Waterfall Wash would enter the segmented portion. Therefore the main portion of McMicken Dam would be unaffected by the diversion. Segmenting the dam will also involve the construction of drainage facilities to safely store runoff currently draining to the high fissure risk area. Diversion of runoff from Waterfall Wash into this area will require those facilities to be increased in size. The additional cost to upsize the facilities has not been estimated as of the time of this report.

4.0 Work Assignment 2C – North Inlet Channel Investigation Project

4.1 General

Work Assignment 2C was initiated based on the hydrologic model results from Work Assignment 2A. The purpose of this work assignment was to eliminate overtopping of the Beardsley Canal during the 100-year event by increasing the conveyance capacity of Beardsley Canal Wash from Olive Avenue to Cholla Wash without impacting Sonoran Ridge Estates. Peak discharges from the Waterfall Wash model were to be used as the benchmark. From that model, the peak discharge at Olive Avenue is 2,454 cfs. This discharge is a reduction of approximately 400 cfs from what was used in the Pre-Design Study.

4.2 Hydrology

After the notice to proceed was given, the District requested some modifications to the Waterfall Wash model. The Waterfall Wash model was created for the purpose of evaluating the proposed diversion on Waterfall Wash. Without the diversion, many of the refinements to the original model would not have been made. The purpose of the requested modifications was to develop a model for this work assignment that only corrected for the errors in the White Tanks Update model. The following is a listing of the corrections.

- The point rainfall depth was increased from 4.03 inches to 4.15 inches,
- An arial reduction factor for an area of 5 square miles was added,
- Flow path slope for subbasin 1 was revised from 829.4 to 505.5 feet/mile,
- Flow path slope for subbasin 2 was revised from 162.4 to 334 feet/mile,
- The desert/rangeland S-Graph was used for subbasin 3A,
- The K_n for subbasin 3A was changed from 0.05 to 0.03,
- The desert/rangeland S-Graph was used for subbasin 3, and
- The K_n for subbasin 3 was changed from 0.05 to 0.03,

The resulting watershed model, herein referred to as the North Inlet Channel model, was run for both the 6- and 24-hour storm durations. Printouts of these models are provided in Appendix F. Input and output files are also provided digitally on CD-Rom as Appendix G. For this model, the 24-hour storm duration was the critical flood producing storm at Olive and Northern Avenues. The 100-year,

24-hour model results are shown in Table 3. Also shown in that table are the corresponding results from the White Tanks Update and Waterfall Wash models for comparison. As can be seen from Table 3, the results of the North Inlet Channel model are very similar to the results of the Waterfall Wash model. The differences of the North Inlet Channel model results compared to the White Tanks Update model results are primarily due to hydrograph timing similarly to the discussion for the Waterfall Wash model results comparison. To illustrate the effects of hydrograph timing, the North Inlet Channel model was run with a unit hydrograph for subbasin 2 generated with the original flow path slope of 162.4 feet/mile. The resulting 100-year, 24-hour peak discharge at CP2 is 2,771 cfs compared to 2,488 cfs with a flow path slope of 334 feet/mile. The longer time to peak associated with a flow path slope for subbasin 2 of 162.4 feet/mile combines more directly with the routed peak from subbasin 1, thus producing a higher combined peak discharge.

Table 3

Comparison of HEC-1 Model Results for Work Assignment 2C

	North Inlet Channel				Waterfall Wash				White Tanks Update			
HEC-1 ID	Drainage Area sq. miles	Peak Discharge cfs	Runoff Volume acre-ft	Time to Peak hours	Drainage Area sq. miles	Peak Discharge cfs	Runoff Volume acre-ft	Time to Peak hours	Drainage Area sq. miles	Peak Discharge cfs	Runoff Volume acre-ft	Time to Peak hours
1	1.94	1,541	134	12.42	1.99	1,505	137	12.42	1.94	1,719	122	12.42
2	1.82	1,413	142	12.50	---	---	---	---	1.82	1,339	131	12.75
CP2	3.76	2,488	275	12.58	4.01	2,376	322	12.67	3.76	2,821	250	12.75
3A	0.29	445	17	12.08	---	---	---	---	0.29	313	15	12.33
3	0.81	1,219	48	12.17	---	---	---	---	0.81	863	44	12.33
CP3	4.86	2,437	338	12.75	4.89	2,405	376	12.75	4.86	2,823	308	12.83
DI189	4.86	449	24	12.75	4.89	435	29	12.75	4.86	629	30	12.83
D3	4.86	1,988	314	12.75	4.89	1,970	347	12.75	4.86	2,194	278	12.83
CP10	10.87	6,903	691	12.75	10.90	6,950	723	12.75	10.87	6,619	639	12.75

4.3 Hydraulics

4.3.1 General

The base hydraulic model used to evaluate the proposed improvements is the HEC-RAS model prepared for the Sonoran Ridge Estates development. That model is an update of an existing HEC-2 model prepared as part of the White Tanks/Agua Fria ADMS. The updates include the following.

- Updated cross sectional geometry within the Sonoran Ridge Estates property limits developed from current, detailed topographic mapping prepared for Sonoran Ridge Estates.
- Updated culvert data for the Olive Avenue culvert crossing reflecting the addition of a 2 barrel box culvert to the existing 2 barrel cmp as well as a detailed survey of the overtopping section. The detailed survey was performed by Premier Engineering for Sonoran Ridge Estates.
- Updated peak discharges.

4.3.3 Roughness Coefficients

Manning's n-values used in the Sonoran Ridge Estates HEC-RAS model are essentially taken from the White Tanks/Agua Fria ADMS HEC-2 model with only minor changes. In general, the Manning's n-values range from 0.03 to 0.035 for the main channel, 0.03 to 0.04 for the left overbank and 0.03 to 0.06 for the right overbank. For both the upstream and downstream cross sections defining the culvert crossings at Northern and Olive Avenues, a Manning's n-value of 0.024 was used for the entire cross section. Figure 4 is a ground photograph taken of the main channel near Olive Avenue. As can be seen in this photograph, there is a significant growth of shrubs and mature trees in the channel bottom. The bed material present in the main channel can be characterized as a matrix of fine to course sand with very fine gravel. A Manning's n-value of 0.03 and 0.035 is representative of the bed material present in the wash, but is not representative of the overall roughness characteristics considering the degree of vegetation in the channel. Based on the vegetation, in the present state of growth, a Manning's n-value for the channel of 0.05 to perhaps 0.07 would be more appropriate.

Figure 4
Beardsley Canal Wash main channel looking downstream from Olive Avenue

4.3.4 Flow Data

In both the original HEC-2 model and the Sonoran Ridge Estates HEC-RAS model, flow data was coded to reflect the breakout at Olive and Northern Avenues. Since the development of the original HEC-2 model, the hydrology of the watershed has been revised, as discussed previously. Table 4 lists the peak discharges used in both the original HEC-2 model and the Sonoran Ridge Estates HEC-RAS model. The discharges shown in Table 4 are organized in the HEC-2 format of downstream to upstream. The discharges listed for the original HEC-2 model are taken from the White Tanks/Agua Fria ADMS HEC-1. The discharges listed for the HEC-RAS model are, in general, from the White Tanks Update HEC-1 model but with a diversion rating curve for the break-out at Olive Avenue that is not reflective of the detailed survey.

Table 4
Summary of peak discharges used in the hydraulic models for Beardsley Canal Wash

River Station miles	Peak Discharge HEC-2 (WLB) cfs	HEC-RAS (Premier) cfs
1.074	3,655	4,588
1.159	4,150	5,219
1.237	4,645	5,851
1.313	5,141	6,483
1.556	3,816	4,868
1.616	2,048	2,540
2.072	1,755	2,177
2.167	2,245	2,177

4.3.5 Results

The limits of the channel improvements as specified in the scope of work are from the Cholla Wash confluence to Olive Avenue. This assumes that the recommended improvements to the Northern Avenue culvert crossing proposed in the Pre-Design Study would eliminate the breakout condition at that location. This was a necessary first step, since verification of the effectiveness of the proposed culvert was not done as part of the Pre-Design Study. The proposed culvert crossing for Northern Avenue is an 8 barrel, 10' x 7' box. The bottom width of this crossing would be approximately 87 feet. Downstream of Northern Avenue, the channel bottom width is approximately 30. Upstream of Northern Avenue, the channel bottom width is approximately 20 feet. In an attempt to simulate the proposed improvements at Northern Avenue, not knowing how the transition in and out of the culvert would be designed, the existing culvert was removed and an open channel was modeled. The peak discharge of 2,437 cfs at Olive Avenue was coded into the model for the reach between Olive and Cholla Wash. For the reach from Cholla Wash to Northern, a peak discharge of 7,184 cfs was used. The discharge of 7,184 cfs is the discharge that would occur at Northern Avenue (HEC-1 ID) CP10 without the diversion of flow at Olive Avenue. Even without the backwater effects from the existing Northern Avenue culvert, the Beardsley Canal is overtopped in the Cholla to Northern reach at river station 1.556 and from river station 1.313 to 1.148.

In addition, the increase in the peak discharge that would result from the elimination of the break-out at Olive Avenue would cause an increase in the water surface elevation greater than one foot due to encroachment of the floodplain as proposed for Sonoran Ridge Estates. The two river stations where

this occurs are 2.159 and 1.159 and the surcharge is 1.4 and 1.3 feet, respectively. Also, encroachment for the floodway run results in a decrease in the water surface elevation at river stations 1.616, 1.074 and 0.998. The reductions to the water surface elevations due to encroachment at these locations are 0.3, 0.2 and 0.2 feet, respectively.

4.4 Conclusion

Based on the initial results of the hydraulic analysis, it became clear that the required effort to satisfy the intent of this work assignment extended beyond the scope of work. Therefore, the District requested that all work on this work assignment be stopped. The District also requested Stantec to prepare a listing of design issues that must be addressed in order to carry forward the preferred alternative of the Pre-Design Study. Only issues that were discovered as part of these work assignments are listed. Standard design issues such as the need for current detailed topographic mapping and surveys are not listed.

- Determine the type of drainage easement that exists on the west side of the Beardsley Canal. The type of drainage easement is significant in regard to the presence of the vegetation in the channel as it relates to Manning's n-values and the resulting water surface elevations.
- Revise the diversion rating curve at Olive Avenue to account for the change in hydraulic conditions due to the culvert modifications proposed in the Pre-Design Study.
- Evaluate additional alternatives to the Northern Avenue crossing of the Beardsley Canal Wash that could improve the hydraulic and sediment conditions that would be caused by the currently proposed crossing.
- Verify that the Beardsley Canal is not overtopped between Cholla Wash and Northern Avenue with the proposed improvements in place.
- Evaluate the potential for lateral migration of the Beardsley Canal Wash.
- Review the encroachment limits along the Beardsley Canal Wash

APPENDIX A

DRAFT REPORT

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1.0 EXECUTIVE SUMMARY

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2.0 INTRODUCTION

2.1 Purpose and Scope

The Waterfall Wash Diversion Design and Investigation Project (Project) is Work Assignment 2, Part B of the McMicken Dam Fissure Risk Zone Remediation Project, FCD 2002C011. This report, prepared by Stantec Consulting Inc (Stantec), is the final deliverable for the Project to the Flood Control District of Maricopa County (District).

The purpose of this project is to prepare a 15% design package for diversion of Waterfall Wash for the 100-year flood to McMicken Dam. The goal is to reduce the peak flow reaching the Beardsley Canal (Canal) and to reduce the occurrence of breakout of those flows over the canal at Olive and Northern Avenues. The purpose of this report is to present the alternatives analysis and recommended alternative.

2.2 Project Description

2.2.1 Project Location

Waterfall Wash is located on the east flank of the White Tank Mountains and drains easterly until the flows are blocked by the Beardsley Canal and diverted south. The proposed diversion is located west of McMicken Dam at approximately the Peoria Avenue alignment. The diversion is also located a short distance east from White Tanks Mountain Regional Park. Figure 2-1 is a location map of the project and Figure 2-2 is a vicinity map.

2.2.2 Existing Conditions

The wash carries runoff from Waterfall Canyon in the White Tank Mountains. Figure 2-3 shows a photo of Waterfall Canyon from the trail head at White Tanks Mountain Regional Park. The main wash bisects the park and flows in a well incised channel until it reaches a point approximately 800 feet downstream of the west line of section 20. At this point, the wash is located at the base of a small mountain where the main channel and a smaller tributary channel flow around the mountain. It appears that high flows would combine at this point, while lower flows remain in the separate channels. Below this point, the gradient is flatter and the stream becomes highly braided. The main channel flows just south of the south abutment of McMicken

Dam and then continues easterly where it eventually reaches the Beardsley Canal. The flow is diverted by the canal south where it either continues into White Tanks FRS No. 3 or for higher discharges, overflows the canal and continues to the east.

2.2.3 Proposed Diversion

Flow in Waterfall Wash is diverted north so that it is stored in McMicken Dam. This is accomplished by constructing a diversion dike across the channel. The amount of flow being diverted is controlled by a weir or culvert which diverts the flow into a diversion channel. Once the flow rate exceeds the design capacity of the dike and weir or culvert, it overtops the dike and continues in the historic flow path. Diverted flow is conveyed in an engineered channel north until it reaches the outfall wash. It then flows in this wash easterly into the McMicken Dam impoundment.

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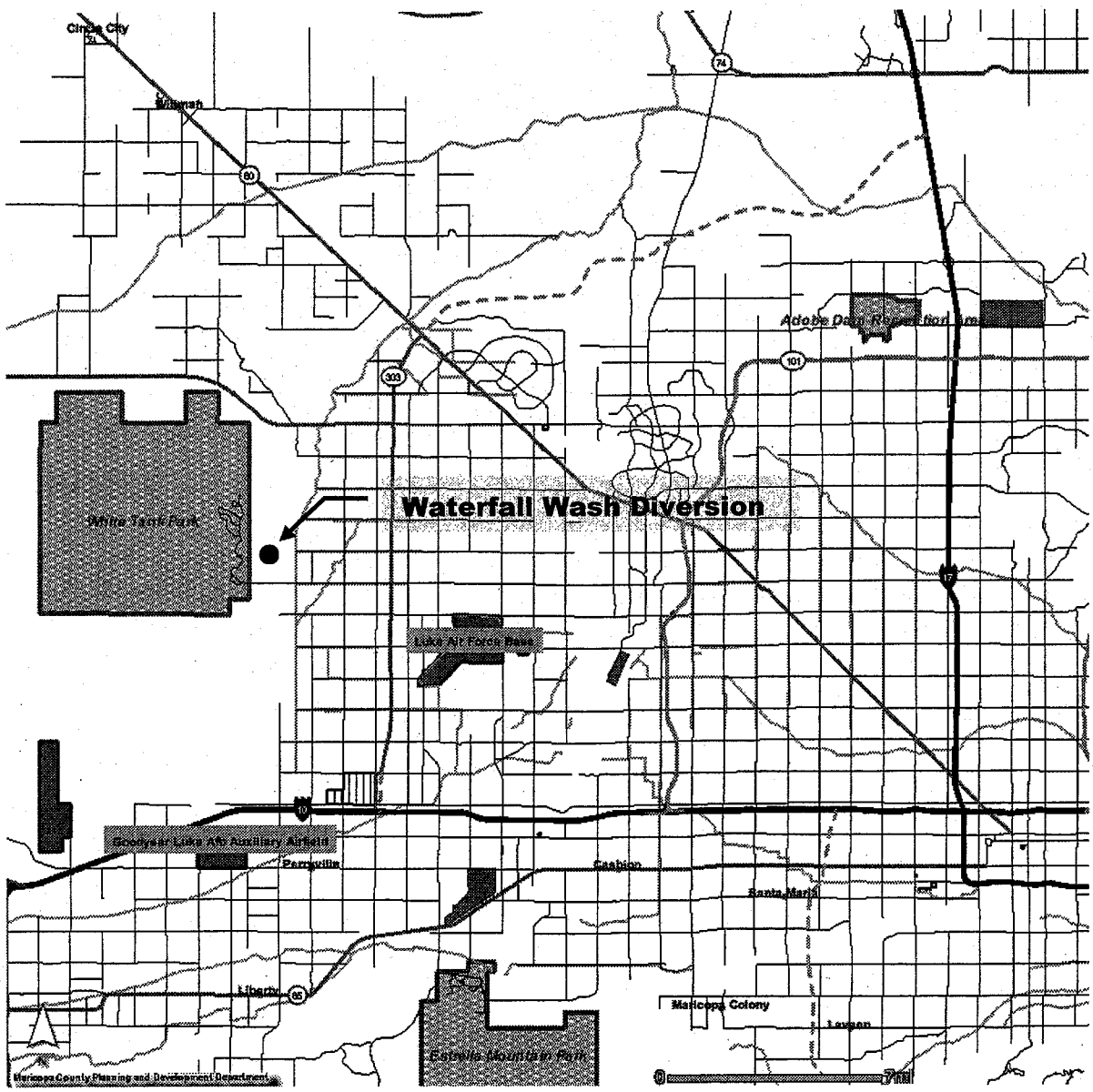

Figure 2-1 Location Map

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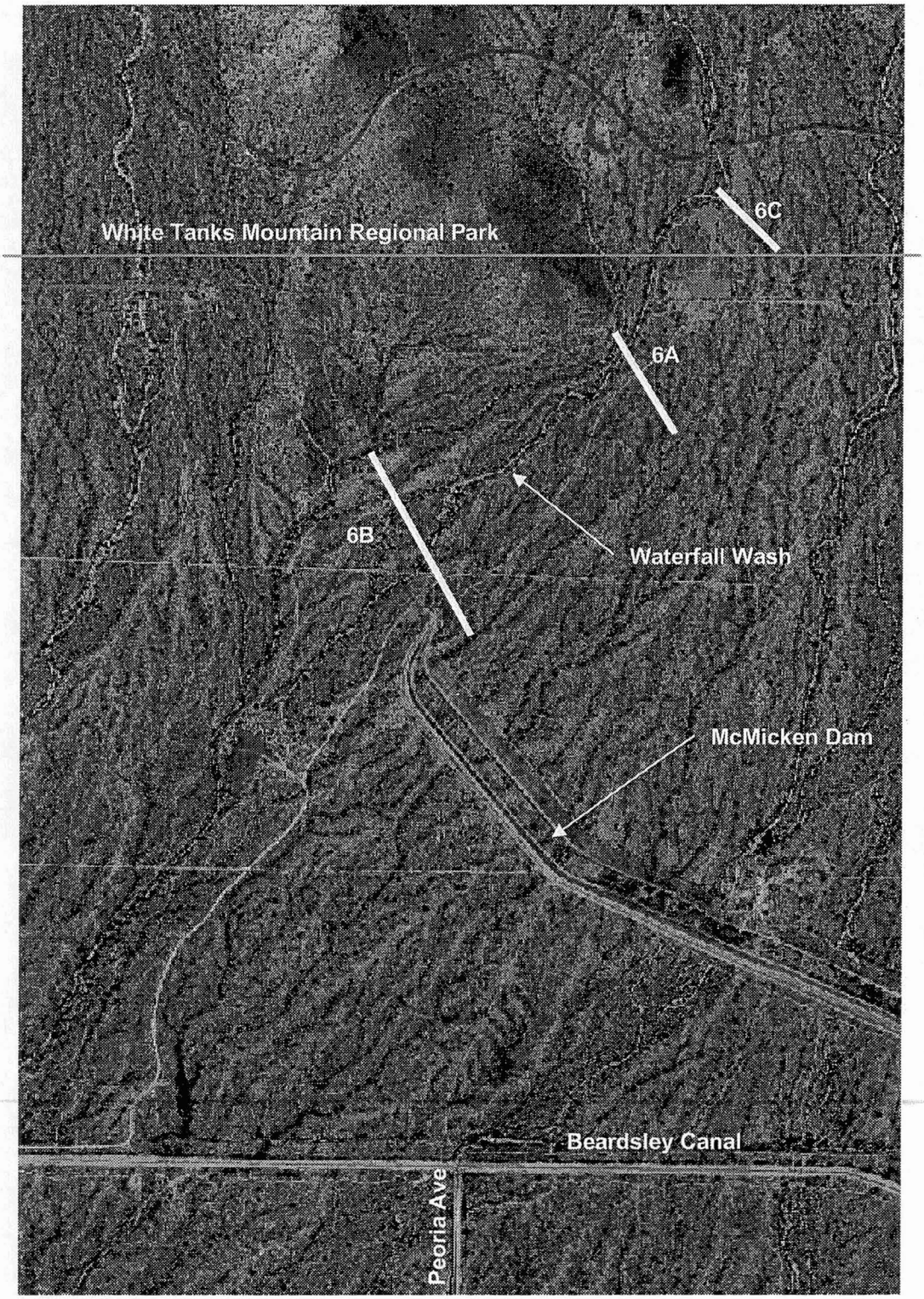

Figure 2-2 Vicinity Map

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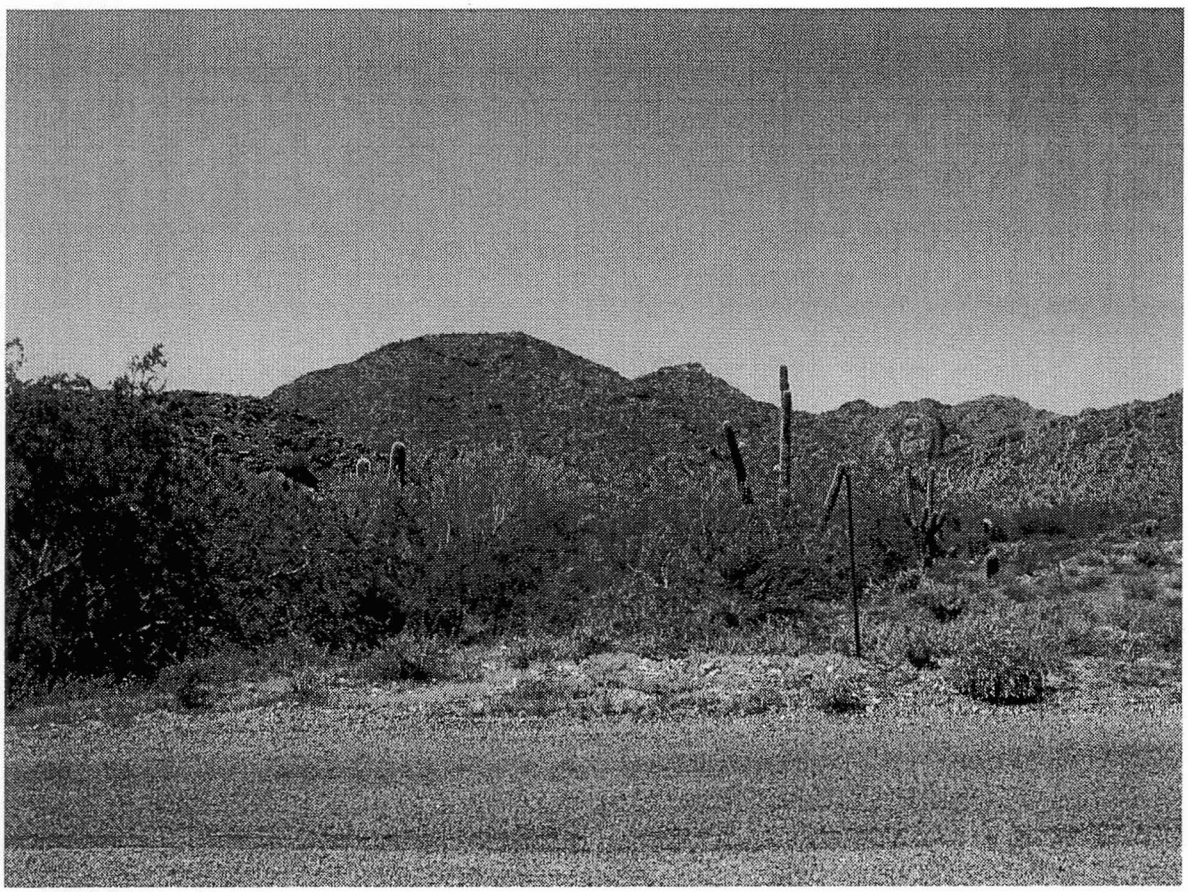

Figure 2-3 Waterfall Canyon from White Tank Mountain Road

3.0 DATA REVIEW

The following information was collected, reviewed and utilized in the analysis and preliminary design of the project.

3.1 FRS #3 Basin Alternatives Report

Design Issues and Basin Alternatives Report, White Tanks FRS #3 Modifications Design Project, Volumes I & II, Prepared by URS, August 2001.

The purpose of the Design Issues and Basin Alternatives Report was to formulate and design detention basin alternatives to replace White Tanks Flood Retarding Structure #3 (FRS #3). Flood hydrology used in the analysis was developed in May 2000. As part of the hydrologic analysis for the study, several diversion options were considered. Preliminary analysis showed that a diversion of Waterfall Wash into McMicken Dam would be the most cost effective north/south diversion and it was included in several of the alternatives. A typical plan and cross section of the diversion channel were presented along with a construction cost estimate.

3.2 FRS #3 North Inlet Channel Pre-Design Study

White Tanks Flood Retarding Structure #3 North Inlet Channel, Pre-Design Study Report, Prepared by Wood, Patel & Associates, July 2002

The purpose of the North Inlet Channel Pre-Design Study was to design alternatives for the North Inlet Channel from Peoria Avenue to White Tanks FRS #3 and to study alternatives for diversion of flow crossing the Beardsley Canal at Northern Avenue. The goal was to identify methods of preventing flow breakouts from the Beardsley Canal Wash across the Canal between Peoria Avenue and FRS #3. The hydrology base model was developed by URS for the Loop 303 Level II Report dated September 2001. Five alternatives were presented in the report and Alternative 4 was selected which includes an additional channel on the east side of the Canal to convey those flows which breakout over the Canal.

3.3 White Tanks Hydrology Model

The most current watershed model for the White Tanks area, specifically the White Tanks FRS3 contributing area was prepared for the Loop 303 Corridor/White Tanks ADMP Update (URS,

Sept. 2002). That model is based on a watershed model prepared for the White Tanks/Agua Fria ADMS (WLB, Oct. 1991). The Loop 303 Corridor/White Tanks ADMP Update Model, herein referred to as the White Tanks Update, is for a 100-year, 24-hour storm. The drainage area considered in that study is 180 square miles.

3.4 McMicken Dam Hydrology

Several studies have been conducted of the hydrology of McMicken Dam and are listed below. These have all been reviewed by Stantec.

- Corps of Engineers, U.S. Army, Los Angeles District, Design Memorandum No. 1, Hydrology and Hydraulic Design for Trilby Wash Detention Basin and Outlet Channel, November 1953
- Flood Control, Lower Agua Fria River and Vicinity, Maricopa County, Arizona, Design Memorandum No. 2, Design Analysis for Trilby Wash Detention Basin and outlet Channel, March 1954, Sacramento District, Corps of Engineers, U.S. Army
- Surface Water Hydrology Report, McMicken Dam Restoration Study, Maricopa County, Arizona, Sergent, Hauskins & Beckwith Consulting Geotechnical Engineers, February, 1983
- Report on A Hydrologic Analysis of the McMicken Dam Watershed, Prepared for Maricopa County Flood Control District, Rumann & Sutko, March 1987
- Hydrologic Analysis for McMicken Dam, Prepared by R. W. Cruff, Flood Control District of Maricopa County, Engineering Division, March 2000.

3.5 Mapping

Topographic mapping used for the design is the two foot contour mapping obtained from the North Inlet Channel Pre-Design Study Report by Wood Patel. This mapping doesn't cover portions of the upper watershed (west). The watershed delineation in this area was performed using USGS mapping.

4.0 ALTERNATIVES

Three alternative locations were considered for the diversion. Additionally, two alternative methods of diversion were considered. All three alternatives will achieve the primary goal which is to reduce the peak flow at the Beardsley Canal so that breakouts will not occur during the 100 year flood.

4.1 Diversion Methods

Two methods of diverting the flow were considered - weir and orifice. Both methods require a diversion dike constructed across the channel to impound water and provide sufficient headwater to divert the flow. A weir structure was judged to be a more reliable and cheaper method of diverting the flow.

4.1.1 Weir

A broad-crested weir is constructed with sufficient capacity to pass the 100-year flow without overtopping the diversion dike. Once the diversion dike is overtopped, excess flow begins to return to the historic flow path. The weir is constructed several feet above the invert of the channel which provides a basin where the inflowing water will drop most of the sediment load and then overtop the weir during the larger flow events. Flow over the top and at the toe of the weir will be erosive and erosion protection must be provided. Gabions or grouted rock riprap will provide the desired erosion protection, and these materials are readily available on-site. The primary disadvantage of the weir option is that it will require periodic maintenance to remove the accumulated sediment in the basin. This sediment will consist of finer sand and gravel during the smaller runoff events. Larger flood events will transport cobbles and boulders.

4.1.2 Orifice

Pipe or box culverts are constructed through an embankment and designed with sufficient capacity to pass the 100-year flow without overtopping the diversion dike. The culverts could be constructed at the invert elevation of the channel to minimize the required height of the diversion dike and culvert embankment. An 8-barrel, 72 inch diameter pipe culvert or alternatively, a 5-cell, 8'W x 6'H box culvert would have the required capacity. However, both of these culvert options are more expensive in comparison to the weir option. Construction of the pipe culverts

at the channel invert elevation may allow sediment to block the culvert inlets or fill the pipes during lower flows which could cause failure of the diversion during the design flow event. The sediment could be captured upstream of the culvert inlet by constructing an apron with a drop inlet, however, this would add to the cost. Alternatively, the culverts could be set several feet higher than the channel invert, however, this would raise the height of the required diversion dike and culvert embankment and increase the cost.

4.2 Alternative 6A

4.2.1 Description

Alternative 6A consists of a diversion dike and weir located approximately 3,800 feet west-northwest of the south end of the dam. Features include:

- The diversion dike has a maximum hydraulic height of about 11 feet and is 500 feet long with a fuseplug constructed in a 350 feet long overflow section.
- The diversion weir is approximately 130 feet wide and lined with gabions to provide erosion protection.
- The diversion channel is approximately 350 feet long, unlined, with a riprap basin at the end.
- The outfall wash is unlined and unimproved and flows approximately 3,600 feet to the confluence with the existing low flow channel at McMicken Dam.

4.2.2 Opportunities

The main opportunities attributed to alternative 6A are listed below:

- The location of the diversion structure maximizes the amount of runoff that may be diverted. It does this by easily allowing the capture and diversion of the southern tributary wash.
- Construction in this location minimizes the required length of the diversion dike. The tributary wash is in close proximity to the main channel and the main channel is well incised. This minimizes the length and amount of fill to construct the dike.
- The required length of the diversion channel is relatively short and channel lining is not required.

- Rock outcrops and deposits of cobbles and boulders in this location may be used to construct the gabion or riprap erosion protection.

4.2.3 Constraints

The main constraints attributed to alternative 6A are listed below:

- The diverted flow is discharged into a natural wash and must travel approximately 3,600 feet before it reaches the low flow channel. This requires the purchase of approximately 23 acres of right of way from the State Land Department. The width of this right of way strip is based on the limits of scour and lateral migration of the outlet wash.
- Erosion in the outlet wash will cause degradation over time and flows will transport this material into the low flow channel for the dam. This will require either periodic maintenance to remove the material or stabilization of the channel with grade control structures or channel lining.
- A proposed multi-use trail connection from the dam to the park will probably need to cross the diversion channel. This may require construction of access ramps across the diversion channel.
- Bedrock outcrops are observed in the south tributary channel. Rock excavation may be required to construct the diversion structure.

4.3 Alternative 6B

4.3.1 Description

Alternative 6B consists of a diversion dike and weir located approximately 1,000 feet west-southwest of the south end of the dam. Features include:

- The diversion dike has a maximum hydraulic height of about 7 feet and is approximately 1,000 feet long with a fuseplug constructed in three overflow sections.
- A low flow channel is constructed from the south tributary to the main channel along the toe of the diversion dike and is approximately 1,000 feet long.
- The diversion weir is approximately 130 feet wide and lined with gabions to provide erosion protection.

- The diversion channel is approximately 500 feet long with a riprap basin at the end.
- The outfall wash is unlined and unimproved and flows approximately 500 feet to the confluence with the existing low flow channel at McMicken Dam.

4.3.2 Opportunities

The main opportunities attributed to alternative 6B are listed below:

- The diversion is located very close to the end of the dam. This reduces the amount of right of way required for the outlet wash. It also reduces the amount of maintenance required to manage sediment transported by the outlet wash.
- Location of the diversion structure next to the dam makes it easier to inspect and maintain.
- Slightly more flow can be diverted since the diversion is located further down in the watershed
- Sedimentation (large sized gravel, cobbles and boulders) upstream of the diversion dike and weir may be reduced because some of that sediment load is dropped out of the channel west of the proposed diversion location.
- Bedrock and rock excavation to construct the dike and diversion channel is not expected in this location.

4.3.3 Constraints

The main constraints attributed to alternative 6B are listed below:

- The stream is braided and a portion of the flow diverges to the south. This requires construction of a much longer diversion dike to capture and divert the entire flow from the watershed.
- A low flow channel is required to divert water along the diversion dike from the south tributary to the main channel.
- At least two grade control structures are required to reduce or prevent degradation and scour of the channel. Alternatively, the channel would require lining with soil cement or concrete and construction of an energy dissipater at the end.

- The proposed multi-use trail connection from the dam to the park will probably need to cross the diversion channel. This may require construction of access ramps across the diversion channel.
- The contributing watershed is larger than the other alternatives and this will result in more sediment being deposited upstream of the weir and in the low flow channel.

4.4 Alternative 6C

4.4.1 Description

Alternative 6C consists of a diversion dike and culverts located approximately 5,600 feet west-northwest of the south end of the dam. The diversion would be located within White Tanks Mountain Regional Park. Features include:

- The diversion dike has a maximum hydraulic height of about 14 feet and is approximately 600 feet long with a fuseplug constructed in a 280 feet long overflow section.
- Diversion is controlled by a 6 barrel, 10 feet wide by 6 feet high, concrete box culvert passing under the parking lot in the park.
- The diversion channel is approximately 350 feet long, unlined, with a riprap basin at the end.
- The outfall wash is unlined and unimproved and flows approximately 5,000 feet to the confluence with the existing low flow channel at McMicken Dam.

4.4.2 Opportunities

The main opportunities attributed to alternative 6C are listed below:

- There is a significant bend in the main channel which provides a good location for the diversion dike. Sedimentation in this location may be less of a problem since the natural channel flow is already changing direction and the watershed producing the sediment is smaller.
- The length of the diversion dike is minimized since only the flow in the main channel is diverted.
- The required length of the diversion channel is relatively short and channel lining is not required.

- The outfall wash for this diversion discharges flow into McMicken Dam at approximately station 71+00. This flow would be diverted into the north basin of McMicken Dam, assuming the dam is segmented as recommended in the FRZR Alternatives Report.

4.4.3 Constraints

The main constraints attributed to alternative 6C are listed below:

- The diverted flow is discharged into a natural wash and must travel approximately 5,000 feet before it reaches the low flow channel. This requires the purchase of approximately 46 acres of right of way. Most of the land must be purchased from the State Land Department and some must also be acquired from the Maricopa County Parks and Recreation Department. The width of this right of way strip is based on the limits of scour and lateral migration of the outlet wash.
- Erosion in the outlet wash will cause degradation over time and flows will transport this material into the low flow channel for the dam. This will require either periodic maintenance to remove the material or stabilization of the channel with grade control structures or channel lining.
- The diversion channel crosses an existing roadway / parking lot within the park. A or culvert crossing is required.
- Diversion of the southern tributary is not possible at this location. This alternative captures and diverts the least amount of runoff.
- A diversion structure constructed at this location may present a safety hazard since it is located within the park and adjacent to the parking lot and trailhead for Waterfall Canyon.

5.0 DESIGN

5.1 Hydrology

The watershed models used to evaluate the proposed diversion structure are based on the White Tanks Update model. The study area represented by that model is approximately 180 square miles. The contributing drainage area considered for this study is approximately 11 square miles which comprises the majority of the White Tanks FRS 3 north inlet channel drainage area. This area is generally bounded on the south by Northern Avenue, on the east by the Beardsley Canal, on the west by the White Tank Mountains and on the north by McMicken Dam. Figure 5-1 shows the location of the watershed in relation to McMicken Dam and the Beardsley Canal.

The physiographic characteristics of the watershed are highly varied. The majority of this area lies within the rugged mountainous terrain of the White Tank Mountain County Park. Elevations within the park range from 1,600 to over 4,000 feet. The watercourses are generally steep and well defined and flow from west to east in long narrow valleys. Near the park boundary, the terrain changes abruptly to a relatively steep piedmont terrace with a distributary network of channels. The study watershed is drained by two main watercourses, Waterfall Wash and Cholla Wash. Waterfall wash is located in the northern portion of the watershed very near the southern terminus of McMicken Dam. Waterfall Wash is intercepted by the Beardsley Canal at Olive Avenue where it is diverted to the south, flowing along the canal alignment. The drainage area at this point is approximately 5 square miles. Cholla Wash drains the southern portion of the study watershed. Cholla Wash is intercepted by the Beardsley Canal midway between Olive and Northern Avenues where it combines with runoff from Waterfall wash, then continues flowing south along the canal alignment.

Soils in the mountainous portion of the watershed can be characterized as a gravelly loam or sandy loam with significant areas of rock outcroppings. On the piedmont, the soils progressively transition to a finer grained matrix moving in an easterly direction away from the base of the mountains. These soils can generally be characterized as a sandy or silty clay. Under present conditions, the study watershed is essentially undeveloped.

Runoff from the watershed is concentrated along the Beardsley Canal where it is diverted from the natural flow paths. For high flows, the canal is overtopped at Olive Avenue and Northern

Avenues. Diversion of runoff from a portion of Waterfall Wash is intended to eliminate overtopping during the 100-year event without adversely impacting the operation of McMicken Dam. Three proposed diversion locations are investigated. All three lie within the limits of subbasin 2 as defined in the White Tanks Update model. One of these (Alternative 6A) is located at the northern point of a rock outcropping, just east of the park boundary. Because of the hydrologic and physiographic characteristics of this subbasin, the general proximity of the alternative locations to one another and for the purposes of this analysis, Alternative 6A is considered typical of the hydrologic conditions to be considered for modeling of a diversion and its impacts downstream. In other words, the magnitude of the runoff volume diverted to McMicken Dam and the resulting peak discharge along the Beardsley Canal will not significantly differ for the three proposed diversion sites.

Runoff magnitudes at the proposed diversion location for Alternative 6A is determined by subdividing subbasin 2 as defined in the White Tanks Update model. The new subbasins are identified as 2A and 2 and are shown in Figure 5-1. New subbasin parameters were estimated for subbasins 2A and 2 per the methods employed in the White Tanks Update model and the procedures set forth in the Drainage Design Manual of Maricopa County; Volume I, Hydrology (Manual). All other watershed parameters from the White Tanks Update model were reviewed for reasonableness. Three issues were identified during the review.

- The point precipitation depth was revised from 4.03 inches selected for the 180 square mile White Tanks Update watershed to 4.15 inches for the 11 square mile study watershed.
- The subbasin lag for subbasin 1 was recalculated to correct an error in the flow path slope.
- The unit hydrograph for subbasin 3 was recalculated based on the use of the Desert/Rangeland S-graph instead of the Phoenix Mountain S-graph.

The revised model, herein referred to as the Waterfall Wash Model was run for the 100-year, 24-hour storm for comparison to the White Tanks Update Model. The results from those two models are shown in Table 5.1-1. The Waterfall Wash Model is the model used for the evaluation of the proposed diversion.

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Table 5.1-1 - Comparison of 100-year, 24-hour Model Results

	Waterfall Wash Model				White Tanks Update Model			
HEC-1 ID	Drainage Area sq. miles	Peak Discharge cfs	Runoff Volume acre-ft	Time to Peak hours	Drainage Area sq. miles	Peak Discharge cfs	Runoff Volume acre-ft	Time to Peak hours
1	1.99	1,433	130	12.42	1.94	1,719	122	12.42
CP2	4.01	2,239	307	12.67	3.76	2,821	250	12.75
3	0.88	1,108	54	12.17	1.10	1,048	59	12.33
CP3	4.89	2,256	359	12.75	4.86	2,823	308	12.83
CP10	10.90	6,683	692	12.75	10.87	6,483	627	12.75

5.1.1 100-year

Given the size of the study watershed it cannot be determined whether the 6-hour local storm or the 24-hour general storm will produce the greatest runoff magnitudes. Therefore, the Waterfall Wash Model is run for both the 6 and 24-hour storms. The dimensions of the diversion structure are based on the critical flood producing storm. The critical flood producing storm at the proposed diversion locations is the 6-hour storm for peak discharge and the 24-hour storm for runoff volume. A summary of the peak discharge and runoff volume at key locations for both the 6- and 24-hour storms for both existing and proposed conditions is provided in Table 5.1-2. The HEC-1 operation MCMICK represents the flow that is diverted to McMicken Dam. Correspondingly, the HEC-1 operation WFW represents the flow that is allowed to continue downstream in Waterfall Wash. Highlighted in Table 2 are the results for the critical storm at each location. The controlling peak discharge and runoff volume at the diversion location for Alternative 6A (HEC-1 operation CP2A) is 2,081 cfs and 237 acre-feet, respectively. Of that, 1,941 cfs is diverted to McMicken Dam with 140 cfs continuing downstream.

The values listed in Table 5.1-2 for the proposed condition represent the hydraulics of the diversion for Alternative 6A. The peak discharges used to size the diversion structure for Alternatives 6B and 6C are based on the existing condition unit discharge at HEC-1 operations CP2 and CP2A, respectively. At CP2, the unit discharge is approximately 600 cfs/sq. mile. The drainage area for the diversion at Alternative 6B is 3.7 square miles. At a unit discharge of 600 cfs/sq. mile, the peak inflow to the diversion structure for Alternative 6B is 2,205 cfs with 2,130 cfs being diverted to McMicken Dam and 75 cfs continuing downstream. At CP2A, the unit discharge is approximately 660 cfs/square mile. The drainage area for the diversion at Alternative 6C is 3.17 square miles. At a unit discharge of 660 cfs/sq. mile, the peak inflow to

the diversion structure for Alternative 6C is 1,744 cfs with 1,675 cfs being diverted to McMicken Dam and 69 cfs continuing downstream.

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Table 5.1-2 – Summary of 100-year Model Results

HEC-1	Existing Condition				Proposed Condition			
	6-Hour		24-Hour		6-Hour		24-Hour	
	Discharge	Volume	Discharge	Volume	Discharge	Volume	Discharge	Volume
ID	cfs	Acre-ft	cfs	Acre-ft	cfs	Acre-ft	cfs	Acre-ft
CP2A	2081	231	1971	237	2081	231	1,971	237
MCMI CK	-	-	-	-	1941	185	1,833	164
WFW	-	-	-	-	140	46	139	73
2	1209	82	971	72	1209	82	971	72
CP2	2375	294	2239	307	938	116	1,061	143
3	1459	72	1197	54	1459	75	1,197	54
CP3	2434	343	2256	359	1578	172	1,742	196
CP10	5288	590	6683	692	4861	478	6,167	575

5.1.2 Probable Maximum Flood

The proposed diversion is designed to divert flows up to the 100-year event to McMicken Dam. Flows in excess of the 100-year event are to continue downstream of the structure in the natural flow paths. However, it is likely that some portion of the runoff from more severe events, such as the Probable Maximum Flood (PMF) will be diverted to McMicken Dam. Runoff magnitudes for the PMF were estimated using the Waterfall Wash Model and the 6-hour Probable Maximum Precipitation (PMP). The PMP for the study area was estimated using the procedures set forth in the Hydrometeorological Report No. 49. The temporal distribution of the PMP is from the Hydrometeorological Report No. 5. The PMP discharge and runoff volume at the proposed diversion alternative 6A is 14,451 cfs and 1,589 acre-feet, respectively. Discharge and runoff volumes and the amount of the PMF diverted into the dam were not estimated for alternatives 6B and 6C, but would be similar.

Estimation of the amount of the PMF runoff volume that will end up in the McMicken Dam impoundment area is difficult and requires estimation of the weir coefficients for both the diversion weir and the overflow of the dike, estimation of the breach rate of the fuseplug and calculation of the outflow hydrograph through the breach, and estimation of flow through any natural breakouts in the channel upstream of the diversion structure. Diversion of flows in excess of the 100-year event will continue in the diversion channel until the channel is overtopped or until the diversion dike is completely breached and flow returns to the natural channel. The maximum capacity of the diversion channel (including freeboard) is approximately 3,100 cfs. Assuming that the diversion channel could convey flow to McMicken Dam at the maximum capacity for the duration of the PMF, the corresponding volume of runoff would be approximately 540 acre-feet. In addition to the diversion structure, runoff during the PMF may reach McMicken Dam due to insufficient capacity of Waterfall Wash to convey runoff of this magnitude. Estimation of the runoff volume that naturally breaks out of Waterfall Wash upstream of the diversion structure would require a detailed hydraulic analysis and involve numerous assumptions. Although this level of analysis is beyond the scope of this study, a range of volumes that might be expected to reach McMicken Dam naturally can be estimated. From an inspection of the runoff hydrograph at CP2A, assuming that 500 cfs breaks out, the runoff volume that would reach McMicken Dam is approximately 230 acre-feet. For a break out of 2,000 cfs, the runoff volume is approximately 450 acre-feet and for a break out of 5,000 cfs, the runoff volume is approximately 800 acre-feet.

5.1.3 Effect on McMicken Dam

Two different alternatives are proposed for mitigation of the fissure risk zone for the dam. These include rehabilitation of the dam by constructing a new embankment adjacent to the existing; and segmenting the dam by constructing an additional embankment to separate the fissure risk zone from the rest of the dam to the north. The impact of the proposed diversion on each of these alternatives is discussed in the following section. Increased flow into McMicken Dam from Diversion Alternative 6A is approximately 167 acre-feet during the 100 year storm and up to as much as 1,300 acre-feet during the PMF. Diversion volumes from Alternatives 6B and 6C are similar.

5.1.3.1 Dam Rehabilitation

This alternative is least affected by the proposed diversion of Waterfall Wash. The dam is designed to safely capture and convey the Standard Project Flood. The maximum design capacity of the reservoir is approximately 36,000 acre-feet. Diversion of the 100 year flow from Waterfall Wash into McMicken Dam will have no adverse impact on the dam. For the PMF, it is estimated that neglecting routing and discharge of the flow through the outlet works and spillway, the additional discharge could raise the water surface elevation in the dam as much as 0.4 foot. However, it is possible that some flow would break out of Waterfall Wash and end up in McMicken Dam even if the diversion is not constructed. Routing of the hydrographs will likely reduce the impact to the dam. Due to the difference in times for the runoff to peak and for those peak discharges to reach the spillway and outlet works of the dam, the maximum rise in the water surface of the reservoir due to the diversion of Waterfall Wash may be less than the maximum estimate of 0.4 foot. It is possible that most of the diverted flow would be routed through the reservoir and the dam before the peak flow from Trilby Wash reached the dam.

5.1.3.2 Dam Segmentation

This alternative is adversely affected by the proposed diversion during the PMF event. Total storage behind the south end of the dam below the segment is estimated to be approximately 770 acre-feet. Total 100-year runoff volume including the diversion is approximately 287 acre-feet. Diversion of the 100 year flow from Waterfall Wash will have no adverse impact on the south end of the segmented dam.

Direct runoff from the PMF into the south end of the dam is approximately 270 acre-feet. With the diverted and break out flows, the total combined runoff is estimated between 810 and 1,570 acre-feet. This is greater than the capacity of the south end of the segmented dam. Even if break out flows were eliminated, it appears that additional improvements would be required for the south segment of the dam to make this a viable alternative. These improvements could include construction of a spillway, raising the embankment, or excavation within the impoundment area to provide additional storage.

5.1.4 Effect on North Inlet Channel

In the White Tanks FRS #3, North Inlet Channel Pre-Design Study Report (Wood, Patel & Associates, July 2002) it is implied that the Beardsley Canal is overtopped at Olive and Northern Avenues due to insufficient culvert capacity at these locations. The existing crossing at Olive Avenue is a double barrel corrugated metal pipe (cmp) one 8-foot and one 7-foot in diameter. From the White Tanks Update model, the 100-year peak discharge at this location is 2,823 cfs. Based on an HEC-2 model prepared by the FCDMC for this area, a rating curve was developed describing the hydraulic conditions at this location. From that rating curve overtopping of the canal begins when the peak discharge exceeds 1,565 cfs. At a peak discharge of 2,823 cfs, 622 cfs would overtop the canal with the remaining 2,201 cfs continuing downstream. Recently, as part of a residential development planned for this area, the existing crossing was augmented by a 2 barrel 10' x 6' box culvert that was backfilled on 1 November 2002. The preferred alternative selected as part of the White Tanks FRS #3, North Inlet Channel Pre-Design Study at this location involved three elements. First the existing cmp culvert is to be replaced by a 2 barrel box culvert similar to the one recently completed for the residential development. The new crossing would be a 4 barrel 10' x 6' box culvert. Second, a siphon under the canal would be constructed, capable of conveying the 622 cfs that currently breaks out over the canal. Third, a parallel channel on the east side of the canal would be constructed to convey the breakout flow south to Northern Avenue.

Diversion of the 100-year peak discharge from Waterfall Wash into McMicken Dam results in a peak discharge at Olive Avenue (HEC-1 operation CP3) of approximately 1,750 cfs. Based on the existing condition hydraulic rating curve, a breakout of approximately 185 cfs would still occur at this discharge. However, with the additional conveyance capacity of the 2 barrel 10' x 6' box culvert constructed as part of the residential development, it is likely that the total conveyance capacity of the culverts can convey the 1,750 cfs discharge without overtopping the

canal. Thus, construction of the diversion structure on Waterfall Wash would eliminate the need for further improvement of the culvert crossing at Olive Avenue and, more importantly, eliminate the need for the parallel channel and connecting siphons on the east side of Beardsley canal.

From the White Tanks Update model, the existing condition 100-year peak discharge at Northern Avenue is 6,483 cfs of which approximately 1,900 cfs breaks out over the Beardsley Canal. The peak discharge contributing to this point from the Cholla Wash subwatershed alone is approximately 4,868 cfs. Diversion of the 100-year peak discharge from Waterfall Wash results in a peak discharge at Northern Avenue of 6,167 cfs. At this discharge, a breakout of approximately 1,100 cfs will still occur. At this location the preferred alternative selected as part of the White Tanks FRS #3, North Inlet Channel Pre-Design Study involved the construction of a new 8 barrel 10' x 7' box culvert. The discharge used to size the proposed culvert is 6,970 cfs. At this discharge, each barrel of the proposed culvert would convey approximately 870 cfs. Therefore, it is likely that with the construction of the Waterfall Wash diversion structure, the proposed culvert could be reduced to a 7-barrel box.

The total estimated cost of the proposed facilities identified in the White Tanks FRS #3, North Inlet Channel Pre-Design Study Report is approximately $4,500,000. Of that $49,500 is for the 2 barrel box culvert at Olive Avenue, $2,800,000 is for the parallel channel and connecting siphons on the east side of Beardsley Canal and $240,500 for the new 8 barrel box culvert at Northern Avenue. The total estimated cost of the Waterfall Wash diversion structure alternative 6A is $1,066,000. Construction of the Waterfall Wash diversion structure could save as much as $1,800,000 in improvements for the North Inlet Channel.

5.2 Geotechnical Investigation

A geotechnical investigation has not been performed for this project, however, sufficient information exists to classify the surficial materials in the general area. Samples tested by the Corps of Engineers for the design of McMicken Dam indicate that the soils forming the embankment (borrowed from the low flow channel) are classified as silty or clayey gravely sand, containing from 15% to 20% gravel. A report of the soil tests is included in Design Memorandum No. 2 for the Trilby Wash Detention Basin and Outlet Channel.

A preliminary geologic reconnaissance of the diversion structure for alternative 6A was conducted by AMEC to characterize the alignment. The preliminary report is provided in the

appendix. This report was prepared because bedrock was observed in outcrops within the south tributary channel at this location; see Figure 5-2. There is a concern that shallow bedrock may increase the difficulty of excavation for alternative 6A and possibly also for alternative 6C.

Field observations also show that there are significant amounts of gravel, cobbles and boulders within Waterfall Wash. It is unknown how deep and to what extent these deposits exist. These deposits may be useful for construction of gabion or dumped riprap erosion protection.

5.3 Sediment Transport

Waterfall Wash carries a significant sediment load. Field investigation shows that the bed is heavily armored with cobbles and boulders however, there is evidence of active bank erosion. Figure 5-3 shows bed armoring near alternative 6A and Figure 5-3 shows significant bank erosion immediately upstream of the proposed diversion alternative 6A. Sediment is deposited in flatter areas and consists of coarse sand and fine gravel. It is likely that during a 100 year event the wash would also transport significant quantities of the larger gravel, cobbles and boulders. The Corps used a design value of 0.2 acre-foot/sq. mile/year for design of the entire dam. However, this value is for the entire watershed and is not characteristic of this project watershed. Investigation of sedimentation rates given in the Maricopa County Drainage Design Manual indicates that a rate of 0.3 might be more appropriate. It may also be appropriate to apply a safety factor to this value and assume for design purposes a value of 0.6. Using these values, it can be expected that two acre-feet of sediment or more will be deposited on an annual basis upstream of the diversion dike and weir.

For alternatives 6A and 6C, diversion of flows to the outlet wash will greatly increase the flow in the wash. The natural slope is between 1.5% to 2.0%. Flow in the diversion channel is maintained at subcritical, low velocity conditions. However, once flow is discharged into the outlet wash, it will accelerate. It is expected that scour and sediment transport from the wash into McMicken Dam will increase. Lateral migration and degradation of the wash may occur. This may require grade control or channel lining to reduce the amount of sediment transport and the width of the required right of way.

For alternative 6B, flow is not diverted into an outlet wash, instead it is discharged directly into the existing low flow channel at the dam. However, a low flow channel is required to move flows north from the south tributary to the main channel. This channel will be subject to sediment

deposition. The diversion channel requires either channel lining to prevent scour or grade control to maintain subcritical flow.

Scour countermeasures are also required to prevent damage to the diversion structure and channel. Riprap or gabions are recommended since the material is readily available. The overflow weir for the diversion should be protected. Riprap should be placed at the end of the diversion channel to prevent head cutting. Riprap is also required at the outlet of the low flow culverts.

5.4 Design Components

5.4.1 Diversion Dike and Weir

The flow diversion is accomplished by constructing a dike across the wash. A weir is constructed at one end to discharge the flow to a diversion channel. Flow is impounded behind the dike until the depth exceeds the weir elevation. The water then flows over the weir into the diversion channel. The weir is designed to divert approximately the 100-year discharge without overtopping the dike. Once the 100-year discharge is exceeded, the depth of water will reach the top of the diversion dike and begin to overtop. Increasing flows will increase the quantity of water flowing through the weir and over the dike and erosion of the dike will begin.

5.4.2 Fuse Plug Spillway

The dike is constructed with a fuse plug section so that flows larger than the 100-year will not be diverted into the dam. The fuse plug is an economical alternative to a gate or a large uncontrolled overflow spillway for passing the larger, infrequent flows downstream. It is sized to allow larger flows up to the PMF to pass through with minimal additional flow over the diversion weir.

The fuse plug is an embankment designed to wash out in a predictable manner when breached. The embankment materials are selected and placed so that a constant rate of lateral erosion will occur as the structure is breached. Breaching is initiated by overflow at a low spot in the embankment crest, called a pilot channel. Highly erodible material is placed in the pilot channel section, allowing breaching to occur rapidly, and the remainder of the fuse plug embankment will wash out laterally at a constant, predictable rate without overtopping.

5.4.3 Low Flow Culverts

Flow is to be maintained in the wash downstream of the diversion dike. Low flow culverts constructed through the diversion dike will allow a small amount of water to flow during all storm events. The culverts must be designed to prevent plugging with sediment during the frequent storms. By flattening and widening the channel upstream of the diversion dike, sediment will drop out before entering the pipes. The inlet may also be placed above the invert of the channel to allow ponding to occur and increase the amount of sediment that may be deposited upstream of the diversion.

5.4.4 Diversion Channel

The diversion channel conveys the flow north from the diversion weir and discharges the flow either to an outlet wash or directly to the low flow channel in the dam. Presumably, most of the sediment is dropped out upstream of the diversion weir so that the diverted water is clear. The design of the diversion channels maintains low velocity, sub-critical flow so that channel stabilization is not required. Alternative 6B may require lining or grade control to stabilize the channel if it discharges directly to the low flow channel.

5.4.5 Outlet Wash

Alternatives 6A and 6C divert flows to a point west of the dam into existing natural washes. The flow is discharged at low velocity, sub-critical flow conditions and is clear water. However, the flow then turns and flows downgradient to the dam. It is assumed that these natural washes will begin to scour and incise, possibly migrating laterally during larger flow events. The flow will accelerate and begin transporting sediment which will be deposited in the low flow channel at the dam. Eventually the channels will begin to armor and establish an equilibrium condition. However, it may be desirable to stabilize the channel by construction of grade control structures. This will in effect, flatten the longitudinal slope of the channel, reduce the flow velocity and limit the amount of sediment transport which occurs.

Alternative 6B may be designed to divert flow directly into the low flow channel and does not place flow into an outlet wash. However, it is recommended that the diversion channel be stabilized by construction of drop structures to flatten the slope and prevent scour and potential flow breakout.

5.4.6 Land Acquisition

All three alternatives considered require acquisition of right of way. The right of way also includes sufficient area for a 14' wide access road to reach the diversion structure. The following table summarizes the right of way requirements in acres for each alternative.

Table 5.4-3 - Right of Way Requirements

Alternative	State Land	County Park	Total
6A	32.8	0.0	34.2
6A with stabilized outlet channel	19.1	0.0	19.1
6B	10.0	0.0	10.0
6B with stabilized outlet channel	10.0	0.0	10.0
6C	45.9	14.5	60.4
6C with stabilized outlet channel	17.6	4.4	22.0

5.5 Environmental Impact

5.5.1 Air Quality

The alternatives would have minimal direct and indirect adverse impacts on air quality as a result of local construction traffic and activities. Dust suppression measures will be implemented during construction to minimize adverse effects on local air quality. Minor adverse impacts would result from construction vehicle and equipment emissions. None of the alternatives, once constructed, include any point source emissions.

5.5.2 Threatened and Endangered Species

Special status species include plants and wildlife that, because of their scarcity or documented declining population in the state have been placed on lists of endangered, threatened, proposed, candidate or otherwise sensitive status. The Waterfall Wash Diversion project is located within the Agua Fria watershed (ID #15070102) in Maricopa County. According to the Arizona Department of Game and Fish Heritage Data Management System, three special status bird species, three special status mammal species, three special status plant species, two special status reptile species, and one special status fish species occur in this watershed, as

listed in the table below. The special status fish, the Sonora sucker, is of no concern because there are no perennial streams or lakes in the project area.

Table 5.5-4 - Special Status Species That May Exist In The Project Area

Species	Common Name	Latin Name
Bird	Western burrowing owl	Athene cunicularia hypugaea
Bird	Black-bellied whistling duck	Dendrocygna autumnalis
Bird	Bald eagle	Haliaeetus leucocephalus
Mammal	Greater western mastiff bat	Eumops perotis californicus
Mammal	Cave myotis	Myotis velifer
Mammal	Pocketed free-tailed bat	Nyctinomops femorosaccus
Plant	Arizona agave	Agave arizonica
Plant	Toumey agave	Agave toumeyana var bella
Plant	Yellow spine prickly pear	Opuntia phaeacantha var flavispina
Reptile	Sonoran desert tortoise	Gopherus agassizii
Reptile	Mexican garter snake	Thamnophis eques megalops

It is not expected that the special status species are present at the locations of the alternatives, all of which are within an area of limited acreage. However, it will be necessary to survey the recommended alternative project area to assess it for presence of any of the other special status species and/or their habitat. If encountered, a mitigation plan for the preferred alternative will need to be developed that includes local access/haul routes during construction, the area where new structures will be constructed and areas from where any on-site construction materials are borrowed.

5.5.3 Traffic and Transportation

Once constructed, the alternatives would not have an adverse impact on local traffic and transportation patterns. During construction, the impact would be temporal and very minor, particularly since it is presently anticipated to borrow the vast majority of the required construction materials (embankment fill, soil for soil cement) from on-site sources.

5.5.4 Cultural Resources

According to the AZSITE database for the state of Arizona, there has been one relevant cultural resource survey conducted adjacent to the general McMicken Dam project area. The survey was conducted in January and February of the year 2000 and covered 3,343 acres west of the dam (Potter and Garrotto, 2000). Of particular interest is the result that a number of significant sites were discovered directly west of the southern end of the dam on state land.

Once the recommended alternative is selected, it will be necessary to conduct a 100 percent pedestrian survey of the area of potential effect, including local access/haul routes during construction, the areas where new structures will be constructed and areas from where any on-site construction materials are borrowed. If any potentially significant cultural resources can be located, a treatment plan developed for their mitigation should be developed.

5.5.5 Waters of the United States

Since all three alternatives divert flow from Waterfall Wash into McMicken Dam, there will be impacts to jurisdictional waters of the U.S. The Trilby Wash Basin, an impoundment created by McMicken Dam to control surface water runoff emanating from the White Tank Mountains to the west, has been determined to be jurisdictional waters of the U.S. Any activities requiring discharge or fill within Trilby Wash Basin or its tributaries will require a Clean Water Act (CWA) Section 404 Permit from the USACOE.

5.6 Cost

The cost to implement each alternative is estimated to assist with alternative evaluation. Unit prices for the cost estimates are comparable to those utilized in the North Inlet Channel Pre-Design Study Report. This allows direct comparison of the alternatives considered with the alternatives evaluated in that study. The following unit prices were utilized to develop the cost estimates.

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Table 5.6-5 - Unit Prices

Item	Unit	Unit Prices
Excavation	CY	$3.25
Rock Excavation	CY	$10.00
Embankment	CY	$4.00
Fuse Plug Embankment	CY	$20.00
Reinforced Concrete	CY	$310.00
Reinforced Concrete, Colored	CY	$340.00
Railing	LF	$15.00
Dumped Riprap	CY	$45.00
Gabions	CY	$90.00
Soil Cement	CY	$30.00
30 inch RGRCP	LF	$60.00
30 inch Headwall	EA	$2,000.00
Desert Landscaping	AC	$12,000.00
Hydroseeding	AC	$2,200.00
Maintenance Road	SF	$1.00
Aesthetic Features (rural)	%	7%
Engineering and Construction Administration	%	12%
Construction and Other Contingency	%	20%
Right of Way	AC	$16,000.00
Right of Way Administrative Costs	AC	$1,600.00
Operation and Maintenance of Concrete	AC/YR	$40.00
Operation and Maintenance of Landscaped Features	AC/YR	$531.00
Operation and Maintenance of Channels	AC/YR	$531.00
Operation and Maintenance of Basins	AC/YR	$531.00
Operation and Maintenance of Gabions	AC/YR	$100.00

For purposes of this analysis, cost estimates are provided for the following conditions:

1) The outlet wash is not stabilized against erosion or lateral migration and sufficient right of way is purchased to contain the channel. The cost for removal of sediment from the McMicken Dam

low flow channel is not estimated. O&M cost for the un-improved outlet wash is not estimated. These costs are presented in Table 5.6-6.

2) The outlet wash is stabilized by the construction of soil cement drop structures and excavation of a trapezoidal earth channel. These costs are presented in Table 5.6-7.

3) Costs are provided for Waterfall Wash only, the cost impacts to the North Inlet Channel are discussed in Section 5.1.4.

Table 5.6-6 - Alternatives Cost Estimate Summary

Item	Alt 6A	Alt 6B	Alt 6C
Construction	$451,500	$630,100	$826,700
Right of Way	$601,700	$177,100	$1,062,600
Operation and Maintenance	$52,400	$124,600	$55,100
Life Cycle Total	$1,105,000	$932,000	$1,944,000

Table 5.6-7 - Alternatives Cost Estimate Summary with Stabilized Outlet Wash

Item	Alt 6A	Alt 6B	Alt 6C
Construction	$1,034,600	$630,100	$1,990,200
Right of Way	$352,000	$177,100	$387,200
Operation and Maintenance	$355,100	$124,600	$594,100
Life Cycle Total	$1,742,000	$932,000	$2,971,000

For both conditions, Alternative 6C has the highest cost. For the un-stabilized wash, this is due to the high cost for right of way acquisition. For the stabilized outlet wash, it is due to the high cost of construction and maintenance of the outlet wash channel.

Alternative 6B is the cheapest under both scenarios. The diversion channel discharges directly into McMicken Dam and this requires very little right of way, no need to stabilize an outlet wash or maintain that channel in the future.

Alternatives 6A and 6B are both economically feasible to reduce the cost of improvements for the North Inlet Channel. With the cost of stabilization of the outlet wash and O&M included, alternative 6C does not reduce the cost of improvements for the North Inlet Channel.

5.7 Alternatives Evaluation

In addition to the opportunities and constraints presented in Chapter 4 and the evaluations of the specific design features and costs presented in this chapter, additional opportunities and benefits were evaluated. The evaluation is in the form of a matrix which corresponds to the evaluation matrix presented in the North Inlet Channel Pre-Design Study Report. This allows direct comparison to the alternatives presented in that study and includes the additional evaluation of the North Inlet Channel below Northern Avenue.

Table 5.7-8 - North Inlet Channel Alternative Opportunities Evaluation

Advantage	Alternative							
	1	2	3	4	5	6A	6B	6C
Increased safety	👍	👍	👍	👍		👍	👍	👍
Cost effectiveness			👍	👍	👍	👍	👍	👍
Partnering opportunities			👍	👍		👍	👍	👍
Low impact of adjacent neighbors			👍	👍	👍	👍	👍	
Ability to implement monetarily			👍	👍	👍	👍	👍	👍
Acceptable to public			👍	👍		👍	👍	👍
Acceptable to District			👍	👍		?	?	?
Low environmental impact			👍	👍	👍	👍	👍	👍
Provides relief to FRS #3 inflow volume				👍		👍	👍	👍
Low O&M costs		👍	👍	👍		👍	👍	👍
Ability to phase construction			👍	👍		👍	👍	👍
Low construction impact			👍	👍	👍	👍	👍	👍

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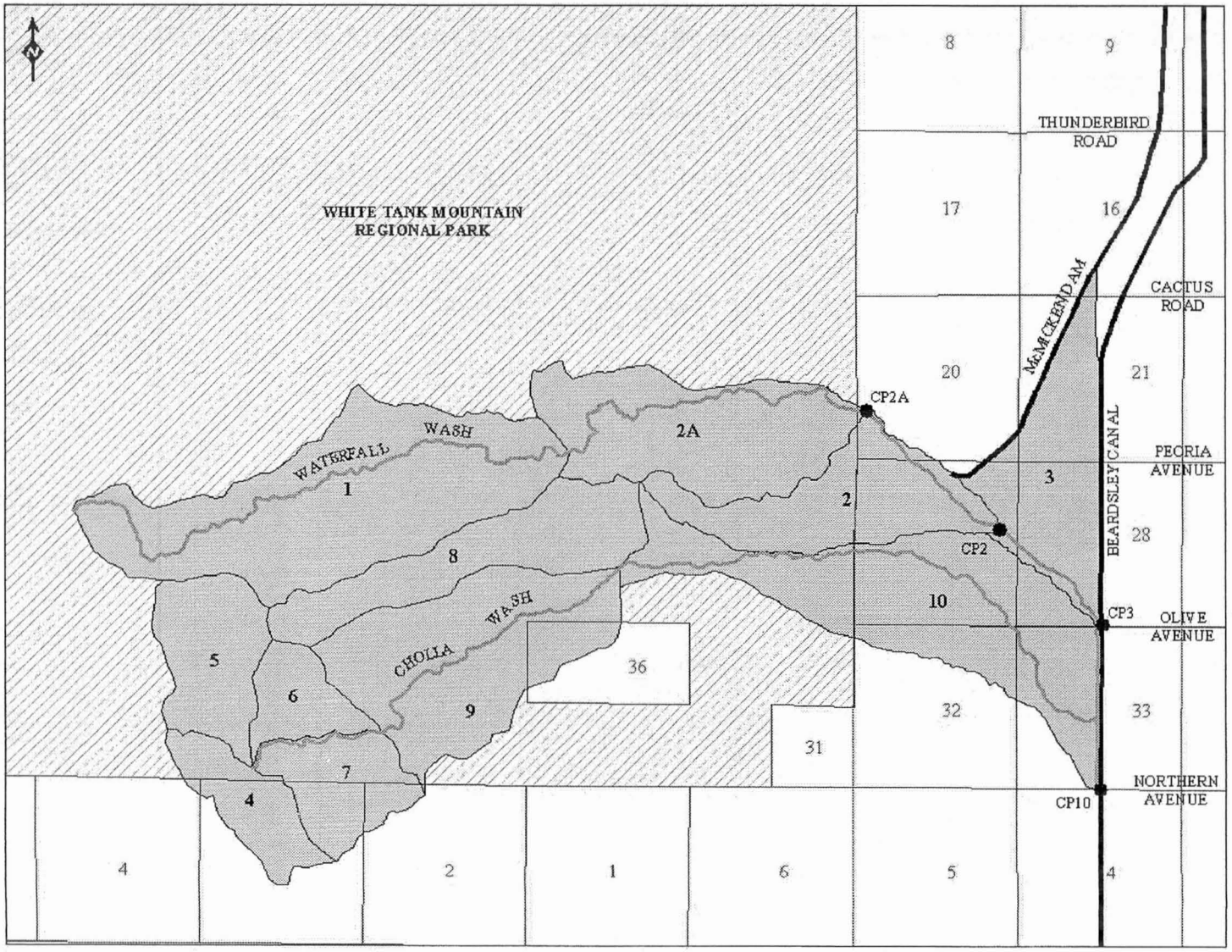


Figure 5-1 Drainage Area Map

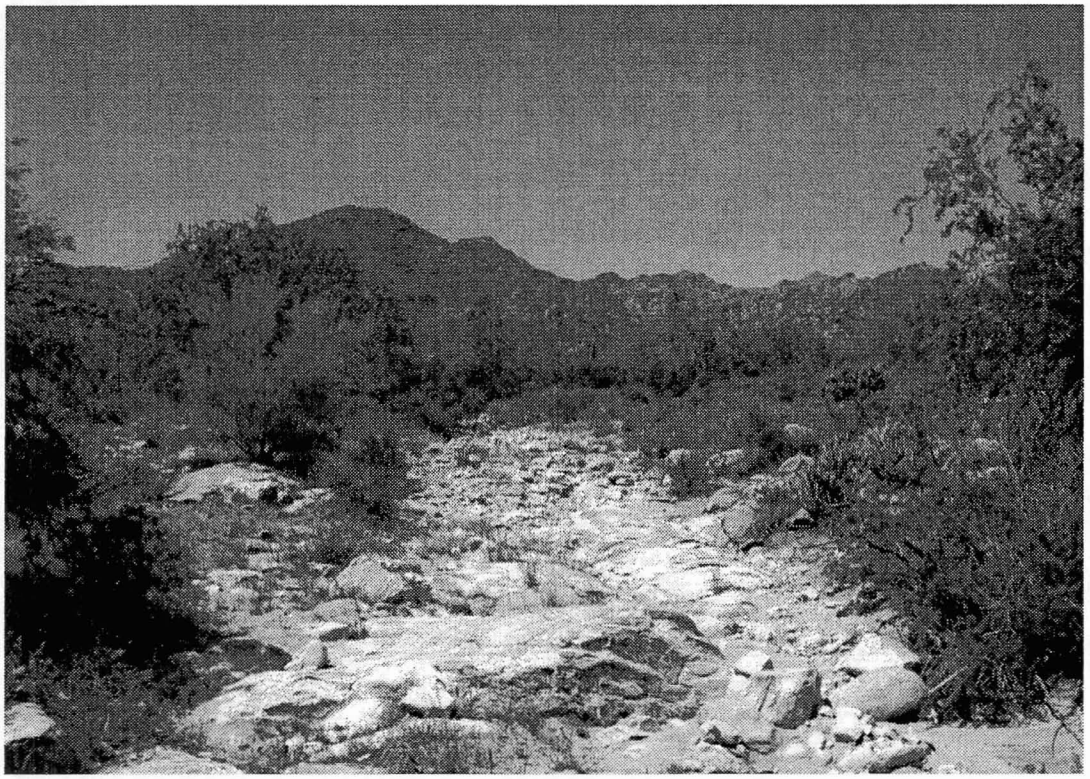


Figure 5-2 Rock Outcrop near Alternative 6A

Figure 5-3 Bed Armoring near Alternative 6A

DRAFT

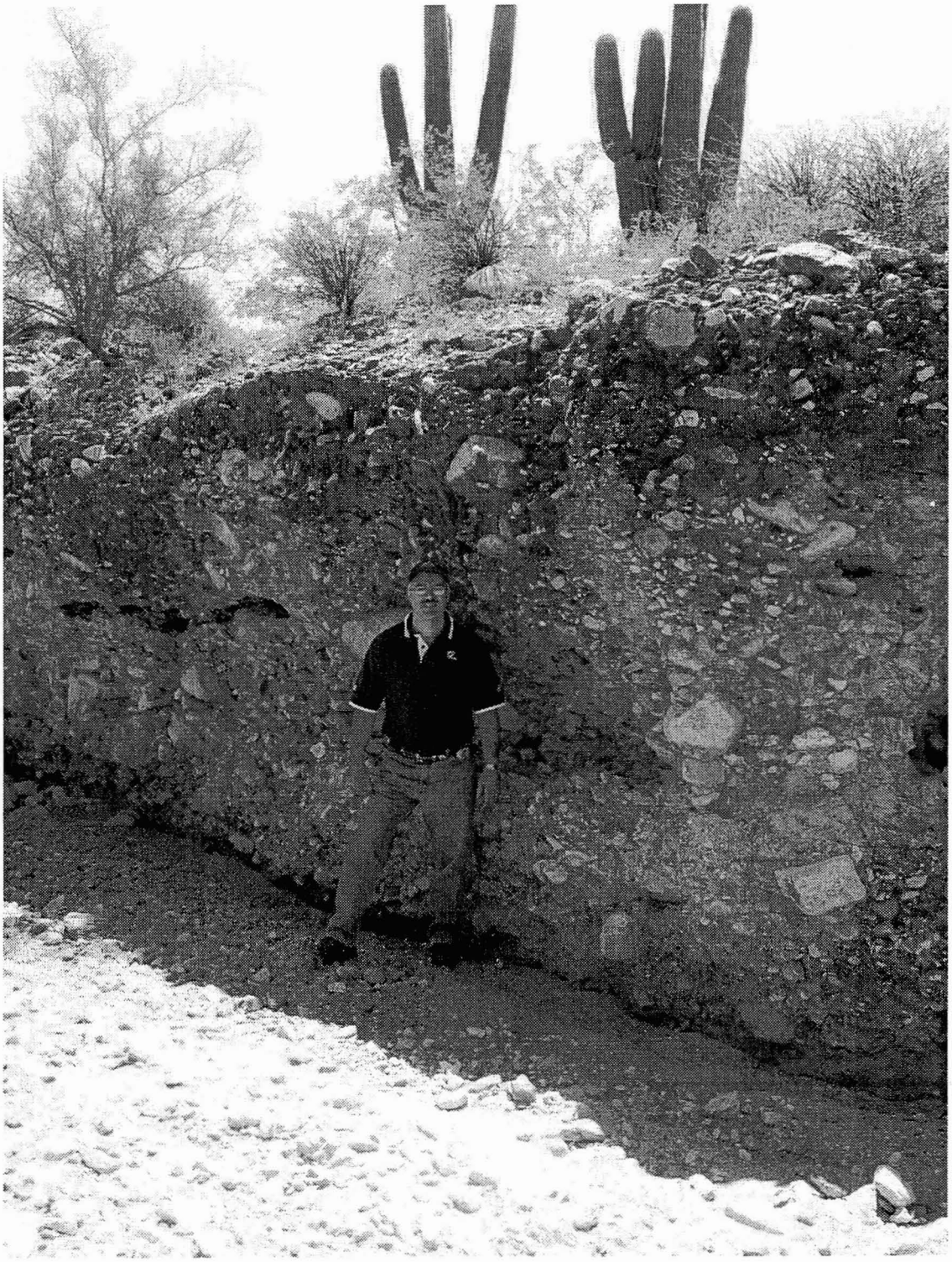


Figure 5-4 Bank Erosion in Waterfall Wash

6.0 RECOMMENDED ALTERNATIVE

6.1 Diversion Structure

6.2 Diversion Channel

6.3 Outlet Wash

6.4 North Inlet Channel

6.5 McMicken Dam

6.6 Cost

6.7 Issues and Recommendations

The following design issues should be considered during final design of the project:

- A geotechnical investigation should be conducted prior to final design of the project. The investigation should provide data suitable for assessing the presence of bedrock and the ability to excavate that rock. It should also assess the quantity of cobbles and boulders for construction of riprap and gabion erosion protection. Gradation data should be provided suitable for conducting sediment transport and scour calculations and for estimating the rate of breach of the fuse plug embankment.

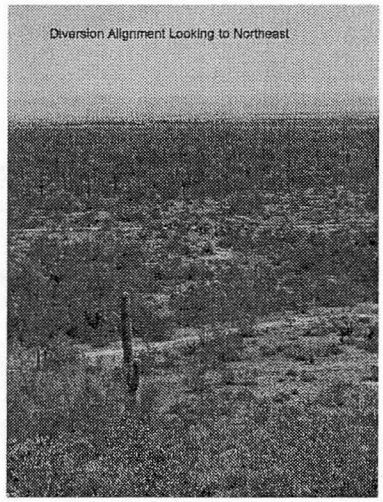
- Subsidence is not considered to be a critical issue in the design and function of the diversion structure, however, this should be reviewed and addressed in the final design.
- An estimation should be made of the amount of natural breakout flow in the Waterfall Wash which drains to McMicken Dam.
-
-
-

W:\active\82000257\Task2\Reports\Draft Report.doc

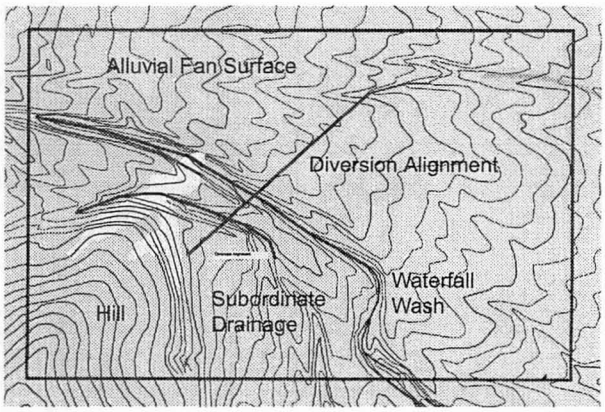
DRAFT

APPENDIX A

Field Memorandum
Waterfall Wash Diversion
2-117-001066-2
4/25/03
R.Weeks

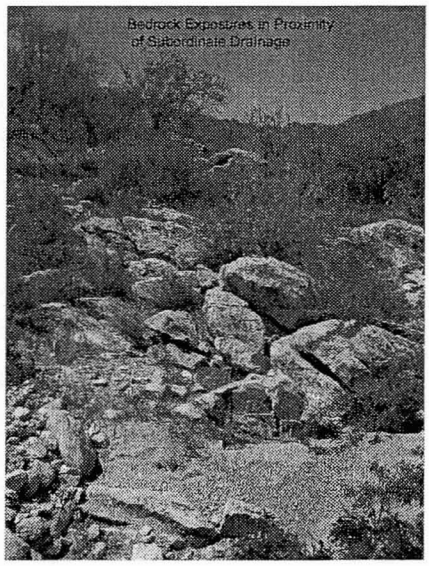


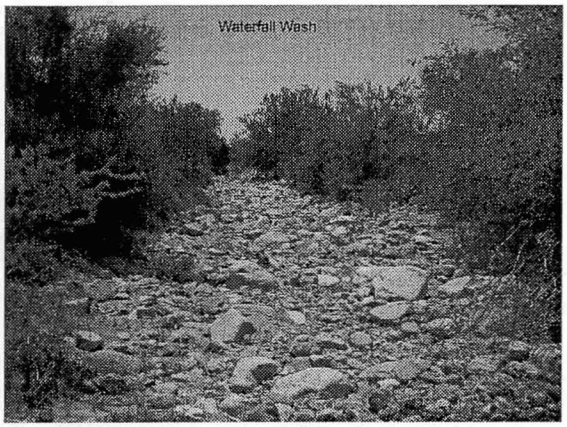
At the request of Chuck Gopperton of Stantec, the tentative alignment of the Waterfall Wash diversion west of the southern terminus of McMicken Dam was visited on Thursday April 24th 2003. A geologic reconnaissance of the alignment, and the flank of the hill to the southwest was performed. The focus of this reconnaissance was to assess the shallow geotechnical conditions; and in particular, the likely depth to competent bedrock along the proposed diversion corridor.



The diversion alignment trends northeastward, beginning at the foot of a prominent hill, traversing a subordinate arroyo, then crossing the incised channel of Waterfall Wash. The alignment terminates in the headward reach of a small arroyo in the alluvial fan surface that would direct the flow of Waterfall Wash behind McMicken Dam. The total length of the alignment is about 750 feet.

Extensive exposures of Cretaceous/Tertiary White Tank Granite are present in the hillside off the southwestern end of the alignment. Locally, the White Tank Granite is a competent, moderately fractured and pegmatitic rock. Projecting northeastward off the plunging ridgeline of the hill, exposures of this rock continue into the channel bottom of the subordinate drainage immediately north of the alignment. The small terrace on southwest of the subordinate drainage is likely composed of coarse fanglomerate, with some granitic boulders visible. The depth to bedrock below this terrace, and under the terrain between Waterfall Wash and the subordinate drainage, is probably quite shallow, possibly less that 10 feet.





The bottom of Waterfall Wash is armored with highly imbricated, subrounded cobbles and boulders, predominantly composed of White Tank Granite. No bedrock exposures were observed in the channel bottom in the proximity of the diversion alignment. The channel is incised in the alluvial fan some 10 to 12 feet. The fan surface further to the northeast is strewn with large 4 to 5-foot diameter boulders. Moderate cementation was observed in the shallow fanglomerates downstream of the alignment. Depth to bedrock below the Waterfall Wash channel and under the alluvial fan surface to the northeast is unknown.

If additional insights into the subsurface profile are needed, shallow seismic refraction profiling could be performed along the alignment.

DRAFT

APPENDIX B

HYDROLOGY MEMO

Memo

Stantec

To: File

From: Mike Gerlach, P.E.
Phoenix

File: 82000257

Date: 11 July 2003

Reference: McMicken FRZR FCD 2002C011 - Work Assignment 2

The area considered for Work Assignment 2 is only a small portion of the White Tanks Update study area. In the White Tanks Update model, the Waterfall Wash diversion study area is defined by 11 subbasins, 4 subbasins for Waterfall Wash and 7 subbasins for Cholla Wash. The HEC-1 input for these subbasins along with the associated channel routing, hydrograph combine and diversion operations were extracted into a separate model for convenience. This new model is herein referred to as the Waterfall Wash model. A review of the input parameters for the Waterfall Wash watershed was conducted with the following issues found.

- The point precipitation depth estimated for the entire White Tanks Update model is considered low for analysis of just the Waterfall Wash model watershed.
- Errant flow path slope for subbasin 1.
- Precipitation areal reduction factor for an area of 5 sq. miles is added to be representative of the area at Olive Avenue.
- The Phoenix Mountain S-graph was used for subbasins more characteristic of the Desert/Rangeland S-graph (note that the Desert/Rangeland S-graph was probably not available for use at the time of the White Tanks/Agua Fria ADMS).

All other parameters were used without change. The following is a brief discussion of the data and approach used to correct the issues listed above.

The point precipitation depth for the Waterfall Wash watershed was estimated using the National Weather Service NOAA Atlas 2 web based precipitation frequency estimator (http://www.nws.noaa.gov/oh/hdsc/noaaatlas2.htm). Input is the latitude and longitude for the project area. Output is the 2-year, 6- and 24-hour and the 100-year, 6- and 24-hour point precipitation depths. The point precipitation depths estimated for the Waterfall Wash watershed are 1.34, 1.55, 3.34, and 4.15 for the 2-year, 6- and 24-hour and the 100-year, 6- and 24-hour frequencies, respectively.

Correction of the flow path slope for subbasin 1 required the recalculation of the unit hydrograph ordinates. The basin parameters were measured and input into DDMSW. The revised input parameters are listed in Table A-1 along with the original parameters for comparison. Data was measured from a combination of the best available mapping. In the upper portions of the watershed, USGS 7.5 Minute Series

Quadrangle mapping was used for subbasin delineation, and parameter measurement. For all other areas, circa 1987 2-foot contour interval mapping prepared as part of the White Tanks/Agua Fria ADMS was used.

Table A-1
Unit hydrograph parameters for subbasin 1

	Waterfall Wash Model	White Tanks Update Model
Drainage Area, in sq. miles	1.986	1.94
Flow Path Length, in miles	3.893	3.40
Length from Centroid, in miles	1.443	1.36
Slope, in feet/mile	505.5	829.4
Roughness Coefficient, K_n	0.05	0.05
S-graph Type	Phoenix Mountain	Phoenix Mountain
Basin Lag, in hours	0.71	0.66

In the White Tanks Update model, the Phoenix Mountain S-graph was used for subbasins 3 and 3A. These subbasin areas are more characteristic of the Desert/Rangeland S-graph. For this analysis, these subbasins were combined into a single subbasin and identified as subbasin 3. The physical parameters for the calculation of the unit hydrograph were measured and input into DDMSW. The new unit hydrograph parameters for subbasin 3 are as follows.

- Drainage area = 0.875 square miles,
- Flow path length = 2.190 miles,
- Length from Centroid = 0.806 miles,
- Slope = 37.9 feet/mile, and
- Roughness coefficient, K_n = 0.025

The resulting basin lag is 0.37 hours. Green and Ampt rainfall loss parameters were estimated using the data and procedures in the Hydrology Manual. The basin average XKSAT variable was computed using the soils information provided in Appendix B of the Hydrology Manual and a visual estimate of the areal extent of each soil map unit present in the subbasin. The soil map units present in subbasin 3 and corresponding XKSAT values are listed in Table A-2.

Table A-2
Soil map units for subbasin 3

Soil Map Unit	XKSAT Inches/hour
AbA	0.38
AdB	0.40
AGB	0.40
AkB	0.27
AL	0.40
EPD	0.12
Gr	0.23
Tb	0.40
Vr	0.63

Approximate percentages of the soil map units occurring within subbasin 3 were estimated as follows.

- 75% soil map unit AkB, XKSAT = 0.27 in/hr,
- 15% soil map unit Vr, XKSAT = 0.63 in/hr
- 10% all others combine, approximate XKSAT = 0.40 in/hr.

The resulting basin average XKSAT is 0.32 inches/hour. The Green and Ampt variables DTHETA and PSIF were estimated from Figure 4.2 of the Hydrology Manual to be 0.35 and 4.39 inches, respectively. A surface retention loss of 0.15 inches is used. There is no development or naturally occurring impervious area present in this subbasin.

In order to estimate the peak discharge and runoff hydrograph to be diverted into McMicken Dam, subbasin 2 as defined in the White Tanks Update model was subdivided at a point approximately 0.75 miles upstream of concentration point 2. New unit hydrograph parameters were measured, input into DDMSW and are listed in Table A-3.

Table A-3
Unit hydrograph parameters for subbasin 2A and 2

	Subbasin 2A	Subbasin 2
Drainage Area, in sq. miles	1.186	0.839
Flow Path Length, in miles	2.404	2.473
Length from Centroid, in miles	1.202	0.806
Slope, in feet/mile	405.6	567.7
Roughness Coefficient, K_n	0.05	0.05
S-graph Type	Phoenix Mountain	Phoenix Mountain
Basin Lag, in hours	0.57	0.47

Green and Ampt rainfall loss parameters are estimated similarly to what was done for subbasin 3. The soil map units present in subbasins 2A and 2 and corresponding XKSAT and percent impervious values are listed in Table A-4.

Table A-4
Soil map units for subbasin 2A and 2

Soil Map Unit	XKSAT Inches/hour	RTIMP %
100	0.40	20
AGB	0.40	0
AkB	0.27	0
CO	0.29	20
EPD	0.12	0
RS	0.40	65
Tb	0.40	0

The basin average XKSAT for subbasins 2A and 2 are 0.30 and 0.29 inches/hour, respectively. The Green and Ampt variables DTHETA and PSIF were estimated from Figure 4.2 of the Hydrology Manual. A surface retention loss of 0.25 inches is used for both subbasins. There is no development present in these subbasins, naturally occurring impervious percentages are taken directly from the Hydrology Manual.

The routing reach from CP1 to CP2 in the White Tanks Update model is edited for length and slope to reflect the new concentration point CP2A. The normal depth option of the Modified Puls channel routing option is used to route the runoff from CP2A to CP2. Geometry is taken from the 1987 topography supplied by the District. Manning's n-values used for adjacent reaches are used for this reach.

In additional to these changes, the District provided a revised rating curve at Olive Avenue for the flow breakout over the Beardsley Canal. The rating curve reflects recent improvements to the culvert crossing and is based on a detailed hydraulic

analysis of the crossing. The District also requested changes to the rainfall depth-area reduction factors for the 24-hour models. The resulting 100-year peak discharges at select locations are listed in Table A-5. For comparison, the 100-year peak discharges from the White Tanks Update model are also shown.

Table A-5
Comparison of 100-year existing condition peak discharges

HEC-1 ID	Waterfall Wash Model 6-Hour cfs	Waterfall Wash Model 24-Hour cfs	White Tanks Update Model 24-Hour cfs
CP2A	2,106	2,091	---
CP2	2,397	2,376	2,821
CP3	2,454	2,405	2,823
DI189	457	435	629
D3	1,997	1,970	2,194
CP10	5,457	6,950	6,619

Hydrologic channel routing parameters associated with the revised subbasin delineations were developed from the most current detailed topographic mapping. Two topographic mapping sources were available for this purpose. The first is circa 1987, 2-foot contour interval mapping prepared as part of the White Tanks/Agua Fria ADMS. The second source is circa 2002, 2-foot contour interval mapping prepared for McMicken Dam. Manning's n-values used for the new routing reaches were based on field observations and consistency with values in the existing model. The values for the normal depth channel routing variable NSTPS was selected based on the resulting attenuation of the time to peak. For example, if the upstream hydrograph time to peak was 4.25 hours and the time to peak of the routed hydrograph is 4.50 hours, then a value of 3 is used for NSTPS (NMIN = 5). This is an optimization process were an initial value of NSTPS is selected and then modified based on the model results.

Copy:

MCG:

mcg Waterfall Wash 6-28-03.doc

APPENDIX C

WATERFALL WASH EXISTING CONDITIONS HEC-1 INPUT & OUTPUT

```
1*************************************
*                                   *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN  1998            *
*            VERSION 4.1            *
*                                   *
*  RUN DATE   02OCT03  TIME  08:21:42  *
*                                   *
*************************************
```

```
*************************************
*                                   *
*    U.S. ARMY CORPS OF ENGINEERS   *
*    HYDROLOGIC ENGINEERING CENTER  *
*          609 SECOND STREET        *
*       DAVIS, CALIFORNIA 95616     *
*           (916) 756-1104          *
*                                   *
*************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX        XXX
```

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

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

1 HEC-1 INPUT PAGE 1

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

  1           ID   Waterfall Wash Diversion
  2           ID   Part of the McMicken Dam FRZR, FCD 2002C011
  3           ID   For Flood Control District of Maricopa County
  4           ID   By  Stantec Consulting Inc
  5           ID
  6           ID   File:  EX100-6.ih1
  7           ID   Date:  2 October 2003
  8           ID
  9           ID   Waterfall Wash is immediately adjacent to the southern watershed limits of
 10           ID   the McMicken Dam watershed.  Runoff from Waterfall Wash overtops the
 11           ID   Beardsley canal, located just downstream of the dam.  It is proposed that
 12           ID   the 100-year runoff be diverted into the McMicken Dam impoundment area with
 13           ID   excess runoff continuing downstream, bypassing the diversion structure.
 14           ID
 15           ID   Model Input Parameters
 16           ID   Rainfall:  100-year, 6-hour design rainfall
 17           ID   Rainfall Losses:  Green & Ampt
 18           ID   Unit Hydrograph:  Phoenix Mountain and Desert/Rangeland S-Graph
 19           ID
 20           IT       5                    800
 21           IO       5
 22           IN      15
              *
 23           JD    3.34    0.01
 24           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
 25           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
 26           PC   0.962   0.972   0.983   0.991   1.000
 27           JD   3.318    0.50
 28           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
 29           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
 30           PC   0.962   0.972   0.983   0.991   1.000
 31           JD   3.256    2.80
 32           PC   0.000   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.067   0.076
 33           PC   0.087   0.100   0.120   0.163   0.252   0.451   0.694   0.837   0.900   0.938
 34           PC   0.950   0.963   0.975   0.988   1.000
 35           JD   3.079    16.0
 36           PC   0.000   0.015   0.020   0.030   0.048   0.063   0.076   0.090   0.105   0.119
 37           PC   0.135   0.152   0.175   0.222   0.304   0.472   0.670   0.796   0.868   0.912
 38           PC   0.946   0.960   0.973   0.987   1.000
              *

 39           KK       1
 40           KM   Sub-Basin      1
 41           KM
 42           KM      The Phoenix Mountain S-Graph is used for this basin.
```

```
 43          KM          Lag Used =  42.5 minutes
 44          KM
 45          BA   1.986
 46          LG    0.20    0.35    4.00    0.52   10.00
 47          UI     159     182     516     806    1063    1227    1606    1662    1095     933
 48          UI     843     739     645     568     461     395     366     318     260     205
 49          UI     188     174     137     121     112      78      78      78      65      31
 50          UI      30      31      31      30      31      30      31      30       0       0
 51          UI       0       0       0       0       0       0       0       0       0       0
             *
1                                          HEC-1 INPUT                                          PAGE  2

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

 52          KK      R1
 53          KM    Route runoff from subbasin 1 to concentration point CP2A
 54          RS       3    FLOW      -1
 55          RC    0.06    0.04    0.06   12841  0.0537
 56          RX    1000    1125    1300    1390    1405    1490    1590    1750
 57          RY    1440    1439    1437    1428    1428    1439    1442    1444
             *

 58          KK      2A
 59          KM   Sub-Basin     2A
 60          KM
 61          KM      The Phoenix Mountain S-Graph is used for this basin.
 62          KM          Lag Used =  34.4 minutes
 63          KM
 64          BA   1.186
 65          LG    0.25    0.35    4.51    0.30   20.43
 66          UI     117     214     499     751     930    1296     940     716     619     525
 67          UI     455     360     296     264     213     165     142     128      91      91
 68          UI      59      57      58      32      22      23      22      22      23      22
 69          UI      23       0       0       0       0       0       0       0       0       0
 70          UI       0       0       0       0       0       0       0       0       0       0
             *

 71          KK    CP2A
 72          KM    Combine routed hydrograph from subbasin 1 with runoff from subbasin 2A
 73          HC       2
             *

 74          KK     R2A
 75          KM    Route runoff from concentration point CP2A to CP2
 76          KM    Normal Depth channel route - geometry taken from 2' CI mapping
 77          RS       2    FLOW      -1
 78          RC    0.06    0.04    0.06    6177  0.0186
 79          RX    1000    1033    1057    1216    1229    1254    1352    1373
 80          RY     106     104     102   100.1   100.0     102     104   104.5
             *

 81          KK       2
 82          KM   Sub-Basin      2
 83          KM
 84          KM      The Phoenix Mountain S-Graph is used for this basin.
 85          KM          Lag Used =  28.0 minutes
 86          KM
 87          BA   0.839
 88          LG    0.25    0.35    4.58    0.29   16.10
 89          UI     101     261     556     751    1095     751     572     492     397     307
 90          UI     247     210     150     124     105      77      65      49      49      24
 91          UI      20      19      20      19      19       0       0       0       0       0
 92          UI       0       0       0       0       0       0       0       0       0       0
             *
1                                          HEC-1 INPUT                                          PAGE  3

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

 93          KK     CP2
 94          KM    Combine routed hydrograph from CP2A with runoff from subbasin 2
 95          HC       2
             *

 96          KK    RCP2
 97          KM        ROUTE COMBINED HYDROGRAPHS AT CP2 TO CP3.
 98          RS       2              -1       0
 99          RC     .06    .035     .06    4500   .0111
100          RX    1000    1100    1350    1705    1735    1780    1850    2000
101          RY    1304    1302    1302    1298    1298    1303    1302    1305
```

```
                *
102             KK       3
103             KM   Sub-Basin      3
104             KM
105             KM      The Desert/Rangeland S-Graph is used for this basin.
106             KM          Lag Used =  22.4 minutes
107             KM
108             BA   0.875
109             LG    0.15    0.35    4.39    0.32    0.00
110             UI    134.    529.    972.   1245.   1215.    885.    598.    402.    267.    179.
111             UI    119.     92.     34.     33.     33.     33.      0.      0.      0.      0.
112             UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
                *

113             KK     CP3
114             KM    Combine routed hydrograph from CP2 with runoff from subbasin 3
115             HC       2
                *

116             KK      D3
117             KM    Divert runoff overtopping the Beardsley Canal at Olive Avenue.
118             KM    Rating curve provided by FCDMC based on a HEC-RAS model developed for the
119             KM    improved culvert crossing at Olive Avenue
120             DT   DI189
121             DI       0    1432    2823    3000    4000
122             DQ       0       0     622     728    1728
                *

123             KK    RCP3
124             KM        ROUTE FLOW FROM CP3 TO CP10.
125             RS       2              -1       0
126             RC     .05     .03     .05    5280   .0083
127             RX    1010    1015    1020    1050    1100    1275    1580    1750
128             RY    1251    1249    1249    1245    1245    1250    1250    1254
                *

129             KK       4
130             KM        RUNOFF HYDROGRAPH FORM SUB-BASIN 4.
131             BA     .30
                *    LG    0.35    0.15    8.01   0.081  18.504
132             LG     .20     .35    4.35     .44    9.00
133             UI     47.    191.    286.    443.    513.    346.    237.    115.     67.     36.
```



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

134             UI     14.     14.      0.      0.      0.      0.      0.      0.      0.      0.
135             UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
                *

136             KK       5
137             KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 5.
138             BA     .72
                *    LG    0.35    0.15   8.023   0.081  17.926
139             LG     .20     .35    4.30     .45    9.00
140             UI    109.    433.    653.    981.   1241.    852.    594.    323.    177.    104.
141             UI     33.     33.     33.      0.      0.      0.      0.      0.      0.      0.
142             UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

143             KK     CP5
144             KM        ADD HYDROGRAPHS AT CP5.
145             HC       2    1.02

146             KK    RCP5
147             KM        ROUTE COMBINED HYDROGRAPHS AT CP5 TO CP6.
148             RS       1              -1       0
149             RC     .08     .05     .08    2400   .0833
150             RX     955     970     985    1000    1020    1035    1050    1065
151             RY    2815    2810    2805    2800    2800    2805    2810    2815
                *

152             KK       6
153             KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 6.
154             BA     .45
                *    LG    0.35    0.15   7.976   0.082      20
155             LG     .20     .35    3.95     .53   10.00
156             UI    206.    627.   1145.    834.    421.    154.     53.     33.      0.      0.
157             UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

158             KK     CP6
```

```
159          KM        ADD HYDROGRAPHS AT CP6.
160          HC       2    1.47

161          KK    RCP6
162          KM        ROUTE COMBINED HYDROGRAPHS AT CP6 TO CP7.
163          RS       1              -1       0
164          RC     .08     .05     .08    2400    .0833
165          RX     955     970     985    1000    1020    1035    1050    1065
166          RY    2815    2810    2805    2800    2800    2805    2810    2815
             *

167          KK       7
168          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 7.
169          BA     .31
             *     LG    0.35    0.15   7.976   0.082      20
170          LG     .20     .35    3.95     .53   10.00
171          UI    124.    383.    708.    610.    347.    132.     54.     21.      0.      0.
172          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1                                          HEC-1 INPUT                                          PAGE  5

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

173          KK     CP7
174          KM        ADD HYDROGRAPHS AT CP7.
175          HC       2    1.78

176          KK    RCP7
177          KM        ROUTE COMBINED HYDROGRAPHS AT CP7 TO CP9.
178          RS       3              -1       0
179          RC     .08     .05     .08   10200   .07745
180          RX    1000    1045    1120    1195    1230    1300    1350    1450
181          RY    1910    1880    1850    1838    1838    1850    1880    1910
             *

182          KK       9
183          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 9.
184          BA    1.40
             *     LG    0.35    0.15   7.909   0.084  19.572
185          LG     .20     .35    4.00     .52   10.00
186          UI    155.    380.    725.    933.   1213.   1828.   1593.   1225.    939.    707.
187          UI    389.    261.    178.    116.     47.     47.     47.     47.      0.      0.
188          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

189          KK   I1CP9
190          KM        ADD HYDROGRAPHS AT CP9.
191          HC       2    3.18
             *

192          KK       8
193          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 8.
194          BA     .81
             *     LG    0.35    0.15   7.976   0.082      20
195          LG     .20     .35    3.95     .53   10.00
196          UI    103.    314.    536.    704.   1058.   1138.    821.    608.    420.    207.
197          UI    147.     95.     31.     31.     31.      0.      0.      0.      0.      0.
198          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

199          KK     CP9
200          KM        ADD HYDROGRAPHS AT CP9.
201          HC       2    3.99

202          KK    RCP9
203          KM        ROUTE COMBINED HYDROGRAPHS AT CP9 TO CP10.
204          RS       8              -1       0
205          RC     .06    .035     .06   19200   .0232
206          RX    1000    1085    1310    1395    1415    1450    1630    1665
207          RY    1317    1314    1311    1308    1308    1314    1314    1317
             *

208          KK      10
209          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 10.
210          BA    2.02
             *     LG   0.347   0.248   5.124   0.254    4.52
211          LG     .16     .35    4.55     .36    4.00
212          UI    119.    119.    219.    428.    547.    632.    709.    813.    930.   1153.
213          UI   1500.   1391.   1155.   1006.    893.    765.    668.    577.    473.    323.
1                                          HEC-1 INPUT                                          PAGE  6

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
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```
214          UI    210.    201.    191.    119.    119.     84.     36.     36.     36.     36.
215          UI     36.     36.     36.     36.      0.      0.      0.      0.      0.      0.
216          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

217          KK  I1CP10
218          KM        ADD HYDROGRAPHS AT I1CP10
219          HC       2    6.01

220          KK    CP10
221          KM        ADD HYDROGRAPHS AT CP10
222          HC       2
             *
223          ZZ
1*************************************                                    *************************************
*                                   *                                    *                                   *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                 *   U.S. ARMY CORPS OF ENGINEERS    *
*             JUN  1998             *                                    *   HYDROLOGIC ENGINEERING CENTER   *
*          VERSION 4.1              *                                    *         609 SECOND STREET         *
*                                   *                                    *      DAVIS, CALIFORNIA 95616      *
*  RUN DATE   02OCT03  TIME  08:21:42  *                                 *          (916) 756-1104           *
*                                   *                                    *                                   *
*************************************                                    *************************************
```

Waterfall Wash Diversion
Part of the McMicken Dam FRZR, FCD 2002C011
For Flood Control District of Maricopa County
By Stantec Consulting Inc

File: EX100-6.ih1
Date: 2 October 2003

Waterfall Wash is immediately adjacent to the southern watershed limits of the McMicken Dam watershed. Runoff from Waterfall Wash overtops the Beardsley canal, located just downstream of the dam. It is proposed that the 100-year runoff be diverted into the McMicken Dam impoundment area with excess runoff continuing downstream, bypassing the diversion structure.

Model Input Parameters
Rainfall: 100-year, 6-hour design rainfall
Rainfall Losses: Green & Ampt
Unit Hydrograph: Phoenix Mountain and Desert/Rangeland S-Graph

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

   IT          HYDROGRAPH TIME DATA
                      NMIN          5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1   0  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ        800  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      3   0  ENDING DATE
                    NDTIME       1835  ENDING TIME
                     ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL     .08 HOURS
                     TOTAL TIME BASE   66.58 HOURS

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

23 JD          INDEX STORM NO. 1
                      STRM       3.34  PRECIPITATION DEPTH
                      TRDA        .01  TRANSPOSITION DRAINAGE AREA

24 PI            PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                    .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
```

```
                .03      .01      .01      .01      .01      .01      .01      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00

27 JD        INDEX STORM NO. 2
                STRM        3.32  PRECIPITATION DEPTH
                TRDA         .50  TRANSPOSITION DRAINAGE AREA

28 PI         PRECIPITATION PATTERN
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .01      .01      .01      .01      .01      .01      .03
                .03      .03      .05      .05      .05      .15      .15      .15      .03      .03
                .03      .01      .01      .01      .01      .01      .01      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00

31 JD        INDEX STORM NO. 3
                STRM        3.26  PRECIPITATION DEPTH
                TRDA        2.80  TRANSPOSITION DRAINAGE AREA

32 PI         PRECIPITATION PATTERN
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00      .00      .01      .01      .01      .01      .01      .01      .03
                .03      .03      .07      .07      .07      .08      .08      .08      .05      .05
                .05      .02      .02      .02      .01      .01      .01      .00      .00      .00
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00

35 JD        INDEX STORM NO. 4
                STRM        3.08  PRECIPITATION DEPTH
                TRDA       16.00  TRANSPOSITION DRAINAGE AREA

36 PI         PRECIPITATION PATTERN
                .01      .01      .00      .00      .00      .00      .00      .00      .00      .01
                .01      .01      .00      .01      .00      .00      .00      .00      .00      .00
                .00      .00      .01      .00      .00      .00      .00      .01      .01      .01
                .01      .01      .01      .01      .01      .01      .02      .02      .02      .03
                .03      .03      .06      .06      .06      .07      .07      .07      .04      .04
                .04      .02      .02      .02      .01      .01      .01      .01      .01      .01
                .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                .00      .00
1
                                          RUNOFF SUMMARY
                                   FLOW IN CUBIC FEET PER SECOND
                                TIME IN HOURS,  AREA IN SQUARE MILES

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

        HYDROGRAPH AT
+                            1      1470.    4.42         273.        69.         25.      1.99
        ROUTED TO
+                           R1      1367.    4.67         272.        69.         25.      1.99
        HYDROGRAPH AT
+                           2A      1414.    4.33         233.        59.         21.      1.19
        2 COMBINED AT
+                         CP2A      2106.    4.58         465.       118.         42.      3.17
        ROUTED TO
+                          R2A      2017.    4.75         464.       118.         42.      3.17
        HYDROGRAPH AT
+                            2      1209.    4.25         164.        41.         15.       .84
        2 COMBINED AT
+                          CP2      2397.    4.67         588.       149.         54.      4.01
        ROUTED TO
+                         RCP2      2330.    4.83         587.       149.         54.      4.01
        HYDROGRAPH AT
+                            3      1459.    4.17         145.        36.         13.       .88
```

	2 COMBINED AT						
+	CP3	2454.	4.75	686.	174.	63.	4.89
	DIVERSION TO						
+	DI189	457.	4.75	60.	15.	5.	4.89
	HYDROGRAPH AT						
+	D3	1997.	4.75	626.	159.	57.	4.89
	ROUTED TO						
+	RCP3	1968.	4.92	625.	159.	57.	4.89
	HYDROGRAPH AT						
+	4	588.	4.25	51.	13.	5.	.30
	HYDROGRAPH AT						
+	5	1261.	4.25	118.	29.	11.	.72
	2 COMBINED AT						
+	CP5	1623.	4.25	160.	40.	14.	1.02
	ROUTED TO						
+	RCP5	1622.	4.25	160.	40.	14.	1.02
	HYDROGRAPH AT						
+	6	1123.	4.08	75.	19.	7.	.45
	2 COMBINED AT						
+	CP6	2045.	4.17	216.	54.	20.	1.47
	ROUTED TO						
+	RCP6	1995.	4.17	216.	54.	20.	1.47
	HYDROGRAPH AT						
+	7	741.	4.08	51.	13.	5.	.31
	2 COMBINED AT						
+	CP7	2312.	4.17	253.	63.	23.	1.78
	ROUTED TO						
+	RCP7	2090.	4.33	253.	63.	23.	1.78
	HYDROGRAPH AT						
+	9	1632.	4.33	203.	51.	18.	1.40
	2 COMBINED AT						
+	I1CP9	2996.	4.33	412.	103.	37.	3.18
	HYDROGRAPH AT						
+	8	1190.	4.33	126.	32.	11.	.81
	2 COMBINED AT						
+	CP9	3604.	4.33	496.	124.	45.	3.99
	ROUTED TO						
+	RCP9	3267.	4.75	494.	124.	45.	3.99
	HYDROGRAPH AT						
+	10	1533.	4.75	296.	74.	27.	2.02
	2 COMBINED AT						
+	I1CP10	4242.	4.75	712.	179.	65.	6.01
	2 COMBINED AT						
+	CP10	5457.	4.75	1210.	307.	111.	10.90

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

```
1****************************************                    ****************************************
*                                      *                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS       *
*              JUN  1998               *                    *   HYDROLOGIC ENGINEERING CENTER      *
*            VERSION 4.1               *                    *         609 SECOND STREET            *
*                                      *                    *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE   02OCT03  TIME  08:21:52  *                    *          (916) 756-1104              *
*                                      *                    *                                      *
****************************************                    ****************************************

X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX

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

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

1                                          HEC-1 INPUT                                                PAGE  1

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

  1           ID   Waterfall Wash Diversion
  2           ID   Part of the McMicken Dam FRZR, FCD 2002C011
  3           ID   For Flood Control District of Maricopa County
  4           ID   By  Stantec Consulting Inc
  5           ID
  6           ID   File:  EX100-24.ih1
  7           ID   Date:  2 October 2003
  8           ID
  9           ID   Waterfall Wash is immediately adjacent to the southern watershed limits of
 10           ID   the McMicken Dam watershed.  Runoff from Waterfall Wash overtops the
 11           ID   Beardsley canal, located just downstream of the dam.  It is proposed that
 12           ID   the 100-year runoff be diverted into the McMicken Dam impoundment area with
 13           ID   excess runoff continuing downstream, bypassing the diversion structure.
 14           ID
 15           ID   Model Input Parameters
 16           ID   Rainfall:  100-year, 24-hour design rainfall
 17           ID   Rainfall Losses:  Green & Ampt
 18           ID   Unit Hydrograph:  Phoenix Mountain and Desert/Rangeland S-Graph
 19           ID
 20           IT       5                    800
 21           IO       5
 22           IN      15
              *
 23           JD    4.15    0.01
 24           PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
 25           PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
 26           PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
 27           PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
 28           PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
 29           PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
 30           PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
 31           PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
 32           PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
 33           PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
 34           JD   4.046    5.00
 35           JD   3.943   10.00
 36           JD   3.735   30.00
              *

 37           KK       1
 38           KM   Sub-Basin      1
 39           KM
 40           KM      The Phoenix Mountain S-Graph is used for this basin.
 41           KM          Lag Used =  42.5 minutes
 42           KM
```

```
 43          BA   1.986
 44          LG    0.20    0.35    4.00    0.52   10.00
 45          UI     159     182     516     806    1063    1227    1606    1662    1095     933
 46          UI     843     739     645     568     461     395     366     318     260     205
 47          UI     188     174     137     121     112      78      78      78      65      31
 48          UI      30      31      31      30      31      30      31      30       0       0
 49          UI       0       0       0       0       0       0       0       0       0       0
             *
1                                          HEC-1 INPUT                                          PAGE  2

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

 50          KK      R1
 51          KM    Route runoff from subbasin 1 to concentration point CP2A
 52          RS       3    FLOW      -1
 53          RC    0.06    0.04    0.06   12841  0.0537
 54          RX    1000    1125    1300    1390    1405    1490    1590    1750
 55          RY    1440    1439    1437    1428    1428    1439    1442    1444
             *

 56          KK      2A
 57          KM   Sub-Basin     2A
 58          KM
 59          KM      The Phoenix Mountain S-Graph is used for this basin.
 60          KM          Lag Used =  34.4 minutes
 61          KM
 62          BA   1.186
 63          LG    0.25    0.35    4.51    0.30   20.43
 64          UI     117     214     499     751     930    1296     940     716     619     525
 65          UI     455     360     296     264     213     165     142     128      91      91
 66          UI      59      57      58      32      22      23      22      22      23      22
 67          UI      23       0       0       0       0       0       0       0       0       0
 68          UI       0       0       0       0       0       0       0       0       0       0
             *

 69          KK    CP2A
 70          KM    Combine routed hydrograph from subbasin 1 with runoff from subbasin 2A
 71          HC       2
             *

 72          KK     R2A
 73          KM    Route runoff from concentration point CP2A to CP2
 74          KM    Normal Depth channel route - geometry taken from 2' CI mapping
 75          RS       2    FLOW      -1
 76          RC    0.06    0.04    0.06    6177  0.0186
 77          RX    1000    1033    1057    1216    1229    1254    1352    1373
 78          RY     106     104     102   100.1   100.0     102     104   104.5
             *

 79          KK       2
 80          KM   Sub-Basin      2
 81          KM
 82          KM      The Phoenix Mountain S-Graph is used for this basin.
 83          KM          Lag Used =  28.0 minutes
 84          KM
 85          BA   0.839
 86          LG    0.25    0.35    4.58    0.29   16.10
 87          UI     101     261     556     751    1095     751     572     492     397     307
 88          UI     247     210     150     124     105      77      65      49      49      24
 89          UI      20      19      20      19      19       0       0       0       0       0
 90          UI       0       0       0       0       0       0       0       0       0       0
             *
1                                          HEC-1 INPUT                                          PAGE  3

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

 91          KK     CP2
 92          KM    Combine routed hydrograph from CP2A with runoff from subbasin 2
 93          HC       2
             *

 94          KK    RCP2
 95          KM        ROUTE COMBINED HYDROGRAPHS AT CP2 TO CP3.
 96          RS       2              -1       0
 97          RC     .06    .035     .06    4500   .0111
 98          RX    1000    1100    1350    1705    1735    1780    1850    2000
 99          RY    1304    1302    1302    1298    1298    1303    1302    1305
             *
```

```
100          KK       3
101          KM   Sub-Basin      3
102          KM
103          KM      The Desert/Rangeland S-Graph is used for this basin.
104          KM          Lag Used =  22.4 minutes
105          KM
106          BA   0.875
107          LG    0.15    0.35    4.39    0.32    0.00
108          UI    134.    529.    972.   1245.   1215.    885.    598.    402.    267.    179.
109          UI    119.     92.     34.     33.     33.     33.      0.      0.      0.      0.
110          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
             *

111          KK     CP3
112          KM    Combine routed hydrograph from CP2 with runoff from subbasin 3
113          HC       2
             *

114          KK      D3
115          KM    Divert runoff overtopping the Beardsley Canal at Olive Avenue.
116          KM    Rating curve provided by FCDMC based on a HEC-RAS model developed for the
117          KM    improved culvert crossing at Olive Avenue
118          DT   DI189
119          DI       0    1432    2823    3000    4000
120          DQ       0       0     622     728    1728
             *

121          KK    RCP3
122          KM        ROUTE FLOW FROM CP3 TO CP10.
123          RS       2              -1       0
124          RC     .05     .03     .05    5280   .0083
125          RX    1010    1015    1020    1050    1100    1275    1580    1750
126          RY    1251    1249    1249    1245    1245    1250    1250    1254
             *

127          KK       4
128          KM        RUNOFF HYDROGRAPH FORM SUB-BASIN 4.
129          BA     .30
             *    LG    0.35    0.15    8.01   0.081  18.504
130          LG     .20     .35    4.35     .44    9.00
131          UI     47.    191.    286.    443.    513.    346.    237.    115.     67.     36.
```



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

132          UI     14.     14.      0.      0.      0.      0.      0.      0.      0.      0.
133          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
             *

134          KK       5
135          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 5.
136          BA     .72
             *    LG    0.35    0.15   8.023   0.081  17.926
137          LG     .20     .35    4.30     .45    9.00
138          UI    109.    433.    653.    981.   1241.    852.    594.    323.    177.    104.
139          UI     33.     33.     33.      0.      0.      0.      0.      0.      0.      0.
140          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

141          KK     CP5
142          KM        ADD HYDROGRAPHS AT CP5.
143          HC       2    1.02

144          KK    RCP5
145          KM        ROUTE COMBINED HYDROGRAPHS AT CP5 TO CP6.
146          RS       1              -1       0
147          RC     .08     .05     .08    2400   .0833
148          RX     955     970     985    1000    1020    1035    1050    1065
149          RY    2815    2810    2805    2800    2800    2805    2810    2815
             *

150          KK       6
151          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 6.
152          BA     .45
             *    LG    0.35    0.15   7.976   0.082      20
153          LG     .20     .35    3.95     .53   10.00
154          UI    206.    627.   1145.    834.    421.    154.     53.     33.      0.      0.
155          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

156          KK     CP6
157          KM        ADD HYDROGRAPHS AT CP6.
158          HC       2    1.47
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159          KK    RCP6
160          KM        ROUTE COMBINED HYDROGRAPHS AT CP6 TO CP7.
161          RS       1              -1       0
162          RC     .08      .05     .08    2400   .0833
163          RX     955      970     985    1000    1020    1035    1050    1065
164          RY    2815     2810    2805    2800    2800    2805    2810    2815
             *

165          KK       7
166          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 7.
167          BA     .31
             *     LG    0.35    0.15   7.976   0.082      20
168          LG     .20      .35    3.95     .53   10.00
169          UI    124.     383.    708.    610.    347.    132.     54.     21.      0.      0.
170          UI      0.       0.      0.      0.      0.      0.      0.      0.      0.      0.
1                                          HEC-1 INPUT                                          PAGE  5

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

171          KK     CP7
172          KM        ADD HYDROGRAPHS AT CP7.
173          HC       2    1.78

174          KK    RCP7
175          KM        ROUTE COMBINED HYDROGRAPHS AT CP7 TO CP9.
176          RS       3              -1       0
177          RC     .08      .05     .08   10200  .07745
178          RX    1000     1045    1120    1195    1230    1300    1350    1450
179          RY    1910     1880    1850    1838    1838    1850    1880    1910
             *

180          KK       9
181          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 9.
182          BA    1.40
             *     LG    0.35    0.15   7.909   0.084  19.572
183          LG     .20      .35    4.00     .52   10.00
184          UI    155.     380.    725.    933.   1213.   1828.   1593.   1225.    939.    707.
185          UI    389.     261.    178.    116.     47.     47.     47.     47.      0.      0.
186          UI      0.       0.      0.      0.      0.      0.      0.      0.      0.      0.

187          KK   I1CP9
188          KM        ADD HYDROGRAPHS AT CP9.
189          HC       2    3.18
             *

190          KK       8
191          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 8.
192          BA     .81
             *     LG    0.35    0.15   7.976   0.082      20
193          LG     .20      .35    3.95     .53   10.00
194          UI    103.     314.    536.    704.   1058.   1138.    821.    608.    420.    207.
195          UI    147.      95.     31.     31.     31.      0.      0.      0.      0.      0.
196          UI      0.       0.      0.      0.      0.      0.      0.      0.      0.      0.

197          KK     CP9
198          KM        ADD HYDROGRAPHS AT CP9.
199          HC       2    3.99

200          KK    RCP9
201          KM        ROUTE COMBINED HYDROGRAPHS AT CP9 TO CP10.
202          RS       8              -1       0
203          RC     .06     .035     .06   19200   .0232
204          RX    1000     1085    1310    1395    1415    1450    1630    1665
205          RY    1317     1314    1311    1308    1308    1314    1314    1317
             *

206          KK      10
207          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 10.
208          BA    2.02
             *     LG   0.347   0.248   5.124   0.254    4.52
209          LG     .16      .35    4.55     .36    4.00
210          UI    119.     119.    219.    428.    547.    632.    709.    813.    930.   1153.
211          UI   1500.    1391.   1155.   1006.    893.    765.    668.    577.    473.    323.
1                                          HEC-1 INPUT                                          PAGE  6

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

212          UI    210.     201.    191.    119.    119.     84.     36.     36.     36.     36.
213          UI     36.      36.     36.     36.      0.      0.      0.      0.      0.      0.
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```
214          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

215          KK  I1CP10
216          KM        ADD HYDROGRAPHS AT I1CP10
217          HC       2    6.01

218          KK    CP10
219          KM        ADD HYDROGRAPHS AT CP10
220          HC       2
             *
221          ZZ
1****************************************                                    ****************************************
*                                      *                                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *   U.S. ARMY CORPS OF ENGINEERS       *
*              JUN   1998              *                                    *   HYDROLOGIC ENGINEERING CENTER      *
*            VERSION 4.1               *                                    *         609 SECOND STREET            *
*                                      *                                    *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE   02OCT03  TIME  08:21:52  *                                    *          (916) 756-1104              *
*                                      *                                    *                                      *
****************************************                                    ****************************************
```

Waterfall Wash Diversion
Part of the McMicken Dam FRZR, FCD 2002C011
For Flood Control District of Maricopa County
By Stantec Consulting Inc

File: EX100-24.ih1
Date: 2 October 2003

Waterfall Wash is immediately adjacent to the southern watershed limits of the McMicken Dam watershed. Runoff from Waterfall Wash overtops the Beardsley canal, located just downstream of the dam. It is proposed that the 100-year runoff be diverted into the McMicken Dam impoundment area with excess runoff continuing downstream, bypassing the diversion structure.

Model Input Parameters
Rainfall: 100-year, 24-hour design rainfall
Rainfall Losses: Green & Ampt
Unit Hydrograph: Phoenix Mountain and Desert/Rangeland S-Graph

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

   IT          HYDROGRAPH TIME DATA
                      NMIN          5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1    0  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ        800  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      3    0  ENDING DATE
                    NDTIME       1835  ENDING TIME
                    ICENT          19  CENTURY MARK

                COMPUTATION INTERVAL     .08 HOURS
                     TOTAL TIME BASE   66.58 HOURS

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

23 JD          INDEX STORM NO. 1
                      STRM       4.15  PRECIPITATION DEPTH
                      TRDA        .01  TRANSPOSITION DRAINAGE AREA

24 PI            PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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.03	.09	.09	.09	.01	.01	.01	.01	.01	.01
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34 JD INDEX STORM NO. 2

STRM 4.05 PRECIPITATION DEPTH

TRDA 5.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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35 JD INDEX STORM NO. 3

STRM 3.94 PRECIPITATION DEPTH

TRDA 10.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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36 JD INDEX STORM NO. 4

STRM 3.73 PRECIPITATION DEPTH

TRDA 30.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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1

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

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	1	1505.	12.42	250.	69.	25.	1.99		
+	ROUTED TO	R1	1344.	12.67	250.	69.	25.	1.99		
+	HYDROGRAPH AT	2A	1245.	12.33	196.	57.	20.	1.19		
+	2 COMBINED AT	CP2A	2091.	12.58	444.	125.	45.	3.17		
+	ROUTED TO	R2A	1999.	12.75	443.	125.	45.	3.17		
+	HYDROGRAPH AT	2	1000.	12.25	133.	38.	14.	.84		
+	2 COMBINED AT	CP2	2376.	12.67	574.	162.	58.	4.01		
+	ROUTED TO	RCP2	2298.	12.83	574.	162.	58.	4.01		
+	HYDROGRAPH AT	3	1235.	12.17	112.	28.	10.	.88		

+	2 COMBINED AT	CP3	2405.	12.75	684.	189.	68.	4.89
+	DIVERSION TO	DI189	435.	12.75	59.	15.	5.	4.89
+	HYDROGRAPH AT	D3	1970.	12.75	625.	174.	63.	4.89
+	ROUTED TO	RCP3	1943.	12.92	624.	174.	63.	4.89
+	HYDROGRAPH AT	4	427.	12.25	39.	11.	4.	.30
+	HYDROGRAPH AT	5	1005.	12.25	93.	25.	9.	.72
+	2 COMBINED AT	CP5	1427.	12.25	132.	36.	13.	1.02
+	ROUTED TO	RCP5	1428.	12.25	132.	36.	13.	1.02
+	HYDROGRAPH AT	6	808.	12.08	57.	16.	6.	.45
+	2 COMBINED AT	CP6	2024.	12.17	188.	51.	19.	1.47
+	ROUTED TO	RCP6	1955.	12.17	188.	51.	19.	1.47
+	HYDROGRAPH AT	7	535.	12.08	39.	11.	4.	.31
+	2 COMBINED AT	CP7	2457.	12.17	227.	62.	22.	1.78
+	ROUTED TO	RCP7	2140.	12.33	227.	62.	22.	1.78
+	HYDROGRAPH AT	9	1537.	12.33	177.	49.	18.	1.40
+	2 COMBINED AT	I1CP9	3661.	12.33	402.	110.	40.	3.18
+	HYDROGRAPH AT	8	969.	12.33	102.	28.	10.	.81
+	2 COMBINED AT	CP9	4615.	12.33	502.	138.	50.	3.99
+	ROUTED TO	RCP9	3905.	12.75	502.	138.	50.	3.99
+	HYDROGRAPH AT	10	1481.	12.75	259.	67.	24.	2.02
+	2 COMBINED AT	I1CP10	5316.	12.75	750.	202.	73.	6.01
+	2 COMBINED AT	CP10	6950.	12.75	1325.	363.	131.	10.90

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

APPENDIX D

WATERFALL WASH PROPOSED CONDITIONS HEC-1 INPUT & OUTPUT

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN   1998              *
*            VERSION 4.1               *
*                                      *
*  RUN DATE   02OCT03  TIME  08:23:49  *
*                                      *
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****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
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X     X  XXXXXXX   XXXXX            X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

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

1 HEC-1 INPUT PAGE 1

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

  1           ID   Waterfall Wash Diversion
  2           ID   Part of the McMicken Dam FRZR, FCD 2002C011
  3           ID   For Flood Control District of Maricopa County
  4           ID   By  Stantec Consulting Inc
  5           ID
  6           ID   File:  PR100-6.ih1
  7           ID   Date:  2 October 2003
  8           ID
  9           ID   Waterfall Wash is immediately adjacent to the southern watershed limits of
 10           ID   the McMicken Dam watershed.  Runoff from Waterfall Wash overtops the
 11           ID   Beardsley canal, located just downstream of the dam.  It is proposed that
 12           ID   the 100-year runoff be diverted into the McMicken Dam impoundment area with
 13           ID   excess runoff continuing downstream, bypassing the diversion structure.
 14           ID
 15           ID   Model Input Parameters
 16           ID   Rainfall:  100-year, 6-hour design rainfall
 17           ID   Rainfall Losses:  Green & Ampt
 18           ID   Unit Hydrograph:  Phoenix Mountain and Desert/Rangeland S-Graph
 19           ID
 20           IT       5                    800
 21           IO       5
 22           IN      15
              *
 23           JD    3.34    0.01
 24           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
 25           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
 26           PC   0.962   0.972   0.983   0.991   1.000
 27           JD   3.318    0.50
 28           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
 29           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
 30           PC   0.962   0.972   0.983   0.991   1.000
 31           JD   3.256    2.80
 32           PC   0.000   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.067   0.076
 33           PC   0.087   0.100   0.120   0.163   0.252   0.451   0.694   0.837   0.900   0.938
 34           PC   0.950   0.963   0.975   0.988   1.000
 35           JD   3.079    16.0
 36           PC   0.000   0.015   0.020   0.030   0.048   0.063   0.076   0.090   0.105   0.119
 37           PC   0.135   0.152   0.175   0.222   0.304   0.472   0.670   0.796   0.868   0.912
 38           PC   0.946   0.960   0.973   0.987   1.000
              *

 39           KK       1
 40           KM   Sub-Basin      1
 41           KM
 42           KM      The Phoenix Mountain S-Graph is used for this basin.
```

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 43          KM          Lag Used =  42.5 minutes
 44          KM
 45          BA   1.986
 46          LG    0.20    0.35    4.00    0.52   10.00
 47          UI     159     182     516     806    1063    1227    1606    1662    1095     933
 48          UI     843     739     645     568     461     395     366     318     260     205
 49          UI     188     174     137     121     112      78      78      78      65      31
 50          UI      30      31      31      30      31      30      31      30       0       0
 51          UI       0       0       0       0       0       0       0       0       0       0
             *
1                                          HEC-1 INPUT                                          PAGE  2

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

 52          KK      R1
 53          KM    Route runoff from subbasin 1 to concentration point CP2A
 54          RS       3    FLOW      -1
 55          RC    0.06    0.04    0.06   12841  0.0537
 56          RX    1000    1125    1300    1390    1405    1490    1590    1750
 57          RY    1440    1439    1437    1428    1428    1439    1442    1444
             *

 58          KK      2A
 59          KM   Sub-Basin     2A
 60          KM
 61          KM      The Phoenix Mountain S-Graph is used for this basin.
 62          KM          Lag Used =  34.4 minutes
 63          KM
 64          BA   1.186
 65          LG    0.25    0.35    4.51    0.30   20.43
 66          UI     117     214     499     751     930    1296     940     716     619     525
 67          UI     455     360     296     264     213     165     142     128      91      91
 68          UI      59      57      58      32      22      23      22      22      23      22
 69          UI      23       0       0       0       0       0       0       0       0       0
 70          UI       0       0       0       0       0       0       0       0       0       0
             *

 71          KK    CP2A
 72          KM    Combine routed hydrograph from subbasin 1 with runoff from subbasin 2A
 73          HC       2
             *

 74          KK     WFW
 75          KM    Divert 100-year runoff to McMicken Dam.  Frequent flows will continue
 76          KM    downstream through culverts in the embankment
 77          DT  MCMICK
 78          DI       0     112     242     811    1689    1907    2017    2126    2235    3540
 79          DQ       0       0     124     683    1552    1769    1877    1986    2094    3390
             *

 80          KK     R2A
 81          KM    Route runoff from concentration point CP2A to CP2
 82          KM    Normal Depth channel route - geometry taken from 2' CI mapping
 83          RS       5    FLOW      -1
 84          RC    0.06    0.04    0.06    6177  0.0186
 85          RX    1000    1033    1057    1216    1229    1254    1352    1373
 86          RY     106     104     102   100.1   100.0     102     104   104.5
             *

 87          KK       2
 88          KM   Sub-Basin      2
 89          KM
 90          KM      The Phoenix Mountain S-Graph is used for this basin.
 91          KM          Lag Used =  28.0 minutes
 92          KM
 93          BA   0.839
 94          LG    0.25    0.35    4.58    0.29   16.10
 95          UI     101     261     556     751    1095     751     572     492     397     307
1                                          HEC-1 INPUT                                          PAGE  3

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

 96          UI     247     210     150     124     105      77      65      49      49      24
 97          UI      20      19      20      19      19       0       0       0       0       0
 98          UI       0       0       0       0       0       0       0       0       0       0
             *

 99          KK     CP2
100          KM    Combine routed hydrograph from CP2A with runoff from subbasin 2
101          HC       2
```

```
                *

102             KK    RCP2
103             KM        ROUTE COMBINED HYDROGRAPHS AT CP2 TO CP3.
104             RS       2              -1       0
105             RC     .06     .035     .06    4500   .0111
106             RX    1000     1100    1350    1705    1735    1780    1850    2000
107             RY    1304     1302    1302    1298    1298    1303    1302    1305
                *

108             KK       3
109             KM   Sub-Basin      3
110             KM
111             KM      The Desert/Rangeland S-Graph is used for this basin.
112             KM          Lag Used =  22.4 minutes
113             KM
114             BA   0.875
115             LG    0.15    0.35    4.39    0.32    0.00
116             UI    134.    529.    972.   1245.   1215.    885.    598.    402.    267.    179.
117             UI    119.     92.     34.     33.     33.     33.      0.      0.      0.      0.
118             UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
                *

119             KK     CP3
120             KM    Combine routed hydrograph from CP2 with runoff from subbasin 3
121             HC       2
                *

122             KK      D3
123             KM    Divert runoff overtopping the Beardsley Canal at Olive Avenue.
124             KM    Rating curve provided by FCDMC based on a HEC-RAS model developed for the
125             KM    improved culvert crossing at Olive Avenue
126             DT   DI189
127             DI       0    1432    2823    3000    4000
128             DQ       0       0     622     728    1728
                *

129             KK    RCP3
130             KM        ROUTE FLOW FROM CP3 TO CP10.
131             RS       2              -1       0
132             RC     .05     .03     .05    5280   .0083
133             RX    1010    1015    1020    1050    1100    1275    1580    1750
134             RY    1251    1249    1249    1245    1245    1250    1250    1254
                *
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LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

135             KK       4
136             KM        RUNOFF HYDROGRAPH FORM SUB-BASIN 4.
137             BA     .30
                *    LG    0.35    0.15    8.01   0.081  18.504
138             LG     .20     .35    4.35     .44    9.00
139             UI     47.    191.    286.    443.    513.    346.    237.    115.     67.     36.
140             UI     14.     14.      0.      0.      0.      0.      0.      0.      0.      0.
141             UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
                *

142             KK       5
143             KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 5.
144             BA     .72
                *    LG    0.35    0.15   8.023   0.081  17.926
145             LG     .20     .35    4.30     .45    9.00
146             UI    109.    433.    653.    981.   1241.    852.    594.    323.    177.    104.
147             UI     33.     33.     33.      0.      0.      0.      0.      0.      0.      0.
148             UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

149             KK     CP5
150             KM        ADD HYDROGRAPHS AT CP5.
151             HC       2    1.02

152             KK    RCP5
153             KM        ROUTE COMBINED HYDROGRAPHS AT CP5 TO CP6.
154             RS       1              -1       0
155             RC     .08     .05     .08    2400   .0833
156             RX     955     970     985    1000    1020    1035    1050    1065
157             RY    2815    2810    2805    2800    2800    2805    2810    2815
                *

158             KK       6
```

```
159          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 6.
160          BA     .45
             *     LG    0.35    0.15   7.976   0.082      20
161          LG     .20     .35    3.95     .53   10.00
162          UI    206.    627.   1145.    834.    421.    154.     53.     33.      0.      0.
163          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

164          KK     CP6
165          KM        ADD HYDROGRAPHS AT CP6.
166          HC       2    1.47

167          KK    RCP6
168          KM        ROUTE COMBINED HYDROGRAPHS AT CP6 TO CP7.
169          RS       1              -1       0
170          RC     .08     .05     .08    2400   .0833
171          RX     955     970     985    1000    1020    1035    1050    1065
172          RY    2815    2810    2805    2800    2800    2805    2810    2815
             *
1                                          HEC-1 INPUT                                          PAGE  5

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


173          KK       7
174          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 7.
175          BA     .31
             *     LG    0.35    0.15   7.976   0.082      20
176          LG     .20     .35    3.95     .53   10.00
177          UI    124.    383.    708.    610.    347.    132.     54.     21.      0.      0.
178          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

179          KK     CP7
180          KM        ADD HYDROGRAPHS AT CP7.
181          HC       2    1.78

182          KK    RCP7
183          KM        ROUTE COMBINED HYDROGRAPHS AT CP7 TO CP9.
184          RS       3              -1       0
185          RC     .08     .05     .08   10200  .07745
186          RX    1000    1045    1120    1195    1230    1300    1350    1450
187          RY    1910    1880    1850    1838    1838    1850    1880    1910
             *

188          KK       9
189          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 9.
190          BA    1.40
             *     LG    0.35    0.15   7.909   0.084  19.572
191          LG     .20     .35    4.00     .52   10.00
192          UI    155.    380.    725.    933.   1213.   1828.   1593.   1225.    939.    707.
193          UI    389.    261.    178.    116.     47.     47.     47.     47.      0.      0.
194          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

195          KK   I1CP9
196          KM        ADD HYDROGRAPHS AT CP9.
197          HC       2    3.18
             *

198          KK       8
199          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 8.
200          BA     .81
             *     LG    0.35    0.15   7.976   0.082      20
201          LG     .20     .35    3.95     .53   10.00
202          UI    103.    314.    536.    704.   1058.   1138.    821.    608.    420.    207.
203          UI    147.     95.     31.     31.     31.      0.      0.      0.      0.      0.
204          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

205          KK     CP9
206          KM        ADD HYDROGRAPHS AT CP9.
207          HC       2    3.99

208          KK    RCP9
209          KM        ROUTE COMBINED HYDROGRAPHS AT CP9 TO CP10.
210          RS       8              -1       0
211          RC     .06    .035     .06   19200   .0232
212          RX    1000    1085    1310    1395    1415    1450    1630    1665
213          RY    1317    1314    1311    1308    1308    1314    1314    1317
             *
1                                          HEC-1 INPUT                                          PAGE  6

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

```
214          KK      10
215          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 10.
216          BA    2.02
             *     LG   0.347   0.248   5.124   0.254    4.52
217          LG     .16     .35    4.55     .36    4.00
218          UI    119.    119.    219.    428.    547.    632.    709.    813.    930.   1153.
219          UI   1500.   1391.   1155.   1006.    893.    765.    668.    577.    473.    323.
220          UI    210.    201.    191.    119.    119.     84.     36.     36.     36.     36.
221          UI     36.     36.     36.     36.      0.      0.      0.      0.      0.      0.
222          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

223          KK  I1CP10
224          KM        ADD HYDROGRAPHS AT I1CP10
225          HC       2    6.01

226          KK    CP10
227          KM        ADD HYDROGRAPHS AT CP10
228          HC       2
             *
229          ZZ
1****************************************                                    ****************************************
*                                      *                                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *   U.S. ARMY CORPS OF ENGINEERS       *
*              JUN   1998              *                                    *   HYDROLOGIC ENGINEERING CENTER      *
*            VERSION 4.1               *                                    *         609 SECOND STREET            *
*                                      *                                    *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE   02OCT03  TIME  08:23:49  *                                    *          (916) 756-1104              *
*                                      *                                    *                                      *
****************************************                                    ****************************************
```

Waterfall Wash Diversion
Part of the McMicken Dam FRZR, FCD 2002C011
For Flood Control District of Maricopa County
By Stantec Consulting Inc

File: PR100-6.ih1
Date: 2 October 2003

Waterfall Wash is immediately adjacent to the southern watershed limits of the McMicken Dam watershed. Runoff from Waterfall Wash overtops the Beardsley canal, located just downstream of the dam. It is proposed that the 100-year runoff be diverted into the McMicken Dam impoundment area with excess runoff continuing downstream, bypassing the diversion structure.

Model Input Parameters
Rainfall: 100-year, 6-hour design rainfall
Rainfall Losses: Green & Ampt
Unit Hydrograph: Phoenix Mountain and Desert/Rangeland S-Graph

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

   IT          HYDROGRAPH TIME DATA
                      NMIN          5  MINUTES IN COMPUTATION INTERVAL
                     IDATE     1    0  STARTING DATE
                     ITIME        0000  STARTING TIME
                        NQ         800  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE     3    0  ENDING DATE
                    NDTIME        1835  ENDING TIME
                     ICENT          19  CENTURY MARK

                COMPUTATION INTERVAL     .08 HOURS
                     TOTAL TIME BASE   66.58 HOURS

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

23 JD          INDEX STORM NO. 1
                      STRM       3.34  PRECIPITATION DEPTH
```

```
                    TRDA          .01  TRANSPOSITION DRAINAGE AREA

24 PI            PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                    .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                    .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00

27 JD          INDEX STORM NO. 2
                    STRM         3.32  PRECIPITATION DEPTH
                    TRDA          .50  TRANSPOSITION DRAINAGE AREA

28 PI            PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                    .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                    .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00

31 JD          INDEX STORM NO. 3
                    STRM         3.26  PRECIPITATION DEPTH
                    TRDA         2.80  TRANSPOSITION DRAINAGE AREA

32 PI            PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                    .03       .03       .07       .07       .07       .08       .08       .08       .05       .05
                    .05       .02       .02       .02       .01       .01       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00

35 JD          INDEX STORM NO. 4
                    STRM         3.08  PRECIPITATION DEPTH
                    TRDA        16.00  TRANSPOSITION DRAINAGE AREA

36 PI            PRECIPITATION PATTERN
                    .01       .01       .00       .00       .00       .00       .00       .00       .00       .01
                    .01       .01       .00       .01       .00       .00       .00       .00       .00       .00
                    .00       .00       .01       .00       .00       .00       .00       .01       .01       .01
                    .01       .01       .01       .01       .01       .01       .02       .02       .02       .03
                    .03       .03       .06       .06       .06       .07       .07       .07       .04       .04
                    .04       .02       .02       .02       .01       .01       .01       .01       .01       .01
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00
1
                                                  RUNOFF SUMMARY
                                          FLOW IN CUBIC FEET PER SECOND
                                        TIME IN HOURS,  AREA IN SQUARE MILES

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

        HYDROGRAPH AT
+                            1       1470.   4.42          273.        69.         25.       1.99

        ROUTED TO
+                           R1       1367.   4.67          272.        69.         25.       1.99

        HYDROGRAPH AT
+                           2A       1414.   4.33          233.        59.         21.       1.19

        2 COMBINED AT
+                         CP2A       2106.   4.58          465.       118.         42.       3.17

        DIVERSION TO
+                        MCMICK      1966.   4.58          377.        94.         34.       3.17

        HYDROGRAPH AT
+                          WFW        140.   4.58           88.        23.          8.       3.17

        ROUTED TO
```

+	R2A	138.	5.00	87.	23.	8.	3.17
+ HYDROGRAPH AT	2	1209.	4.25	164.	41.	15.	.84
+ 2 COMBINED AT	CP2	938.	4.25	227.	59.	21.	4.01
+ ROUTED TO	RCP2	865.	4.50	226.	59.	21.	4.01
+ HYDROGRAPH AT	3	1459.	4.17	145.	36.	13.	.88
+ 2 COMBINED AT	CP3	1578.	4.33	337.	87.	31.	4.89
+ DIVERSION TO	DI189	88.	4.33	4.	1.	0.	4.89
+ HYDROGRAPH AT	D3	1490.	4.33	333.	86.	31.	4.89
+ ROUTED TO	RCP3	1421.	4.50	332.	86.	31.	4.89
+ HYDROGRAPH AT	4	588.	4.25	51.	13.	5.	.30
+ HYDROGRAPH AT	5	1261.	4.25	118.	29.	11.	.72
+ 2 COMBINED AT	CP5	1623.	4.25	160.	40.	14.	1.02
+ ROUTED TO	RCP5	1622.	4.25	160.	40.	14.	1.02
+ HYDROGRAPH AT	6	1123.	4.08	75.	19.	7.	.45
+ 2 COMBINED AT	CP6	2045.	4.17	216.	54.	20.	1.47
+ ROUTED TO	RCP6	1995.	4.17	216.	54.	20.	1.47
+ HYDROGRAPH AT	7	741.	4.08	51.	13.	5.	.31
+ 2 COMBINED AT	CP7	2312.	4.17	253.	63.	23.	1.78
+ ROUTED TO	RCP7	2090.	4.33	253.	63.	23.	1.78
+ HYDROGRAPH AT	9	1632.	4.33	203.	51.	18.	1.40
+ 2 COMBINED AT	I1CP9	2996.	4.33	412.	103.	37.	3.18
+ HYDROGRAPH AT	8	1190.	4.33	126.	32.	11.	.81
+ 2 COMBINED AT	CP9	3604.	4.33	496.	124.	45.	3.99
+ ROUTED TO	RCP9	3267.	4.75	494.	124.	45.	3.99
+ HYDROGRAPH AT	10	1533.	4.75	296.	74.	27.	2.02
+ 2 COMBINED AT	I1CP10	4242.	4.75	712.	179.	65.	6.01
+ 2 COMBINED AT	CP10	4857.	4.75	946.	241.	87.	10.90

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

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1****************************************                    ****************************************
*                                      *                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS       *
*              JUN  1998               *                    *   HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.1                *                    *          609 SECOND STREET           *
*                                      *                    *       DAVIS, CALIFORNIA 95616        *
*  RUN DATE   02OCT03  TIME  08:23:58  *                    *           (916) 756-1104             *
*                                      *                    *                                      *
****************************************                    ****************************************

                                    X     X  XXXXXXX   XXXXX           X
                                    X     X  X        X     X         XX
                                    X     X  X        X                X
                                    XXXXXXX  XXXX     X        XXXXX   X
                                    X     X  X        X                X
                                    X     X  X        X     X          X
                                    X     X  XXXXXXX   XXXXX          XXX

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

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

1                                                HEC-1 INPUT                                                PAGE  1

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

  1           ID   Waterfall Wash Diversion
  2           ID   Part of the McMicken Dam FRZR, FCD 2002C011
  3           ID   For Flood Control District of Maricopa County
  4           ID   By  Stantec Consulting Inc
  5           ID
  6           ID   File:  PR100-24.ih1
  7           ID   Date:  2 October 2003
  8           ID
  9           ID   Waterfall Wash is immediately adjacent to the southern watershed limits of
 10           ID   the McMicken Dam watershed.  Runoff from Waterfall Wash overtops the
 11           ID   Beardsley canal, located just downstream of the dam.  It is proposed that
 12           ID   the 100-year runoff be diverted into the McMicken Dam impoundment area with
 13           ID   excess runoff continuing downstream, bypassing the diversion structure.
 14           ID
 15           ID   Model Input Parameters
 16           ID   Rainfall:  100-year, 24-hour design rainfall
 17           ID   Rainfall Losses:  Green & Ampt
 18           ID   Unit Hydrograph:  Phoenix Mountain and Desert/Rangeland S-Graph
 19           ID
 20           IT       5                    800
 21           IO       5
 22           IN      15
              *
 23           JD    4.15    0.01
 24           PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
 25           PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
 26           PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
 27           PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
 28           PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
 29           PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
 30           PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
 31           PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
 32           PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
 33           PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
 34           JD   4.046    5.00
 35           JD   3.943   10.00
 36           JD   3.735   30.00
              *

 37           KK       1
 38           KM   Sub-Basin      1
 39           KM
 40           KM      The Phoenix Mountain S-Graph is used for this basin.
 41           KM          Lag Used =  42.5 minutes
 42           KM
```

```
 43          BA   1.986
 44          LG    0.20    0.35    4.00    0.52   10.00
 45          UI     159     182     516     806    1063    1227    1606    1662    1095     933
 46          UI     843     739     645     568     461     395     366     318     260     205
 47          UI     188     174     137     121     112      78      78      78      65      31
 48          UI      30      31      31      30      31      30      31      30       0       0
 49          UI       0       0       0       0       0       0       0       0       0       0
             *
1                                          HEC-1 INPUT                                          PAGE  2

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

 50          KK      R1
 51          KM    Route runoff from subbasin 1 to concentration point CP2A
 52          KM    Normal Depth channel route - geometry taken from 2' CI mapping
 53          RS       3    FLOW      -1
 54          RC    0.06    0.04    0.06   12841  0.0537
 55          RX    1000    1125    1300    1390    1405    1490    1590    1750
 56          RY    1440    1439    1437    1428    1428    1439    1442    1444
             *

 57          KK      2A
 58          KM   Sub-Basin     2A
 59          KM
 60          KM      The Phoenix Mountain S-Graph is used for this basin.
 61          KM          Lag Used =  34.4 minutes
 62          KM
 63          BA   1.186
 64          LG    0.25    0.35    4.51    0.30   20.43
 65          UI     117     214     499     751     930    1296     940     716     619     525
 66          UI     455     360     296     264     213     165     142     128      91      91
 67          UI      59      57      58      32      22      23      22      22      23      22
 68          UI      23       0       0       0       0       0       0       0       0       0
 69          UI       0       0       0       0       0       0       0       0       0       0
             *

 70          KK    CP2A
 71          KM    Combine routed hydrograph from subbasin 1 with runoff from subbasin 2A
 72          HC       2
             *

 73          KK     WFW
 74          KM    Divert 100-year runoff to McMicken Dam.  Frequent flows will continue
 75          KM    downstream through culverts in the embankment
 76          DT  MCMICK
 77          DI       0     112     242     811    1689    1907    2017    2126    2235    3540
 78          DQ       0       0     124     683    1552    1769    1877    1986    2094    3390
             *

 79          KK     R2A
 80          KM    Route runoff from concentration point CP2A to CP2
 81          KM    Normal Depth channel route - geometry taken from 2' CI mapping
 82          RS       5    FLOW      -1
 83          RC    0.06    0.04    0.06    6177  0.0186
 84          RX    1000    1033    1057    1216    1229    1254    1352    1373
 85          RY     106     104     102   100.1   100.0     102     104   104.5
             *

 86          KK       2
 87          KM   Sub-Basin      2
 88          KM
 89          KM      The Phoenix Mountain S-Graph is used for this basin.
 90          KM          Lag Used =  28.0 minutes
 91          KM
 92          BA   0.839
 93          LG    0.25    0.35    4.58    0.29   16.10
1                                          HEC-1 INPUT                                          PAGE  3

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

 94          UI     101     261     556     751    1095     751     572     492     397     307
 95          UI     247     210     150     124     105      77      65      49      49      24
 96          UI      20      19      20      19      19       0       0       0       0       0
 97          UI       0       0       0       0       0       0       0       0       0       0
             *

 98          KK     CP2
 99          KM    Combine routed hydrograph from CP2A with runoff from subbasin 2
100          HC       2
             *
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101          KK    RCP2
102          KM        ROUTE COMBINED HYDROGRAPHS AT CP2 TO CP3.
103          RS       2              -1       0
104          RC     .06     .035     .06    4500   .0111
105          RX    1000    1100    1350    1705    1735    1780    1850    2000
106          RY    1304    1302    1302    1298    1298    1303    1302    1305
             *

107          KK       3
108          KM   Sub-Basin      3
109          KM
110          KM      The Desert/Rangeland S-Graph is used for this basin.
111          KM          Lag Used =  22.4 minutes
112          KM
113          BA   0.875
114          LG    0.15    0.35    4.39    0.32    0.00
115          UI    134.    529.    972.   1245.   1215.    885.    598.    402.    267.    179.
116          UI    119.     92.     34.     33.     33.     33.      0.      0.      0.      0.
117          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
             *

118          KK    CP3
119          KM    Combine routed hydrograph from CP2 with runoff from subbasin 3
120          HC       2
             *

121          KK      D3
122          KM    Divert runoff overtopping the Beardsley Canal at Olive Avenue.
123          KM    Rating curve provided by FCDMC based on a HEC-RAS model developed for the
124          KM    improved culvert crossing at Olive Avenue
125          DT   DI189
126          DI       0    1432    2823    3000    4000
127          DQ       0       0     622     728    1728
             *

128          KK    RCP3
129          KM        ROUTE FLOW FROM CP3 TO CP10.
130          RS       2              -1       0
131          RC     .05     .03     .05    5280   .0083
132          RX    1010    1015    1020    1050    1100    1275    1580    1750
133          RY    1251    1249    1249    1245    1245    1250    1250    1254
             *
1                                          HEC-1 INPUT                                          PAGE  4

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

134          KK       4
135          KM        RUNOFF HYDROGRAPH FORM SUB-BASIN 4.
136          BA     .30
             *    LG    0.35    0.15    8.01   0.081  18.504
137          LG     .20     .35    4.35     .44    9.00
138          UI     47.    191.    286.    443.    513.    346.    237.    115.     67.     36.
139          UI     14.     14.      0.      0.      0.      0.      0.      0.      0.      0.
140          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
             *

141          KK       5
142          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 5.
143          BA     .72
             *    LG    0.35    0.15   8.023   0.081  17.926
144          LG     .20     .35    4.30     .45    9.00
145          UI    109.    433.    653.    981.   1241.    852.    594.    323.    177.    104.
146          UI     33.     33.     33.      0.      0.      0.      0.      0.      0.      0.
147          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

148          KK     CP5
149          KM        ADD HYDROGRAPHS AT CP5.
150          HC       2    1.02

151          KK    RCP5
152          KM        ROUTE COMBINED HYDROGRAPHS AT CP5 TO CP6.
153          RS       1              -1       0
154          RC     .08     .05     .08    2400   .0833
155          RX     955     970     985    1000    1020    1035    1050    1065
156          RY    2815    2810    2805    2800    2800    2805    2810    2815
             *

157          KK       6
158          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 6.
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```
159          BA     .45
             *     LG    0.35    0.15   7.976   0.082      20
160          LG     .20     .35    3.95     .53   10.00
161          UI    206.    627.   1145.    834.    421.    154.     53.     33.      0.      0.
162          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

163          KK     CP6
164          KM        ADD HYDROGRAPHS AT CP6.
165          HC       2    1.47

166          KK    RCP6
167          KM        ROUTE COMBINED HYDROGRAPHS AT CP6 TO CP7.
168          RS       1              -1       0
169          RC     .08     .05     .08    2400   .0833
170          RX     955     970     985    1000    1020    1035    1050    1065
171          RY    2815    2810    2805    2800    2800    2805    2810    2815
             *
1                                          HEC-1 INPUT                                          PAGE  5

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


172          KK       7
173          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 7.
174          BA     .31
             *     LG    0.35    0.15   7.976   0.082      20
175          LG     .20     .35    3.95     .53   10.00
176          UI    124.    383.    708.    610.    347.    132.     54.     21.      0.      0.
177          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

178          KK     CP7
179          KM        ADD HYDROGRAPHS AT CP7.
180          HC       2    1.78

181          KK    RCP7
182          KM        ROUTE COMBINED HYDROGRAPHS AT CP7 TO CP9.
183          RS       3              -1       0
184          RC     .08     .05     .08   10200  .07745
185          RX    1000    1045    1120    1195    1230    1300    1350    1450
186          RY    1910    1880    1850    1838    1838    1850    1880    1910
             *

187          KK       9
188          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 9.
189          BA    1.40
             *     LG    0.35    0.15   7.909   0.084  19.572
190          LG     .20     .35    4.00     .52   10.00
191          UI    155.    380.    725.    933.   1213.   1828.   1593.   1225.    939.    707.
192          UI    389.    261.    178.    116.     47.     47.     47.     47.      0.      0.
193          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

194          KK   I1CP9
195          KM        ADD HYDROGRAPHS AT CP9.
196          HC       2    3.18
             *

197          KK       8
198          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 8.
199          BA     .81
             *     LG    0.35    0.15   7.976   0.082      20
200          LG     .20     .35    3.95     .53   10.00
201          UI    103.    314.    536.    704.   1058.   1138.    821.    608.    420.    207.
202          UI    147.     95.     31.     31.     31.      0.      0.      0.      0.      0.
203          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

204          KK     CP9
205          KM        ADD HYDROGRAPHS AT CP9.
206          HC       2    3.99

207          KK    RCP9
208          KM        ROUTE COMBINED HYDROGRAPHS AT CP9 TO CP10.
209          RS       8              -1       0
210          RC     .06    .035     .06   19200   .0232
211          RX    1000    1085    1310    1395    1415    1450    1630    1665
212          RY    1317    1314    1311    1308    1308    1314    1314    1317
             *
1                                          HEC-1 INPUT                                          PAGE  6

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
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```
213          KK      10
214          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 10.
215          BA    2.02
             *     LG   0.347   0.248   5.124   0.254    4.52
216          LG     .16     .35    4.55     .36    4.00
217          UI    119.    119.    219.    428.    547.    632.    709.    813.    930.   1153.
218          UI   1500.   1391.   1155.   1006.    893.    765.    668.    577.    473.    323.
219          UI    210.    201.    191.    119.    119.     84.     36.     36.     36.     36.
220          UI     36.     36.     36.     36.      0.      0.      0.      0.      0.      0.
221          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

222          KK  I1CP10
223          KM        ADD HYDROGRAPHS AT I1CP10
224          HC       2    6.01

225          KK    CP10
226          KM        ADD HYDROGRAPHS AT CP10
227          HC       2
             *
228          ZZ
1****************************************                                    ****************************************
*                                      *                                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *    U.S. ARMY CORPS OF ENGINEERS      *
*              JUN  1998               *                                    *    HYDROLOGIC ENGINEERING CENTER     *
*            VERSION 4.1               *                                    *          609 SECOND STREET           *
*                                      *                                    *       DAVIS, CALIFORNIA 95616        *
*  RUN DATE   02OCT03  TIME  08:23:58  *                                    *           (916) 756-1104             *
*                                      *                                    *                                      *
****************************************                                    ****************************************
```

Waterfall Wash Diversion
Part of the McMicken Dam FRZR, FCD 2002C011
For Flood Control District of Maricopa County
By Stantec Consulting Inc

File: PR100-24.ih1
Date: 2 October 2003

Waterfall Wash is immediately adjacent to the southern watershed limits of the McMicken Dam watershed. Runoff from Waterfall Wash overtops the Beardsley canal, located just downstream of the dam. It is proposed that the 100-year runoff be diverted into the McMicken Dam impoundment area with excess runoff continuing downstream, bypassing the diversion structure.

Model Input Parameters
Rainfall: 100-year, 24-hour design rainfall
Rainfall Losses: Green & Ampt
Unit Hydrograph: Phoenix Mountain and Desert/Rangeland S-Graph

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

    IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1   0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      3   0  ENDING DATE
                     NDTIME       1835  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   66.58 HOURS

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

 23 JD          INDEX STORM NO. 1
                       STRM       4.15  PRECIPITATION DEPTH
                       TRDA        .01  TRANSPOSITION DRAINAGE AREA
```

```
24 PI          PRECIPITATION PATTERN
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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                  .01       .01       .01       .01       .01       .01       .01       .01       .03       .03
                  .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
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                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00

34 JD          INDEX STORM NO. 2
                  STRM        4.05  PRECIPITATION DEPTH
                  TRDA        5.00  TRANSPOSITION DRAINAGE AREA

 0 PI          PRECIPITATION PATTERN
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .01       .00       .01
                  .01       .01       .01       .01       .01       .01       .01       .01       .03       .03
                  .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
                  .01       .01       .01       .01       .01       .01       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00

35 JD          INDEX STORM NO. 3
                  STRM        3.94  PRECIPITATION DEPTH
                  TRDA       10.00  TRANSPOSITION DRAINAGE AREA

 0 PI          PRECIPITATION PATTERN
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                  .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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36 JD        INDEX STORM NO. 4
                STRM        3.73  PRECIPITATION DEPTH
                TRDA       30.00  TRANSPOSITION DRAINAGE AREA

 0 PI          PRECIPITATION PATTERN
                .00  .00  .00  .00  .00  .00  .00  .00  .00  .00
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                .01  .01  .01  .01  .01  .01  .01  .01  .03  .03
                .03  .09  .09  .09  .01  .01  .01  .01  .01  .01
                .01  .01  .01  .01  .01  .01  .00  .00  .00  .00
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                .00  .00  .00  .00  .00  .00  .00  .00  .00  .00
1
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RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	1	1505.	12.42	250.	69.	25.	1.99		
+	ROUTED TO	R1	1344.	12.67	250.	69.	25.	1.99		
+	HYDROGRAPH AT	2A	1245.	12.33	196.	57.	20.	1.19		
+	2 COMBINED AT	CP2A	2091.	12.58	444.	125.	45.	3.17		
+	DIVERSION TO	MCMICK	1951.	12.58	351.	88.	32.	3.17		
+	HYDROGRAPH AT	WFW	140.	12.58	93.	37.	13.	3.17		

+	ROUTED TO	R2A	138.	13.00	92.	37.	13.	3.17
+	HYDROGRAPH AT	2	1000.	12.25	133.	38.	14.	.84
+	2 COMBINED AT	CP2	1101.	12.25	224.	74.	27.	4.01
+	ROUTED TO	RCP2	926.	12.42	223.	74.	27.	4.01
+	HYDROGRAPH AT	3	1235.	12.17	112.	28.	10.	.88
+	2 COMBINED AT	CP3	1826.	12.25	334.	102.	37.	4.89
+	DIVERSION TO	DI189	176.	12.25	7.	2.	1.	4.89
+	HYDROGRAPH AT	D3	1650.	12.25	327.	100.	36.	4.89
+	ROUTED TO	RCP3	1520.	12.50	327.	100.	36.	4.89
+	HYDROGRAPH AT	4	427.	12.25	39.	11.	4.	.30
+	HYDROGRAPH AT	5	1005.	12.25	93.	25.	9.	.72
+	2 COMBINED AT	CP5	1427.	12.25	132.	36.	13.	1.02
+	ROUTED TO	RCP5	1428.	12.25	132.	36.	13.	1.02
+	HYDROGRAPH AT	6	808.	12.08	57.	16.	6.	.45
+	2 COMBINED AT	CP6	2024.	12.17	188.	51.	19.	1.47
+	ROUTED TO	RCP6	1955.	12.17	188.	51.	19.	1.47
+	HYDROGRAPH AT	7	535.	12.08	39.	11.	4.	.31
+	2 COMBINED AT	CP7	2457.	12.17	227.	62.	22.	1.78
+	ROUTED TO	RCP7	2140.	12.33	227.	62.	22.	1.78
+	HYDROGRAPH AT	9	1537.	12.33	177.	49.	18.	1.40
+	2 COMBINED AT	I1CP9	3661.	12.33	402.	110.	40.	3.18
+	HYDROGRAPH AT	8	969.	12.33	102.	28.	10.	.81
+	2 COMBINED AT	CP9	4615.	12.33	502.	138.	50.	3.99
+	ROUTED TO	RCP9	3905.	12.75	502.	138.	50.	3.99
+	HYDROGRAPH AT	10	1481.	12.75	259.	67.	24.	2.02
+	2 COMBINED AT	I1CP10	5316.	12.75	750.	202.	73.	6.01
+	2 COMBINED AT	CP10	6253.	12.75	1038.	292.	105.	10.90

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

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1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN   1998              *
*            VERSION 4.1               *
*                                      *
*  RUN DATE   02OCT03  TIME  08:24:05  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X       X     X        XX
X     X  X       X                X
XXXXXXX  XXXX    X        XXXXX   X
X     X  X       X                X
X     X  X       X     X          X
X     X  XXXXXXX   XXXXX         XXX
```

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

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

1 HEC-1 INPUT PAGE 1

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

  1           ID   Waterfall Wash Diversion
  2           ID   Part of the McMicken Dam FRZR, FCD 2002C011
  3           ID   For Flood Control District of Maricopa County
  4           ID   By  Stantec Consulting Inc
  5           ID
  6           ID   File:  PR10-6.ih1
  7           ID   Date:  2 October 2003
  8           ID
  9           ID   Waterfall Wash is immediately adjacent to the southern watershed limits of
 10           ID   the McMicken Dam watershed.  Runoff from Waterfall Wash overtops the
 11           ID   Beardsley canal, located just downstream of the dam.  It is proposed that
 12           ID   the 100-year runoff be diverted into the McMicken Dam impoundment area with
 13           ID   excess runoff continuing downstream, bypassing the diversion structure.
 14           ID
 15           ID   Model Input Parameters
 16           ID   Rainfall:  10-year, 6-hour design rainfall
 17           ID   Rainfall Losses:  Green & Ampt
 18           ID   Unit Hydrograph:  Phoenix Mountain and Desert/Rangeland S-Graph
 19           ID
 20           IT       5                    800
 21           IO       5
 22           IN      15
              *
 23           JD    2.17    0.01
 24           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
 25           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
 26           PC   0.962   0.972   0.983   0.991   1.000
 27           JD    2.16    0.50
 28           JD    2.12    2.80
 29           PC   0.000   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.067   0.076
 30           PC   0.087   0.100   0.120   0.163   0.252   0.451   0.694   0.837   0.900   0.938
 31           PC   0.950   0.963   0.975   0.988   1.000
 32           JD    2.00    16.0
 33           PC   0.000   0.015   0.020   0.030   0.048   0.063   0.076   0.090   0.105   0.119
 34           PC   0.135   0.152   0.175   0.222   0.304   0.472   0.670   0.796   0.868   0.912
 35           PC   0.946   0.960   0.973   0.987   1.000
              *

 36           KK       1
 37           KM   Sub-Basin      1
 38           KM
 39           KM      The Phoenix Mountain S-Graph is used for this basin.
 40           KM          Lag Used =  42.5 minutes
 41           KM
 42           BA   1.986
```

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 43          LG    0.20    0.35    4.00    0.52   10.00
 44          UI     159     182     516     806    1063    1227    1606    1662    1095     933
 45          UI     843     739     645     568     461     395     366     318     260     205
 46          UI     188     174     137     121     112      78      78      78      65      31
 47          UI      30      31      31      30      31      30      31      30       0       0
 48          UI       0       0       0       0       0       0       0       0       0       0
             *
```



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

 49          KK      R1
 50          KM    Route runoff from subbasin 1 to concentration point CP2A
 51          RS       3    FLOW      -1
 52          RC    0.06    0.04    0.06   12841  0.0537
 53          RX    1000    1125    1300    1390    1405    1490    1590    1750
 54          RY    1440    1439    1437    1428    1428    1439    1442    1444
             *

 55          KK      2A
 56          KM   Sub-Basin     2A
 57          KM
 58          KM      The Phoenix Mountain S-Graph is used for this basin.
 59          KM          Lag Used =  34.4 minutes
 60          KM
 61          BA   1.186
 62          LG    0.25    0.35    4.51    0.30   20.43
 63          UI     117     214     499     751     930    1296     940     716     619     525
 64          UI     455     360     296     264     213     165     142     128      91      91
 65          UI      59      57      58      32      22      23      22      22      23      22
 66          UI      23       0       0       0       0       0       0       0       0       0
 67          UI       0       0       0       0       0       0       0       0       0       0
             *

 68          KK    CP2A
 69          KM    Combine routed hydrograph from subbasin 1 with runoff from subbasin 2A
 70          HC       2
             *

 71          KK     WFW
 72          KM    Divert 100-year runoff to McMicken Dam.  Frequent flows will continue
 73          KM    downstream through culverts in the embankment
 74          DT  MCMICK
 75          DI       0     112     242     811    1689    1907    2017    2126    2235    3540
 76          DQ       0       0     124     683    1552    1769    1877    1986    2094    3390
             *
 77          ZZ
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1*************************************                    *************************************
*                                   *                    *                                   *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                 *   U.S. ARMY CORPS OF ENGINEERS    *
*              JUN   1998           *                    *   HYDROLOGIC ENGINEERING CENTER   *
*           VERSION 4.1             *                    *         609 SECOND STREET         *
*                                   *                    *      DAVIS, CALIFORNIA 95616      *
* RUN DATE  02OCT03  TIME  08:24:05 *                    *          (916) 756-1104           *
*                                   *                    *                                   *
*************************************                    *************************************
```

Waterfall Wash Diversion
Part of the McMicken Dam FRZR, FCD 2002C011
For Flood Control District of Maricopa County
By Stantec Consulting Inc

File: PR10-6.ih1
Date: 2 October 2003

Waterfall Wash is immediately adjacent to the southern watershed limits of the McMicken Dam watershed. Runoff from Waterfall Wash overtops the Beardsley canal, located just downstream of the dam. It is proposed that the 100-year runoff be diverted into the McMicken Dam impoundment area with excess runoff continuing downstream, bypassing the diversion structure.

Model Input Parameters
Rainfall: 10-year, 6-hour design rainfall
Rainfall Losses: Green & Ampt
Unit Hydrograph: Phoenix Mountain and Desert/Rangeland S-Graph

```
21 IO          OUTPUT CONTROL VARIABLES
```

```
                IPRNT          5  PRINT CONTROL
                IPLOT          0  PLOT CONTROL
                QSCAL         0.  HYDROGRAPH PLOT SCALE

IT          HYDROGRAPH TIME DATA
                 NMIN          5  MINUTES IN COMPUTATION INTERVAL
                IDATE      1   0  STARTING DATE
                ITIME       0000  STARTING TIME
                   NQ        800  NUMBER OF HYDROGRAPH ORDINATES
              NDDATE      3   0  ENDING DATE
              NDTIME       1835  ENDING TIME
               ICENT         19  CENTURY MARK

          COMPUTATION INTERVAL     .08 HOURS
               TOTAL TIME BASE   66.58 HOURS

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

23 JD       INDEX STORM NO. 1
                 STRM       2.17  PRECIPITATION DEPTH
                 TRDA        .01  TRANSPOSITION DRAINAGE AREA

24 PI         PRECIPITATION PATTERN
              .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
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              .03    .03    .05    .05    .05    .15    .15    .15    .03    .03
              .03    .01    .01    .01    .01    .01    .01    .00    .00    .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
              .00    .00

27 JD       INDEX STORM NO. 2
                 STRM       2.16  PRECIPITATION DEPTH
                 TRDA        .50  TRANSPOSITION DRAINAGE AREA

 0 PI         PRECIPITATION PATTERN
              .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
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              .03    .03    .05    .05    .05    .15    .15    .15    .03    .03
              .03    .01    .01    .01    .01    .01    .01    .00    .00    .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
              .00    .00

28 JD       INDEX STORM NO. 3
                 STRM       2.12  PRECIPITATION DEPTH
                 TRDA       2.80  TRANSPOSITION DRAINAGE AREA

29 PI         PRECIPITATION PATTERN
              .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
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              .00    .00    .00    .01    .01    .01    .01    .01    .01    .03
              .03    .03    .07    .07    .07    .08    .08    .08    .05    .05
              .05    .02    .02    .02    .01    .01    .01    .00    .00    .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
              .00    .00

32 JD       INDEX STORM NO. 4
                 STRM       2.00  PRECIPITATION DEPTH
                 TRDA      16.00  TRANSPOSITION DRAINAGE AREA

33 PI         PRECIPITATION PATTERN
              .01    .01    .00    .00    .00    .00    .00    .00    .00    .01
              .01    .01    .00    .01    .00    .00    .00    .00    .00    .00
              .00    .00    .01    .00    .00    .00    .00    .01    .01    .01
              .01    .01    .01    .01    .01    .01    .02    .02    .02    .03
              .03    .03    .06    .06    .06    .07    .07    .07    .04    .04
              .04    .02    .02    .02    .01    .01    .01    .01    .01    .01
              .00    .00    .00    .00    .00    .00    .00    .00    .00    .00
              .00    .00
1
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RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	1	554.	4.42	102.	26.	9.	1.99		
+	ROUTED TO	R1	474.	4.75	101.	26.	9.	1.99		
+	HYDROGRAPH AT	2A	725.	4.33	117.	29.	11.	1.19		
+	2 COMBINED AT	CP2A	737.	4.58	183.	46.	17.	3.17		
+	DIVERSION TO	MCMICK	611.	4.58	112.	28.	10.	3.17		
+	HYDROGRAPH AT	WFW	127.	4.58	71.	18.	7.	3.17		

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

```
1****************************************                    ****************************************
*                                      *                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS       *
*              JUN   1998              *                    *   HYDROLOGIC ENGINEERING CENTER      *
*            VERSION 4.1               *                    *         609 SECOND STREET            *
*                                      *                    *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE   02OCT03  TIME  08:24:15  *                    *          (916) 756-1104              *
*                                      *                    *                                      *
****************************************                    ****************************************

X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX        XXX

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

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

1                                          HEC-1 INPUT                                                    PAGE  1

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

  1           ID   Waterfall Wash Diversion
  2           ID   Part of the McMicken Dam FRZR, FCD 2002C011
  3           ID   For Flood Control District of Maricopa County
  4           ID   By  Stantec Consulting Inc
  5           ID
  6           ID   File:  PR10-24.ih1
  7           ID   Date:  2 October 2003
  8           ID
  9           ID   Waterfall Wash is immediately adjacent to the southern watershed limits of
 10           ID   the McMicken Dam watershed.  Runoff from Waterfall Wash overtops the
 11           ID   Beardsley canal, located just downstream of the dam.  It is proposed that
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 13           ID   excess runoff continuing downstream, bypassing the diversion structure.
 14           ID
 15           ID   Model Input Parameters
 16           ID   Rainfall:  10-year, 24-hour design rainfall
 17           ID   Rainfall Losses:  Green & Ampt
 18           ID   Unit Hydrograph:  Phoenix Mountain and Desert/Rangeland S-Graph
 19           ID
 20           IT       5                    800
 21           IO       5
 22           IN      15
              *
 23           JD    2.63    0.01
 24           PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
 25           PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
 26           PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
 27           PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
 28           PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
 29           PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
 30           PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
 31           PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
 32           PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
 33           PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
 34           JD   2.564    5.00
 35           JD   2.499   10.000
 36           JD   2.367   30.000
              *

 37           KK       1
 38           KM   Sub-Basin      1
 39           KM
 40           KM      The Phoenix Mountain S-Graph is used for this basin.
 41           KM          Lag Used =  42.5 minutes
 42           KM
```

```
          43          BA   1.986
          44          LG    0.20    0.35    4.00    0.52   10.00
          45          UI     159     182     516     806    1063    1227    1606    1662    1095     933
          46          UI     843     739     645     568     461     395     366     318     260     205
          47          UI     188     174     137     121     112      78      78      78      65      31
          48          UI      30      31      31      30      31      30      31      30       0       0
          49          UI       0       0       0       0       0       0       0       0       0       0
                      *
1                                                HEC-1 INPUT                                                PAGE  2

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


          50          KK      R1
          51          KM    Route runoff from subbasin 1 to concentration point CP2A
          52          KM    Normal Depth channel route - geometry taken from 2' CI mapping
          53          RS       4    FLOW      -1
          54          RC    0.06    0.04    0.06   12841  0.0537
          55          RX    1000    1125    1300    1390    1405    1490    1590    1750
          56          RY    1440    1439    1437    1428    1428    1439    1442    1444
                      *

          57          KK      2A
          58          KM   Sub-Basin     2A
          59          KM
          60          KM      The Phoenix Mountain S-Graph is used for this basin.
          61          KM          Lag Used =  34.4 minutes
          62          KM
          63          BA   1.186
          64          LG    0.25    0.35    4.51    0.30   20.43
          65          UI     117     214     499     751     930    1296     940     716     619     525
          66          UI     455     360     296     264     213     165     142     128      91      91
          67          UI      59      57      58      32      22      23      22      22      23      22
          68          UI      23       0       0       0       0       0       0       0       0       0
          69          UI       0       0       0       0       0       0       0       0       0       0
                      *

          70          KK    CP2A
          71          KM    Combine routed hydrograph from subbasin 1 with runoff from subbasin 2A
          72          HC       2
                      *

          73          KK     WFW
          74          KM    Divert 100-year runoff to McMicken Dam.  Frequent flows will continue
          75          KM    downstream through culverts in the embankment
          76          DT  MCMICK
          77          DI       0     112     242     811    1689    1907    2017    2126    2235    3540
          78          DQ       0       0     124     683    1552    1769    1877    1986    2094    3390
                      *
          79          ZZ
1*************************************                                  *************************************
 *                                   *                                  *                                   *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                  *   U.S. ARMY CORPS OF ENGINEERS    *
 *             JUN   1998            *                                  *   HYDROLOGIC ENGINEERING CENTER   *
 *           VERSION 4.1             *                                  *         609 SECOND STREET         *
 *                                   *                                  *      DAVIS, CALIFORNIA 95616      *
 *  RUN DATE   02OCT03  TIME  08:24:15  *                                  *         (916) 756-1104            *
 *                                   *                                  *                                   *
 *************************************                                  *************************************
```

Waterfall Wash Diversion
Part of the McMicken Dam FRZR, FCD 2002C011
For Flood Control District of Maricopa County
By Stantec Consulting Inc

File: PR10-24.ih1
Date: 2 October 2003

Waterfall Wash is immediately adjacent to the southern watershed limits of the McMicken Dam watershed. Runoff from Waterfall Wash overtops the Beardsley canal, located just downstream of the dam. It is proposed that the 100-year runoff be diverted into the McMicken Dam impoundment area with excess runoff continuing downstream, bypassing the diversion structure.

Model Input Parameters
Rainfall: 10-year, 24-hour design rainfall
Rainfall Losses: Green & Ampt
Unit Hydrograph: Phoenix Mountain and Desert/Rangeland S-Graph

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

   IT          HYDROGRAPH TIME DATA
                      NMIN           5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1    0  STARTING DATE
                     ITIME        0000  STARTING TIME
                        NQ         800  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      3    0  ENDING DATE
                    NDTIME        1835  ENDING TIME
                     ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL      .08 HOURS
                      TOTAL TIME BASE   66.58 HOURS

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

23 JD          INDEX STORM NO. 1
                      STRM       2.63  PRECIPITATION DEPTH
                      TRDA        .01  TRANSPOSITION DRAINAGE AREA

24 PI            PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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                    .01       .01       .01       .01       .01       .01       .01       .01       .03       .03
                    .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
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                    .00       .00       .00       .00       .00       .00       .00       .00

34 JD          INDEX STORM NO. 2
                      STRM       2.56  PRECIPITATION DEPTH
                      TRDA       5.00  TRANSPOSITION DRAINAGE AREA

 0 PI            PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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                .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
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                .00       .00       .00       .00       .00       .00       .00       .00
35 JD         INDEX STORM NO. 3
                STRM        2.50  PRECIPITATION DEPTH
                TRDA       10.00  TRANSPOSITION DRAINAGE AREA

 0 PI           PRECIPITATION PATTERN
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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                .00       .00       .00       .00       .00       .00       .00       .00
36 JD         INDEX STORM NO. 4
                STRM        2.37  PRECIPITATION DEPTH
                TRDA       30.00  TRANSPOSITION DRAINAGE AREA

 0 PI           PRECIPITATION PATTERN
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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                .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
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.00	.00	.00	.00	.00	.00	.00	.00		

1

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

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	1	673.	12.42	114.	32.	12.	1.99		
+	ROUTED TO	R1	584.	12.75	113.	32.	12.	1.99		
+	HYDROGRAPH AT	2A	631.	12.33	99.	30.	11.	1.19		
+	2 COMBINED AT	CP2A	926.	12.67	211.	62.	22.	3.17		
+	DIVERSION TO	MCMICK	797.	12.67	136.	34.	12.	3.17		
+	HYDROGRAPH AT	WFW	129.	12.67	75.	28.	10.	3.17		

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

APPENDIX E

WATERFALL WASH EXISTING CONDITIONS PMF HEC-1 INPUT AND OUTPUT

```
1****************************************                    ****************************************
*                                      *                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS       *
*              JUN  1998               *                    *   HYDROLOGIC ENGINEERING CENTER      *
*            VERSION 4.1               *                    *         609 SECOND STREET            *
*                                      *                    *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE   02OCT03  TIME  08:24:24  *                    *          (916) 756-1104              *
*                                      *                    *                                      *
****************************************                    ****************************************

                                                  X     X  XXXXXXX   XXXXX           X
                                                  X     X  X        X     X         XX
                                                  X     X  X        X                X
                                                  XXXXXXX  XXXX     X        XXXXX   X
                                                  X     X  X        X                X
                                                  X     X  X        X     X          X
                                                  X     X  XXXXXXX   XXXXX         XXX


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

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

1                                                    HEC-1 INPUT                                                    PAGE  1

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

  1           ID   Waterfall Wash Diversion
  2           ID   Part of the McMicken Dam FRZR, FCD #
  3           ID      For Flood Control District of Maricopa County
  4           ID      By  Stantec Consulting Inc
  5           ID
  6           ID   File:  EXPMP-6.ih1
  7           ID   Date:  2 October 2003
  8           ID
  9           ID   Waterfall Wash is immediately adjacent to the southern watershed limits of
 10           ID   the McMicken Dam watershed.  Runoff from Waterfall Wash overtops the
 11           ID   Beardsley canal, located just downstream of the dam.  It is proposed that
 12           ID   the 100-year runoff be diverted into the McMicken Dam impoundment area with
 13           ID   excess runoff continuing downstream, bypassing the diversion structure.
 14           ID
 15           ID   Model Input Parameters
 16           ID      Rainfall:  Local Storm PMP and HMR-5 distribution
 17           ID      Rainfall Losses:  Initial Loss plus Uniform Loss
 18           ID      Unit Hydrograph:  Phoenix Mountain and Desert/Rangeland S-Graph
 19           ID
 20           IT       5                    800
 21           IO       5
              *

 22           KK       1
 23           KM   Sub-Basin      1
 24           KM
 25           KM      The Phoenix Mountain S-Graph is used for this basin.
 26           KM          Lag Used =  42.5 minutes
 27           KM
 28           BA   1.986
 29           IN      15
 30           PB    12.4
 31           PI   0.010   0.010   0.010   0.010   0.175   0.175   0.175   0.175   5.900   1.800
 32           PI   0.700   0.700   0.375   0.375   0.375   0.375   0.150   0.150   0.150   0.150
 33           PI   0.075   0.075   0.075   0.075
 34           LG    0.20    0.35    4.00    0.52   10.00
 35           UI     159     182     516     806    1063    1227    1606    1662    1095     933
 36           UI     843     739     645     568     461     395     366     318     260     205
 37           UI     188     174     137     121     112      78      78      78      65      31
 38           UI      30      31      31      30      31      30      31      30       0       0
 39           UI       0       0       0       0       0       0       0       0       0       0
              *

 40           KK      R1
 41           KM    Route runoff from subbasin 1 to concentration point CP1
```

```
          42          RS       1    FLOW      -1
          43          RC    0.06    0.04    0.06   12841  0.0537
          44          RX    1000    1125    1300    1390    1405    1490    1590    1750
          45          RY    1440    1439    1437    1428    1428    1439    1442    1444
                      *
1                                                HEC-1 INPUT                                                    PAGE  2

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


          46          KK      2A
          47          KM   Sub-Basin     2A
          48          KM
          49          KM      The Phoenix Mountain S-Graph is used for this basin.
          50          KM          Lag Used =  34.4 minutes
          51          KM
          52          BA   1.186
          53          LG    0.25    0.35    4.51    0.30   20.43
          54          UI     117     214     499     751     930    1296     940     716     619     525
          55          UI     455     360     296     264     213     165     142     128      91      91
          56          UI      59      57      58      32      22      23      22      22      23      22
          57          UI      23       0       0       0       0       0       0       0       0       0
          58          UI       0       0       0       0       0       0       0       0       0       0
                      *

          59          KK    CP2A
          60          KO       1
          61          KM    Combine routed hydrograph from subbasin 1 with runoff from subbasin 2A
          62          HC       2
                      *
          63          ZZ
1*************************************                                    *************************************
*                                   *                                    *                                   *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                 *   U.S. ARMY CORPS OF ENGINEERS    *
*             JUN   1998            *                                    *   HYDROLOGIC ENGINEERING CENTER   *
*           VERSION 4.1             *                                    *         609 SECOND STREET         *
*                                   *                                    *      DAVIS, CALIFORNIA 95616      *
*  RUN DATE   02OCT03  TIME  08:24:24 *                                  *          (916) 756-1104           *
*                                   *                                    *                                   *
*************************************                                    *************************************
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Waterfall Wash Diversion
Part of the McMicken Dam FRZR, FCD #
For Flood Control District of Maricopa County
By Stantec Consulting Inc

File: EXPMP-6.ih1
Date: 2 October 2003

Waterfall Wash is immediately adjacent to the southern watershed limits of the McMicken Dam watershed. Runoff from Waterfall Wash overtops the Beardsley canal, located just downstream of the dam. It is proposed that the 100-year runoff be diverted into the McMicken Dam impoundment area with excess runoff continuing downstream, bypassing the diversion structure.

Model Input Parameters
Rainfall: Local Storm PMP and HMR-5 distribution
Rainfall Losses: Initial Loss plus Uniform Loss
Unit Hydrograph: Phoenix Mountain and Desert/Rangeland S-Graph

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

    IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ        800  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      3    0  ENDING DATE
                     NDTIME       1835  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   66.58 HOURS

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


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


            **************
            *            *
  59 KK     *      CP2A  *
            *            *
            **************

  60 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          1  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE
                           Combine routed hydrograph from subbasin 1 with runoff from subbasin 2A

  62 HC          HYDROGRAPH COMBINATION
                      ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                          ***

*****************************************************************************************************************************************
*
                                                HYDROGRAPH AT STATION     CP2A
                                                   SUM OF  2 HYDROGRAPHS

*****************************************************************************************************************************************
*
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DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW
1		0000	1	0.	*	1		1640	201	0.	*	2		0920	401	0.	*	3		0200	601	0.
1		0005	2	0.	*	1		1645	202	0.	*	2		0925	402	0.	*	3		0205	602	0.
1		0010	3	0.	*	1		1650	203	0.	*	2		0930	403	0.	*	3		0210	603	0.
1		0015	4	1.	*	1		1655	204	0.	*	2		0935	404	0.	*	3		0215	604	0.
1		0020	5	1.	*	1		1700	205	0.	*	2		0940	405	0.	*	3		0220	605	0.
1		0025	6	2.	*	1		1705	206	0.	*	2		0945	406	0.	*	3		0225	606	0.
1		0030	7	3.	*	1		1710	207	0.	*	2		0950	407	0.	*	3		0230	607	0.
1		0035	8	4.	*	1		1715	208	0.	*	2		0955	408	0.	*	3		0235	608	0.
1		0040	9	4.	*	1		1720	209	0.	*	2		1000	409	0.	*	3		0240	609	0.
1		0045	10	5.	*	1		1725	210	0.	*	2		1005	410	0.	*	3		0245	610	0.
1		0050	11	6.	*	1		1730	211	0.	*	2		1010	411	0.	*	3		0250	611	0.
1		0055	12	6.	*	1		1735	212	0.	*	2		1015	412	0.	*	3		0255	612	0.
1		0100	13	7.	*	1		1740	213	0.	*	2		1020	413	0.	*	3		0300	613	0.
1		0105	14	9.	*	1		1745	214	0.	*	2		1025	414	0.	*	3		0305	614	0.
1		0110	15	12.	*	1		1750	215	0.	*	2		1030	415	0.	*	3		0310	615	0.
1		0115	16	18.	*	1		1755	216	0.	*	2		1035	416	0.	*	3		0315	616	0.
1		0120	17	28.	*	1		1800	217	0.	*	2		1040	417	0.	*	3		0320	617	0.
1		0125	18	41.	*	1		1805	218	0.	*	2		1045	418	0.	*	3		0325	618	0.
1		0130	19	58.	*	1		1810	219	0.	*	2		1050	419	0.	*	3		0330	619	0.
1		0135	20	72.	*	1		1815	220	0.	*	2		1055	420	0.	*	3		0335	620	0.
1		0140	21	84.	*	1		1820	221	0.	*	2		1100	421	0.	*	3		0340	621	0.
1		0145	22	95.	*	1		1825	222	0.	*	2		1105	422	0.	*	3		0345	622	0.
1		0150	23	106.	*	1		1830	223	0.	*	2		1110	423	0.	*	3		0350	623	0.
1		0155	24	116.	*	1		1835	224	0.	*	2		1115	424	0.	*	3		0355	624	0.
1		0200	25	125.	*	1		1840	225	0.	*	2		1120	425	0.	*	3		0400	625	0.
1		0205	26	376.	*	1		1845	226	0.	*	2		1125	426	0.	*	3		0405	626	0.
1		0210	27	856.	*	1		1850	227	0.	*	2		1130	427	0.	*	3		0410	627	0.
1		0215	28	2054.	*	1		1855	228	0.	*	2		1135	428	0.	*	3		0415	628	0.
1		0220	29	3865.	*	1		1900	229	0.	*	2		1140	429	0.	*	3		0420	629	0.
1		0225	30	6301.	*	1		1905	230	0.	*	2		1145	430	0.	*	3		0425	630	0.
1		0230	31	9441.	*	1		1910	231	0.	*	2		1150	431	0.	*	3		0430	631	0.
1		0235	32	11808.	*	1		1915	232	0.	*	2		1155	432	0.	*	3		0435	632	0.
1		0240	33	13629.	*	1		1920	233	0.	*	2		1200	433	0.	*	3		0440	633	0.
1		0245	34	14321.	*	1		1925	234	0.	*	2		1205	434	0.	*	3		0445	634	0.
1		0250	35	14475.	*	1		1930	235	0.	*	2		1210	435	0.	*	3		0450	635	0.
1		0255	36	13973.	*	1		1935	236	0.	*	2		1215	436	0.	*	3		0455	636	0.
1		0300	37	12930.	*	1		1940	237	0.	*	2		1220	437	0.	*	3		0500	637	0.

1	0305	38	11925.	*	1	1945	238	0.	*	2	1225	438	0.	*	3	0505	638	0.
1	0310	39	10962.	*	1	1950	239	0.	*	2	1230	439	0.	*	3	0510	639	0.
1	0315	40	10022.	*	1	1955	240	0.	*	2	1235	440	0.	*	3	0515	640	0.
1	0320	41	9092.	*	1	2000	241	0.	*	2	1240	441	0.	*	3	0520	641	0.
1	0325	42	8190.	*	1	2005	242	0.	*	2	1245	442	0.	*	3	0525	642	0.
1	0330	43	7381.	*	1	2010	243	0.	*	2	1250	443	0.	*	3	0530	643	0.
1	0335	44	6681.	*	1	2015	244	0.	*	2	1255	444	0.	*	3	0535	644	0.
1	0340	45	6039.	*	1	2020	245	0.	*	2	1300	445	0.	*	3	0540	645	0.
1	0345	46	5398.	*	1	2025	246	0.	*	2	1305	446	0.	*	3	0545	646	0.
1	0350	47	4894.	*	1	2030	247	0.	*	2	1310	447	0.	*	3	0550	647	0.
1	0355	48	4484.	*	1	2035	248	0.	*	2	1315	448	0.	*	3	0555	648	0.
1	0400	49	4114.	*	1	2040	249	0.	*	2	1320	449	0.	*	3	0600	649	0.
1	0405	50	3766.	*	1	2045	250	0.	*	2	1325	450	0.	*	3	0605	650	0.
1	0410	51	3437.	*	1	2050	251	0.	*	2	1330	451	0.	*	3	0610	651	0.
1	0415	52	3158.	*	1	2055	252	0.	*	2	1335	452	0.	*	3	0615	652	0.
1	0420	53	2908.	*	1	2100	253	0.	*	2	1340	453	0.	*	3	0620	653	0.
1	0425	54	2666.	*	1	2105	254	0.	*	2	1345	454	0.	*	3	0625	654	0.
1	0430	55	2403.	*	1	2110	255	0.	*	2	1350	455	0.	*	3	0630	655	0.
1	0435	56	2161.	*	1	2115	256	0.	*	2	1355	456	0.	*	3	0635	656	0.
1	0440	57	1883.	*	1	2120	257	0.	*	2	1400	457	0.	*	3	0640	657	0.
1	0445	58	1632.	*	1	2125	258	0.	*	2	1405	458	0.	*	3	0645	658	0.
1	0450	59	1421.	*	1	2130	259	0.	*	2	1410	459	0.	*	3	0650	659	0.
1	0455	60	1271.	*	1	2135	260	0.	*	2	1415	460	0.	*	3	0655	660	0.
1	0500	61	1143.	*	1	2140	261	0.	*	2	1420	461	0.	*	3	0700	661	0.
1	0505	62	1032.	*	1	2145	262	0.	*	2	1425	462	0.	*	3	0705	662	0.
1	0510	63	942.	*	1	2150	263	0.	*	2	1430	463	0.	*	3	0710	663	0.
1	0515	64	853.	*	1	2155	264	0.	*	2	1435	464	0.	*	3	0715	664	0.
1	0520	65	759.	*	1	2200	265	0.	*	2	1440	465	0.	*	3	0720	665	0.
1	0525	66	660.	*	1	2205	266	0.	*	2	1445	466	0.	*	3	0725	666	0.
1	0530	67	574.	*	1	2210	267	0.	*	2	1450	467	0.	*	3	0730	667	0.
1	0535	68	503.	*	1	2215	268	0.	*	2	1455	468	0.	*	3	0735	668	0.
1	0540	69	442.	*	1	2220	269	0.	*	2	1500	469	0.	*	3	0740	669	0.
1	0545	70	389.	*	1	2225	270	0.	*	2	1505	470	0.	*	3	0745	670	0.
1	0550	71	344.	*	1	2230	271	0.	*	2	1510	471	0.	*	3	0750	671	0.
1	0555	72	304.	*	1	2235	272	0.	*	2	1515	472	0.	*	3	0755	672	0.
1	0600	73	271.	*	1	2240	273	0.	*	2	1520	473	0.	*	3	0800	673	0.
1	0605	74	242.	*	1	2245	274	0.	*	2	1525	474	0.	*	3	0805	674	0.
1	0610	75	216.	*	1	2250	275	0.	*	2	1530	475	0.	*	3	0810	675	0.
1	0615	76	192.	*	1	2255	276	0.	*	2	1535	476	0.	*	3	0815	676	0.
1	0620	77	171.	*	1	2300	277	0.	*	2	1540	477	0.	*	3	0820	677	0.
1	0625	78	155.	*	1	2305	278	0.	*	2	1545	478	0.	*	3	0825	678	0.
1	0630	79	137.	*	1	2310	279	0.	*	2	1550	479	0.	*	3	0830	679	0.
1	0635	80	121.	*	1	2315	280	0.	*	2	1555	480	0.	*	3	0835	680	0.
1	0640	81	109.	*	1	2320	281	0.	*	2	1600	481	0.	*	3	0840	681	0.
1	0645	82	98.	*	1	2325	282	0.	*	2	1605	482	0.	*	3	0845	682	0.
1	0650	83	87.	*	1	2330	283	0.	*	2	1610	483	0.	*	3	0850	683	0.
1	0655	84	78.	*	1	2335	284	0.	*	2	1615	484	0.	*	3	0855	684	0.
1	0700	85	69.	*	1	2340	285	0.	*	2	1620	485	0.	*	3	0900	685	0.
1	0705	86	61.	*	1	2345	286	0.	*	2	1625	486	0.	*	3	0905	686	0.
1	0710	87	54.	*	1	2350	287	0.	*	2	1630	487	0.	*	3	0910	687	0.
1	0715	88	48.	*	1	2355	288	0.	*	2	1635	488	0.	*	3	0915	688	0.
1	0720	89	42.	*	2	0000	289	0.	*	2	1640	489	0.	*	3	0920	689	0.
1	0725	90	37.	*	2	0005	290	0.	*	2	1645	490	0.	*	3	0925	690	0.
1	0730	91	32.	*	2	0010	291	0.	*	2	1650	491	0.	*	3	0930	691	0.
1	0735	92	28.	*	2	0015	292	0.	*	2	1655	492	0.	*	3	0935	692	0.
1	0740	93	24.	*	2	0020	293	0.	*	2	1700	493	0.	*	3	0940	693	0.
1	0745	94	22.	*	2	0025	294	0.	*	2	1705	494	0.	*	3	0945	694	0.
1	0750	95	19.	*	2	0030	295	0.	*	2	1710	495	0.	*	3	0950	695	0.
1	0755	96	16.	*	2	0035	296	0.	*	2	1715	496	0.	*	3	0955	696	0.
1	0800	97	14.	*	2	0040	297	0.	*	2	1720	497	0.	*	3	1000	697	0.
1	0805	98	13.	*	2	0045	298	0.	*	2	1725	498	0.	*	3	1005	698	0.
1	0810	99	11.	*	2	0050	299	0.	*	2	1730	499	0.	*	3	1010	699	0.
1	0815	100	10.	*	2	0055	300	0.	*	2	1735	500	0.	*	3	1015	700	0.
1	0820	101	8.	*	2	0100	301	0.	*	2	1740	501	0.	*	3	1020	701	0.
1	0825	102	7.	*	2	0105	302	0.	*	2	1745	502	0.	*	3	1025	702	0.
1	0830	103	6.	*	2	0110	303	0.	*	2	1750	503	0.	*	3	1030	703	0.
1	0835	104	5.	*	2	0115	304	0.	*	2	1755	504	0.	*	3	1035	704	0.
1	0840	105	5.	*	2	0120	305	0.	*	2	1800	505	0.	*	3	1040	705	0.
1	0845	106	4.	*	2	0125	306	0.	*	2	1805	506	0.	*	3	1045	706	0.
1	0850	107	4.	*	2	0130	307	0.	*	2	1810	507	0.	*	3	1050	707	0.
1	0855	108	3.	*	2	0135	308	0.	*	2	1815	508	0.	*	3	1055	708	0.
1	0900	109	3.	*	2	0140	309	0.	*	2	1820	509	0.	*	3	1100	709	0.
1	0905	110	2.	*	2	0145	310	0.	*	2	1825	510	0.	*	3	1105	710	0.
1	0910	111	2.	*	2	0150	311	0.	*	2	1830	511	0.	*	3	1110	711	0.
1	0915	112	2.	*	2	0155	312	0.	*	2	1835	512	0.	*	3	1115	712	0.
1	0920	113	2.	*	2	0200	313	0.	*	2	1840	513	0.	*	3	1120	713	0.
1	0925	114	1.	*	2	0205	314	0.	*	2	1845	514	0.	*	3	1125	714	0.
1	0930	115	1.	*	2	0210	315	0.	*	2	1850	515	0.	*	3	1130	715	0.
1	0935	116	1.	*	2	0215	316	0.	*	2	1855	516	0.	*	3	1135	716	0.
1	0940	117	1.	*	2	0220	317	0.	*	2	1900	517	0.	*	3	1140	717	0.
1	0945	118	1.	*	2	0225	318	0.	*	2	1905	518	0.	*	3	1145	718	0.

1	0950	119	1.	*	2	0230	319	0.	*	2	1910	519	0.	*	3	1150	719	0.
1	0955	120	1.	*	2	0235	320	0.	*	2	1915	520	0.	*	3	1155	720	0.
1	1000	121	0.	*	2	0240	321	0.	*	2	1920	521	0.	*	3	1200	721	0.
1	1005	122	0.	*	2	0245	322	0.	*	2	1925	522	0.	*	3	1205	722	0.
1	1010	123	0.	*	2	0250	323	0.	*	2	1930	523	0.	*	3	1210	723	0.
1	1015	124	0.	*	2	0255	324	0.	*	2	1935	524	0.	*	3	1215	724	0.
1	1020	125	0.	*	2	0300	325	0.	*	2	1940	525	0.	*	3	1220	725	0.
1	1025	126	0.	*	2	0305	326	0.	*	2	1945	526	0.	*	3	1225	726	0.
1	1030	127	0.	*	2	0310	327	0.	*	2	1950	527	0.	*	3	1230	727	0.
1	1035	128	0.	*	2	0315	328	0.	*	2	1955	528	0.	*	3	1235	728	0.
1	1040	129	0.	*	2	0320	329	0.	*	2	2000	529	0.	*	3	1240	729	0.
1	1045	130	0.	*	2	0325	330	0.	*	2	2005	530	0.	*	3	1245	730	0.
1	1050	131	0.	*	2	0330	331	0.	*	2	2010	531	0.	*	3	1250	731	0.
1	1055	132	0.	*	2	0335	332	0.	*	2	2015	532	0.	*	3	1255	732	0.
1	1100	133	0.	*	2	0340	333	0.	*	2	2020	533	0.	*	3	1300	733	0.
1	1105	134	0.	*	2	0345	334	0.	*	2	2025	534	0.	*	3	1305	734	0.
1	1110	135	0.	*	2	0350	335	0.	*	2	2030	535	0.	*	3	1310	735	0.
1	1115	136	0.	*	2	0355	336	0.	*	2	2035	536	0.	*	3	1315	736	0.
1	1120	137	0.	*	2	0400	337	0.	*	2	2040	537	0.	*	3	1320	737	0.
1	1125	138	0.	*	2	0405	338	0.	*	2	2045	538	0.	*	3	1325	738	0.
1	1130	139	0.	*	2	0410	339	0.	*	2	2050	539	0.	*	3	1330	739	0.
1	1135	140	0.	*	2	0415	340	0.	*	2	2055	540	0.	*	3	1335	740	0.
1	1140	141	0.	*	2	0420	341	0.	*	2	2100	541	0.	*	3	1340	741	0.
1	1145	142	0.	*	2	0425	342	0.	*	2	2105	542	0.	*	3	1345	742	0.
1	1150	143	0.	*	2	0430	343	0.	*	2	2110	543	0.	*	3	1350	743	0.
1	1155	144	0.	*	2	0435	344	0.	*	2	2115	544	0.	*	3	1355	744	0.
1	1200	145	0.	*	2	0440	345	0.	*	2	2120	545	0.	*	3	1400	745	0.
1	1205	146	0.	*	2	0445	346	0.	*	2	2125	546	0.	*	3	1405	746	0.
1	1210	147	0.	*	2	0450	347	0.	*	2	2130	547	0.	*	3	1410	747	0.
1	1215	148	0.	*	2	0455	348	0.	*	2	2135	548	0.	*	3	1415	748	0.
1	1220	149	0.	*	2	0500	349	0.	*	2	2140	549	0.	*	3	1420	749	0.
1	1225	150	0.	*	2	0505	350	0.	*	2	2145	550	0.	*	3	1425	750	0.
1	1230	151	0.	*	2	0510	351	0.	*	2	2150	551	0.	*	3	1430	751	0.
1	1235	152	0.	*	2	0515	352	0.	*	2	2155	552	0.	*	3	1435	752	0.
1	1240	153	0.	*	2	0520	353	0.	*	2	2200	553	0.	*	3	1440	753	0.
1	1245	154	0.	*	2	0525	354	0.	*	2	2205	554	0.	*	3	1445	754	0.
1	1250	155	0.	*	2	0530	355	0.	*	2	2210	555	0.	*	3	1450	755	0.
1	1255	156	0.	*	2	0535	356	0.	*	2	2215	556	0.	*	3	1455	756	0.
1	1300	157	0.	*	2	0540	357	0.	*	2	2220	557	0.	*	3	1500	757	0.
1	1305	158	0.	*	2	0545	358	0.	*	2	2225	558	0.	*	3	1505	758	0.
1	1310	159	0.	*	2	0550	359	0.	*	2	2230	559	0.	*	3	1510	759	0.
1	1315	160	0.	*	2	0555	360	0.	*	2	2235	560	0.	*	3	1515	760	0.
1	1320	161	0.	*	2	0600	361	0.	*	2	2240	561	0.	*	3	1520	761	0.
1	1325	162	0.	*	2	0605	362	0.	*	2	2245	562	0.	*	3	1525	762	0.
1	1330	163	0.	*	2	0610	363	0.	*	2	2250	563	0.	*	3	1530	763	0.
1	1335	164	0.	*	2	0615	364	0.	*	2	2255	564	0.	*	3	1535	764	0.
1	1340	165	0.	*	2	0620	365	0.	*	2	2300	565	0.	*	3	1540	765	0.
1	1345	166	0.	*	2	0625	366	0.	*	2	2305	566	0.	*	3	1545	766	0.
1	1350	167	0.	*	2	0630	367	0.	*	2	2310	567	0.	*	3	1550	767	0.
1	1355	168	0.	*	2	0635	368	0.	*	2	2315	568	0.	*	3	1555	768	0.
1	1400	169	0.	*	2	0640	369	0.	*	2	2320	569	0.	*	3	1600	769	0.
1	1405	170	0.	*	2	0645	370	0.	*	2	2325	570	0.	*	3	1605	770	0.
1	1410	171	0.	*	2	0650	371	0.	*	2	2330	571	0.	*	3	1610	771	0.
1	1415	172	0.	*	2	0655	372	0.	*	2	2335	572	0.	*	3	1615	772	0.
1	1420	173	0.	*	2	0700	373	0.	*	2	2340	573	0.	*	3	1620	773	0.
1	1425	174	0.	*	2	0705	374	0.	*	2	2345	574	0.	*	3	1625	774	0.
1	1430	175	0.	*	2	0710	375	0.	*	2	2350	575	0.	*	3	1630	775	0.
1	1435	176	0.	*	2	0715	376	0.	*	2	2355	576	0.	*	3	1635	776	0.
1	1440	177	0.	*	2	0720	377	0.	*	3	0000	577	0.	*	3	1640	777	0.
1	1445	178	0.	*	2	0725	378	0.	*	3	0005	578	0.	*	3	1645	778	0.
1	1450	179	0.	*	2	0730	379	0.	*	3	0010	579	0.	*	3	1650	779	0.
1	1455	180	0.	*	2	0735	380	0.	*	3	0015	580	0.	*	3	1655	780	0.
1	1500	181	0.	*	2	0740	381	0.	*	3	0020	581	0.	*	3	1700	781	0.
1	1505	182	0.	*	2	0745	382	0.	*	3	0025	582	0.	*	3	1705	782	0.
1	1510	183	0.	*	2	0750	383	0.	*	3	0030	583	0.	*	3	1710	783	0.
1	1515	184	0.	*	2	0755	384	0.	*	3	0035	584	0.	*	3	1715	784	0.
1	1520	185	0.	*	2	0800	385	0.	*	3	0040	585	0.	*	3	1720	785	0.
1	1525	186	0.	*	2	0805	386	0.	*	3	0045	586	0.	*	3	1725	786	0.
1	1530	187	0.	*	2	0810	387	0.	*	3	0050	587	0.	*	3	1730	787	0.
1	1535	188	0.	*	2	0815	388	0.	*	3	0055	588	0.	*	3	1735	788	0.
1	1540	189	0.	*	2	0820	389	0.	*	3	0100	589	0.	*	3	1740	789	0.
1	1545	190	0.	*	2	0825	390	0.	*	3	0105	590	0.	*	3	1745	790	0.
1	1550	191	0.	*	2	0830	391	0.	*	3	0110	591	0.	*	3	1750	791	0.
1	1555	192	0.	*	2	0835	392	0.	*	3	0115	592	0.	*	3	1755	792	0.
1	1600	193	0.	*	2	0840	393	0.	*	3	0120	593	0.	*	3	1800	793	0.
1	1605	194	0.	*	2	0845	394	0.	*	3	0125	594	0.	*	3	1805	794	0.
1	1610	195	0.	*	2	0850	395	0.	*	3	0130	595	0.	*	3	1810	795	0.
1	1615	196	0.	*	2	0855	396	0.	*	3	0135	596	0.	*	3	1815	796	0.
1	1620	197	0.	*	2	0900	397	0.	*	3	0140	597	0.	*	3	1820	797	0.
1	1625	198	0.	*	2	0905	398	0.	*	3	0145	598	0.	*	3	1825	798	0.
1	1630	199	0.	*	2	0910	399	0.	*	3	0150	599	0.	*	3	1830	799	0.

```
     1     1635  200        0.   *    2     0915  400        0.   *    3     0155  600        0.   *    3     1835  800        0.
                                  *                                  *                                  *
*****************************************************************************************************************************
*
  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     66.58-HR
+   (CFS)       (HR)
                              (CFS)
+   14475.      2.83                3204.        802.        289.        289.
                           (INCHES)  9.392       9.408       9.408       9.408
                            (AC-FT)  1589.       1592.       1592.       1592.

                         CUMULATIVE AREA =    3.17 SQ MI

1
                                                   RUNOFF SUMMARY
                                              FLOW IN CUBIC FEET PER SECOND
                                           TIME IN HOURS,  AREA IN SQUARE MILES

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

        HYDROGRAPH AT
+                            1      9976.    2.75        1932.       483.        174.       1.99
        ROUTED TO
+                           R1      8827.    2.83        1930.       483.        174.       1.99
+                                                                                          1434.26        2.83

        HYDROGRAPH AT
+                           2A      6983.    2.67        1275.       319.        115.       1.19
        2 COMBINED AT
+                         CP2A     14475.    2.83        3204.       802.        289.       3.17


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

APPENDIX F

NORTH INLET CHANNEL HEC-1 INPUT AND OUTPUT

```
1****************************************                    ****************************************
*                                      *                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS       *
*              JUN   1998              *                    *   HYDROLOGIC ENGINEERING CENTER      *
*            VERSION 4.1               *                    *          609 SECOND STREET           *
*                                      *                    *       DAVIS, CALIFORNIA 95616        *
*  RUN DATE   02OCT03  TIME  09:14:15  *                    *          (916) 756-1104              *
*                                      *                    *                                      *
****************************************                    ****************************************

                                                  X     X  XXXXXXX   XXXXX          X
                                                  X     X  X        X     X        XX
                                                  X     X  X        X              X
                                                  XXXXXXX  XXXX     X        XXXXX X
                                                  X     X  X        X              X
                                                  X     X  X        X     X        X
                                                  X     X  XXXXXXX   XXXXX        XXX

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

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

1                                                HEC-1 INPUT                                                PAGE  1

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

        1           ID   North Inlet Channel
        2           ID   Part of the McMicken Dam FRZR, FCD 2002C011
        3           ID   For Flood Control District of Maricopa County
        4           ID   By  Stantec Consulting Inc
        5           ID
        6           ID   File:  EX100-6.ih1
        7           ID   Date:  2 October 2003
        8           ID
        9           ID   This model represents the Beardsley Canal Wash watershed at Northern
       10           ID   Avenue.  Runoff from the watershed exceeds the culvert capacity at Olive
       11           ID   Avenue which results in flow overtopping the Beardsley Canal.
       12           ID
       13           ID   Model Input Parameters
       14           ID   Rainfall:  100-year, 6-hour design rainfall
       15           ID   Rainfall Losses:  Green & Ampt
       16           ID   Unit Hydrograph:  Phoenix Mountain and Desert/Rangeland S-Graph
       17           ID
       18           IT       5                    800
       19           IO       5
       20           IN      15
                    *DIAGRAM
                    *
       21           JD    3.34    0.01
       22           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
       23           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
       24           PC   0.962   0.972   0.983   0.991   1.000
       25           JD   3.318    0.50
       26           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
       27           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
       28           PC   0.962   0.972   0.983   0.991   1.000
       29           JD   3.256    2.80
       30           PC   0.000   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.067   0.076
       31           PC   0.087   0.100   0.120   0.163   0.252   0.451   0.694   0.837   0.900   0.938
       32           PC   0.950   0.963   0.975   0.988   1.000
       33           JD   3.079    16.0
       34           PC   0.000   0.015   0.020   0.030   0.048   0.063   0.076   0.090   0.105   0.119
       35           PC   0.135   0.152   0.175   0.222   0.304   0.472   0.670   0.796   0.868   0.912
       36           PC   0.946   0.960   0.973   0.987   1.000
                    *

       37           KK       1
       38           KM   Sub-Basin      1
       39           KM
       40           KM      The Phoenix Mountain S-Graph is used for this basin.
       41           KM          Lag Used =  42.5 minutes
```

```
 42          KM
 43          BA    1.94
 44          LG    0.20    0.35    4.00    0.52      10
 45          UI     166     232     588     934    1190    1417    1903    1314    1016     915
 46          UI     804     692     591     487     408     373     319     251     213     186
 47          UI     165     127     129      83      82      83      65      32      33      32
 48          UI      31      33      32      32      32      32       0       0       0       0
 49          UI       0       0       0       0       0       0       0       0       0       0
             *
1                                          HEC-1 INPUT                                          PAGE  2

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

 50          KK    RCP1
 51          KM        ROUTE FLOW FROM CP1 TO CP2.
 52          RS       5              -1       0
 53          RC     .06     .04     .06   17800   .0469
 54          RX    1000    1125    1300    1390    1405    1490    1590    1750
 55          RY    1440    1439    1437    1428    1428    1439    1442    1444
             *

 56          KK       2
 57          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 2.
 58          BA    1.82
 59          LG     .18     .35    4.55     .37   12.00
 60          UI     133     135     370     590     832     955    1124    1534    1182     882
 61          UI     781     695     631     560     486     415     350     316     291     251
 62          UI     207     169     158     145     119     103     101      71      65      65
 63          UI      65      45      25      26      25      26      25      26      25      26
 64          UI      26      25       0       0       0       0       0       0       0       0
 65          UI       0       0       0       0       0       0       0       0       0       0
             *

 66          KK     CP2
 67          KM    Combine routed hydrograph from CP2A with runoff from subbasin 2
 68          HC       2
             *

 69          KK    RCP2
 70          KM        ROUTE COMBINED HYDROGRAPHS AT CP2 TO CP3.
 71          RS       2              -1       0
 72          RC     .06    .035     .06    4500   .0111
 73          RX    1000    1100    1350    1705    1735    1780    1850    2000
 74          RY    1304    1302    1302    1298    1298    1303    1302    1305
             *

 75          KK      3A   BASIN
 76          BA   0.290
 77          LG    0.15    0.35    4.30    0.42       0
 78          UI      80     314     510     513     338     200     120      72      43      21
 79          UI      14      14       0       0       0       0       0       0       0       0
 80          UI       0       0       0       0       0       0       0       0       0       0
             *

 81          KK   RCP3A
 82          KM        ROUTE FLOW FROM CP3A TO CP3
 83          RS       2              -1       0
 84          RC     .03     .03     .05    5300   .0060
 85          RX    1000    1023    1032    1046    1058    1067    1250    1540
 86          RY    1289    1288    1286    1284    1284    1286    1288    1291
             *
1                                          HEC-1 INPUT                                          PAGE  3

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

 87          KK       3   BASIN
 88          BA   0.810
 89          LG    0.15    0.35    4.45    0.38       0
 90          UI     199     777    1298    1396    1017     616     379     239     139      93
 91          UI      37      37      37       0       0       0       0       0       0       0
 92          UI       0       0       0       0       0       0       0       0       0       0
             *

 93          KK     CP3
 94          KM    Combine routed hydrograph from CP2 with runoff from subbasin 3
 95          HC       3
             *

 96          KK      D3
```

```
 97          KM    Divert runoff overtopping the Beardsley Canal at Olive Avenue.
 98          KM    Rating curve provided by FCDMC based on a HEC-RAS model developed for the
 99          KM    improved culvert crossing at Olive Avenue
100          DT   DI189
101          DI       0    1432    2823    3000    4000
102          DQ       0       0     622     728    1728
             *

103          KK    RCP3
104          KM        ROUTE FLOW FROM CP3 TO CP10.
105          RS       2              -1       0
106          RC     .05     .03     .05    5280   .0083
107          RX    1010    1015    1020    1050    1100    1275    1580    1750
108          RY    1251    1249    1249    1245    1245    1250    1250    1254
             *

109          KK       4
110          KM        RUNOFF HYDROGRAPH FORM SUB-BASIN 4.
111          BA     .30
             *    LG    0.35    0.15    8.01   0.081  18.504
112          LG     .20     .35    4.35     .44    9.00
113          UI     47.    191.    286.    443.    513.    346.    237.    115.     67.     36.
114          UI     14.     14.      0.      0.      0.      0.      0.      0.      0.      0.
115          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
             *

116          KK       5
117          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 5.
118          BA     .72
             *    LG    0.35    0.15   8.023   0.081  17.926
119          LG     .20     .35    4.30     .45    9.00
120          UI    109.    433.    653.    981.   1241.    852.    594.    323.    177.    104.
121          UI     33.     33.     33.      0.      0.      0.      0.      0.      0.      0.
122          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
```



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

123          KK     CP5
124          KM        ADD HYDROGRAPHS AT CP5.
125          HC       2    1.02

126          KK    RCP5
127          KM        ROUTE COMBINED HYDROGRAPHS AT CP5 TO CP6.
128          RS       1              -1       0
129          RC     .08     .05     .08    2400   .0833
130          RX     955     970     985    1000    1020    1035    1050    1065
131          RY    2815    2810    2805    2800    2800    2805    2810    2815
             *

132          KK       6
133          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 6.
134          BA     .45
             *    LG    0.35    0.15   7.976   0.082      20
135          LG     .20     .35    3.95     .53   10.00
136          UI    206.    627.   1145.    834.    421.    154.     53.     33.      0.      0.
137          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

138          KK     CP6
139          KM        ADD HYDROGRAPHS AT CP6.
140          HC       2    1.47

141          KK    RCP6
142          KM        ROUTE COMBINED HYDROGRAPHS AT CP6 TO CP7.
143          RS       1              -1       0
144          RC     .08     .05     .08    2400   .0833
145          RX     955     970     985    1000    1020    1035    1050    1065
146          RY    2815    2810    2805    2800    2800    2805    2810    2815
             *

147          KK       7
148          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 7.
149          BA     .31
             *    LG    0.35    0.15   7.976   0.082      20
150          LG     .20     .35    3.95     .53   10.00
151          UI    124.    383.    708.    610.    347.    132.     54.     21.      0.      0.
152          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

153          KK     CP7
154          KM        ADD HYDROGRAPHS AT CP7.
```

```
155          HC       2    1.78

156          KK    RCP7
157          KM        ROUTE COMBINED HYDROGRAPHS AT CP7 TO CP9.
158          RS       3              -1       0
159          RC     .08     .05     .08   10200  .07745
160          RX    1000    1045    1120    1195    1230    1300    1350    1450
161          RY    1910    1880    1850    1838    1838    1850    1880    1910
             *
1                                          HEC-1 INPUT                                                    PAGE  5

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


162          KK       9
163          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 9.
164          BA    1.40
             *     LG    0.35    0.15   7.909   0.084  19.572
165          LG     .20     .35    4.00     .52   10.00
166          UI    155.    380.    725.    933.   1213.   1828.   1593.   1225.    939.    707.
167          UI    389.    261.    178.    116.     47.     47.     47.     47.      0.      0.
168          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

169          KK   I1CP9
170          KM        ADD HYDROGRAPHS AT CP9.
171          HC       2    3.18
             *

172          KK       8
173          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 8.
174          BA     .81
             *     LG    0.35    0.15   7.976   0.082      20
175          LG     .20     .35    3.95     .53   10.00
176          UI    103.    314.    536.    704.   1058.   1138.    821.    608.    420.    207.
177          UI    147.     95.     31.     31.     31.      0.      0.      0.      0.      0.
178          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

179          KK     CP9
180          KM        ADD HYDROGRAPHS AT CP9.
181          HC       2    3.99

182          KK    RCP9
183          KM        ROUTE COMBINED HYDROGRAPHS AT CP9 TO CP10.
184          RS       8              -1       0
185          RC     .06    .035     .06   19200   .0232
186          RX    1000    1085    1310    1395    1415    1450    1630    1665
187          RY    1317    1314    1311    1308    1308    1314    1314    1317
             *

188          KK      10
189          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 10.
190          BA    2.02
             *     LG   0.347   0.248   5.124   0.254    4.52
191          LG     .16     .35    4.55     .36    4.00
192          UI    119.    119.    219.    428.    547.    632.    709.    813.    930.   1153.
193          UI   1500.   1391.   1155.   1006.    893.    765.    668.    577.    473.    323.
194          UI    210.    201.    191.    119.    119.     84.     36.     36.     36.     36.
195          UI     36.     36.     36.     36.      0.      0.      0.      0.      0.      0.
196          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

197          KK  I1CP10
198          KM        ADD HYDROGRAPHS AT I1CP10
199          HC       2    6.01
1                                          HEC-1 INPUT                                                    PAGE  6

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


200          KK    CP10
201          KM        ADD HYDROGRAPHS AT CP10
202          HC       2
             *
203          ZZ
1
             SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

   37          1
```

```
                V
                V
 50          RCP1
                .
                .
 56             .            2
                .            .
                .            .
 66           CP2............
                V
                V
 69          RCP2
                .
                .
 75             .           3A
                .            V
                .            V
 81             .        RCP3A
                .            .
                .            .
 87             .            .            3
                .            .            .
                .            .            .
 93           CP3........................
                .
                .
100             .-------> DI189
 96           D3
                V
                V
103          RCP3
                .
                .
109             .            4
                .            .
                .            .
116             .            .            5
                .            .            .
                .            .            .
123             .          CP5............
                .            V
                .            V
126             .         RCP5
                .            .
                .            .
132             .            .            6
                .            .            .
                .            .            .
138             .          CP6............
                .            V
                .            V
141             .         RCP6
                .            .
                .            .
147             .            .            7
                .            .            .
                .            .            .
153             .          CP7............
                .            V
                .            V
156             .         RCP7
                .            .
                .            .
162             .            .            9
                .            .            .
                .            .            .
169             .        I1CP9............
                .            .
                .            .
172             .            .            8
                .            .            .
                .            .            .
179             .          CP9............
                .            V
                .            V
182             .         RCP9
                .            .
                .            .
188             .            .           10
                .            .            .
                .            .            .
```

```
197            .       I1CP10............
               .            .
               .            .
200         CP10............

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                    ****************************************
*                                      *                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS       *
*              JUN  1998               *                    *   HYDROLOGIC ENGINEERING CENTER      *
*            VERSION 4.1               *                    *          609 SECOND STREET           *
*                                      *                    *       DAVIS, CALIFORNIA 95616        *
*  RUN DATE   02OCT03  TIME  09:14:15  *                    *          (916) 756-1104              *
*                                      *                    *                                      *
****************************************                    ****************************************
```

North Inlet Channel
Part of the McMicken Dam FRZR, FCD 2002C011
For Flood Control District of Maricopa County
By Stantec Consulting Inc

File: EX100-6.ih1
Date: 2 October 2003

This model represents the Beardsley Canal Wash watershed at Northern Avenue. Runoff from the watershed exceeds the culvert capacity at Olive Avenue which results in flow overtopping the Beardsley Canal.

Model Input Parameters
Rainfall: 100-year, 6-hour design rainfall
Rainfall Losses: Green & Ampt
Unit Hydrograph: Phoenix Mountain and Desert/Rangeland S-Graph

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

   IT          HYDROGRAPH TIME DATA
                      NMIN          5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1   0  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ        800  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      3   0  ENDING DATE
                    NDTIME       1835  ENDING TIME
                     ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   66.58 HOURS

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

21 JD          INDEX STORM NO. 1
                      STRM       3.34  PRECIPITATION DEPTH
                      TRDA        .01  TRANSPOSITION DRAINAGE AREA

22 PI            PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                    .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                    .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00

25 JD          INDEX STORM NO. 2
                      STRM       3.32  PRECIPITATION DEPTH
                      TRDA        .50  TRANSPOSITION DRAINAGE AREA

26 PI            PRECIPITATION PATTERN
```

```
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                    .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                    .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00

29 JD          INDEX STORM NO. 3
                    STRM        3.26  PRECIPITATION DEPTH
                    TRDA        2.80  TRANSPOSITION DRAINAGE AREA

30 PI            PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                    .03       .03       .07       .07       .07       .08       .08       .08       .05       .05
                    .05       .02       .02       .02       .01       .01       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00

33 JD          INDEX STORM NO. 4
                    STRM        3.08  PRECIPITATION DEPTH
                    TRDA       16.00  TRANSPOSITION DRAINAGE AREA

34 PI            PRECIPITATION PATTERN
                    .01       .01       .00       .00       .00       .00       .00       .00       .00       .01
                    .01       .01       .00       .01       .00       .00       .00       .00       .00       .00
                    .00       .00       .01       .00       .00       .00       .00       .01       .01       .01
                    .01       .01       .01       .01       .01       .01       .02       .02       .02       .03
                    .03       .03       .06       .06       .06       .07       .07       .07       .04       .04
                    .04       .02       .02       .02       .01       .01       .01       .01       .01       .01
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00
1
```

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

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	1	1518.	4.42	268.	67.	24.	1.94		
+	ROUTED TO	RCP1	1371.	4.75	267.	67.	24.	1.94		
+	HYDROGRAPH AT	2	1480.	4.50	295.	74.	27.	1.82		
+	2 COMBINED AT	CP2	2281.	4.67	509.	129.	46.	3.76		
+	ROUTED TO	RCP2	2187.	4.83	508.	129.	46.	3.76		
+	HYDROGRAPH AT	3A	609.	4.08	46.	12.	4.	.29		
+	ROUTED TO	RCP3A	423.	4.33	46.	12.	4.	.29		
+	HYDROGRAPH AT	3	1472.	4.17	126.	31.	11.	.81		
+	3 COMBINED AT	CP3	2270.	4.75	616.	155.	56.	4.86		
+	DIVERSION TO	DI189	375.	4.75	44.	11.	4.	4.86		
+	HYDROGRAPH AT	D3	1895.	4.75	572.	144.	52.	4.86		
+	ROUTED TO	RCP3	1864.	4.92	571.	144.	52.	4.86		

+	HYDROGRAPH AT	4	588.	4.25	51.	13.	5.	.30
+	HYDROGRAPH AT	5	1261.	4.25	118.	29.	11.	.72
+	2 COMBINED AT	CP5	1623.	4.25	160.	40.	14.	1.02
+	ROUTED TO	RCP5	1622.	4.25	160.	40.	14.	1.02
+	HYDROGRAPH AT	6	1123.	4.08	75.	19.	7.	.45
+	2 COMBINED AT	CP6	2045.	4.17	216.	54.	20.	1.47
+	ROUTED TO	RCP6	1995.	4.17	216.	54.	20.	1.47
+	HYDROGRAPH AT	7	741.	4.08	51.	13.	5.	.31
+	2 COMBINED AT	CP7	2312.	4.17	253.	63.	23.	1.78
+	ROUTED TO	RCP7	2090.	4.33	253.	63.	23.	1.78
+	HYDROGRAPH AT	9	1632.	4.33	203.	51.	18.	1.40
+	2 COMBINED AT	I1CP9	2996.	4.33	412.	103.	37.	3.18
+	HYDROGRAPH AT	8	1190.	4.33	126.	32.	11.	.81
+	2 COMBINED AT	CP9	3604.	4.33	496.	124.	45.	3.99
+	ROUTED TO	RCP9	3267.	4.75	494.	124.	45.	3.99
+	HYDROGRAPH AT	10	1533.	4.75	296.	74.	27.	2.02
+	2 COMBINED AT	I1CP10	4242.	4.75	712.	179.	65.	6.01
+	2 COMBINED AT	CP10	5337.	4.75	1153.	292.	105.	10.87

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

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN   1998              *
*            VERSION 4.1               *
*                                      *
*  RUN DATE   02OCT03  TIME  09:14:27  *
*                                      *
****************************************
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```
****************************************
*                                      *
*   U.S. ARMY CORPS OF ENGINEERS       *
*   HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET            *
*      DAVIS, CALIFORNIA 95616         *
*          (916) 756-1104              *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

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

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

1 HEC-1 INPUT PAGE 1

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

  1           ID   North Inlet Channel
  2           ID   Part of the McMicken Dam FRZR, FCD 2002C011
  3           ID   For Flood Control District of Maricopa County
  4           ID   By  Stantec Consulting Inc
  5           ID
  6           ID   File:  EX100-24.ih1
  7           ID   Date:  2 October 2003
  8           ID
  9           ID   This model represents the Beardsley Canal Wash watershed at Northern
 10           ID   Avenue.  Runoff from the watershed exceeds the culvert capacity at Olive
 11           ID   Avenue which results in flow overtopping the Beardsley Canal.
 12           ID
 13           ID   Model Input Parameters
 14           ID   Rainfall:  100-year, 24-hour design rainfall
 15           ID   Rainfall Losses:  Green & Ampt
 16           ID   Unit Hydrograph:  Phoenix Mountain and Desert/Rangeland S-Graph
 17           ID
 18           IT       5                    800
 19           IO       5
 20           IN      15
              *DIAGRAM
              *
 21           JD    4.15    0.01
 22           PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
 23           PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
 24           PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
 25           PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
 26           PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
 27           PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
 28           PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
 29           PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
 30           PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
 31           PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
 32           JD   4.046    5.00
 33           JD   3.943   10.00
 34           JD   3.735   30.00
              *
 35           KK       1
 36           KM   Sub-Basin      1
 37           KM
 38           KM      The Phoenix Mountain S-Graph is used for this basin.
 39           KM          Lag Used =  42.5 minutes
 40           KM
 41           BA    1.94
```

```
 42        LG    0.20    0.35    4.00    0.52      10
 43        UI     166     232     588     934    1190    1417    1903    1314    1016     915
 44        UI     804     692     591     487     408     373     319     251     213     186
 45        UI     165     127     129      83      82      83      65      32      33      32
 46        UI      31      33      32      32      32      32       0       0       0       0
 47        UI       0       0       0       0       0       0       0       0       0       0
           *
1                                        HEC-1 INPUT                                          PAGE  2

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

 48        KK    RCP1
 49        KM        ROUTE FLOW FROM CP1 TO CP2.
 50        RS       5              -1       0
 51        RC     .06     .04     .06   17800   .0469
 52        RX    1000    1125    1300    1390    1405    1490    1590    1750
 53        RY    1440    1439    1437    1428    1428    1439    1442    1444
           *

 54        KK       2
 55        KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 2.
 56        BA    1.82
 57        LG     .18     .35    4.55     .37   12.00
 58        UI     133     135     370     590     832     955    1124    1534    1182     882
 59        UI     781     695     631     560     486     415     350     316     291     251
 60        UI     207     169     158     145     119     103     101      71      65      65
 61        UI      65      45      25      26      25      26      25      26      25      26
 62        UI      26      25       0       0       0       0       0       0       0       0
 63        UI       0       0       0       0       0       0       0       0       0       0
           *

 64        KK     CP2
 65        KM    Combine routed hydrograph from CP2A with runoff from subbasin 2
 66        HC       2
           *

 67        KK    RCP2
 68        KM        ROUTE COMBINED HYDROGRAPHS AT CP2 TO CP3.
 69        RS       2              -1       0
 70        RC     .06    .035     .06    4500   .0111
 71        RX    1000    1100    1350    1705    1735    1780    1850    2000
 72        RY    1304    1302    1302    1298    1298    1303    1302    1305
           *

 73        KK      3A   BASIN
 74        BA   0.290
 75        LG    0.15    0.35    4.30    0.42       0
 76        UI      80     314     510     513     338     200     120      72      43      21
 77        UI      14      14       0       0       0       0       0       0       0       0
 78        UI       0       0       0       0       0       0       0       0       0       0
           *

 79        KK   RCP3A
 80        KM        ROUTE FLOW FROM CP3A TO CP3
 81        RS       2              -1       0
 82        RC     .03     .03     .05    5300   .0060
 83        RX    1000    1023    1032    1046    1058    1067    1250    1540
 84        RY    1289    1288    1286    1284    1284    1286    1288    1291
           *
1                                        HEC-1 INPUT                                          PAGE  3

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

 85        KK      3   BASIN
 86        BA   0.810
 87        LG    0.15    0.35    4.45    0.38       0
 88        UI     199     777    1298    1396    1017     616     379     239     139      93
 89        UI      37      37      37       0       0       0       0       0       0       0
 90        UI       0       0       0       0       0       0       0       0       0       0
           *

 91        KK     CP3
 92        KM    Combine routed hydrograph from CP2 with runoff from subbasin 3
 93        HC       3
           *

 94        KK      D3
 95        KM    Divert runoff overtopping the Beardsley Canal at Olive Avenue.
 96        KM    Rating curve provided by FCDMC based on a HEC-RAS model developed for the
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 97          KM    improved culvert crossing at Olive Avenue
 98          DT   DI189
 99          DI       0    1432    2823    3000    4000
100          DQ       0       0     622     728    1728
             *

101          KK    RCP3
102          KM        ROUTE FLOW FROM CP3 TO CP10.
103          RS       2              -1       0
104          RC     .05     .03     .05    5280   .0083
105          RX    1010    1015    1020    1050    1100    1275    1580    1750
106          RY    1251    1249    1249    1245    1245    1250    1250    1254
             *

107          KK       4
108          KM        RUNOFF HYDROGRAPH FORM SUB-BASIN 4.
109          BA     .30
             *    LG    0.35    0.15    8.01   0.081  18.504
110          LG     .20     .35    4.35     .44    9.00
111          UI     47.    191.    286.    443.    513.    346.    237.    115.     67.     36.
112          UI     14.     14.      0.      0.      0.      0.      0.      0.      0.      0.
113          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
             *

114          KK       5
115          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 5.
116          BA     .72
             *    LG    0.35    0.15   8.023   0.081  17.926
117          LG     .20     .35    4.30     .45    9.00
118          UI    109.    433.    653.    981.   1241.    852.    594.    323.    177.    104.
119          UI     33.     33.     33.      0.      0.      0.      0.      0.      0.      0.
120          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
```



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

121          KK     CP5
122          KM        ADD HYDROGRAPHS AT CP5.
123          HC       2    1.02

124          KK    RCP5
125          KM        ROUTE COMBINED HYDROGRAPHS AT CP5 TO CP6.
126          RS       1              -1       0
127          RC     .08     .05     .08    2400   .0833
128          RX     955     970     985    1000    1020    1035    1050    1065
129          RY    2815    2810    2805    2800    2800    2805    2810    2815
             *

130          KK       6
131          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 6.
132          BA     .45
             *    LG    0.35    0.15   7.976   0.082      20
133          LG     .20     .35    3.95     .53   10.00
134          UI    206.    627.   1145.    834.    421.    154.     53.     33.      0.      0.
135          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

136          KK     CP6
137          KM        ADD HYDROGRAPHS AT CP6.
138          HC       2    1.47

139          KK    RCP6
140          KM        ROUTE COMBINED HYDROGRAPHS AT CP6 TO CP7.
141          RS       1              -1       0
142          RC     .08     .05     .08    2400   .0833
143          RX     955     970     985    1000    1020    1035    1050    1065
144          RY    2815    2810    2805    2800    2800    2805    2810    2815
             *

145          KK       7
146          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 7.
147          BA     .31
             *    LG    0.35    0.15   7.976   0.082      20
148          LG     .20     .35    3.95     .53   10.00
149          UI    124.    383.    708.    610.    347.    132.     54.     21.      0.      0.
150          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

151          KK     CP7
152          KM        ADD HYDROGRAPHS AT CP7.
153          HC       2    1.78
```

```
 154          KK    RCP7
 155          KM        ROUTE COMBINED HYDROGRAPHS AT CP7 TO CP9.
 156          RS       3              -1       0
 157          RC     .08     .05     .08   10200  .07745
 158          RX    1000    1045    1120    1195    1230    1300    1350    1450
 159          RY    1910    1880    1850    1838    1838    1850    1880    1910
              *
1                                          HEC-1 INPUT                                                    PAGE  5

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


 160          KK       9
 161          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 9.
 162          BA    1.40
              *     LG    0.35    0.15   7.909   0.084  19.572
 163          LG     .20     .35    4.00     .52   10.00
 164          UI    155.    380.    725.    933.   1213.   1828.   1593.   1225.    939.    707.
 165          UI    389.    261.    178.    116.     47.     47.     47.     47.      0.      0.
 166          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 167          KK   I1CP9
 168          KM        ADD HYDROGRAPHS AT CP9.
 169          HC       2    3.18
              *

 170          KK       8
 171          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 8.
 172          BA     .81
              *     LG    0.35    0.15   7.976   0.082      20
 173          LG     .20     .35    3.95     .53   10.00
 174          UI    103.    314.    536.    704.   1058.   1138.    821.    608.    420.    207.
 175          UI    147.     95.     31.     31.     31.      0.      0.      0.      0.      0.
 176          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 177          KK     CP9
 178          KM        ADD HYDROGRAPHS AT CP9.
 179          HC       2    3.99

 180          KK    RCP9
 181          KM        ROUTE COMBINED HYDROGRAPHS AT CP9 TO CP10.
 182          RS       8              -1       0
 183          RC     .06    .035     .06   19200   .0232
 184          RX    1000    1085    1310    1395    1415    1450    1630    1665
 185          RY    1317    1314    1311    1308    1308    1314    1314    1317
              *

 186          KK      10
 187          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 10.
 188          BA    2.02
              *     LG   0.347   0.248   5.124   0.254    4.52
 189          LG     .16     .35    4.55     .36    4.00
 190          UI    119.    119.    219.    428.    547.    632.    709.    813.    930.   1153.
 191          UI   1500.   1391.   1155.   1006.    893.    765.    668.    577.    473.    323.
 192          UI    210.    201.    191.    119.    119.     84.     36.     36.     36.     36.
 193          UI     36.     36.     36.     36.      0.      0.      0.      0.      0.      0.
 194          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 195          KK  I1CP10
 196          KM        ADD HYDROGRAPHS AT I1CP10
 197          HC       2    6.01
1                                          HEC-1 INPUT                                                    PAGE  6

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


 198          KK    CP10
 199          KM        ADD HYDROGRAPHS AT CP10
 200          HC       2
              *
 201          ZZ
1
          SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

   35          1
               V
               V
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 48        RCP1
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 54           .           2
              .           .
              .           .
 64         CP2............
              V
              V
 67        RCP2
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              .
 73           .          3A
              .           V
              .           V
 79           .       RCP3A
              .           .
              .           .
 85           .           .           3
              .           .           .
              .           .           .
 91         CP3........................
              .
              .
 98           .-------->   DI189
 94         D3
              V
              V
101        RCP3
              .
              .
107           .           4
              .           .
              .           .
114           .           .           5
              .           .           .
              .           .           .
121           .         CP5............
              .           V
              .           V
124           .        RCP5
              .           .
              .           .
130           .           .           6
              .           .           .
              .           .           .
136           .         CP6............
              .           V
              .           V
139           .        RCP6
              .           .
              .           .
145           .           .           7
              .           .           .
              .           .           .
151           .         CP7............
              .           V
              .           V
154           .        RCP7
              .           .
              .           .
160           .           .           9
              .           .           .
              .           .           .
167           .       I1CP9............
              .           .
              .           .
170           .           .           8
              .           .           .
              .           .           .
177           .         CP9............
              .           V
              .           V
180           .        RCP9
              .           .
              .           .
186           .           .          10
              .           .           .
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195           .      I1CP10............
              .           .
```

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  198        CP10............

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN   1998              *
*            VERSION 4.1               *
*                                      *
*  RUN DATE   02OCT03  TIME  09:14:27  *
*                                      *
****************************************
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```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

North Inlet Channel
Part of the McMicken Dam FRZR, FCD 2002C011
For Flood Control District of Maricopa County
By Stantec Consulting Inc

File: EX100-24.ih1
Date: 2 October 2003

This model represents the Beardsley Canal Wash watershed at Northern Avenue. Runoff from the watershed exceeds the culvert capacity at Olive Avenue which results in flow overtopping the Beardsley Canal.

Model Input Parameters
Rainfall: 100-year, 24-hour design rainfall
Rainfall Losses: Green & Ampt
Unit Hydrograph: Phoenix Mountain and Desert/Rangeland S-Graph

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

   IT          HYDROGRAPH TIME DATA
                      NMIN          5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1    0  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ        800  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      3    0  ENDING DATE
                    NDTIME       1835  ENDING TIME
                     ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL     .08 HOURS
                     TOTAL TIME BASE   66.58 HOURS

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

21 JD          INDEX STORM NO. 1
                      STRM       4.15  PRECIPITATION DEPTH
                      TRDA        .01  TRANSPOSITION DRAINAGE AREA

22 PI            PRECIPITATION PATTERN
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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                     .01       .01       .01       .01       .01       .01       .01       .01       .03       .03
                     .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
                     .01       .01       .01       .01       .01       .01       .00       .00       .00       .00
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                .00       .00       .00       .00       .00       .00       .00       .00

32 JD         INDEX STORM NO. 2
                STRM        4.05  PRECIPITATION DEPTH
                TRDA        5.00  TRANSPOSITION DRAINAGE AREA

 0 PI           PRECIPITATION PATTERN
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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                .01       .01       .01       .01       .01       .01       .01       .01       .03       .03
                .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .00       .00       .00       .00
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33 JD         INDEX STORM NO. 3
                STRM        3.94  PRECIPITATION DEPTH
                TRDA       10.00  TRANSPOSITION DRAINAGE AREA

 0 PI           PRECIPITATION PATTERN
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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                .01       .01       .01       .01       .01       .01       .01       .01       .03       .03
                .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .00       .00       .00       .00
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34 JD        INDEX STORM NO. 4
                STRM        3.73  PRECIPITATION DEPTH
                TRDA       30.00  TRANSPOSITION DRAINAGE AREA

 0 PI         PRECIPITATION PATTERN
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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                .01       .01       .01       .01       .01       .01       .01       .01       .03       .03
                .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .00       .00       .00       .00
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                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	1	1541.	12.42	245.	67.	24.	1.94		
+	ROUTED TO	RCP1	1327.	12.75	245.	67.	24.	1.94		
+	HYDROGRAPH AT	2	1413.	12.50	258.	71.	26.	1.82		
+	2 COMBINED AT	CP2	2488.	12.58	501.	138.	50.	3.76		
+	ROUTED TO	RCP2	2282.	12.75	500.	138.	50.	3.76		
+	HYDROGRAPH AT	3A	445.	12.08	34.	8.	3.	.29		
+	ROUTED TO	RCP3A	318.	12.33	34.	8.	3.	.29		
+	HYDROGRAPH AT	3	1219.	12.17	97.	24.	9.	.81		
+	3 COMBINED AT	CP3	2437.	12.75	629.	170.	61.	4.86		
+	DIVERSION TO	DI189	449.	12.75	49.	12.	4.	4.86		
+	HYDROGRAPH AT	D3	1988.	12.75	580.	158.	57.	4.86		
+	ROUTED TO	RCP3	1934.	12.92	580.	158.	57.	4.86		

+	HYDROGRAPH AT	4	427.	12.25	39.	11.	4.	.30
+	HYDROGRAPH AT	5	1005.	12.25	93.	25.	9.	.72
+	2 COMBINED AT	CP5	1427.	12.25	132.	36.	13.	1.02
+	ROUTED TO	RCP5	1428.	12.25	132.	36.	13.	1.02
+	HYDROGRAPH AT	6	808.	12.08	57.	16.	6.	.45
+	2 COMBINED AT	CP6	2024.	12.17	188.	51.	19.	1.47
+	ROUTED TO	RCP6	1955.	12.17	188.	51.	19.	1.47
+	HYDROGRAPH AT	7	535.	12.08	39.	11.	4.	.31
+	2 COMBINED AT	CP7	2457.	12.17	227.	62.	22.	1.78
+	ROUTED TO	RCP7	2140.	12.33	227.	62.	22.	1.78
+	HYDROGRAPH AT	9	1537.	12.33	177.	49.	18.	1.40
+	2 COMBINED AT	I1CP9	3661.	12.33	402.	110.	40.	3.18
+	HYDROGRAPH AT	8	969.	12.33	102.	28.	10.	.81
+	2 COMBINED AT	CP9	4615.	12.33	502.	138.	50.	3.99
+	ROUTED TO	RCP9	3905.	12.75	502.	138.	50.	3.99
+	HYDROGRAPH AT	10	1481.	12.75	259.	67.	24.	2.02
+	2 COMBINED AT	I1CP10	5316.	12.75	750.	202.	73.	6.01
+	2 COMBINED AT	CP10	6903.	12.75	1282.	348.	126.	10.87

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

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN  1998               *
*            VERSION 4.1               *
*                                      *
*  RUN DATE   02OCT03  TIME  09:14:35  *
*                                      *
****************************************
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```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
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X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
```

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

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

1 HEC-1 INPUT PAGE 1

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

  1           ID   North Inlet Channel
  2           ID   Part of the McMicken Dam FRZR, FCD 2002C011
  3           ID   For Flood Control District of Maricopa County
  4           ID   By  Stantec Consulting Inc
  5           ID
  6           ID   File:  EX100-6.ih1
  7           ID   Date:  2 October 2003
  8           ID
  9           ID   This model represents the Beardsley Canal Wash watershed at Northern
 10           ID   Avenue.  Runoff from the watershed exceeds the culvert capacity at Olive
 11           ID   Avenue which results in flow overtopping the Beardsley Canal.  It is
 12           ID   proposed that the culvert and downstream channel conveyance can be
 13           ID   improved which would eliminate the breakout condition.  To model the
 14           ID   downstream impacts of this proposed condition, the diversion operation at
 15           ID   Olive Avenue is removed.
 16           ID
 17           ID   Model Input Parameters
 18           ID   Rainfall:  100-year, 6-hour design rainfall
 19           ID   Rainfall Losses:  Green & Ampt
 20           ID   Unit Hydrograph:  Phoenix Mountain and Desert/Rangeland S-Graph
 21           ID
 22           IT       5                    800
 23           IO       5
 24           IN      15
              *DIAGRAM
              *
 25           JD    3.34    0.01
 26           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
 27           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
 28           PC   0.962   0.972   0.983   0.991   1.000
 29           JD   3.318    0.50
 30           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
 31           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
 32           PC   0.962   0.972   0.983   0.991   1.000
 33           JD   3.256    2.80
 34           PC   0.000   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.067   0.076
 35           PC   0.087   0.100   0.120   0.163   0.252   0.451   0.694   0.837   0.900   0.938
 36           PC   0.950   0.963   0.975   0.988   1.000
 37           JD   3.079    16.0
 38           PC   0.000   0.015   0.020   0.030   0.048   0.063   0.076   0.090   0.105   0.119
 39           PC   0.135   0.152   0.175   0.222   0.304   0.472   0.670   0.796   0.868   0.912
 40           PC   0.946   0.960   0.973   0.987   1.000
              *

 41           KK       1
```

```
 42          KM   Sub-Basin      1
 43          KM
 44          KM      The Phoenix Mountain S-Graph is used for this basin.
 45          KM          Lag Used =  42.5 minutes
 46          KM
 47          BA    1.94
 48          LG    0.20    0.35    4.00    0.52      10
 49          UI     166     232     588     934    1190    1417    1903    1314    1016     915
 50          UI     804     692     591     487     408     373     319     251     213     186
 51          UI     165     127     129      83      82      83      65      32      33      32
1                                          HEC-1 INPUT                                          PAGE  2

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

 52          UI      31      33      32      32      32      32       0       0       0       0
 53          UI       0       0       0       0       0       0       0       0       0       0
             *

 54          KK    RCP1
 55          KM        ROUTE FLOW FROM CP1 TO CP2.
 56          RS       5              -1       0
 57          RC     .06     .04     .06   17800   .0469
 58          RX    1000    1125    1300    1390    1405    1490    1590    1750
 59          RY    1440    1439    1437    1428    1428    1439    1442    1444
             *

 60          KK       2
 61          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 2.
 62          BA    1.82
 63          LG     .18     .35    4.55     .37   12.00
 64          UI     133     135     370     590     832     955    1124    1534    1182     882
 65          UI     781     695     631     560     486     415     350     316     291     251
 66          UI     207     169     158     145     119     103     101      71      65      65
 67          UI      65      45      25      26      25      26      25      26      25      26
 68          UI      26      25       0       0       0       0       0       0       0       0
 69          UI       0       0       0       0       0       0       0       0       0       0
             *

 70          KK     CP2
 71          KM    Combine routed hydrograph from CP2A with runoff from subbasin 2
 72          HC       2
             *

 73          KK    RCP2
 74          KM        ROUTE COMBINED HYDROGRAPHS AT CP2 TO CP3.
 75          RS       2              -1       0
 76          RC     .06    .035     .06    4500   .0111
 77          RX    1000    1100    1350    1705    1735    1780    1850    2000
 78          RY    1304    1302    1302    1298    1298    1303    1302    1305
             *

 79          KK      3A   BASIN
 80          BA   0.290
 81          LG    0.15    0.35    4.30    0.42       0
 82          UI      80     314     510     513     338     200     120      72      43      21
 83          UI      14      14       0       0       0       0       0       0       0       0
 84          UI       0       0       0       0       0       0       0       0       0       0
             *

 85          KK   RCP3A
 86          KM        ROUTE FLOW FROM CP3A TO CP3
 87          RS       2              -1       0
 88          RC     .03     .03     .05    5300   .0060
 89          RX    1000    1023    1032    1046    1058    1067    1250    1540
 90          RY    1289    1288    1286    1284    1284    1286    1288    1291
             *
1                                          HEC-1 INPUT                                          PAGE  3

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

 91          KK       3   BASIN
 92          BA   0.810
 93          LG    0.15    0.35    4.45    0.38       0
 94          UI     199     777    1298    1396    1017     616     379     239     139      93
 95          UI      37      37      37       0       0       0       0       0       0       0
 96          UI       0       0       0       0       0       0       0       0       0       0
             *

 97          KK     CP3
 98          KM    Combine routed hydrograph from CP2 with runoff from subbasin 3
```

```
 99          HC       3
             *

100          KK    RCP3
101          KM        ROUTE FLOW FROM CP3 TO CP10.
102          RS       2              -1       0
103          RC     .05     .03     .05    5280   .0083
104          RX    1010    1015    1020    1050    1100    1275    1580    1750
105          RY    1251    1249    1249    1245    1245    1250    1250    1254
             *

106          KK       4
107          KM        RUNOFF HYDROGRAPH FORM SUB-BASIN 4.
108          BA     .30
             *     LG    0.35    0.15    8.01   0.081  18.504
109          LG     .20     .35    4.35     .44    9.00
110          UI     47.    191.    286.    443.    513.    346.    237.    115.     67.     36.
111          UI     14.     14.      0.      0.      0.      0.      0.      0.      0.      0.
112          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
             *

113          KK       5
114          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 5.
115          BA     .72
             *     LG    0.35    0.15   8.023   0.081  17.926
116          LG     .20     .35    4.30     .45    9.00
117          UI    109.    433.    653.    981.   1241.    852.    594.    323.    177.    104.
118          UI     33.     33.     33.      0.      0.      0.      0.      0.      0.      0.
119          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

120          KK     CP5
121          KM        ADD HYDROGRAPHS AT CP5.
122          HC       2    1.02

123          KK    RCP5
124          KM        ROUTE COMBINED HYDROGRAPHS AT CP5 TO CP6.
125          RS       1              -1       0
126          RC     .08     .05     .08    2400   .0833
127          RX     955     970     985    1000    1020    1035    1050    1065
128          RY    2815    2810    2805    2800    2800    2805    2810    2815
             *
1                                          HEC-1 INPUT                                          PAGE  4

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

129          KK       6
130          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 6.
131          BA     .45
             *     LG    0.35    0.15   7.976   0.082      20
132          LG     .20     .35    3.95     .53   10.00
133          UI    206.    627.   1145.    834.    421.    154.     53.     33.      0.      0.
134          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

135          KK     CP6
136          KM        ADD HYDROGRAPHS AT CP6.
137          HC       2    1.47

138          KK    RCP6
139          KM        ROUTE COMBINED HYDROGRAPHS AT CP6 TO CP7.
140          RS       1              -1       0
141          RC     .08     .05     .08    2400   .0833
142          RX     955     970     985    1000    1020    1035    1050    1065
143          RY    2815    2810    2805    2800    2800    2805    2810    2815
             *

144          KK       7
145          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 7.
146          BA     .31
             *     LG    0.35    0.15   7.976   0.082      20
147          LG     .20     .35    3.95     .53   10.00
148          UI    124.    383.    708.    610.    347.    132.     54.     21.      0.      0.
149          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

150          KK     CP7
151          KM        ADD HYDROGRAPHS AT CP7.
152          HC       2    1.78

153          KK    RCP7
154          KM        ROUTE COMBINED HYDROGRAPHS AT CP7 TO CP9.
155          RS       3              -1       0
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156          RC     .08     .05     .08   10200  .07745
157          RX    1000    1045    1120    1195    1230    1300    1350    1450
158          RY    1910    1880    1850    1838    1838    1850    1880    1910
             *

159          KK       9
160          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 9.
161          BA    1.40
             *     LG    0.35    0.15   7.909   0.084  19.572
162          LG     .20     .35    4.00     .52   10.00
163          UI    155.    380.    725.    933.   1213.   1828.   1593.   1225.    939.    707.
164          UI    389.    261.    178.    116.     47.     47.     47.     47.      0.      0.
165          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1                                                HEC-1 INPUT                                          PAGE  5

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


166          KK   I1CP9
167          KM        ADD HYDROGRAPHS AT CP9.
168          HC       2    3.18
             *

169          KK       8
170          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 8.
171          BA     .81
             *     LG    0.35    0.15   7.976   0.082      20
172          LG     .20     .35    3.95     .53   10.00
173          UI    103.    314.    536.    704.   1058.   1138.    821.    608.    420.    207.
174          UI    147.     95.     31.     31.     31.      0.      0.      0.      0.      0.
175          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

176          KK     CP9
177          KM        ADD HYDROGRAPHS AT CP9.
178          HC       2    3.99

179          KK    RCP9
180          KM        ROUTE COMBINED HYDROGRAPHS AT CP9 TO CP10.
181          RS       8              -1       0
182          RC     .06    .035     .06   19200   .0232
183          RX    1000    1085    1310    1395    1415    1450    1630    1665
184          RY    1317    1314    1311    1308    1308    1314    1314    1317
             *

185          KK      10
186          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 10.
187          BA    2.02
             *     LG   0.347   0.248   5.124   0.254    4.52
188          LG     .16     .35    4.55     .36    4.00
189          UI    119.    119.    219.    428.    547.    632.    709.    813.    930.   1153.
190          UI   1500.   1391.   1155.   1006.    893.    765.    668.    577.    473.    323.
191          UI    210.    201.    191.    119.    119.     84.     36.     36.     36.     36.
192          UI     36.     36.     36.     36.      0.      0.      0.      0.      0.      0.
193          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

194          KK  I1CP10
195          KM        ADD HYDROGRAPHS AT I1CP10
196          HC       2    6.01

197          KK    CP10
198          KM        ADD HYDROGRAPHS AT CP10
199          HC       2
             *
200          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

   41           1
                V
                V
   54         RCP1
                .
                .
   60           .           2
                .           .
                .           .
   70          CP2............
```

```
                V
                V
  73         RCP2
                .
                .
  79            .          3A
                .           V
                .           V
  85            .       RCP3A
                .           .
                .           .
  91            .           .           3
                .           .           .
                .           .           .
  97         CP3.......................
                V
                V
 100         RCP3
                .
                .
 106            .           4
                .           .
                .           .
 113            .           .           5
                .           .           .
                .           .           .
 120            .         CP5............
                .           V
                .           V
 123            .        RCP5
                .           .
                .           .
 129            .           .           6
                .           .           .
                .           .           .
 135            .         CP6............
                .           V
                .           V
 138            .        RCP6
                .           .
                .           .
 144            .           .           7
                .           .           .
                .           .           .
 150            .         CP7............
                .           V
                .           V
 153            .        RCP7
                .           .
                .           .
 159            .           .           9
                .           .           .
                .           .           .
 166            .       I1CP9............
                .           .
                .           .
 169            .           .           8
                .           .           .
                .           .           .
 176            .         CP9............
                .           V
                .           V
 179            .        RCP9
                .           .
                .           .
 185            .           .          10
                .           .           .
                .           .           .
 194            .      I1CP10............
                .           .
                .           .
 197         CP10............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN   1998              *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   02OCT03  TIME  09:14:35  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
                    North Inlet Channel
                    Part of the McMicken Dam FRZR, FCD 2002C011
                    For Flood Control District of Maricopa County
                    By  Stantec Consulting Inc

                    File:  EX100-6.ih1
                    Date:  2 October 2003

                    This model represents the Beardsley Canal Wash watershed at Northern
                    Avenue.  Runoff from the watershed exceeds the culvert capacity at Olive
                    Avenue which results in flow overtopping the Beardsley Canal.  It is
                    proposed that the culvert and downstream channel conveyance can be
                    improved which would eliminate the breakout condition.  To model the
                    downstream impacts of this proposed condition, the diversion operation at
                    Olive Avenue is removed.

                    Model Input Parameters
                    Rainfall:  100-year, 6-hour design rainfall
                    Rainfall Losses:  Green & Ampt
                    Unit Hydrograph:  Phoenix Mountain and Desert/Rangeland S-Graph


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

   IT          HYDROGRAPH TIME DATA
                      NMIN          5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1   0  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ        800  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      3   0  ENDING DATE
                    NDTIME       1835  ENDING TIME
                     ICENT         19  CENTURY MARK

               COMPUTATION INTERVAL     .08 HOURS
                    TOTAL TIME BASE   66.58 HOURS

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

25 JD          INDEX STORM NO. 1
                      STRM       3.34  PRECIPITATION DEPTH
                      TRDA        .01  TRANSPOSITION DRAINAGE AREA

26 PI            PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                    .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                    .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00

29 JD          INDEX STORM NO. 2
                      STRM       3.32  PRECIPITATION DEPTH
                      TRDA        .50  TRANSPOSITION DRAINAGE AREA

30 PI            PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                    .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                    .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00
```

```
33 JD          INDEX STORM NO. 3
                    STRM        3.26  PRECIPITATION DEPTH
                    TRDA        2.80  TRANSPOSITION DRAINAGE AREA

34 PI            PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                    .03       .03       .07       .07       .07       .08       .08       .08       .05       .05
                    .05       .02       .02       .02       .01       .01       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00

37 JD          INDEX STORM NO. 4
                    STRM        3.08  PRECIPITATION DEPTH
                    TRDA       16.00  TRANSPOSITION DRAINAGE AREA

38 PI            PRECIPITATION PATTERN
                    .01       .01       .00       .00       .00       .00       .00       .00       .00       .01
                    .01       .01       .00       .01       .00       .00       .00       .00       .00       .00
                    .00       .00       .01       .00       .00       .00       .00       .01       .01       .01
                    .01       .01       .01       .01       .01       .01       .02       .02       .02       .03
                    .03       .03       .06       .06       .06       .07       .07       .07       .04       .04
                    .04       .02       .02       .02       .01       .01       .01       .01       .01       .01
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00
1
```

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

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	1	1518.	4.42	268.	67.	24.	1.94		
+	ROUTED TO	RCP1	1371.	4.75	267.	67.	24.	1.94		
+	HYDROGRAPH AT	2	1480.	4.50	295.	74.	27.	1.82		
+	2 COMBINED AT	CP2	2281.	4.67	509.	129.	46.	3.76		
+	ROUTED TO	RCP2	2187.	4.83	508.	129.	46.	3.76		
+	HYDROGRAPH AT	3A	609.	4.08	46.	12.	4.	.29		
+	ROUTED TO	RCP3A	423.	4.33	46.	12.	4.	.29		
+	HYDROGRAPH AT	3	1472.	4.17	126.	31.	11.	.81		
+	3 COMBINED AT	CP3	2270.	4.75	616.	155.	56.	4.86		
+	ROUTED TO	RCP3	2220.	4.92	615.	155.	56.	4.86		
+	HYDROGRAPH AT	4	588.	4.25	51.	13.	5.	.30		
+	HYDROGRAPH AT	5	1261.	4.25	118.	29.	11.	.72		
+	2 COMBINED AT	CP5	1623.	4.25	160.	40.	14.	1.02		
+	ROUTED TO	RCP5	1622.	4.25	160.	40.	14.	1.02		
+	HYDROGRAPH AT	6	1123.	4.08	75.	19.	7.	.45		

```
          2 COMBINED AT
+                          CP6      2045.   4.17        216.        54.        20.       1.47
          ROUTED TO
+                         RCP6      1995.   4.17        216.        54.        20.       1.47
          HYDROGRAPH AT
+                            7       741.   4.08         51.        13.         5.        .31
          2 COMBINED AT
+                          CP7      2312.   4.17        253.        63.        23.       1.78
          ROUTED TO
+                         RCP7      2090.   4.33        253.        63.        23.       1.78
          HYDROGRAPH AT
+                            9      1632.   4.33        203.        51.        18.       1.40
          2 COMBINED AT
+                        I1CP9      2996.   4.33        412.       103.        37.       3.18
          HYDROGRAPH AT
+                            8      1190.   4.33        126.        32.        11.        .81
          2 COMBINED AT
+                          CP9      3604.   4.33        496.       124.        45.       3.99
          ROUTED TO
+                         RCP9      3267.   4.75        494.       124.        45.       3.99
          HYDROGRAPH AT
+                           10      1533.   4.75        296.        74.        27.       2.02
          2 COMBINED AT
+                       I1CP10      4242.   4.75        712.       179.        65.       6.01
          2 COMBINED AT
+                         CP10      5498.   4.75       1175.       297.       107.      10.87

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

```
1****************************************                    ****************************************
*                                      *                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS       *
*              JUN  1998               *                    *   HYDROLOGIC ENGINEERING CENTER      *
*            VERSION 4.1               *                    *         609 SECOND STREET            *
*                                      *                    *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE   02OCT03  TIME  09:14:44  *                    *          (916) 756-1104              *
*                                      *                    *                                      *
****************************************                    ****************************************

X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX

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

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

1                                          HEC-1 INPUT                                                PAGE  1

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

  1           ID   North Inlet Channel
  2           ID   Part of the McMicken Dam FRZR, FCD 2002C011
  3           ID   For Flood Control District of Maricopa County
  4           ID   By  Stantec Consulting Inc
  5           ID
  6           ID   File:  EX100-24.ih1
  7           ID   Date:  2 October 2003
  8           ID
  9           ID   This model represents the Beardsley Canal Wash watershed at Northern
 10           ID   Avenue.  Runoff from the watershed exceeds the culvert capacity at Olive
 11           ID   Avenue which results in flow overtopping the Beardsley Canal.  It is
 12           ID   proposed that the culvert and downstream channel conveyance can be
 13           ID   improved which would eliminate the breakout condition.  To model the
 14           ID   downstream impacts of this proposed condition, the diversion operation at
 15           ID   Olive Avenue is removed.
 16           ID
 17           ID   Model Input Parameters
 18           ID   Rainfall:  100-year, 24-hour design rainfall
 19           ID   Rainfall Losses:  Green & Ampt
 20           ID   Unit Hydrograph:  Phoenix Mountain and Desert/Rangeland S-Graph
 21           ID
 22           IT       5                    800
 23           IO       5
 24           IN      15
              *DIAGRAM
              *
 25           JD    4.15    0.01
 26           PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
 27           PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
 28           PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
 29           PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
 30           PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
 31           PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
 32           PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
 33           PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
 34           PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
 35           PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
 36           JD   4.046    5.00
 37           JD   3.943   10.00
 38           JD   3.735   30.00
              *

 39           KK       1
 40           KM   Sub-Basin      1
 41           KM
```

```
 42          KM      The Phoenix Mountain S-Graph is used for this basin.
 43          KM          Lag Used =  42.5 minutes
 44          KM
 45          BA    1.94
 46          LG    0.20    0.35    4.00    0.52      10
 47          UI     166     232     588     934    1190    1417    1903    1314    1016     915
 48          UI     804     692     591     487     408     373     319     251     213     186
 49          UI     165     127     129      83      82      83      65      32      33      32
 50          UI      31      33      32      32      32      32       0       0       0       0
 51          UI       0       0       0       0       0       0       0       0       0       0
             *
1                                          HEC-1 INPUT                                          PAGE  2

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

 52          KK    RCP1
 53          KM        ROUTE FLOW FROM CP1 TO CP2.
 54          RS       5              -1       0
 55          RC     .06     .04     .06   17800   .0469
 56          RX    1000    1125    1300    1390    1405    1490    1590    1750
 57          RY    1440    1439    1437    1428    1428    1439    1442    1444
             *

 58          KK       2
 59          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 2.
 60          BA    1.82
 61          LG     .18     .35    4.55     .37   12.00
 62          UI     133     135     370     590     832     955    1124    1534    1182     882
 63          UI     781     695     631     560     486     415     350     316     291     251
 64          UI     207     169     158     145     119     103     101      71      65      65
 65          UI      65      45      25      26      25      26      25      26      25      26
 66          UI      26      25       0       0       0       0       0       0       0       0
 67          UI       0       0       0       0       0       0       0       0       0       0
             *

 68          KK     CP2
 69          KM    Combine routed hydrograph from CP2A with runoff from subbasin 2
 70          HC       2
             *

 71          KK    RCP2
 72          KM        ROUTE COMBINED HYDROGRAPHS AT CP2 TO CP3.
 73          RS       2              -1       0
 74          RC     .06    .035     .06    4500   .0111
 75          RX    1000    1100    1350    1705    1735    1780    1850    2000
 76          RY    1304    1302    1302    1298    1298    1303    1302    1305
             *

 77          KK      3A   BASIN
 78          BA   0.290
 79          LG    0.15    0.35    4.30    0.42       0
 80          UI      80     314     510     513     338     200     120      72      43      21
 81          UI      14      14       0       0       0       0       0       0       0       0
 82          UI       0       0       0       0       0       0       0       0       0       0
             *

 83          KK   RCP3A
 84          KM        ROUTE FLOW FROM CP3A TO CP3
 85          RS       2              -1       0
 86          RC     .03     .03     .05    5300   .0060
 87          RX    1000    1023    1032    1046    1058    1067    1250    1540
 88          RY    1289    1288    1286    1284    1284    1286    1288    1291
             *
1                                          HEC-1 INPUT                                          PAGE  3

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

 89          KK       3   BASIN
 90          BA   0.810
 91          LG    0.15    0.35    4.45    0.38       0
 92          UI     199     777    1298    1396    1017     616     379     239     139      93
 93          UI      37      37      37       0       0       0       0       0       0       0
 94          UI       0       0       0       0       0       0       0       0       0       0
             *

 95          KK     CP3
 96          KM    Combine routed hydrograph from CP2 with runoff from subbasin 3
 97          HC       3
             *
```

```
 98          KK    RCP3
 99          KM       ROUTE FLOW FROM CP3 TO CP10.
100          RS       2              -1       0
101          RC     .05     .03     .05    5280   .0083
102          RX    1010    1015    1020    1050    1100    1275    1580    1750
103          RY    1251    1249    1249    1245    1245    1250    1250    1254
             *

104          KK       4
105          KM       RUNOFF HYDROGRAPH FORM SUB-BASIN 4.
106          BA     .30
             *     LG    0.35    0.15    8.01   0.081  18.504
107          LG     .20     .35    4.35     .44    9.00
108          UI     47.    191.    286.    443.    513.    346.    237.    115.     67.     36.
109          UI     14.     14.      0.      0.      0.      0.      0.      0.      0.      0.
110          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
             *

111          KK       5
112          KM       RUNOFF HYDROGRAPH FROM SUB-BASIN 5.
113          BA     .72
             *     LG    0.35    0.15   8.023   0.081  17.926
114          LG     .20     .35    4.30     .45    9.00
115          UI    109.    433.    653.    981.   1241.    852.    594.    323.    177.    104.
116          UI     33.     33.     33.      0.      0.      0.      0.      0.      0.      0.
117          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

118          KK     CP5
119          KM       ADD HYDROGRAPHS AT CP5.
120          HC       2    1.02

121          KK    RCP5
122          KM       ROUTE COMBINED HYDROGRAPHS AT CP5 TO CP6.
123          RS       1              -1       0
124          RC     .08     .05     .08    2400   .0833
125          RX     955     970     985    1000    1020    1035    1050    1065
126          RY    2815    2810    2805    2800    2800    2805    2810    2815
             *
```



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

127          KK       6
128          KM       RUNOFF HYDROGRAPH FROM SUB-BASIN 6.
129          BA     .45
             *     LG    0.35    0.15   7.976   0.082      20
130          LG     .20     .35    3.95     .53   10.00
131          UI    206.    627.   1145.    834.    421.    154.     53.     33.      0.      0.
132          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

133          KK     CP6
134          KM       ADD HYDROGRAPHS AT CP6.
135          HC       2    1.47

136          KK    RCP6
137          KM       ROUTE COMBINED HYDROGRAPHS AT CP6 TO CP7.
138          RS       1              -1       0
139          RC     .08     .05     .08    2400   .0833
140          RX     955     970     985    1000    1020    1035    1050    1065
141          RY    2815    2810    2805    2800    2800    2805    2810    2815
             *

142          KK       7
143          KM       RUNOFF HYDROGRAPH FROM SUB-BASIN 7.
144          BA     .31
             *     LG    0.35    0.15   7.976   0.082      20
145          LG     .20     .35    3.95     .53   10.00
146          UI    124.    383.    708.    610.    347.    132.     54.     21.      0.      0.
147          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

148          KK     CP7
149          KM       ADD HYDROGRAPHS AT CP7.
150          HC       2    1.78

151          KK    RCP7
152          KM       ROUTE COMBINED HYDROGRAPHS AT CP7 TO CP9.
153          RS       3              -1       0
154          RC     .08     .05     .08   10200  .07745
155          RX    1000    1045    1120    1195    1230    1300    1350    1450
```

```
156          RY    1910    1880    1850    1838    1838    1850    1880    1910
             *

157          KK       9
158          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 9.
159          BA    1.40
             *     LG    0.35    0.15   7.909   0.084  19.572
160          LG     .20     .35    4.00     .52   10.00
161          UI    155.    380.    725.    933.   1213.   1828.   1593.   1225.    939.    707.
162          UI    389.    261.    178.    116.     47.     47.     47.     47.      0.      0.
163          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1                                          HEC-1 INPUT                                          PAGE  5

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


164          KK   I1CP9
165          KM        ADD HYDROGRAPHS AT CP9.
166          HC       2    3.18
             *

167          KK       8
168          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 8.
169          BA     .81
             *     LG    0.35    0.15   7.976   0.082      20
170          LG     .20     .35    3.95     .53   10.00
171          UI    103.    314.    536.    704.   1058.   1138.    821.    608.    420.    207.
172          UI    147.     95.     31.     31.     31.      0.      0.      0.      0.      0.
173          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

174          KK     CP9
175          KM        ADD HYDROGRAPHS AT CP9.
176          HC       2    3.99

177          KK    RCP9
178          KM        ROUTE COMBINED HYDROGRAPHS AT CP9 TO CP10.
179          RS       8              -1       0
180          RC     .06    .035     .06   19200   .0232
181          RX    1000    1085    1310    1395    1415    1450    1630    1665
182          RY    1317    1314    1311    1308    1308    1314    1314    1317
             *

183          KK      10
184          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 10.
185          BA    2.02
             *     LG   0.347   0.248   5.124   0.254    4.52
186          LG     .16     .35    4.55     .36    4.00
187          UI    119.    119.    219.    428.    547.    632.    709.    813.    930.   1153.
188          UI   1500.   1391.   1155.   1006.    893.    765.    668.    577.    473.    323.
189          UI    210.    201.    191.    119.    119.     84.     36.     36.     36.     36.
190          UI     36.     36.     36.     36.      0.      0.      0.      0.      0.      0.
191          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

192          KK  I1CP10
193          KM        ADD HYDROGRAPHS AT I1CP10
194          HC       2    6.01

195          KK    CP10
196          KM        ADD HYDROGRAPHS AT CP10
197          HC       2
             *
198          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

   39           1
                V
                V
   52         RCP1
                .
                .
   58           .           2
                .           .
                .           .
   68         CP2............
                V
                V
```

```
 71        RCP2
              .
              .
 77           .          3A
              .           V
              .           V
 83           .       RCP3A
              .           .
              .           .
 89           .           .           3
              .           .           .
              .           .           .
 95         CP3.......................
              V
              V
 98        RCP3
              .
              .
104           .           4
              .           .
              .           .
111           .           .           5
              .           .           .
              .           .           .
118           .         CP5............
              .           V
              .           V
121           .        RCP5
              .           .
              .           .
127           .           .           6
              .           .           .
              .           .           .
133           .         CP6............
              .           V
              .           V
136           .        RCP6
              .           .
              .           .
142           .           .           7
              .           .           .
              .           .           .
148           .         CP7............
              .           V
              .           V
151           .        RCP7
              .           .
              .           .
157           .           .           9
              .           .           .
              .           .           .
164           .       I1CP9............
              .           .
              .           .
167           .           .           8
              .           .           .
              .           .           .
174           .         CP9............
              .           V
              .           V
177           .        RCP9
              .           .
              .           .
183           .           .          10
              .           .           .
              .           .           .
192           .      I1CP10............
              .           .
              .           .
195        CP10............
```

```
(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *             JUN   1998               *
 *           VERSION 4.1                *
 *                                      *
 *  RUN DATE   02OCT03  TIME  09:14:44  *
 *                                      *
 ****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
                    North Inlet Channel
                    Part of the McMicken Dam FRZR, FCD 2002C011
                    For Flood Control District of Maricopa County
                    By  Stantec Consulting Inc

                    File:  EX100-24.ih1
                    Date:  2 October 2003

                    This model represents the Beardsley Canal Wash watershed at Northern
                    Avenue.  Runoff from the watershed exceeds the culvert capacity at Olive
                    Avenue which results in flow overtopping the Beardsley Canal.  It is
                    proposed that the culvert and downstream channel conveyance can be
                    improved which would eliminate the breakout condition.  To model the
                    downstream impacts of this proposed condition, the diversion operation at
                    Olive Avenue is removed.

                    Model Input Parameters
                    Rainfall:  100-year, 24-hour design rainfall
                    Rainfall Losses:  Green & Ampt
                    Unit Hydrograph:  Phoenix Mountain and Desert/Rangeland S-Graph


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

   IT          HYDROGRAPH TIME DATA
                      NMIN           5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1    0  STARTING DATE
                     ITIME        0000  STARTING TIME
                        NQ         800  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      3    0  ENDING DATE
                    NDTIME        1835  ENDING TIME
                     ICENT          19  CENTURY MARK

               COMPUTATION INTERVAL     .08 HOURS
                    TOTAL TIME BASE   66.58 HOURS

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

25 JD          INDEX STORM NO. 1
                     STRM        4.15  PRECIPITATION DEPTH
                     TRDA         .01  TRANSPOSITION DRAINAGE AREA

26 PI            PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .01       .00       .01
                    .01       .01       .01       .01       .01       .01       .01       .01       .03       .03
                    .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
                    .01       .01       .01       .01       .01       .01       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
```

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                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00

36 JD         INDEX STORM NO. 2
                STRM        4.05  PRECIPITATION DEPTH
                TRDA        5.00  TRANSPOSITION DRAINAGE AREA

 0 PI           PRECIPITATION PATTERN
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .01       .00       .01
                .01       .01       .01       .01       .01       .01       .01       .01       .03       .03
                .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00

37 JD         INDEX STORM NO. 3
                STRM        3.94  PRECIPITATION DEPTH
                TRDA       10.00  TRANSPOSITION DRAINAGE AREA

 0 PI           PRECIPITATION PATTERN
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .01       .00       .01
                .01       .01       .01       .01       .01       .01       .01       .01       .03       .03
                .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
                .01       .01       .01       .01       .01       .01       .00       .00       .00       .00
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38 JD         INDEX STORM NO. 4
                STRM        3.73  PRECIPITATION DEPTH
                TRDA       30.00  TRANSPOSITION DRAINAGE AREA

 0 PI           PRECIPITATION PATTERN
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1

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

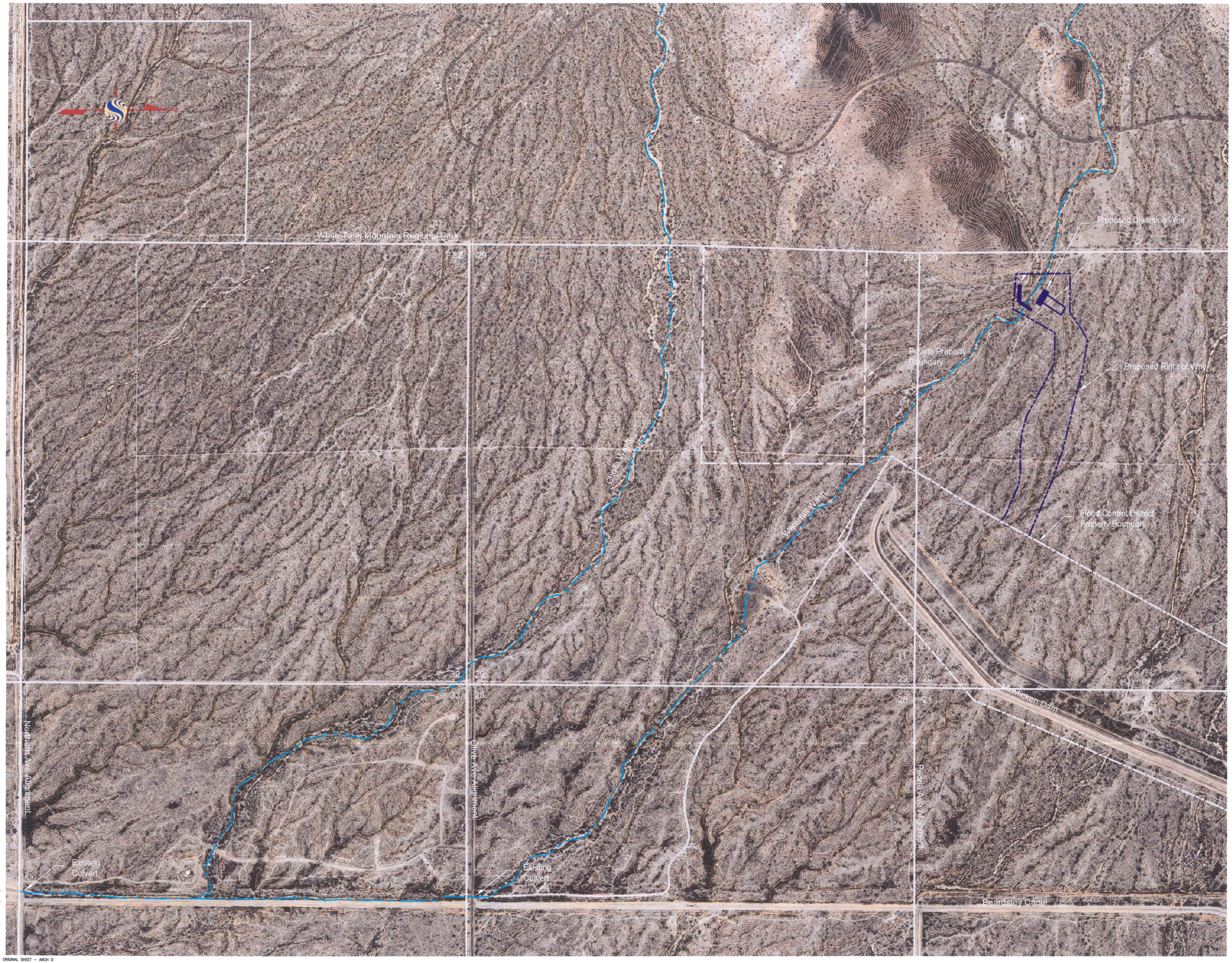
	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	1	1541.	12.42	245.	67.	24.	1.94		
+	ROUTED TO	RCP1	1327.	12.75	245.	67.	24.	1.94		
+	HYDROGRAPH AT	2	1413.	12.50	258.	71.	26.	1.82		
+	2 COMBINED AT	CP2	2488.	12.58	501.	138.	50.	3.76		
+	ROUTED TO	RCP2	2282.	12.75	500.	138.	50.	3.76		
+	HYDROGRAPH AT	3A	445.	12.08	34.	8.	3.	.29		
+	ROUTED TO	RCP3A	318.	12.33	34.	8.	3.	.29		
+	HYDROGRAPH AT	3	1219.	12.17	97.	24.	9.	.81		
+	3 COMBINED AT	CP3	2437.	12.75	629.	170.	61.	4.86		
+	ROUTED TO	RCP3	2349.	12.92	628.	170.	61.	4.86		
+	HYDROGRAPH AT	4	427.	12.25	39.	11.	4.	.30		
+	HYDROGRAPH AT	5	1005.	12.25	93.	25.	9.	.72		
+	2 COMBINED AT	CP5	1427.	12.25	132.	36.	13.	1.02		
+	ROUTED TO	RCP5	1428.	12.25	132.	36.	13.	1.02		
+	HYDROGRAPH AT	6	808.	12.08	57.	16.	6.	.45		

	2 COMBINED AT						
+	CP6	2024.	12.17	188.	51.	19.	1.47
	ROUTED TO						
+	RCP6	1955.	12.17	188.	51.	19.	1.47
	HYDROGRAPH AT						
+	7	535.	12.08	39.	11.	4.	.31
	2 COMBINED AT						
+	CP7	2457.	12.17	227.	62.	22.	1.78
	ROUTED TO						
+	RCP7	2140.	12.33	227.	62.	22.	1.78
	HYDROGRAPH AT						
+	9	1537.	12.33	177.	49.	18.	1.40
	2 COMBINED AT						
+	I1CP9	3661.	12.33	402.	110.	40.	3.18
	HYDROGRAPH AT						
+	8	969.	12.33	102.	28.	10.	.81
	2 COMBINED AT						
+	CP9	4615.	12.33	502.	138.	50.	3.99
	ROUTED TO						
+	RCP9	3905.	12.75	502.	138.	50.	3.99
	HYDROGRAPH AT						
+	10	1481.	12.75	259.	67.	24.	2.02
	2 COMBINED AT						
+	I1CP10	5316.	12.75	750.	202.	73.	6.01
	2 COMBINED AT						
+	CP10	7184.	12.75	1322.	358.	129.	10.87

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

APPENDIX G

HEC-1 MODELS



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Notes

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File Name: wfall_wash.dwg	srg	CG	MCG	05.27.03
	Dwn.	Chkd.	Dsgn.	MM.DD.YY

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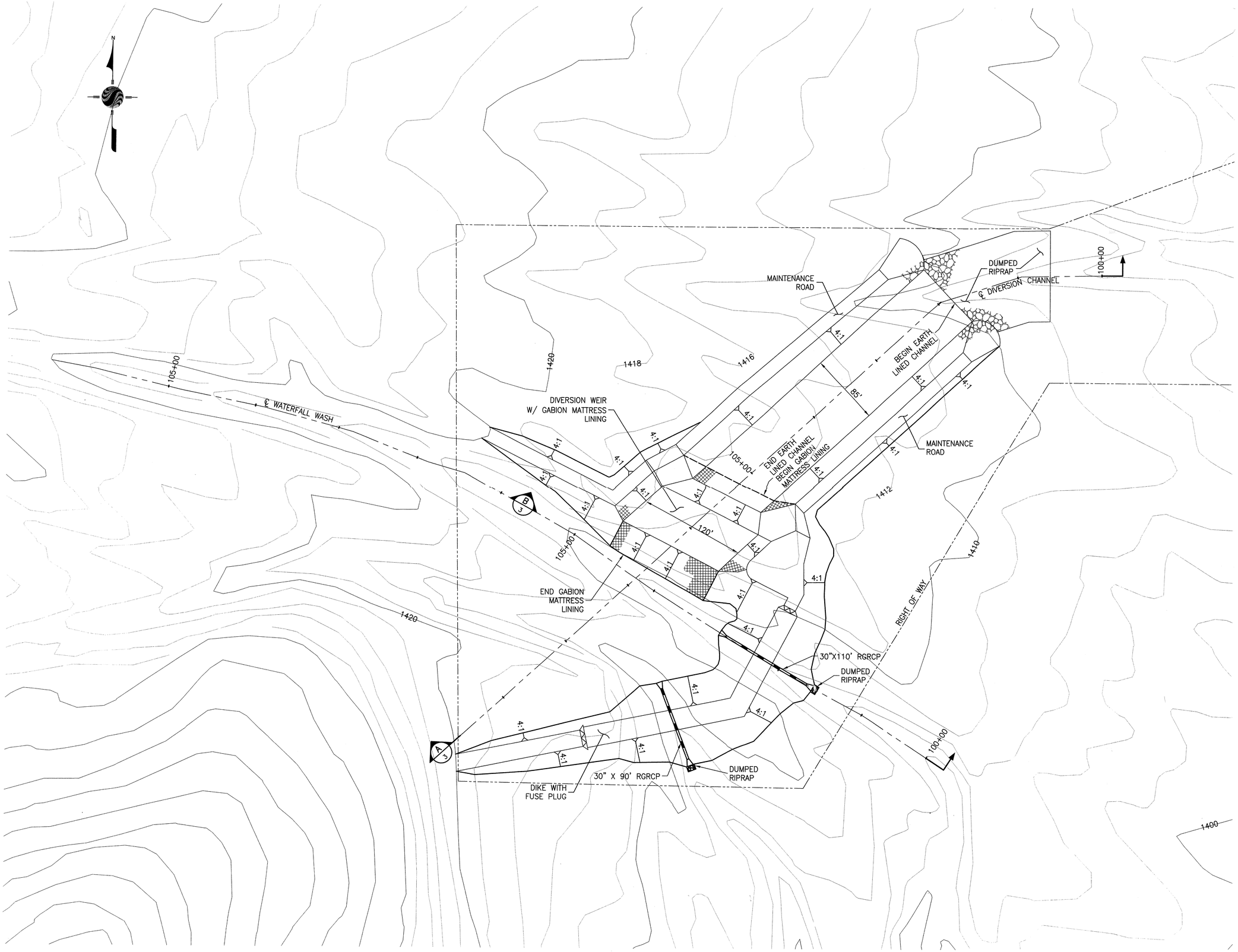
Client/Project
Flood Control District of Maricopa County

McMicken Dam FRZR
Task 2

Title
Waterfall Wash Diversion
Alternative 6A Site Plan

Project No. 82000257
Scale 1"=500'
Drawing No.
Sheet 1 of 3
Revision 0

ORIGINAL SHEET – ARCH D



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Client/Project

Flood Control District of Maricopa County

McMicken Dam FRZR
Task 2
Phoenix, Arizona

Title

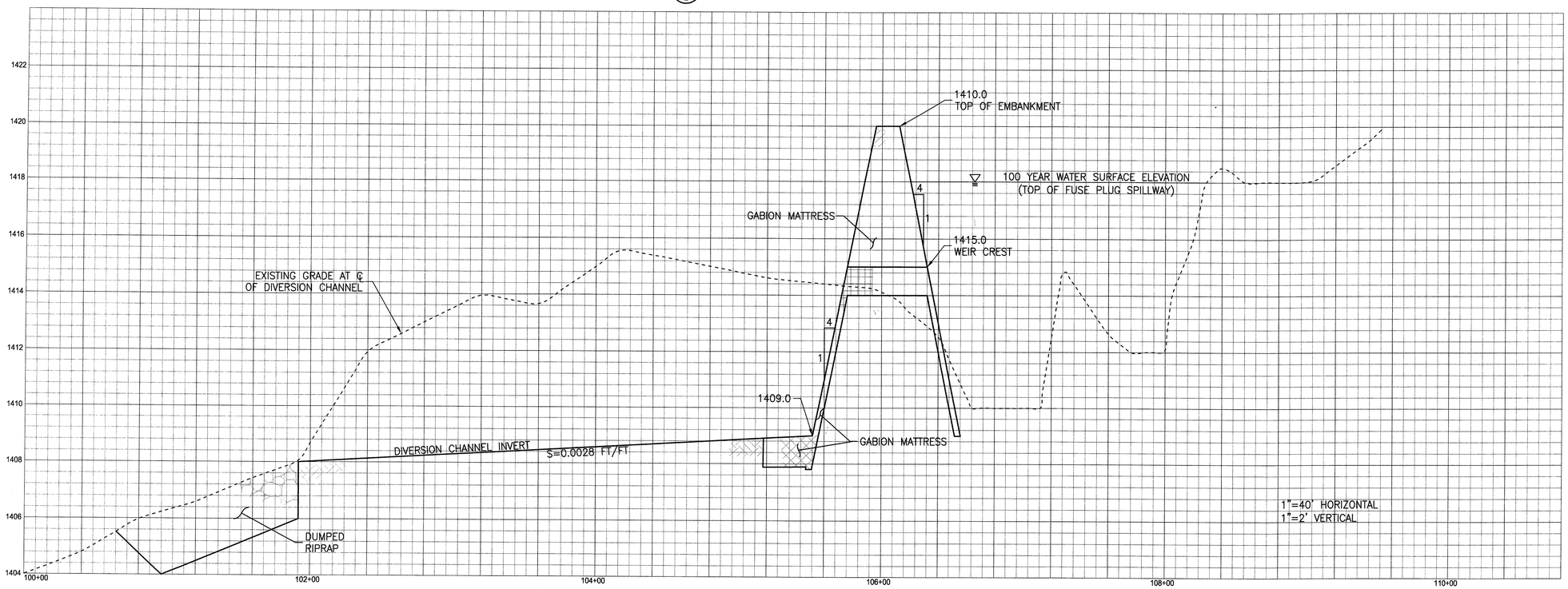
Waterfall Wash Diversion
ALTERNATIVE 6A PLAN

Project No.	Scale
82000257	1"=50'

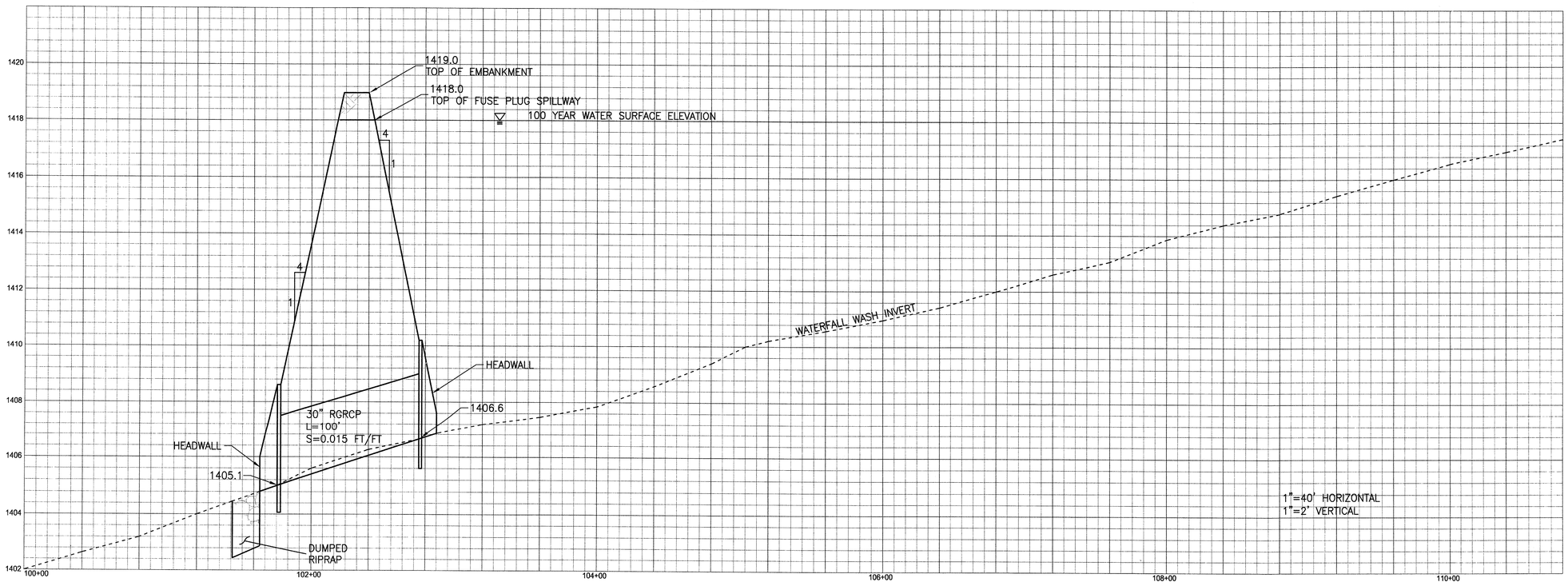
Drawing No.	Sheet	Revision
	2 of 3	

ORIGINAL SHEET – D

A/2 DIVERSION CHANNEL



B/2 WATERFALL WASH



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Client/Project

Flood Control District of Maricopa County

McMicken Dam FRZR
Task 2
Phoenix, Arizona

Title

Waterfall Wash Diversion
Alternative 6A Cross Sections

Project No.	Scale
82000257	As Noted

Drawing No.	Sheet	Revision

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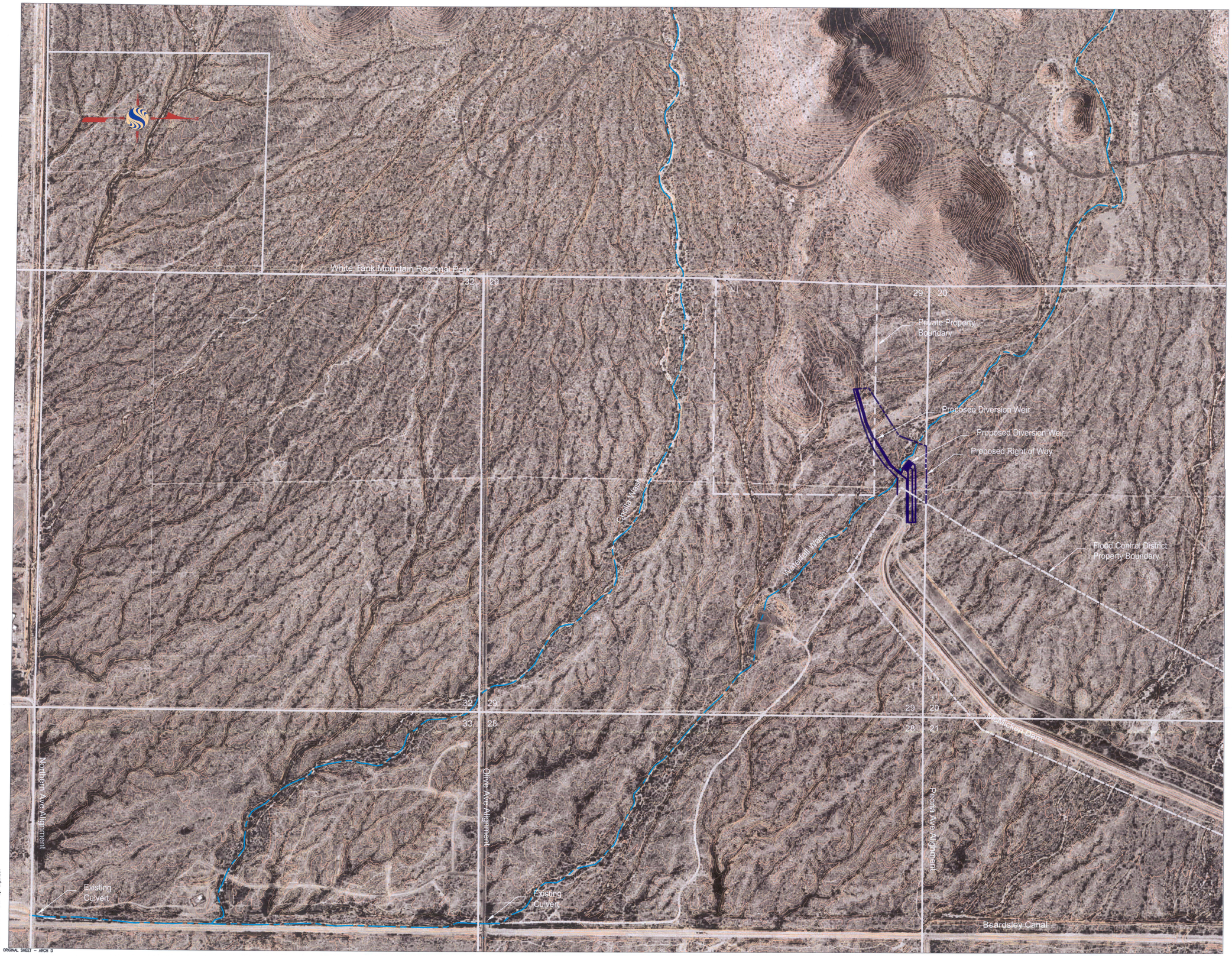

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2003-12-23 11:32AM By: mgeldich

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	Dwn.	Chkd.	Dsgn.	MM.DD.YY

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Client/Project
Flood Control District of Maricopa County

McMicken DAm FRZR
Task 2

Title
Waterfall Wash Diversion
Alternative 6B Site Plan

Project No.	Scale	
82000257	1"=500'	
Drawing No.	Sheet	Revision
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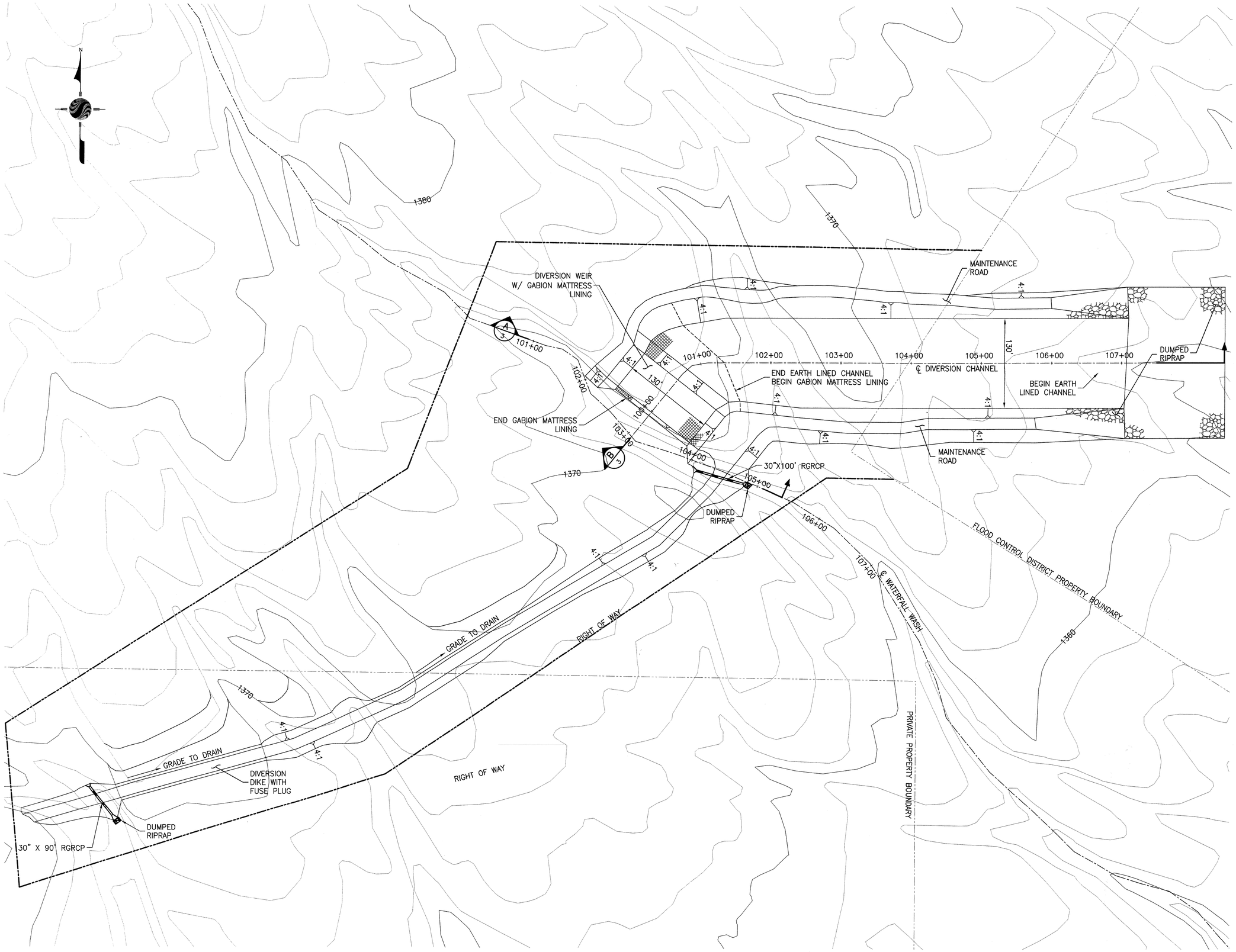

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McMicken Dam FRZR
Task 2
Phoenix, Arizona

Title

Waterfall Wash Diversion
ALTERNATIVE 6B PLAN

Project No. 82000257

Scale 1"=60'

Drawing No.

Sheet

Revision

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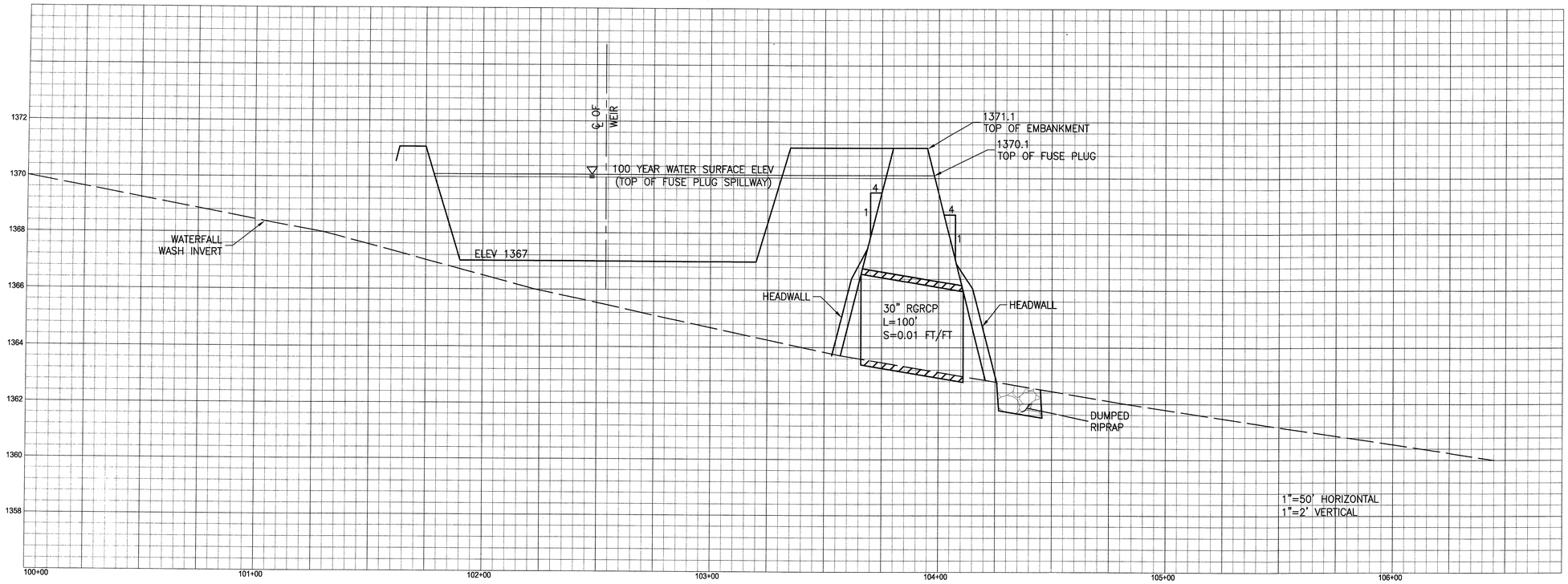

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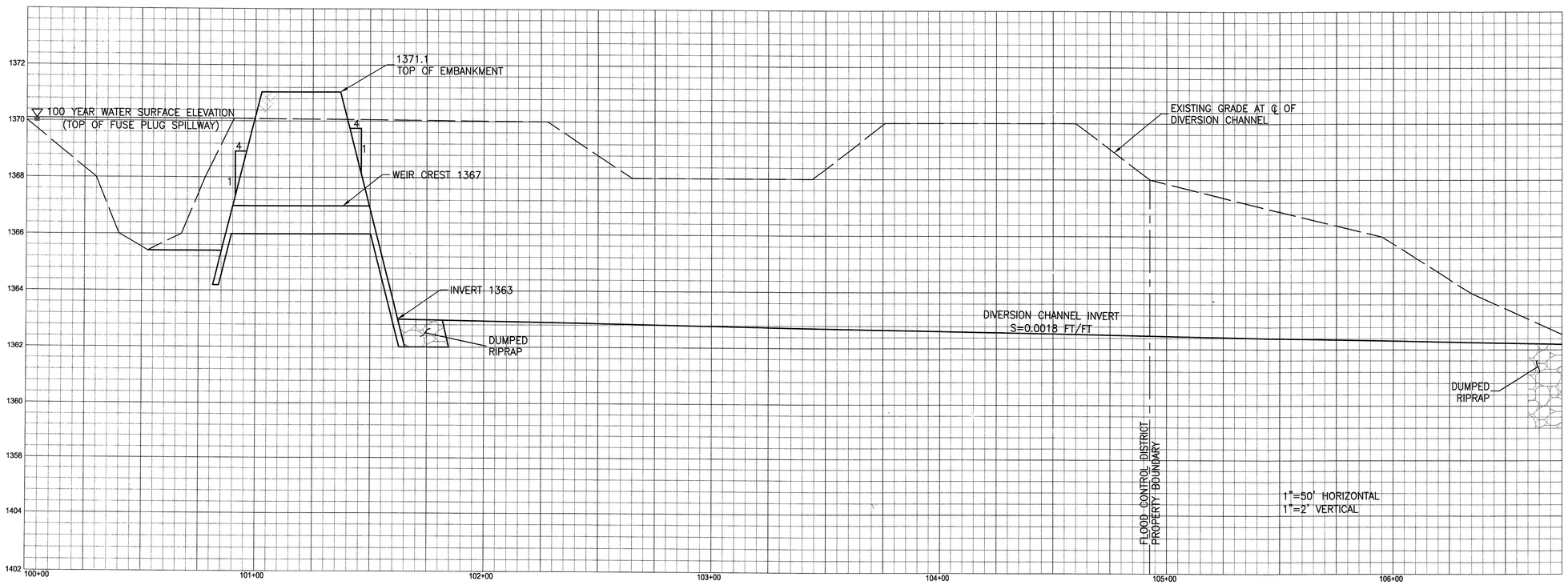

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Client/Project

Flood Control District of Maricopa County

McMicken Dam FRZR
Task 2
Phoenix, Arizona

Title

Waterfall Wash Diversion
ALTERNATIVE 6B CROSS SECTIONS

Project No.	Scale
82000257	As Noted

Drawing No.	Sheet	Revision

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2003-12-23 10:11AM By: mgerlach

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	Dwn.	Chkd.	Dsgn.	MM.DD

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Flood Control District of Maricopa County

McMicken Dam FRZR
Task 2

Title

Waterfall Wash Diversion Alternative 6C Site Plan

Project No.	Scale	
82000257	1"=500'	
Drawing No.	Sheet	Revision
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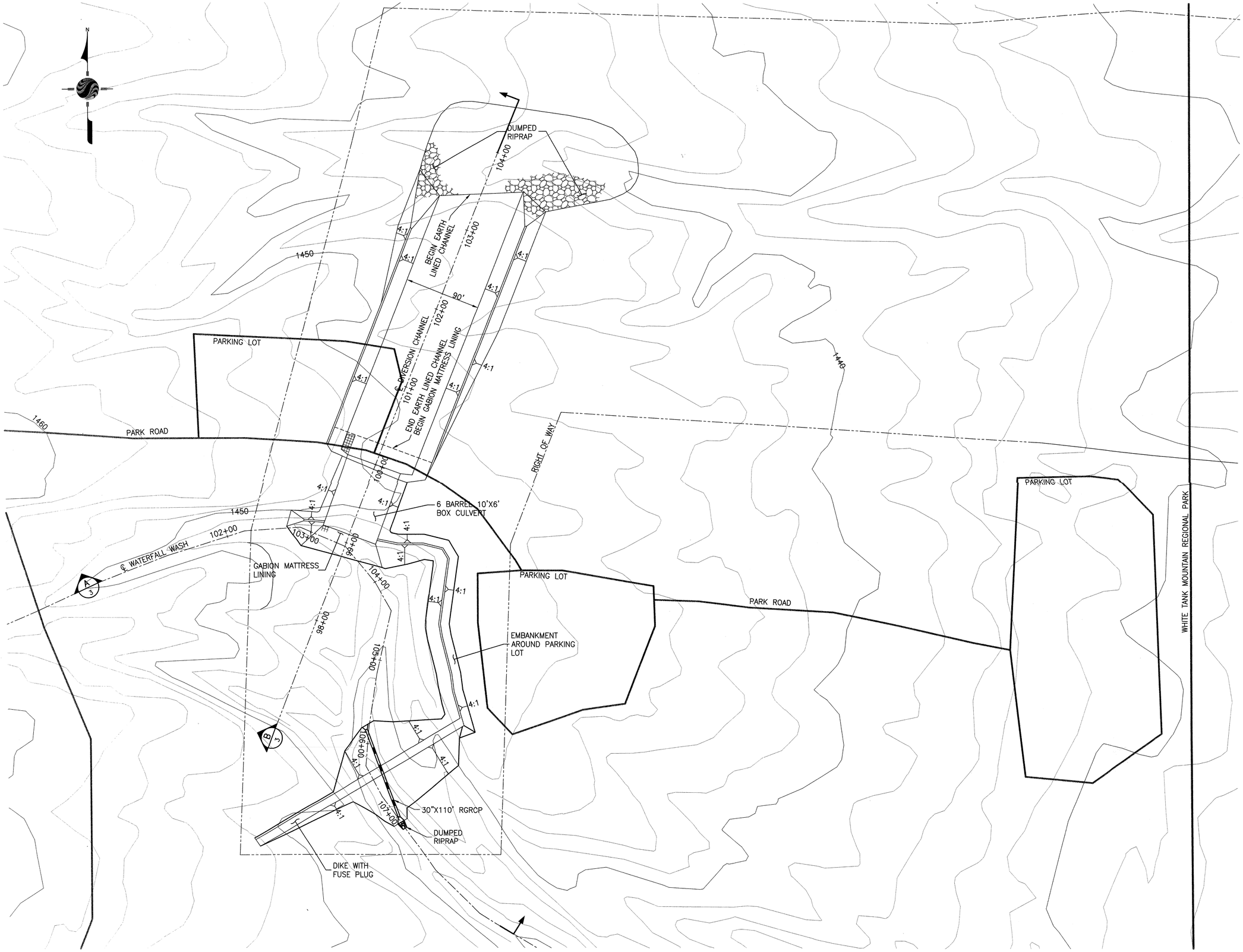

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McMicken Dam FRZR
Task 2
Phoenix, Arizona

Title

Waterfall Wash Diversion
ALTERNATIVE 6C PLAN

Project No.	Scale	
82000257	1"=50'	
Drawing No.	Sheet	Revision

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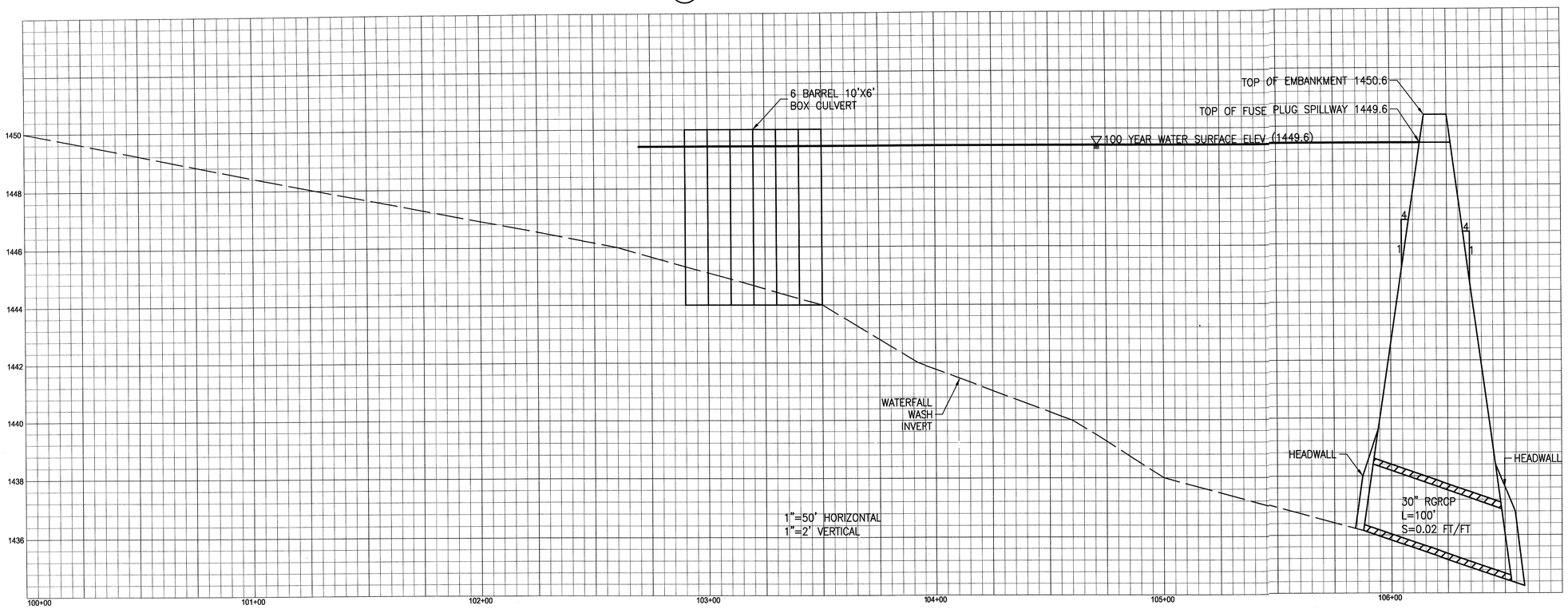
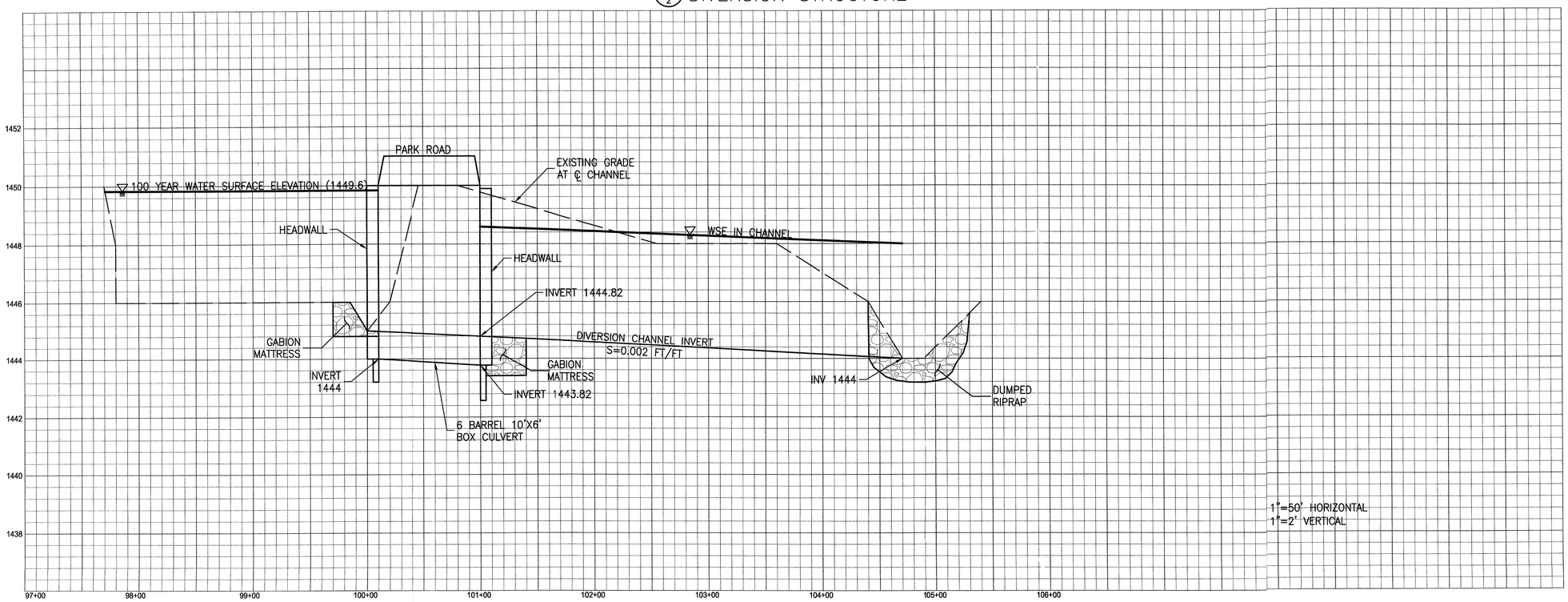
A/2 WATERFALL WASH



B/2 DIVERSION STRUCTURE



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McMicken Dam FRZR
Task 2
Phoenix, Arizona

Title

Waterfall Wash Diversion
ALTERNATIVE 6C CROSS SECTIONS

Project No.	Scale	
82000257	As Noted	
Drawing No.	Sheet	Revision

ORIGINAL SHEET – D