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U.S. Army Corps of Engineers
Los Angeles District

in cooperation with
The City of Tempe

Rio Salado Environmental Restoration Project
Tempe Reach: Phase 2, Salt River
Tempe, Arizona

Design Documentation Report
Final Design Submittal

July 2004

Prepared by
McGann & Associates / Novak Environmental, Joint-Venture

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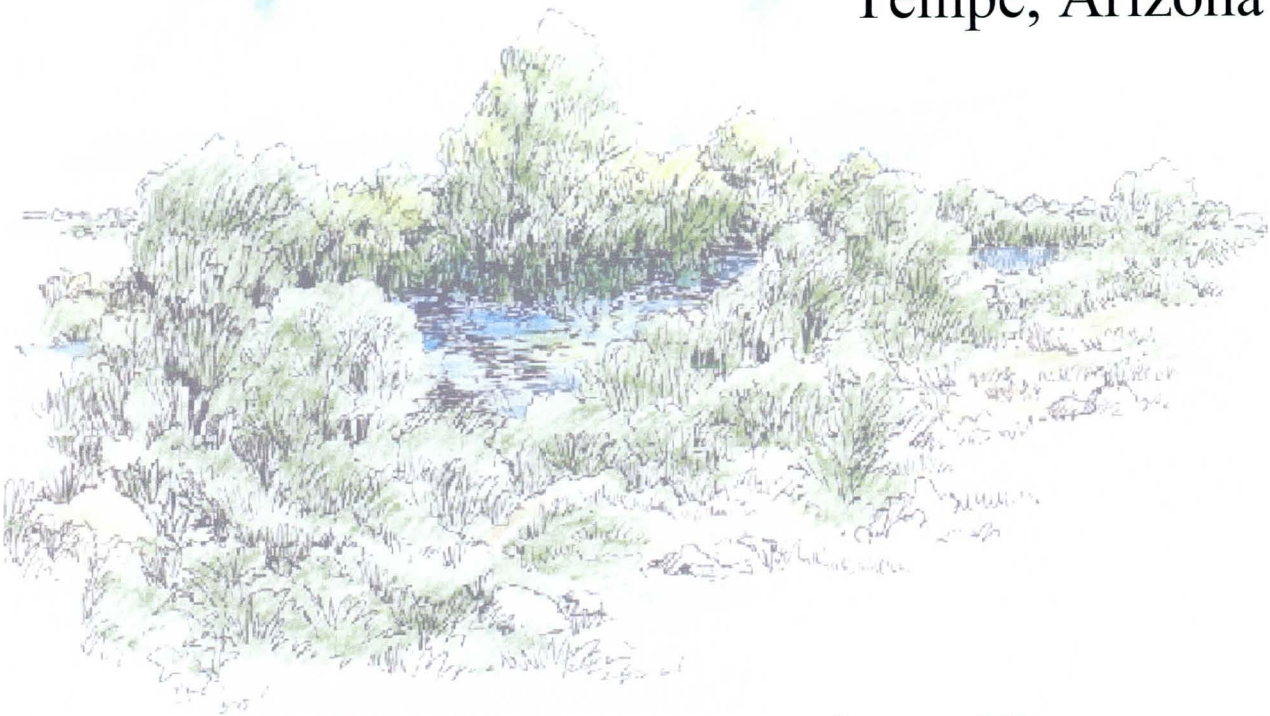

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1.0 Introduction
1.1 Project 1-1
1.2 Project Location 1-1
1.3 Authorization 1-1
1.4 Project Phasing 1-2
1.5 Purpose of Design Documentation Report 1-2
1.6 Related Studies and Reports 1-2
1.7 Related Work by Others 1-3

2.0 Overview of Proposed Improvements - Town Lake to Priest Drive Project Segment
2.1 Introduction 2-1
2.2 Habitat Improvements 2-1
2.3 Water Supply and Irrigation Improvements 2-2
2.4 Public Access Improvements and Public Use Facilities 2-2
2.5 Flood Control Improvements 2-2
2.6 Operations and Maintenance Improvements 2-3

3.0 Habitat Improvements
3.1 Introduction 3-1
3.2 Aquatic Strand Habitat 3-1
3.3 Mesquite Bosque Habitat 3-2
3.4 Lower Sonoran Habitat - Saltbush / Burrobush Association 3-3
3.5 Lower Sonoran Habitat - Palo Verde Association 3-3
3.6 Open Space - Open Edges Habitat 3-4
3.7 Summary of Habitat Types and Values 3-4

4.0 Water Supply and Irrigation
4.1 Introduction 4-1
4.2 Existing Site Conditions 4-1
4.3 Depth to Groundwater 4-2
4.4 Surface Water Runoff from Storm Drains 4-2
4.5 Flows from Tempe Town Lake 4-3
4.6 Overview of Proposed Project Irrigation System(s) 4-3
4.7 Proposed Drip Irrigation System 4-4
4.8 Proposed Booster Pump Station 4-5
4.9 Proposed Filtration System 4-6
4.10 Proposed Flood Irrigation System 4-6
4.11 Irrigation Water Demand - Flood Irrigation 4-7
4.12 Irrigation Water Demand - Drip Irrigation 4-7

5.0 Site Grading Concept
5.1 Introduction 5-1
5.2 Realignment of Existing Low Flow Channel 5-1
5.3 Construction of Berms 5-1
5.4 Grading of Perimeter Service Drive 5-1

Appendix A: Project Geotechnical Report

Appendix B: USGS Stream Gauge Information for Gauge No. 09512165

Appendix C: Earthwork Calculations

Appendix D: Irrigation Pump Information

Appendix E: Irrigation System Filter Information

Appendix F: Hydraulic Analysis of Proposed Low Flow Channel Weirs and Infiltration Basins

1.1 Project:

This Design Documentation Report (DDR) was prepared in conjunction with the Final Design Submittal for the Salt River, Tempe Town Lake to Priest Drive segment of the Rio Salado Environmental Restoration Project, Tempe Reach. Work was performed under contract DACW09-00-D-0006, Task Order 0001, Modification Four (4).

1.2 Project Location:

The project site is located within the Salt River, downstream of Tempe Town Lake in Tempe, Arizona. This section of the project extends from Tempe Town Lake on the east to Priest Drive on the west (See Fig. 1-A).

The project includes the full bottom width of the Salt River and portions of the north bank in the vicinity of of the Tempe Town Lake downstream dam. Habitat plantings will be installed starting approximately 100 feet west of the Tempe Town Lake dam to allow for future dam maintenance without conflicting or impacting habitat plantings. Habitat plantings will also stop approximately thirty (30) feet from the toes of the side slopes of the channels to allow for maintenance vehicle access to maintain the existing bank protection.

A small area on the north bank, near the Tempe Town Lake downstream dam, will be used for an irrigation pump station. Water will be taken from Tempe Town Lake and used for irrigation of the habitat plantings in the channel.

1.3 Authorization:

This project is being conducted under the authority given in Public Law 761, Seventy-fifth Congress, known as Section 6 of the Flood Control Act of 1938 as appropriated under the 1994 Senate Energy and Water Development Bill. This authority, dated June 28, 1938, states "the Secretary of War (now the Secretary of the Army) is hereby authorized and directed to cause preliminary examinations and surveys .... at the following localities: ... Gila River and tributaries, Arizona... ."

A Feasibility Report and an Environmental Impact Statement (EIS) were previously prepared for the Tempe Reach of the Rio Salado Environmental Restoration project. The report found that the "... selected plans are feasible and .... provide environmental restoration benefits that serve the public interest." Detailed plans, specifications, and cost estimates are currently being prepared to allow for implementation of the selected plan.

1.4 Project Phasing

The habitat and related improvements proposed for the Tempe Reach of the Rio Salado project will be developed in three phases. The first phase involved the design of improvements for the Indian Bend Wash segment of the project. This initial phase of construction started in October 2003. The Phase 2 improvements, this project, will be constructed within the Salt River channel and will extend from the Tempe Town Lake to Priest Drive. A third and future phase will encompass a reach of the Salt River between the Tempe Town Lake upstream dam and the existing grade control structure located just west of the McClintock Road alignment. (See Figure 1-A).

1.5 Purpose of Design Documentation Report:

This Design Documentation Report (DDR) was prepared to provide back-up and supporting information related to the design drawings submitted as part of the Final Design Submittal. It includes an overview of the project scope, a discussion of project issues, a summary of proposed project elements, calculations supporting the final design, and copies of related documents and reports that were used in the preparation of the final plans.

1.6 Related Studies and Reports

The following reports were utilized in conjunction with the preparation of the final design submittal documents.

- Rio Salado (Salt River), Arizona. Feasibility Report and Environmental Impact Statement (U.S. Army Corps of Engineers, Los Angeles District, April 1998)
- Final Geotechnical Investigation Report, Rio Salado Habitat / Environmental Restoration Project, Tempe Reach Phase 2 - West End of Tempe Town Lake to Priest Drive, Tempe, Arizona (AMEC Earth and Environmental, Inc., October, 2003)

- Hydraulic Design Report for Salt River Reach of Tempe Rio Salado Environmental Restoration Project (MA/NE Joint Venture, November, 2000)
- Habitat Criteria Report - Rio Salado Environmental Restoration Project (Aspen Environmental Group, March 2001)

1.7 Related Work by Others

The south bank of the Salt River, downstream of Tempe Town Lake, is the location of several projects being undertaken by the City of Tempe. These projects will provide opportunities for the public to view the habitat improvements within the channel. These projects include the new Tempe Center for the Arts and a proposed walkway along the top of the bank. A 2004 construction start date is projected for both of these projects. Other projects, including private mixed-use developments, are contemplated for this area.

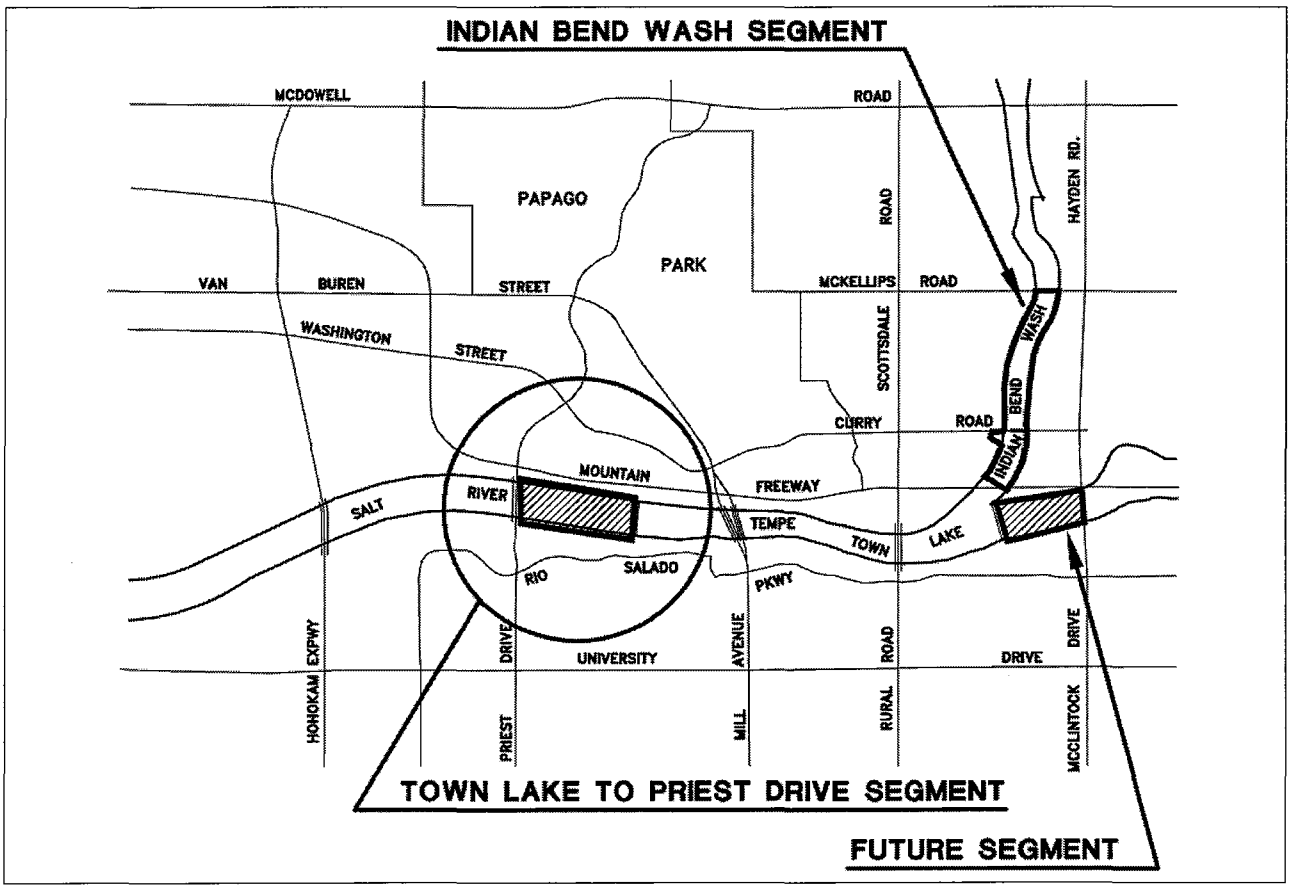


Figure 1-A: Project Location

2.1 Introduction

The Phase 2 project area (Tempe Town Lake to Priest Drive) consists of the bottom of the Salt River channel from the Tempe Town Lake downstream dam to the Priest Drive bridge. Improvements proposed for this project area include; habitat plantings, a pump station to take water from the lake, an automatic irrigation system, unpaved maintenance drives within the channel, earthen berms with constructed weirs, and a realigned low-flow channel. The scope and character of these improvements are outlined below.

2.2 Habitat Improvements

The Feasibility Report for the Rio Salado Environmental Restoration project identified several habitat types to be developed (or re-developed) along the Salt River in Phoenix and Tempe. An additional habitat type was subsequently added for those areas that are within close proximity to Sky Harbor Airport. The proposed habitat types include:

- Wetland - Marsh Habitat
- Cottonwood - Willow Habitat
- Mesquite Bosque Habitat
- Aquatic Strand Habitat
- Open Space - Open Edges Habitat
- Lower Sonoran Habitat (For areas near Sky Harbor Airport)

Within the Phase 2 project area, conditions were found to be appropriate for only four of the six habitat types. These four habitat types are: Mesquite Bosque, Lower Sonoran Habitat (including both Palo Verde and Saltbush/Burrobush associations) Aquatic Strand, and Open Space - Open Edges. Through planting and the construction of related site improvements, each of these four habitat types will be developed as part of the Phase 2 project. Additional information related to habitat development is included in Section 3 of this Design Documentation Report (DDR).

2.3 Water Supply and Irrigation Improvements

To support the proposed habitat development, water from the existing Tempe Town Lake will be utilized. The water will be withdrawn from the lake at a new pump station to be constructed on the north bank of the Salt River near the Tempe Town Lake downstream dam. The water will be filtered and pressurized prior to discharge into an underground, automatic drip irrigation system. These improvements are described in Section 4 of the DDR.

2.4 Public Access Improvements and Public Use Facilities

Limited public use of the proposed habitat improvements within the Phase 2 project area was anticipated and is supported by the approved Feasibility Report. The Phase 2 area, Tempe Town Lake to Priest Drive will not provide for public access to areas within the Salt River channel. The decision to not provide public access to these areas was made due to the danger to individuals who could potentially be within the channel at the time of a flood event or at a time when water is released from the Town Lake. Should such an event occur, the very steep channel banks would make escape from the channel difficult in most project locations.

Instead of access to the channel bottom, the public will be encouraged to view the habitat from vantage points on top of the adjacent banks of the Salt River. Existing and planned developments by the City of Tempe, the project's local sponsor, will result in the construction of public overlooks and observation points.

2.5 Flood Control Improvements

An evaluation of the impacts of the proposed habitat improvements on the capacity of the Salt River channel to convey storm flows was conducted as part of the previously completed Phase 1 design project. This evaluation found that there will be no impact on the 100 year water surface elevation in this area as a result of the proposed habitat improvements. The 100-year event will likely remove all or most of the vegetation within the project area. No new flood control improvements on the Salt River are proposed as part of this phase of work.

2.6 Operations and Maintenance Improvements

Within the Phase 2 project area, unpaved access routes will be provided for maintenance vehicles. These routes will be located along the base of the Salt River channel banks and below the existing downstream dam. Other unpaved maintenance routes will provide access to the proposed berms and weirs. These weirs will require occasional manual operation to flood irrigate habitat plantings and to spread water over the designated infiltration areas. The storage of vehicles, equipment, and supplies used to maintain the project will occur at City of Tempe off-site facilities. Accordingly, new maintenance buildings and storage yards will not be developed as part of this project.

3.1 Introduction:

The habitat types to be developed within the Rio Salado Tempe - Phase Two project site (Salt River channel, Tempe Town Lake to Priest Drive) include the following:

- Aquatic Strand Habitat
- Mesquite Bosque Habitat
- Lower Sonoran Habitat - Saltbush / Burrobush Association
- Lower Sonoran Habitat - Palo Verde Association
- Open Space - Open Edges Habitat

Each of these habitat types is described below. The establishment of each habitat type will be accomplished by the planting of nursery stock trees, shrubs, and cacti and by the seeding of the subject area with native plant seed. A base seed mix has been developed that includes plant species common to several of the habitat types proposed for the project. The seed mixes for individual habitat types will be customized to include species unique to the subject habitat type.

The planting of nursery grown trees and shrubs of the specified species will create a vegetative structure that in some areas will include a low-growing vegetative canopy or overstory. The proposed seeding will facilitate the development of a diverse understory. Seeds that are applied to ground surface by hydroseeding will self-select in response to field conditions and microclimates. Species in the seed mix that thrive in drier or sunnier conditions will germinate more readily in areas where these xeric conditions are present. Species that thrive in wetter areas will germinate where moisture is more prevalent. As the habitat develops, the vegetative structure and species distribution will respond to the varying conditions on the project site.

3.2 Aquatic Strand Habitat

The Aquatic Strand Habitat is a habitat type that will respond opportunistically to wetter conditions within the Salt River channel. These wetter conditions will occur along the low flow channel and in the infiltration areas that will be created to spread and infiltrate the surface water entering the river channel from storm drains on the north and south bank of the Salt River.

The construction of the proposed berms and weirs, and the creation of the infiltration areas (See Section 5 of this DDR) will serve several purposes. One such purpose is the spreading of surface water from the low flow channel to accelerate its infiltration into the soil. A second purpose is the creation of relatively large areas of Aquatic Strand Habitat that can be sustained without supplemental irrigation.

Reference is made to the Final Habitat Criteria Report for the Rio Salado Habitat Restoration Project (November 2002), for plant species that are likely to occur within Aquatic Strand Habitat areas. Generally these plants are herbaceous or small woody species. An overstory or canopy is generally not present within this habitat type. If required as part of the future adaptive management program for the project, areas of Aquatic Strand Habitat can be cleared or cut back using standard construction equipment.

Aquatic Strand Habitat will be developed only in those project areas that are outside of the 10,000' Aviation Safety Zone associated with Sky Harbor Airport.

3.3 Mesquite Bosque Habitat

The Mesquite Bosque is winter deciduous woodland primarily found on the upper terraces of southwestern flood plains. It is an integral component of a complete riparian ecosystem. Dominant canopy species in this habitat type include the following: Velvet Mesquite (*Prosopis velutina*) and Screwbean Mesquite (*P. pubescens*). Understory species include Desert Mallow (*Sphaeralcea ambigua*) and Wolfberry (*Lycium spp.*).

The Mesquite Bosque provides important vertical structure within a riparian habitat. The canopy of the trees shields the ground from rain-splash erosion, while roots of the understory vegetation help reduce sheet and rill erosion. Mesquite Bosque habitats offer significant aesthetic value and are an important part of the historical southwestern riparian landscape.

Mesquite Bosque habitats occur where soil conditions are moist because of frequent flooding and/or high ground water levels. Plant species that naturally occur within this habitat type can, however, withstand drier periods when soil moisture conditions are low. Within the project area, storm water flows will periodically saturate surface soils and a water table is near the ground surface. Ultimately these water sources will support the plants within the proposed mesquite bosque without supplemental irrigation.

To aid in the establishment of the plants, however, a drip irrigation system that can create the soil moisture conditions needed for the establishment of a healthy Mesquite Bosque habitat will be installed as part of this project.

Mesquite Bosque Habitats will be established only in those project areas that are outside of the 10,000' Aviation Safety Zone associated with Sky Harbor Airport.

3.4 Lower Sonoran Habitat - Saltbush / Burrobush Association

The Lower Sonoran Habitat - Saltbush / Burrowbush Association is characterized by low-growing shrubby plants. It generally occurs in dryer areas with lower water tables and/or infrequent flooding or rainfall. This habitat is dominated by shrubs, with scattered trees such as Velvet Mesquite (*Prosopis velutina*) and Desert Willow (*Chilopsis linearis*). Saltbush (*Atriplex canescens*) and Burrobush (*Hymenoclea salsola*) dominate the shrubby understory. Tree species such as Palo Verde (*Cercidium floridium*) are also found within this habitat type.

Several shrub species including Fourwing Saltbush (*Atriplex canescens*) and Bursage (*Ambrosia dumosa*) will be included in the seed mix for areas to be developed with this habitat type.

The Lower Sonoran Habitat - Saltbush Burrobush Association will be developed in those project areas that are within the 10,000' Aviation Safety Zone associated with Sky Harbor Airport.

3.5 Lower Sonoran Habitat - Palo Verde Association

The Lower Sonoran Habitat - Palo Verde Association is the driest of the habitat types and emulates the Palo Verde flats found within the Sonoran Desert. The tree density within this habitat type is approximately one-half the density of trees found within a Mesquite Bosque Habitat. Shrub densities are typically one-third the shrub density when compared with a Mesquite Bosque Habitat. The vegetative structure of this habitat type includes more open space and edges than are typically found within the Mesquite Bosque Habitat.

The tree species that will be present within the Lower Sonoran Habitat - Palo Verde Association include Blue Palo Verde (*Cercidium floridum*), Screwbean Mesquite (*Prosopis pubescens*), and Elderberry (*Sambucus mexicana*).

The Lower Sonoran Habitat - Palo Verde Association will be developed in those project areas that are within the 10,000' Aviation Safety Zone associated with Sky Harbor Airport.

3.6 Open Space - Open Edges Habitat

Open Space - Open Edges Habitat is defined as those areas along the edges and between patches of other habitat types. Open space is used by small birds and other wildlife species for foraging and can serve as a buffer between the adjoining habitat types. It can also serve as a buffer between habitat areas and areas with high levels of human activity.

Open space habitat will occur in many locations within the Salt River. Areas within the Phase 2 project that are Open Space include the edges of the low flow channel, the Salt River channel banks, and areas between other defined habitat types. Additional areas include existing rock outcrops and areas with very shallow bedrock in close proximity to these outcrops.

3.7 Summary of Habitat Types and Values

The table below summarizes the acres of each habitat type to be developed within the Rio Salado - Tempe Reach, Town Lake to Priest Drive project segment. Also listed are the per acre habitat units associated with each habitat type and the total number of habitat units generated by this phase of the project.

Habitat Type	Value (Habitat Units per Acre per the Project Feasibility Report)	Acres within the Rio Salado Tempe - Town Lake to Priest Drive Project Area (Rounded)	Habitat Units created by this Project
Aquatic Strand	.58	5	2.9
Mesquite Bosque	.45	20	9.0
Lower Sonoran - Saltbush / Burrobush Association	.45	18	8.1
Lower Sonoran Palo Verde Association	.45	11	5.0
Open Space - Open Edges	.20	17	3.4
Totals		71	28.4

4.1 Introduction:

Under present conditions, the Town Lake to Priest Drive segment of the Rio Salado Tempe project has very little vegetation, and as such, very low habitat value. The creation of the habitat types described in Section 3.0 of this Design Documentation Report (DDR) will require the installation of native plants from off-site sources and the construction of a supporting irrigation system. Over time, these plants will mature and provide the habitat values noted.

An acknowledged risk associated with this phase of the Rio Salado Tempe project is the potential need to lower the Tempe Town Lake dam(s) with the associated release of large volumes of water that could damage or displace the habitat plantings and other improvements within the Town Lake to Priest Drive segment. In response to this possibility, the Corps of Engineers - Los Angeles District Office and the City of Tempe have articulated the need to find a balance between the habitat values created by the project and the capital cost for the subject improvements. The proposed concept for the development of the Town Lake to Priest Drive segment of the project addresses this need.

4.2 Existing Site Conditions:

There are several site conditions that played a role in the development of the habitat restoration concepts presented herein. These are the presence of shallow ground water within the site, the flow of surface water through the site from storm drain discharges, and water that periodically spills over the downstream dam from Indian Bend Wash storm water flows entering the lake.

The presence of ground water is important in that it will allow native riparian plant species to survive on the site without supplemental irrigation. After receiving supplemental irrigation during a period of establishment, these native riparian plants will develop root systems that extend to the ground water. Once this source of water has been tapped, the supplemental irrigation system can be turned-off.

The discharge of water from storm drains and the surface conveyance of this water through the site is also significant. This water is both a resource and constraint. It is a constraint in the western portion of the site that is within the 10,000' Aviation Safety Zone associated with Phoenix's Sky Harbor Airport. Within this zone, the goal is to minimize surface water so as to discourage the area's use by waterfowl, other large birds, and flocking bird species thereby enhancing aviation safety.

In areas east of the 10,000' Aviation Safety Zone, the storm drain outflows are a resource. In this location the storm drain discharges are a potential source of irrigation water that could be used for the irrigation of the various habitat plantings. The challenge presented by this phase of the project was to find a way to put this water to beneficial use.

4.3 Depth to Groundwater

As documented by the project Geotechnical Report (See Appendix A), the depth to ground water within the site ranges from a few feet to not-more-than six feet (6'). The shallow ground water is due in part to bedrock below this reach of the Salt River that ranges from approximately three feet (3') to approximately thirty-six feet (36') below the river bed / ground surface.

The depth to ground water will likely vary from year to year, based on long-term and/or seasonal weather patterns. Due to the underlying bedrock, however, it is anticipated that shallow ground water will always be present. As such, it can be considered a reliable source of water for riparian plants with root systems capable of reaching it.

4.4 Surface Water Runoff from Storm Drains

The primary source of surface water that enters the site is a large storm drain that discharges into the Salt River channel along its south bank, west of the Tempe Town Lake downstream dam. A second storm drain outlets along the north bank approximately one-thousand feet (1,000') west of the dam. These storm drains collect water from storm events, from municipal park and urban irrigation systems, from the area canal system, and from other sources within the watershed. Collectively, the flow from these sources results in continuous surface flow through the project area.

The United States Geological Service (USGS) operates a stream gauge within the Salt River in the vicinity of Priest Drive. Data collected at this gauge indicates that the median surface flow at Priest Drive during recent years has been as follows. (See also Appendix B).

- 1999 1.80 $Ft.^3$ / sec.
- 2000 3.18 $Ft.^3$ / sec.
- 2001 2.38 $Ft.^3$ / sec.

The concept presented herein calls for this surface water to be intercepted from time to time and spread out over portions of the riverbed. (See Section 5.0). This action will serve two purposes. First, it will allow certain localized areas to be periodically flood irrigated to support vegetation that is consistent with the Aquatic Strand Habitat type. The spreading of this water over a larger area also has the benefit of allowing the subject water to infiltrate into the riverbed soils resulting is some reduction of surface water flows downstream, within the 10,000' Aviation Safety Zone.

4.5 Flows from Tempe Town Lake

Periodically, storm flows from Indian Bend Wash (IBW) enter Tempe Town Lake and raise the water surface elevation causing water to spill over the downstream dam. Although infrequent, the spilling of water from IBW storm flows over the dam has occurred on several occasions since the construction of Town Lake. Although the reporting period is very short, the typical discharge observed during these events is approximately 1,500 to 1,700 cfs.

The infrequent nature of the IBW storm flows makes this an unreliable source of irrigation water. As a result the project design does not propose to utilize this water for irrigation. The design of improvements within the channel, however, does acknowledge that these flows will occasionally move through the site. The weirs and gates to be constructed within the channel have been designed to withstand these flows with minimal or no damage.

4.6 Overview of Proposed Project Irrigation System(s)

The irrigation systems proposed for the project can be summarized as follows:

- A temporary drip irrigation system within portions of the site will be installed for the purpose of establishing the habitat plantings. It will utilize water pumped from Tempe Town Lake into a distribution mainline to be installed within the Salt River Channel.

- In areas where it is feasible to do so, a simple flood irrigation system will be constructed to irrigate portions of the site adjacent to the low-flow channel.

4.7 Proposed Drip Irrigation System

The proposed source of water for the drip irrigation system will be the Tempe Town Lake. Other sources of water were considered, but the use of water from the Lake was found to be most advantageous to the project's local sponsor, the City of Tempe. Water withdrawn from the lake will be metered. This will enable the City to conduct mandated water accounting and reporting activities.

The water will be withdrawn from the lake along the north bank, in the vicinity of the downstream dam. The water will be metered, filtered to remove contaminants that could damage the drip irrigation system, and pumped into a mainline within the channel.

Two parallel mainlines will be constructed. One will be along the base of the north bank and the other along the base of the south bank. Remote control valves will be installed at intervals to provide water to the new habitat plantings. The selected routing of the mainline within the channel was chosen to minimize the need to extend irrigation pipes through, over, or under the existing soil cement and reno mattress bank protection that is continuous along the north and south banks of the Salt River throughout the project area. The mainline will be extended into the channel beneath an existing maintenance access ramp. Within the channel, the mainline and associated remote control valves will be adjacent to the perimeter graded service drive to facilitate access for monitoring and maintenance activities.

Downstream of the mainline and remote control valves, lateral lines will be extended into the channel and drip emitters will be installed to irrigate the new habitat plantings. Although the drip irrigation system is a temporary system, it will be constructed to City of Tempe Parks Department standards. The coarse soil materials present and the potential for localized scour in the vicinity of the irrigation system piping makes the construction of a reasonably durable system important.

The proposed irrigation controller(s) will be installed out of the channel in the vicinity of the proposed pump station. The control system will similarly be constructed to City of Tempe standards and will be connected to the City's existing central control network. By integrating the project irrigation system with the City's central control network, substantial savings can be realized through the remote monitoring and operation of the system.

4.8 Proposed Booster Pump Station:

The booster pump station will be located on City of Tempe property on the north bank of the Salt River near the Town Lake downstream dam. An intake line will be extended from the pump station to the lake. The line will extend through a penetration of the lake's perimeter (safety) wall above the high-water elevation of the lake. The intake line will extend into the lake, to a depth below the minimum water surface elevation and terminate at a screened foot valve.

The booster pump will be of the vertical, multi-stage, centrifugal type. The specified pump will deliver up to 75 gpm at 185 feet of head. The booster pump will include a pressure tank to maintain pressure in the irrigation mainline. The pump will start when a drop in system pressure is detected.

The booster pump will be designed to allow for completion of an irrigation cycle in approximately 15 hours while applying 18 gallons per tree and one gallon per shrub during the course of each cycle. This was established as follows:

	Approximate Quantity	Application Rate (GPH)	Total Demand (GPH)	Total Demand (GPM)
Trees	2450	6.0	14,700	245
Shrubs	4350	1.0	4,350	73
Total	***	***	***	318
Quantity of Zones in System		***	***	28
Average Flow Per Zone		***	***	11.5 GPM

Based on the system flow information provided above, a typical operating scheme will be as follows:

Number of Zones operating simultaneously:	Six (6)
System Flow: (6 Zones x 11.5 gpm)	69 GPM
Run Time Per (Set of 6) Zones	3 Hours
Application Rate - Trees:	18 Gallons (3 Hrs. x 6 GPH)
Application Rate - Shrubs:	3 Gallons (3 Hrs. x 1 GPH)
Time to Complete Irrigation Cycle:	15 Hrs. (28 Zones / 6 = Approx. 5 Sets x 3 Hrs. = 15 Hrs.)

The irrigation pumps will be installed on a concrete slab with a masonry screen wall for security. A double-swing access gate will be provided for equipment and maintenance personnel access to the pumps. The masonry used in the construction of the screen wall will match the masonry used in the construction of the nearby City of Tempe Downstream Operations Building. The irrigation filter(s) and controller(s) will be installed within the pump station enclosure.

The electrical power supply for the pumps and related equipment will be from an existing electrical panel located within the City of Tempe's Downstream Operations Building. Additional information related to the proposed booster pump is included in Appendix D of this DDR.

4.9 Proposed Filtration System:

With the proposed source of irrigation water being Tempe Town Lake, and the proposed system type being a drip system, there is the potential for organic contaminants in the water, such as algae, to clog the drip emitters installed as part of this project. To minimize this potential problem, a sand media filter will be installed between the pump station and the irrigation mainline. This will be in addition to screen filters installed at individual remote control valves.

The backflushing of the filter will be accomplished automatically. A backflush cycle will be initiated each time the difference in pressure upstream and downstream of the filter exceeds a preset range. The backflush water will be returned to Tempe Town Lake.

Additional information related to the proposed filtration system is included in Appendix E of this DDR.

4.10 Proposed Flood Irrigation System:

The proposed flood irrigation system will utilize the surface water flows that enter the site from area storm drains. These flows will be conveyed along a realigned, shallow, low flow channel. At three locations along the low flow channel earthen berms and weir structures will be constructed. Each of the weirs will include a manual gate.

When open, the weir gates will allow normal surface water flows to proceed downstream. When closed, they will cause water to spread out over a level area upstream of the associated berms. The water, when spread out over an area of up to two acres, will infiltrate into the soil and will also irrigate the riparian vegetation planted in these areas.

The proposed berms will be constructed with native soil from the project site. The weir structures will be constructed as detailed on the project plans.

As noted in Section 3.2 of this report, the Aquatic Strand habitat type consists largely of herbaceous stream side plant species with few woody plants and no trees. The presence of aquatic strand vegetation within the infiltration sites will allow these areas to be periodically graded if needed to retain their level condition or to prevent the establishment of trees. The root systems of the herbaceous plants that remain after periodic grading of these areas will facilitate regeneration of vegetative cover after completion of periodic grading operations.

4.11 Irrigation Water Demand - Flood Irrigation

Irrigation demand for the flood irrigated portion of the project was not calculated. The appropriate frequency for the application of irrigation water within the infiltration areas will be established as part of the future Adaptive Management Plan being prepared by others. In-as-much as this is unregulated stormwater and drainage water discharge, the volume of water used need not be metered, recorded, or reported to other agencies. Its use in the proposed manner will, however, serve to reduce the amount of runoff water that flows downstream and into the 10,000' Aviation Safety Zone. It will accomplish this by facilitating infiltration before the surface water enters the Aviation Safety Zone.

4.12 Irrigation Water Demand - Drip Irrigation

The irrigation water demand at plant maturity for various habitat types was established as part of the Indian Bend Wash Phase of the Rio Salado Tempe project. (Reference is hereby made to the "Design Documentation Report - Final Design Submittal for the Rio Salado Environmental Restoration Project, Tempe Reach, Indian Bend Wash," dated September 2002).

Per this report, the peak and average demands for the Mesquite Bosque habitat type were 5,500 gallons per acre per day and 3,500 gallons per acre per day respectively. An irrigation demand for the Lower Sonoran habitat type was not established as part of the early phase of the project. Based on plant densities and the drought tolerant nature of the species used within this habitat type, an order-of-magnitude estimate of the irrigation water demand for the Lower Sonoran Habitat type is estimated to be 50% of that associated with the Mesquite Bosque habitat. Accordingly, the demand is likely to be approximately 2,750 gallons per acre aper day, peak, and 1,750 gallons per acre per day, average.

It is also relevant that the irrigation water demands noted above were based on the demand of mature plants. Within this project area, the presence of shallow ground water will enable plants to utilize ground water, rather than applied irrigation water, within a few years of planting. The individual plants will not be of mature size when they develop root systems necessary for this to occur. As such, the actual demand will be less than noted above.

As can be determined from the above, the determination of a precise irrigation water demand for the project is problematic. For purposes of budgeting water requirements during the initial few years of the project, the following estimate is proposed.

Habitat Type	Acres (Tempe Town Lake to Priest Drive)	Peak Demand (gpd per Acre)	Peak Project Water Demand (gpd)	Average Demand (gpd per Acre)	Average Project Water Demand (gpd)
Mesquite Bosque	20	5500	110000	3500	70000
Lower Sonoran (Palo Verde)	11	2750	30250	1750	19250
Lower Sonoran (Salt / Burrobush)	18	Not Irrigated	0	Not Irrigated	0
Aquatic Strand	5	Not Irrigated	0	Not Irrigated	0
Open Space / Open - Edges	17	Not Irrigated	0	Not Irrigated	0
Totals	**71**		**140,250**		**89,250**

5.1 Introduction:

An integral part of the proposed site development is the grading of areas within the Salt River channel between the Tempe Town Lake Downstream Dam and the Priest Drive Bridge. The grading work will consist of:

- Realignment of the existing low flow channel
- Construction of berms to contain water within designated infiltration areas
- Grading of a perimeter service drive and access drives to the proposed weir locations

5.2 Realignment of the Existing Low Flow Channel

The existing low flow channel through the site will be realigned slightly to facilitate the construction of berms and the development of level infiltration areas. The proposed alignment is shown in Figure 5-A. The realignment work will be accomplished by grading the on-site materials without export or import of soil. Additional information related to the volume of cut and fill required for this project is included in Appendix C to the Design Documentation Report (DDR).

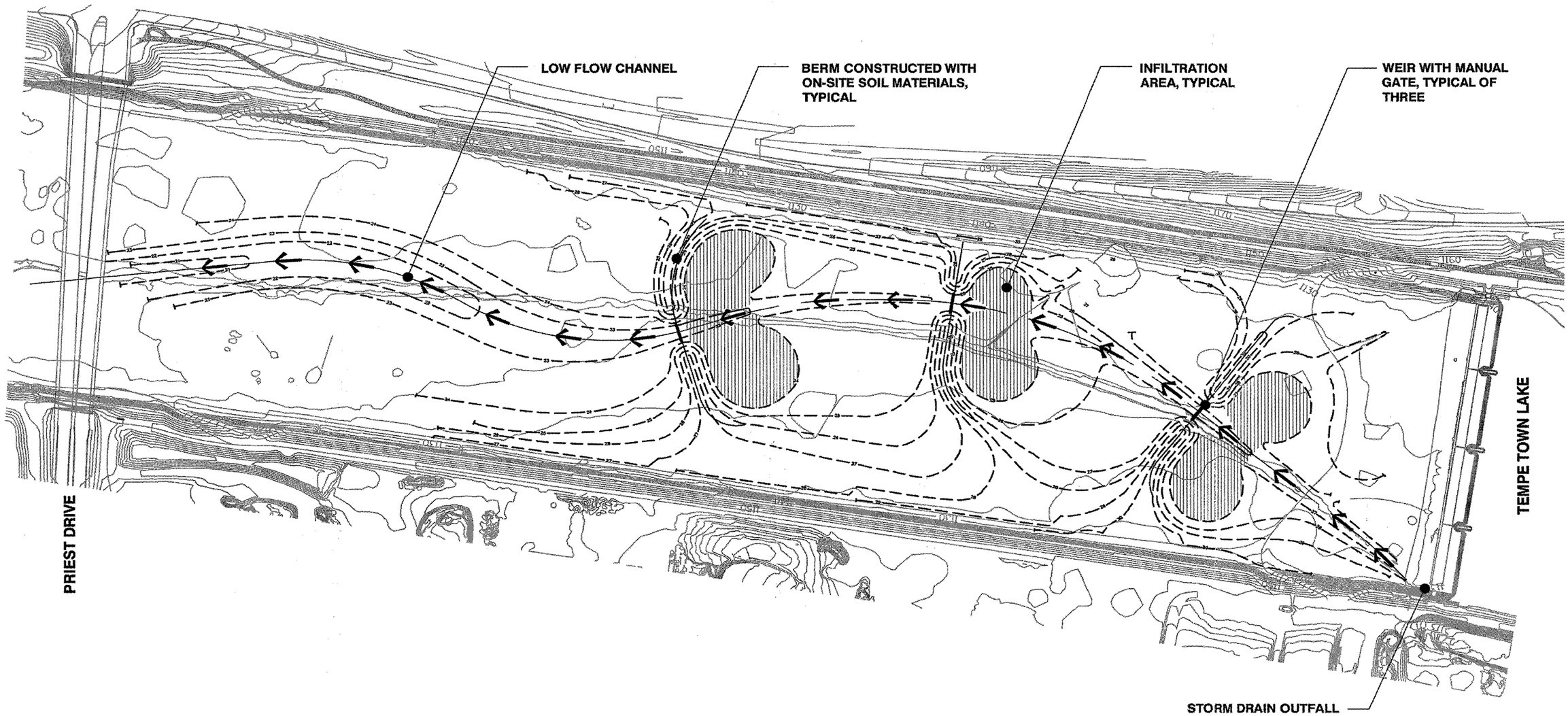
5.3 Construction of Berms

It is proposed that three sets of berms be constructed within the eastern one-half of the site. The function of these berms is to periodically contain water within the designated infiltration areas. The construction of the berms will be accomplished by grading the on-site materials without the import of soil. The berms will be up to three feet (3') in height. Berm width will be variable as shown on the project plans.

5.4 Grading of Perimeter Service Drive

A perimeter service drive will be constructed by grading and compacting existing soil materials. The service drive will parallel both the north and south banks of the Salt River through the project area. The service drive will provide City of Tempe crews access to the habitat plantings. The twenty foot (20') wide drive will also provide access to the soil cement banks as may be needed for Flood Control District of Maricopa County inspection and maintenance activities.

The proposed service drive will cross the channel at the east and west ends of the project. In these locations, it will cross the low flow channel. An at-grade dip crossing is proposed at these two locations.


LOW FLOW CHANNEL
BERM CONSTRUCTED WITH ON-SITE SOIL MATERIALS, TYPICAL
INFILTRATION AREA, TYPICAL
WEIR WITH MANUAL GATE, TYPICAL OF THREE
PRIEST DRIVE
TEMPE TOWN LAKE
STORM DRAIN OUTFALL

Appendix A:
Project Geotechnical Report

amec

Final Geotechnical Investigation Report
Rio Salado Habitat Environmental Restoration Project
Tempe Reach Phase 2
West End of Tempe Town Lake to Priest Drive
Tempe, Arizona

Submitted to:

McGann & Associates –
Novak Environmental Joint Venture
Phoenix, Arizona

Tony J. Freiman

Registered Professional Engineer (Civil)
CERTIFICATE NO.
23982
TONY J.
FREIMAN
Date Signed 10-1-2003
ARIZONA, U. S. A.

Submitted by:

AMEC Earth & Environmental, Inc.
Phoenix, Arizona

1 October, 2003

AMEC Job No. 3-117-001069

amec

1 October, 2003
AMEC Job No. 3-117-001069

Mr. Donald K. McGann
McGann & Associates – Novak Environmental Joint Venture
6814 North Oracle Road
Suite 210
Tucson, Arizona 85704

Dear Mr. McGann:

Re: Geotechnical Investigation
Rio Salado Habitat Environmental Restoration Project –
Tempe Reach Phase 2
West End of Tempe Town Lake to Priest Drive
Tempe, Arizona

Submitted herewith is our Geotechnical Investigation Report for the above referenced project. Included are the results of the field and laboratory investigations. This report also presents a summary of the depth to bedrock in the project area and the results of horticultural soils analyses.

Should you have any questions concerning the recommendations presented in this report, please do not hesitate in contacting us.

Respectfully submitted,

AMEC Earth & Environmental, Inc.

Tony J. Freiman

Tony J. Freiman, P.E.
Senior Engineer

Reviewed by

Daniel N. Fréchette, Ph.D., P.E.
Geotechnical Engineer

G:\Engineering Department\2003 Projects\3-117-001069 Rio Salado Habitat\Report-Phase 2.doc

c: Addressee (6)

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TABLE OF CONTENTS

Page

1.0 INTRODUCTION 1

2.0 PROJECT DESCRIPTION 1

3.0 INVESTIGATION 1
- 3.1 SUBSURFACE EXPLORATION 1
- 3.2 LABORATORY ANALYSES 2
- 3.3 GEOPHYSICAL INVESTIGATION 2

4.0 SITE CONDITIONS AND GEOTECHNICAL PROFILE 2
- 4.1 SITE CONDITIONS 2
- 4.2 GEOLOGIC SETTING 2
- 4.3 GROUNDWATER AND SOIL MOISTURE CONDITIONS 3
- 4.4 HORTICULTURAL TESTING 4

5.0 SUMMARY OF BEDROCK DEPTHS 4

6.0 REFERENCES 6

LIST OF APPENDICES

Appendix A – Field Investigation
Appendix B – Laboratory Test Results
Appendix C – Geophysical Investigation

Tony J. Freiman

Registered Professional Engineer (Civil)
CERTIFICATE NO.
23982
TONY J.
FREIMAN
Date Signed 10-1-2003
ARIZONA, U.S.A.

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation performed by AMEC Earth & Environmental, Inc. (AMEC) for the Rio Salado Habitat Environmental Restoration Project – Tempe Reach Phase 2, located along the Salt River between the downstream dam of Tempe Town Lake and Priest Drive in Tempe, Arizona. The purpose of the investigation was to examine the geotechnical profile beneath the site and to evaluate the engineering and horticultural properties of the subsurface materials.

2.0 PROJECT DESCRIPTION

Details of the project were provided in a facsimile dated January 16, 2003 from Mr. Donald K. McGann of the McGann & Associates/Novak Environmental Joint Venture. Additional details were provided in a telephone conversation with Mr. McGann on January 20, 2003.

Elements of the geotechnical investigation for this present phase of the work include:

- An investigation to define the geotechnical profile, including depth to groundwater.
- An investigation for the depth of bedrock in the project area. Previous geotechnical and geologic investigations were reviewed and summarized.
- Laboratory testing of the encountered soils to determine the horticultural properties.

3.0 INVESTIGATION

3.1 Subsurface Exploration

Fifteen test pits were excavated to depths of 1.5 to 7 feet below existing ground surface. The test pits were excavated using a Terex TX-760 backhoe. Test pits were terminated on bedrock or at shallower depths because of excessive sloughing of test pit slopes due to the inflow of groundwater. The soils encountered during the investigation were continuously examined, visually classified and logged.

Results of the field investigation are presented in Appendix A, including a site plan (Figure 1) showing the test pit and horticultural sample locations and logs of the test pits. Stephan Parker, senior technician of this firm, supervised the field investigation.

3.2 Laboratory Analyses

Particle-size distribution and Atterberg limits testing were performed on selected samples. The results of these tests are presented in Appendix B.

3.3 Geophysical Investigation

Six 120-foot refraction microtremor (ReMi) seismic lines were completed by Michael L. Rucker, P.E. on September 24 at selected test pit sites to obtain estimates of bedrock depth at those locations. A 12-channel Geometrics S-12 seismograph with 120-foot geophone cable and 4.5 Hz vertical geophones was used to sample surface wave energy to develop vertical shear wave profiles. The geophone arrays were oriented east-west along the axis of the riverbed. Surface wave energy sources included ambient noise sampled when commercial aircraft taking off to the east from Sky Harbor International airport were in the near vicinity, and jogging alongside the geophone array during sampling. Interpretations of shear wave profile were made based on the jogging surface wave data. Results of the interpretations, including a brief description of the ReMi method, are presented in Appendix C. A summary of the results is presented in Section 5.0 of this report.

4.0 SITE CONDITIONS AND GEOTECHNICAL PROFILE

4.1 Site Conditions

The site is located in the Salt River between the downstream dam of Tempe Town Lake and the Priest Drive Bridge. At the time of the investigation, the riverbed was essentially flat between the hardbank channel embankment sides. The riverbed was predominantly dry, with a roughly east-west oriented small low flow channel a few feet deep bisecting the riverbed after starting at a storm drain outlet near the south abutment of the Town Lake dam. Another, smaller low flow channel starting at a storm drain outlet at the north bank roughly in the middle of the project site flowed into the larger main low flow channel. A small flow and marsh vegetation was present in these channels. The surface of the riverbed had some sparse vegetation, with denser concentrations near the observed flows. The surface was primarily covered with coarse gravel and cobbles with occasional small diameter boulders.

4.2 Geologic Setting

The geology of the project site was obtained from a geologic map prepared by Schulten and others, 1980[1], and the terminology used in this report conforms to this map. Geologic units

[1] References are listed at the end of this report.

exposed along the Salt River between Tempe Town Lake and Priest Drive include Quaternary unconsolidated deposits and Tertiary and Precambrian bedrock units. The deposits on the south side of the river were mapped as extremely fine alluvium, described as weak to noncalichified deposits of sand, silt and clay.

The north bank of the river contains a mixture of unconsolidated deposits and bedrock units. The bedrock units exposed at the ground surface predominantly consist of the Precambrian Tovrea granite, with minor outcrops of Precambrian metarhyolite and Tertiary sediments. The Tovrea granite crops out extensively west of Priest Drive, extending to about 1,000 feet east of Priest Drive. The Tertiary sediments occur as isolated outcrops east of the Tovrea granite and predominantly consist of interbedded sandstone, siltstone and tuff (the Tempe Beds) with some arkosic breccia (the Stadium Breccia member of the Camels Head Formation). The Tertiary sediments typically are overlain with Quaternary pediment colluvium/alluvium, described as strongly calichified, subangular to angular, ¼- to 8-inch diameter rock fragments.

Two materials dominant within the Salt River channel, the Tovrea granite and Salt River sand and gravel. The Tovrea granite crops out beneath the Priest Drive Bridge and sporadically in the northern portion of the Salt River channel between Priest Drive and the west end of Tempe Town Lake. The granite generally is coarse grained with 1/4- to 1¼-inch diameter rounded crystals of gray quartz, and exhibits red oxidation when weathered. The granite is cut by greenstone and aplite dikes. The Salt River sand and gravel consists of moderately to well sorted, well stratified deposits of sand and gravel, locally bedded with silt.

Seven borings were advanced in the Salt River as part of the Priest Drive Bridge geotechnical investigation performed by Sergent, Hauskins & Beckwith Geotechnical Engineers (1988) (now AMEC Earth & Environmental, Inc.). Borings advanced on the south and north banks of the river encountered the Tovrea granite at depths of 19 and 16.5 feet below the ground surface (bgs), respectively. The remaining five borings were advanced in the river channel. Granite was encountered in three of these borings at depths ranging from 8 to 18 feet bgs. The other two borings were terminated at depths of 11 and 16.5 feet bgs before encountering granite. The granite ranges from soft to hard and from very weathered to unweathered. The overlying materials (channel deposits) consist of clean sands, sand and gravel, and sand, gravel and cobbles with lenses of silty and sandy clays. These materials are moderately firm or medium dense near the surface and generally become dense to very dense with depth.

4.3 Groundwater and Soil Moisture Conditions

Groundwater was encountered in 14 of the 15 test pits. The depth to groundwater varied from 1 to 6 feet below the ground surface. The groundwater depths are presented on the test pit logs.

4.4 Horticultural Testing

Fifteen samples were obtained from the site at the test pit locations indicated on the site plan. A series of horticultural tests were performed by IAS Laboratories on the samples. The test name, method and passing specification, in accordance with the current Arizona Department of Transportation Topsoil Specification (ADOT, 2000), are presented in the following table:

Analysis	Method	Passing Specification
pH	ARIZ 237b	6.0 – 8.3
Soluble Salts	ARIZ 237b	2000 ppm Max
Calcium Carbonates	ARIZ 732	8% Max
Exchangeable Sodium [%]	ARIZ 729	5% Max
Exchangeable Sodium [ppm]	ARIZ 729	300 ppm Max

The results of the horticultural testing are presented in Appendix B.

None of the samples meet the ADOT specifications for topsoil gradation.

All of the samples are from the sand, gravel and cobble deposits of the active Salt River channel. Of the 15 samples tested, all have pH values in excess of the allowable upper bound value of 8.3. The high pH values are typical of clean sand and gravel deposits.

Four samples have an exchangeable sodium concentration in excess of the allowable upper bound value of 5 percent. One sample is at the allowable upper bound value of 5 percent.

5.0 SUMMARY OF BEDROCK DEPTHS

A map showing the depth to bedrock, at selected points across the project site, is presented as Figure 2.

Previous geotechnical investigations in the project area were reviewed in order to determine to the depth to bedrock. The previous geotechnical investigations reviewed were:

- Geotechnical Investigation Report, Priest Drive Bridge, Sergent, Hauskins & Beckwith, 1988.
- Rio Salado Lake Liner Study, CH2M Hill, 1992

The results of the subsurface exploration and geophysical investigation also were incorporated into Figure 2.

Table 1 presents a list of the test pits that encountered bedrock and the depth below present site grade where the bedrock was encountered.

Table 1
Test Pits Encountering Bedrock

Test Pit Number	Depth to Bedrock
TP-13	3 feet
TP-14	3 feet

Table 2 presents a list of the estimated depths to bedrock at the test pit locations using the ReMi Seismic technique described in Section 3.3.

Table 2
Estimated Depth to Bedrock by ReMi Seismic
(Average over the seismic line length of 120 feet)

Line Number	Test Pit Number	Estimated Depth to Bedrock
1	1	28 feet
2	2	27 feet
3	3	36 feet
4	5	18 feet
5	8	23 feet
6	9	18 feet

6.0 REFERENCES

Arizona Department of Transportation, 2000, Standard Specifications for Road and Bridge Construction.

CH2M Hill, 1992, Rio Salado Lake Liner Study.

Schulten, C.S., Bales, J.T, and Pewe, T.L., 1980, Tempe Quadrangle, Maricopa County, Arizona, Department of Geology, Arizona State University, Tempe, Arizona, 14 sheets, scales 1:7,920 to 1:24,000.

Sergent, Hauskins & Beckwith Geotechnical Engineers, 1988, Geotechnical Investigation Report, Priest Drive Bridge and Roadway Design, Rio Salado Drive to Washington Street, Phoenix, Arizona, SHB Job. No. E88-188, Report No. 1, October 21.

APPENDIX A

FIELD INVESTIGATION

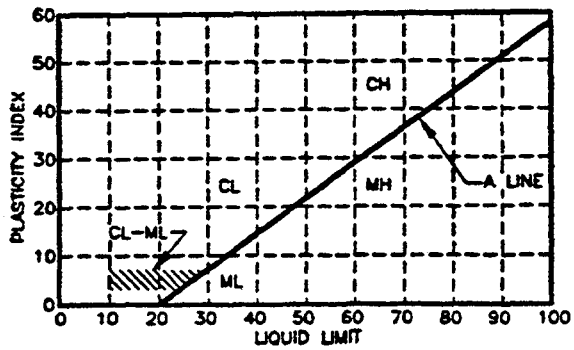
UNIFIED CLASSIFICATION SYSTEM FOR SOILS

Soils are visually classified by the Unified Soil Classification System on the boring logs presented in this report. Grain-size analysis and Atterberg Limits Tests are often performed on selected samples to aid in classification. The classification system is briefly outlined on this chart. For a more detailed description of the system, see "The Unified Soil Classification System" ASTM Designation: D2487.

MAJOR DIVISION				GRAPH SYMBOL	GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE-GRAINED SOILS (Less than 50% passes No. 200 sieve)	GRAVELS (50% or less of coarse fraction passes No. 4 sieve)	CLEAN GRAVELS (Less than 5% passes No. 200 sieve)			GW	Well graded gravels, gravel-sand mixtures or sand-gravel-cobble mixtures.
					GP	poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		GM	Silty gravels, gravel-sand-silt mixtures.
			Limits plot above "A" line & hatched zone on plasticity chart		GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction passes No. 4 sieve)	CLEAN SANDS (Less than 5% passes No. 200 sieve)			SW	Well graded sands, gravelly sands.
					SP	Poorly graded sands, gravelly sands.
		SANDS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		SM	Silty sands, sand-silt mixtures.
			Limits plot above "A" line & hatched zone on plasticity chart		SC	Clayey sands, sand-clay mixtures.
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)	SILTS (LIMITS PLOT BELOW "A" LINE & HATCH ZONE ON PLASTICITY CHART)	SILTS OF LOW PLASTICITY (Liquid Limit Less Than 50)			ML	Inorganic silts, clayey silts with slight plasticity.
		SILTS OF HIGH PLASTICITY (Liquid Limit More Than 50)			MH	Inorganic silts of high plasticity, silty soils, elastic silts.
	CLAYS (LIMITS PLOT ABOVE "A" LINE & HATCH ZONE ON PLASTICITY CHART)	CLAYS OF LOW PLASTICITY (Liquid Limit Less Than 50)			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		CLAYS OF HIGH PLASTICITY (Liquid Limit More Than 50)			CH	Inorganic clays of high plasticity, fat clays, silty and sandy clays of high plasticity.

NOTE: Coarse-grained soils with between 5% & 12% passing the No. 200 sieve and fine-grained soils with limits plotting in the hatched zone on the plasticity chart to have dual symbol.

PLASTICITY CHART



DEFINITIONS OF SOIL FRACTIONS

SOIL COMPONENT	PARTICLE SIZE RANGE
Boulders	Above 300mm (12in.)
Cobbles	300mm to 75mm (12in. to 3in.)
Gravel	75mm (3in.) to No. 4 sieve
Coarse gravel	75mm to 19mm (3in. to 3/4in.)
Fine gravel	19mm (3/4in.) to No. 4 sieve
Sand	No. 4 to No. 200
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Fines (silt or clay)	Below No. 200 sieve

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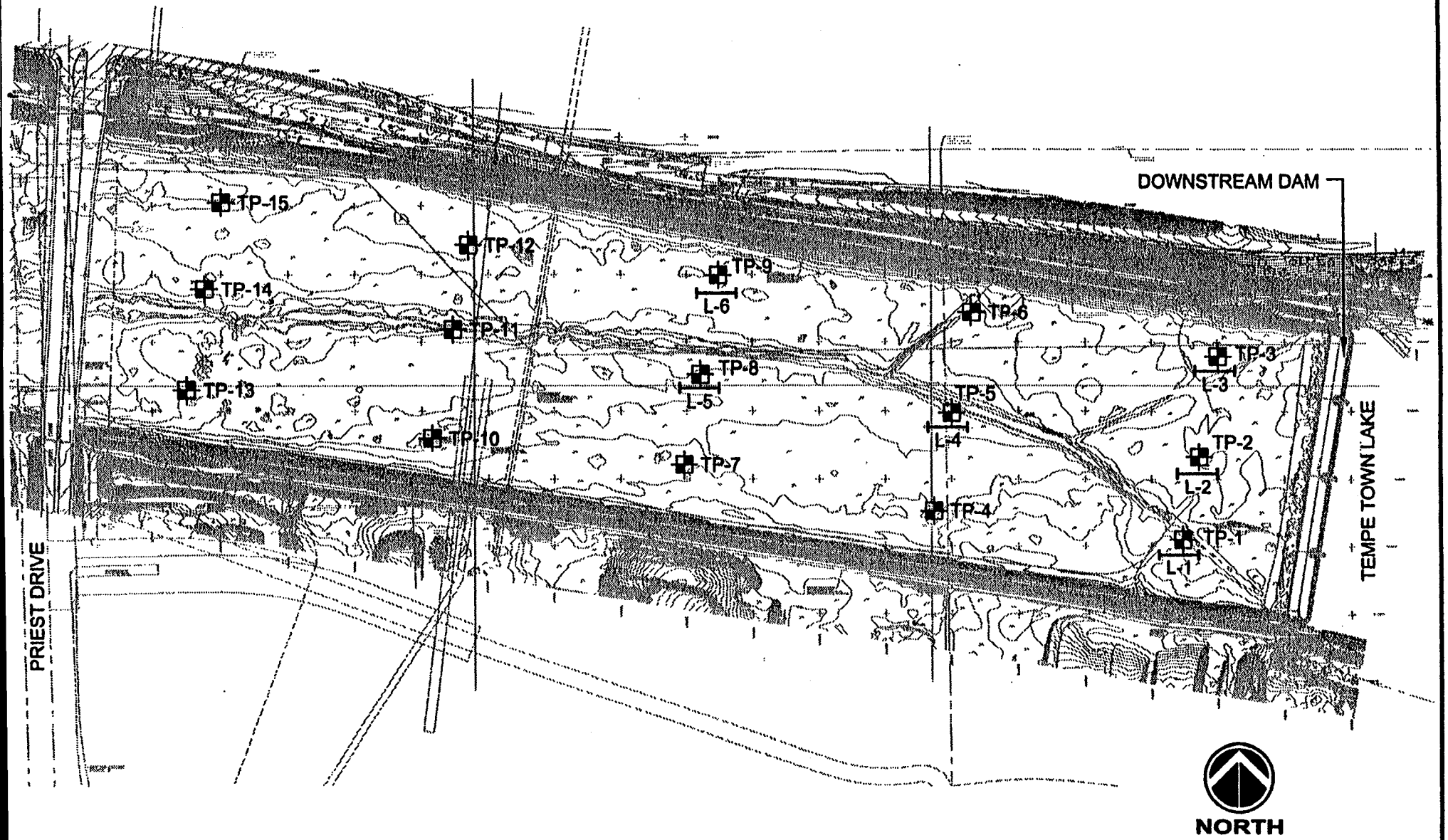


KEY

TP-1 TEST PIT LOCATION

L-1 ReMi SEISMIC LINE LOCATION

JOB NO.	3-117-001069
DESIGN:	DNF
DRAWN:	GWH
DATE:	9/2003
SCALE:	N.T.S.

SITE PLAN
SHOWING TEST PIT LOCATIONS

RIO SALADO HABITAT RESTORATION PROJECT
TEMPE REACH - PHASE II

FIGURE 1

amec

PROJECT Rio Salado Habitat Restoration Project
Tempe Reach - Phase II

amec

JOB NO. 3-117-001069 **DATE** 9/11/03

BACKHOE TYPE Terex TX-760
LOCATION
SURFACE ELEV.
DATUM

GROUNDWATER

	DEPTH	HOUR	DATE
∇	5.0	11:30	9-11-03
▼			

Depth In Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	SOIL DESCRIPTION
0					GP	slightly moist to saturated dense	**SAND, GRAVEL & COBBLES,** up to 8" to 10" maximum size, considerable silt, coarse grained sand, fine to coarse grained, rounded to subrounded gravel, rounded to subrounded cobbles, moderately cemented, nonplastic, medium brown note: hard, white clay lens, present within test pit
1			D				
2							
3							
4							note: occasional 12" boulder below 4'
∇ 5							
6							Stopped Backhoe at 6'
7							
8							
9							
10							

SAMPLE TYPE
B - Undisturbed Block Sample
D - Disturbed Bulk Sample
U - 3" O.D. 2.42" I.D. tube sample
A - Drill Cuttings
G - Grab sample

LOG OF TEST PIT NO. TP-1

GEOTECH_TP 3117001069.GPJ AGRA_PHX.GDT 9/25/03

PROJECT Rio Salado Habitat Restoration Project
Tempe Reach - Phase II

amec

JOB NO. 3-117-001069 **DATE** 9/11/03

BACKHOE TYPE Terex TX-760
LOCATION
SURFACE ELEV.
DATUM

GROUNDWATER

	DEPTH	HOUR	DATE
∇	4.0	13:55	9-11-03
▼			

Depth In Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	SOIL DESCRIPTION
0					GP	slightly moist to saturated dense	**SAND, GRAVEL & COBBLES,** up to 6" to 8" maximum size, predominantly coarse sand, fine to coarse grained gravel, rounded to subrounded cobble, noncemented, nonplastic, medium brown
1			D				note: increasing gravel from 12" to 18" (interbedded with sand)
2							
3							
∇ 4							
							Stopped Backhoe at 4'6"
5							
6							
7							
8							
9							
10							

GEOTECH_TP 3117001069.GPJ AGRA_PHX.GDT 9/25/03

SAMPLE TYPE
B - Undisturbed Block Sample
D - Disturbed Bulk Sample
U - 3" O.D. 2.42" I.D. tube sample
A - Drill Cuttings
G - Grab sample

LOG OF TEST PIT NO. TP-2

PROJECT Rio Salado Habitat Restoration Project
Tempe Reach - Phase II

JOB NO. 3-117-001069 **DATE** 9/12/03

BACKHOE TYPE Terex TX-760
LOCATION
SURFACE ELEV.
DATUM

GROUNDWATER

	DEPTH	HOUR	DATE
∇	3.5	09:45	9-12-03
▼			

Depth In Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	SOIL DESCRIPTION
0					GP	very moist to saturated dense	**SAND, GRAVEL & COBBLES,** some silt, coarse grained sand, fine to coarse grained, rounded to subrounded gravel, rounded to subrounded cobble up to 8" maximum size, noncemented, nonplastic, medium brown
1							
2							
			D				
3							
∇							
4							Stopped Backhoe at 4'
5							
6							
7							
8							
9							
10							

SAMPLE TYPE
B - Undisturbed Block Sample
D - Disturbed Bulk Sample
U - 3" O.D. 2.42" I.D. tube sample
A - Drill Cuttings
G - Grab sample

LOG OF TEST PIT NO. TP-3

GEOTECH_TP 3117001069.GPJ AGRA_PHX.GDT 9/25/03

PROJECT Rio Salado Habitat Restoration Project
Tempe Reach - Phase II

JOB NO. 3-117-001069 **DATE** 9/11/03

BACKHOE TYPE Terex TX-760
LOCATION
SURFACE ELEV.
DATUM

GROUNDWATER

	DEPTH	HOUR	DATE
▽	5.0	10:45	9-11-03
▼			

Depth In Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	SOIL DESCRIPTION
0					GP	slightly moist to saturated dense	**SAND, GRAVEL & COBBLES,** up to 8" maximum size, coarse grained sand, rounded to subrounded gravel, rounded to subrounded cobble, nonplastic, noncemented, light to medium brown
1							note: fine grained gravel lens from 15" to 20", rounded to subrounded, coarse grained, rounded to subrounded cobbles, noncemented, nonplastic, light to medum brown
2			D				
3							
4							
▽ 5							
6							Stopped Backhoe at 6'
7							
8							
9							
10							

SAMPLE TYPE
B - Undisturbed Block Sample
D - Disturbed Bulk Sample
U - 3" O.D. 2.42" I.D. tube sample
A - Drill Cuttings
G - Grab sample

LOG OF TEST PIT NO. TP-4

GEOTECH_TP 3117001069.GPJ AGRA_PHX.GDT 9/25/03

PROJECT Rio Salado Habitat Restoration Project
Tempe Reach - Phase II

amec

JOB NO. 3-117-001069 **DATE** 9/11/03

BACKHOE TYPE Terex TX-760
LOCATION
SURFACE ELEV.
DATUM

GROUNDWATER

	DEPTH	HOUR	DATE
▽	1.3	14:50	9-11-03
▼			

Depth In Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	SOIL DESCRIPTION
0					GP	saturated dense	**SAND, GRAVEL & COBBLES,** considerable sand, fine to coarse grained, rounded to subrounded gravel, rounded to subrounded cobble up to 10" maximum size, noncemented, nonplastic, medium brown
1			D				
2							Stopped Backhoe at 2'
3							
4							
5							
6							
7							
8							
9							
10							

SAMPLE TYPE
B - Undisturbed Block Sample
D - Disturbed Bulk Sample
U - 3" O.D. 2.42" I.D. tube sample
A - Drill Cuttings
G - Grab sample

LOG OF TEST PIT NO. TP-5

GEOTECH_TP 3117001069.GPJ AGRA_PHX.GDT 9/25/03

PROJECT Rio Salado Habitat Restoration Project
Tempe Reach - Phase II

amec

JOB NO. 3-117-001069 **DATE** 9/12/03

BACKHOE TYPE Terex TX-760
LOCATION
SURFACE ELEV.
DATUM

GROUNDWATER

	DEPTH	HOUR	DATE
▽	1.3	10:06	9-12-03
▼			

Depth In Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	SOIL DESCRIPTION
0					GP	saturated	**SAND, GRAVEL & COBBLES,** coarse grained sand, fine to coarse grained, rounded to subrounded gravel, rounded to subrounded cobble up to 8" maximum size, noncemented, nonplastic, medium brown
			D			dense	note: trace of boulders
1							
▽							
2							Stopped Backhoe at 2'
3							
4							
5							
6							
7							
8							
9							
10							

SAMPLE TYPE
B - Undisturbed Block Sample
D - Disturbed Bulk Sample
U - 3" O.D. 2.42" I.D. tube sample
A - Drill Cuttings
G - Grab sample

LOG OF TEST PIT NO. TP-6

GEOTECH_TP 3117001069.GPJ AGRA_PHX.GDT 9/25/03

PROJECT Rio Salado Habitat Restoration Project
Tempe Reach - Phase II

amec

JOB NO. 3-117-001069 **DATE** 9/11/03

BACKHOE TYPE Terex TX-760
LOCATION
SURFACE ELEV.
DATUM

GROUNDWATER

	DEPTH	HOUR	DATE
∇	6.0	11:15	9-11-03
▼			

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	SOIL DESCRIPTION
0					GP	slightly moist to saturated dense	**SAND, GRAVEL & COBBLES,** up to 10" to 12" maxmium size, coarse grained sand, rounded to subrounded gravel, rounded cobble, nonplastic, noncemented, light to meduim brown
1							
2			D				
3							
4							note: boulder layer 12" to 15" thick at 4'
5							
∇ 6							
7							Stopped Backhoe at 7'
8							
9							
10							

SAMPLE TYPE
B - Undisturbed Block Sample
D - Disturbed Bulk Sample
U - 3" O.D. 2.42" I.D. tube sample
A - Drill Cuttings
G - Grab sample

LOG OF TEST PIT NO. TP-7

GEOTECH_TP 3117001069.GPJ AGRA_PHX.GDT 9/25/03

PROJECT Rio Salado Habitat Restoration Project
Tempe Reach - Phase II

amec

JOB NO. 3-117-001069 **DATE** 9/11/03

BACKHOE TYPE Terex TX-760
LOCATION
SURFACE ELEV.
DATUM

GROUNDWATER

DEPTH	HOUR	DATE
3.0	13:10	9-11-03

Depth In Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	SOIL DESCRIPTION
0					GP	very moist to saturated dense	**SAND, GRAVEL & COBBLE,** coarse grained, fine to coarse grained, subrounded to rounded gravel, small cobble up to 12", few 12" boulder, noncemented, nonplastic, medium brown note: lens of fine grained, subrounded gravel from 12" to 18"
1							
			D				
2							
3							
							Stopped Backhoe at 3'6"
4							
5							
6							
7							
8							
9							
10							

SAMPLE TYPE
B - Undisturbed Block Sample
D - Disturbed Bulk Sample
U - 3" O.D. 2.42" I.D. tube sample
A - Drill Cuttings
G - Grab sample

LOG OF TEST PIT NO. TP-8

GEOTECH_TP 3117001069.GPJ AGRA_PHX.GDT 9/25/03

PROJECT Rio Salado Habitat Restoration Project
Tempe Reach - Phase II

JOB NO. 3-117-001069 **DATE** 9/12/03

BACKHOE TYPE Terex TX-760
LOCATION
SURFACE ELEV.
DATUM

GROUNDWATER

	DEPTH	HOUR	DATE
▽	1.0	10:21	9-12-03
▼			

Depth In Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	SOIL DESCRIPTION
0					GP	saturated	**SAND, GRAVEL & COBBLES**, coarse grained sand, fine to coarse grained, rounded to subrounded gravel, rounded to subrounded cobble up to 12" maximum size, noncemented, nonplastic, black to medium brown
			D			dense	
▽ 1							
							Stopped Backhoe at 1'6"
2							
3							
4							
5							
6							
7							
8							
9							
10							

SAMPLE TYPE
B - Undisturbed Block Sample
D - Disturbed Bulk Sample
U - 3" O.D. 2.42" I.D. tube sample
A - Drill Cuttings
G - Grab sample

LOG OF TEST PIT NO. TP-9

GEOTECH_TP 3117001069.GPJ AGRA_PHX.GDT 9/25/03

PROJECT Rio Salado Habitat Restoration Project
Tempe Reach - Phase II

JOB NO. 3-117-001069 **DATE** 9/11/03

BACKHOE TYPE Terex TX-760
LOCATION
SURFACE ELEV.
DATUM

GROUNDWATER

DEPTH	HOUR	DATE
4.0	09:30	9-11-03

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	SOIL DESCRIPTION
0					GP	slightly moist to saturated dense	**SAND, GRAVEL & COBBLES**, coarse grained sand, fine to coarse grained, rounded to subrounded gravel, rounded cobble up to 10" maximum, noncemented, nonplastic, light brown
1			D				
2							
3							
4							
5							Stopped Backhoe at 5'
6							
7							
8							
9							
10							

SAMPLE TYPE
B - Undisturbed Block Sample
D - Disturbed Bulk Sample
U - 3" O.D. 2.42" I.D. tube sample
A - Drill Cuttings
G - Grab sample

LOG OF TEST PIT NO. TP-10

GEOTECH_TP_3117001069.GPJ AGRA_PHX.GDT 9/25/03

PROJECT Rio Salado Habitat Restoration Project
Tempe Reach - Phase II

amec

JOB NO. 3-117-001069 **DATE** 9/11/03

BACKHOE TYPE Terex TX-760
LOCATION
SURFACE ELEV.
DATUM

GROUNDWATER

	DEPTH	HOUR	DATE
▽	1.3	13:25	9-11-03
▼			

Depth In Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	SOIL DESCRIPTION
0					GP	very moist to saturated	**SAND, GRAVEL & COBBLES,** coarse grained sand, fine to coarse grained, rounded to subrounded gravel, rounded to subrounded cobbles up to 8" to 10" diameter, few boulders up to 12", noncemented, nonplastic, medium brown
			D			very dense	
1							
▽							
2							Stopped Backhoe at 2'
3							
4							
5							
6							
7							
8							
9							
10							

SAMPLE TYPE
B - Undisturbed Block Sample
D - Disturbed Bulk Sample
U - 3" O.D. 2.42" I.D. tube sample
A - Drill Cuttings
G - Grab sample

LOG OF TEST PIT NO. TP-11

GEOTECH_TP 3117001069.GPJ AGRA_PHX.GDT 9/25/03

PROJECT Rio Salado Habitat Restoration Project
Tempe Reach - Phase II

JOB NO. 3-117-001069 **DATE** 9/12/03

BACKHOE TYPE Terex TX-760
LOCATION
SURFACE ELEV.
DATUM

GROUNDWATER

	DEPTH	HOUR	DATE
▽	4.0	10:42	9-12-03
▼			

Depth In Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	SOIL DESCRIPTION
0					GP	moist dense	**SAND, GRAVEL & COBBLES,** coarse grained sand, fine to coarse grained, rounded to subrounded gravel, rounded to subrounded cobble up to 12" to 14" maximum size, noncemented, nonplastic, medium brown
1							
2							
			D				
3							
▽ 4					SP	saturated loose	**SAND,** coarse grained sand, occasional fine grained gravel, rounded, nonplastic
5							Stopped Backhoe at 5'
6							
7							
8							
9							
10							

SAMPLE TYPE
B - Undisturbed Block Sample
D - Disturbed Bulk Sample
U - 3" O.D. 2.42" I.D. tube sample
A - Drill Cuttings
G - Grab sample

LOG OF TEST PIT NO. TP-12N

GEOTECH_TP 3117001069.GPJ AGRA_PHX.GDT 9/25/03

PROJECT Rio Salado Habitat Restoration Project
Tempe Reach - Phase II

amec

JOB NO. 3-117-001069 **DATE** 9/12/03

BACKHOE TYPE Terex TX-760
LOCATION
SURFACE ELEV.
DATUM

GROUNDWATER

	DEPTH	HOUR	DATE
▽	4.0	10:42	9-12-03
▼			

Depth In Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	SOIL DESCRIPTION
0					GP	moist dense	**SAND, GRAVEL & COBBLES**, coarse grained sand, fine to coarse grained, rounded to subrounded gravel, rounded to subrounded cobble up to 12" to 14" maximum size, noncemented, nonplastic, medium brown
1							
2					SP	moist to saturated loose	**SAND**, coarse grained sand, occasional fine grained gravel, rounded, nonplastic
			D				
3							
▽ 4							
5							Stopped Backhoe at 4'6"
6							
7							
8							
9							
10							

SAMPLE TYPE
B - Undisturbed Block Sample
D - Disturbed Bulk Sample
U - 3" O.D. 2.42" I.D. tube sample
A - Drill Cuttings
G - Grab sample

LOG OF TEST PIT NO. TP-12S

GEOTECH_TP 3117001069.GPJ AGRA_PHX.GDT 9/25/03

PROJECT Rio Salado Habitat Restoration Project
Tempe Reach - Phase II

amec

JOB NO. 3-117-001069 **DATE** 9/11/03

BACKHOE TYPE Terex TX-760
LOCATION
SURFACE ELEV.
DATUM

GROUNDWATER

	DEPTH	HOUR	DATE
∇		none	
▼			

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	SOIL DESCRIPTION
0					GP	slightly moist dense	Surface - cobbles & boulders from 3" to 18" in diameter **SAND, GRAVEL & COBBLES,** coarse grained sand, fine to coarse grained, rounded to subrounded gravel, rounded cobble, noncemented, nonplastic, light brown
1			D				
2							
3							Backhoe refused on granite bedrock at 3'
4							
5							
6							
7							
8							
9							
10							

SAMPLE TYPE
B - Undisturbed Block Sample
D - Disturbed Bulk Sample
U - 3" O.D. 2.42" I.D. tube sample
A - Drill Cuttings
G - Grab sample

LOG OF TEST PIT NO. TP-13

GEOTECH_TP 3117001069.GPJ AGRA_PHX.GDT 9/25/03

PROJECT Rio Salado Habitat Restoration Project
Tempe Reach - Phase II

amec

JOB NO. 3-117-001069 **DATE** 9/12/03

BACKHOE TYPE Terex TX-760
LOCATION
SURFACE ELEV.
DATUM

GROUNDWATER

	DEPTH	HOUR	DATE
▽	3.0	11:35	9-12-03
▼			

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	SOIL DESCRIPTION
0					GP	moist dense	**SAND, GRAVEL & COBBLES**, coarse grained sand, fine to coarse grained, rounded to subrounded gravel, rounded to subrounded cobble up to 8" maximum size, noncemented, nonplastic, medium brown
1			D				
2							
▽ 3							Backhoe refused on granite bedrock at 3'
4							
5							
6							
7							
8							
9							
10							

SAMPLE TYPE
B - Undisturbed Block Sample
D - Disturbed Bulk Sample
U - 3" O.D. 2.42" I.D. tube sample
A - Drill Cuttings
G - Grab sample

LOG OF TEST PIT NO. TP-14

GEOTECH_TP_3117001069.GPJ AGRA_PHX.GDT 9/25/03

PROJECT Rio Salado Habitat Restoration Project
Tempe Reach - Phase II

amec

JOB NO. 3-117-001069 **DATE** 9/12/03

BACKHOE TYPE Terex TX-760
LOCATION
SURFACE ELEV.
DATUM

GROUNDWATER

	DEPTH	HOUR	DATE
▽	3.0	11:21	9-12-03
▼			

Depth In Feet	Graphical Log	Sample	Sample Type	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	SOIL DESCRIPTION
0					GP	moist to saturated dense	**SAND, GRAVEL & COBBLES**, coarse grained sand, fine to coarse grained, rounded to subrounded gravel, rounded to subrounded cobble up to 8" to 10" maximum size, noncemented, nonplastic, medium brown
1							
			D				
2							
▽ 3							
							Stopped Backhoe at 3'6"
4							
5							
6							
7							
8							
9							
10							

GEOTECH_TP 3117001069.GPJ AGRA_PHX.GDT 9/25/03

SAMPLE TYPE
B - Undisturbed Block Sample
D - Disturbed Bulk Sample
U - 3" O.D. 2.42" I.D. tube sample
A - Drill Cuttings
G - Grab sample

LOG OF TEST PIT NO. TP-15

APPENDIX B

LABORATORY TEST RESULTS

amec

PROJECT:	RIO SALADO HABITAT RESTORATION	JOB NO:	3-117-001069
LOCATION:	TEMPE, AZ	WORK ORDER NO:	1
SAMPLE SOURCE:	SEE BELOW	DATE SAMPLED:	9/15/03

MECHANICAL SIEVE ANALYSIS
GROUP SYMBOL, USCS (ASTM D-2487)

				Silt or Clay	SAND								GRAVEL									COBBLES	
					Fine			Medium			Coarse		Fine				Coarse						
Location & Depth	USCS	LL	PI	#200	#100	#50	#40	#30	#16	#10	#8	#4	1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	3"	6"	Lab #

PERCENT PASSING BY WEIGHT

TP-1 @ 12.0-24.0"	GP	NV	NP	4.6	8	11	13	16	20	23	24	27	29	32	35	40	44	49	53	62	74	100	1
TP-6 @ 6.0-18.0"	GP	NV	NP	3.4	4	5	6	8	15	22	22	30	33	37	41	48	53	58	64	73	85	94	6
TP-8 @ 18.0-30.0"	GP	NV	NP	1.7	3	5	7	9	15	20	22	28	31	37	41	50	58	68	70	78	88	100	8
TP-10 @ 12.0-24.0"	GP	NV	NP	0.6	1	3	5	8	14	17	18	20	21	22	23	27	32	37	43	56	73	81	10
TP-12 SOUTH 30.0-42.0"	SP	NV	NP	1.4	3	8	19	46	90	97	97	98	98	99	100	100	100	100	100	100	100	100	13
TP-15 18.0-30.0"	GP	NV	NP	2.3	3	5	6	9	17	23	23	29	32	36	41	49	58	63	69	76	86	100	16

REVIEWED BY C Mat

IAS Laboratories

2515 East University Drive
Phoenix, Arizona
85034
(602) 273-7248

ADOT Top Soil Specifications

Submitted by: Cliff Metz
Report to: AMEC
Report # : 6621674
Grower: 3-117-001069
Date: September 23, 2003

Sender I.D.	Lab No	pH	Soluble Salts PPM	Calcium Carbonates %	Exchangeable Sodium %	Exchangeable Sodium PPM
TP-1	219	9.0	670	2.5	1.8	130
TP-2	220	9.2	290	0.8	3.7	41
TP-3	221	9.0	450	0.8	5.0	53
TP-4	222	9.2	260	1.3	2.7	27
TP-5	223	9.0	560	0.5	6.6	100
TP-6	224	9.1	770	0.8	4.4	94
TP-7	225	9.0	260	0.8	3.1	34
TP-8	226	9.0	610	1.0	4.6	67
TP-9	227	8.7	610	0.8	7.5	58
TP-10	228	9.1	280	1.1	4.3	44
TP-11	229	8.7	610	1.0	8.7	57
TP-12N	230	9.2	330	1.5	2.8	53
TP-13	232	8.6	930	2.4	2.3	120
TP-14	233	9.3	350	1.0	5.1	64
TP-15	234	8.8	420	1.5	1.6	37

Analysis	Method	Passing Specification
pH	ARIZ 237b	6.0 - 8.3
Soluble Salts	ARIZ 237b	2000 ppm Max
Calcium Carbonates	ARIZ 732	8 % Max
Exchangeable Sodium %	ARIZ 729	5 % Max
Exchangeable Sodium (ppm)	ARIZ 729	300 ppm Max

RECEIVED
SEP 1 8 2003

BY:..... Date 09/16/2003

IAS LABORATORIES
2515 East University Drive
Phoenix, Arizona 85034
Phone : 602-273-7248
Fax : 602-275-3836

6621674

Please perform testing as indicated below. Please include P.O. no. 3119-1453 and Job no. 3-117-001069 on your report.

Thanks
Cliff

TESTING	LAB NO.	BORING
ADOT Top Soil Test (Nutrients)	1	TP-1 @ 12"-24" → 219
	2	TP-2 @ 12"-24" → 220
	3	TP-3 @ 30"-42" → 221
	4	TP-4 @ 18"-30" → 222
	5	TP-5 @ 6"-18" → 223
	6	TP-6 @ 6"-18" → 224
	7	TP-7 @ 24"-36" → 225
	8	TP-8 @ 18"-30" → 226
	9	TP-9 @ 6"-12" → 227
	10	TP-10 @ 12"-24" → 228
	11	TP-11 @ 6"-8" → 229
	12	TP-12N @ 30"-42" → 230
No Sample received →	13 →	TP-12S @ 30"-42"
	14	TP-13 @ 12"-24" → 232
	15	TP-14 @ 12"-24" → 233
	16	TP-15 @ 18"-30" → 234

IAS Laboratories

2515 East University Drive
Phoenix, Arizona
85034
(602) 273-7248

SOIL ANALYSIS REPORT

Today's Date: 9/24/2003
Grower: 3-117-001069
Submitted By: Cliff Metz
Send Report To: AMEC
Report Number: 6621674
Crop: No Interpretive Levels
Date Received: 9/18/2003

VL = Very Low
L = Low
M = Medium
H = High
VH = Very High

Sander Sample Id	Depth	Lab #	pH	Calcium (Ca) PPM	Magnesium (Mg) PPM	Sodium (Na) PPM	Potash (K) PPM	Iron (Fe) PPM	Zinc (Zn) PPM	Manganese (Mn) PPM	Copper (Cu) PPM	Salinity (EC x K) dS/m	Nitrate Nitrogen (NO3-N) PPM	Phosphorus (Bicarb - Soluble P) PPM	Computed % Sodium (ESP)	Sulfur (SO4-S) PPM	Boron (B) PPM	Free Lime Level
TP-1	12-	219	9.0	5900 VH	84 M	130 M	120 M								1.8			
TR-2	12-	220	9.2	740 H	100 M	41 L	23 VL								3.7			
TP-3	30-	221	9.0	690 H	99 M	53 L	27 VL								5.0			
TP-4	18-	222	9.2	700 H	78 M	27 L	18 VL								2.7			
TP-5	6-1	223	9.0	860 H	200 H	100 L	74 L								6.6			
TP-6	6-1	224	9.1	1500 VH	150 H	94 L	50 L								4.4			
TP-7	24-	225	9.0	760 H	86 M	34 L	34 VL								3.1			
TP-8	18-	226	9.0	1000 H	110 M	67 L	41 L								4.6			
TP-9	6-1	227	8.4	490 M	68 M	58 L	30 VL								7.5			
TP-10	12-	228	9.1	690 H	91 M	44 L	39 VL								4.3			
TP-11	6-8	229	8.7	340 M	96 M	57 L	39 VL								8.7			
TP-12N	30-	230	9.2	1400 VH	120 M	53 L	51 L								2.8			
TP-12S	30-	231																
TP-13	12-	232	8.6	4000 VH	270 VH	120 M	68 L								2.3			
TP-14	12-	233	9.3	820 H	120 M	64 L	43 L								5.1			
TP-15	18-	234	8.6	1800 VH	130 H	37 L	50 L								1.8			

IAS Laboratories

2515 East University Drive
Phoenix, Arizona
85034
(602) 273-7248

SOIL FERTILITY RECOMMENDATIONS

Lb/1000 Sq Ft

Grower: 3-117-001069 Send To: AMEC

Report No: 6621674 Date: 9/16/2003 Page: 2

												AMENDMENTS			
Sender Number	Crop	Nitrogen N	Phosphate P2O5	Potash K2O	Magnesium Mg	Sulfur S	Iron Fe	Zinc Zn	Manganese Mn	Copper Cu	Boron B	Elemental Sulfur	Gypsum	Lime	Leaching of Excess Salts

This set of soil samples has higher than specified pH levels for ADOT topsoil specs.
To lower the pH, a general rule of thumb for soils with high calcium carbonate, is to till in 30 lbs sulfur/1000 sq.ft for soils with pH levels of 9.0 and above, 20 lbs sulfur/1000 sq.ft for soils with pH levels of 8.5-9.0, and 10 lbs sulfur/1000 sq.ft for soils with pH levels of 8.5 and below. These soils have a $CaCO_3$ range of .8-2.5%, which are exceptable.
The sodium in ppm meets ADOT specs; the % sodium is above the ADOT range due only to very low calcium levels, not because sodium is excessive.

APPENDIX C

GEOPHYSICAL INVESTIGATION

REFRACTION MICROTREMOR (ReMi) SHEAR WAVE EQUIPMENT & PROCEDURES

Refraction microtemor or ReMi surveys are performed in general accordance with the method described by Louie (2001) to develop vertical one-dimensional shear wave (s-wave) velocity profiles. The same equipment used for ReMi is also used for refraction seismic. When appropriate, both p-wave and s-wave data can be collected with the same physical seismic line setup.

ReMi Seismic Equipment - ReMi surveys are performed using a Geometrics S-12 Smartseis signal enhancement seismograph. This instrument has the capability to digitally record and store up to 12 channels of geophone data in SEG2 format. Up to 16,384 samples can be acquired for each geophone channel at sample intervals as long as 0.25, 0.5, 1 and 2 milliseconds. Sampling events to collect ReMi field data may typically last 6, 12 or 24 seconds. Geophone cables with 12 geophone takeouts at 10-foot or 20-meter spacings are presently used. Vertical geophones with resonant frequencies of 28 Hz and 4.5 Hz are used to obtain surface wave data for s-wave vertical profile analysis. High frequency geophones are used for shorter arrays with shallower depths of investigation, and low frequency geophones are used for longer arrays with greater depths of investigation. Broad band ambient site noise may be used as a surface wave energy source. Controlled surface wave energy sources include jogging alongside shorter geophone arrays and driving a field vehicle alongside longer geophone arrays. The seismograph system is extremely portable. In areas where vehicular access is not possible, the equipment can be mobilized by various means, including backpacking, packhorse, helicopter and canoe.

ReMi Field Procedures - - The field operations are directed by our experienced engineer or geologist, who operates the equipment, prepares the records and examines the data in the field. ReMi seismic lines are generally laid out using the standard spacings on the geophone cables. A depth of investigation of about 100 meters or more may be possible using a 240 meter array. For shorter lines with improved near-surface resolution, 10-foot spacings between geophones with a 120-foot array have a depth of investigation of about 30 to 40 feet or more. Other geophone spacings can also be used.

Data collection consists of the system sampling the ambient or generated surface waves (a sampling event) at the geophone array for several to many seconds. Typical sampling times and intervals for a sampling event may be 6 seconds at 0.5 milliseconds, 12 seconds at 1 millisecond and 24 seconds at 2 milliseconds for array lengths of 60 feet, 120 feet and 240 meters, respectively. Several sampling events are collected at each ReMi setup. For shorter arrays where ReMi with surface wave energy generated by jogging is conducted in concert with seismic refraction data collection, four sampling events may typically be recorded. For longer arrays where urban ambient noise or a field vehicle generates the surface wave energy, six to ten sampling events may be recorded. Field notes, including line number and orientation, topographic variations and other notes as appropriate are made on hard copy of traces. Locations and other notes are made on site maps and in notebooks as appropriate. Sample data files may be transferred by 3.5-inch floppy to the laptop computer and preliminary interpretations made for immediate data adequacy verification as part of the quality control process.

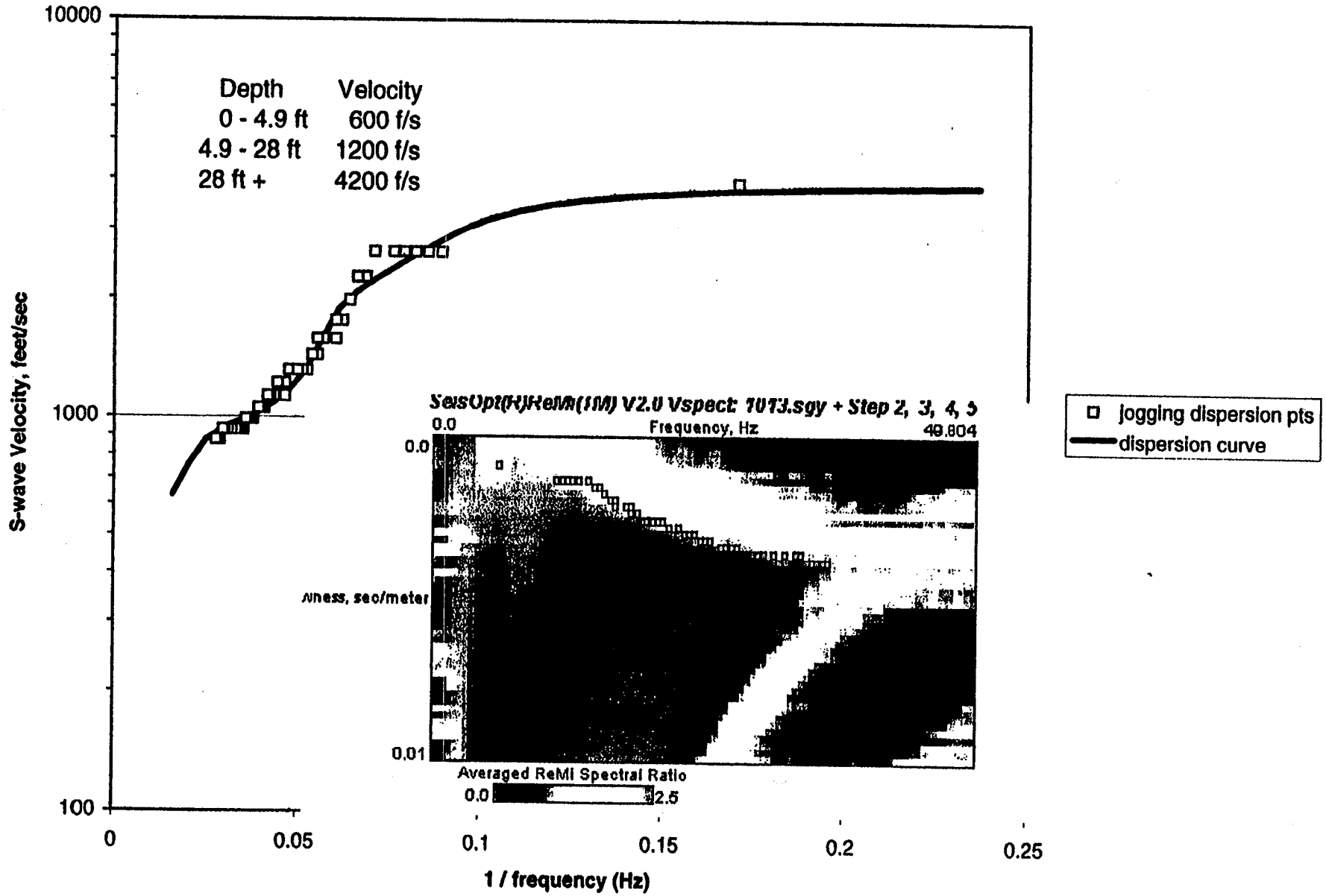
Interpretation - Although preliminary or quality control initial ReMi seismic data interpretations may sometimes be performed in the field, full interpretations are completed in the office. Data files, typically about 580kb each in size, are transferred from the seismograph to the laptop computer using 3.5-inch floppy disks. Interpretation is performed using the SeisOpt ReMi Version 1.0 (2002) software package by Optim, L.L.C., of Reno, Nevada. The software consists of two modules. The ReMiVsSpect module is used to convert the SEG2 files into a spectral energy shear wave frequency versus shear wave velocity presentation for a ReMi seismic setup. The interpreter then selects a dispersion curve consisting of the lower bound of the spectral energy shear wave velocity versus frequency trend, and that dispersion curve is saved to disk. Tracing the lower bound (slowest) of the shear wave velocity at each frequency selects the ambient energy propagating parallel to the geophone array, since energy propagating incident to the array will appear to have a faster propagating velocity. The second module, ReMiDisper, is then invoked. The interpreter models a dispersion curve with multiple layers and s-wave velocities to match the selected dispersion curve from the field data. An interpreted vertical s-wave profile is obtained through this process. It must be understood that this type of interpretation may not result in a unique solution.

Louie, J.L., 2001, Faster, Better: Shear-wave velocity to 100 meters depth from refraction microtremor arrays, Bulletin of the Seismological Society of America, Vol. 91, 347-364.

Refraction Microtremor Interpretation

Line 1
Test Pit 1

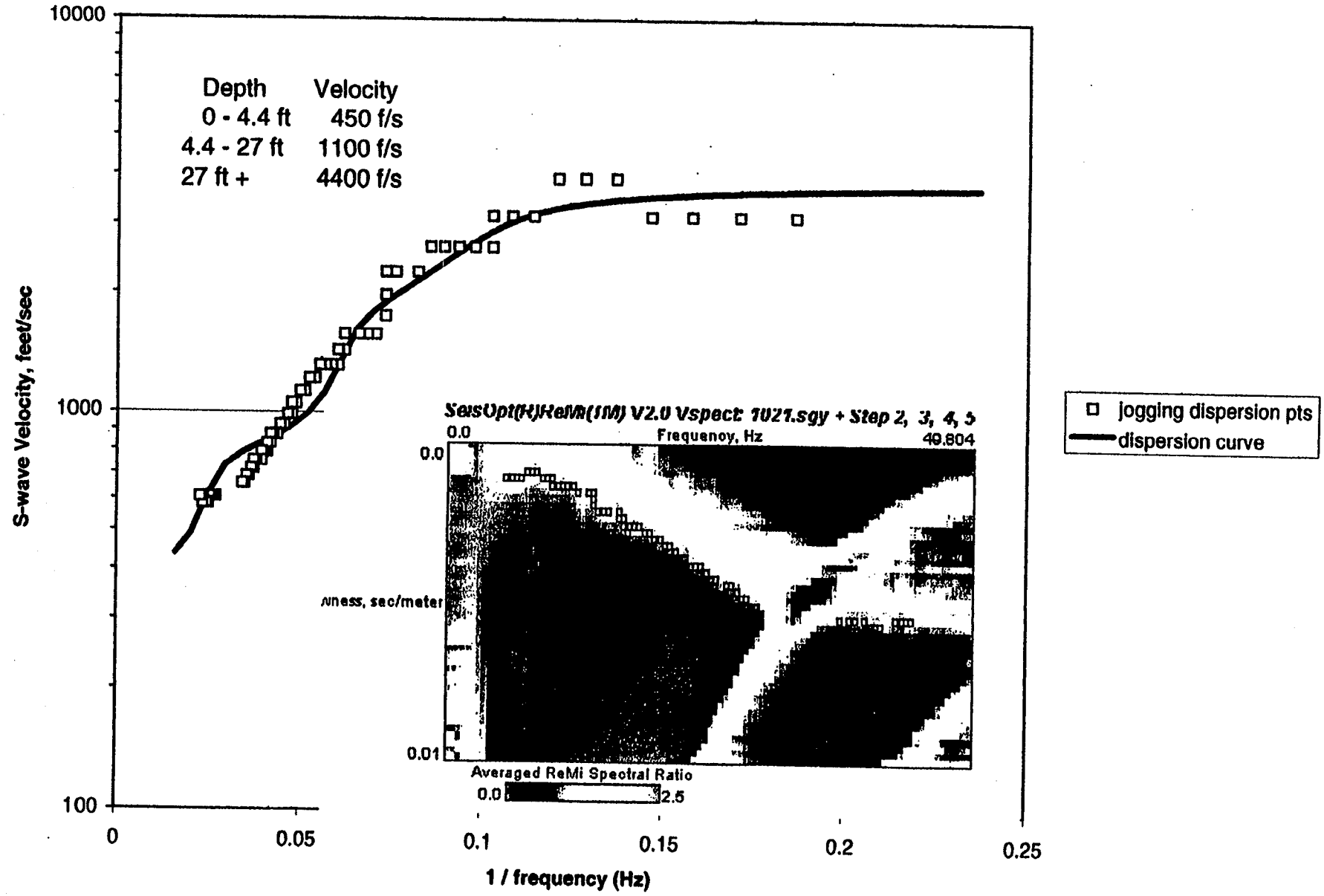
AMEC Job No. 3-117-001069



Refraction Microtremor Interpretation

Line 2
Test Pit 2

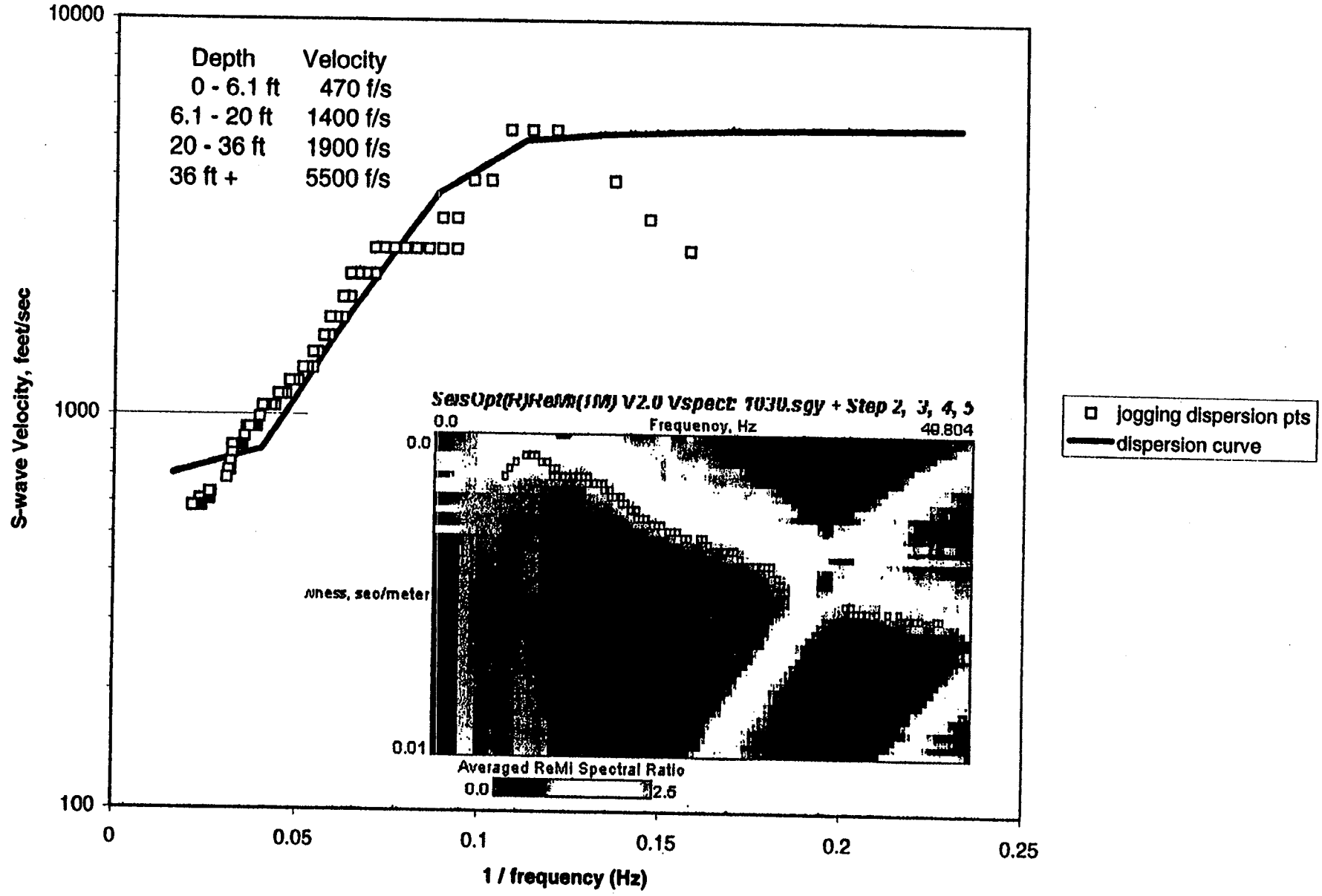
AMEC Job No. 3-117-001069



Refraction Microtremor Interpretation

Line 3
Test Pit 3

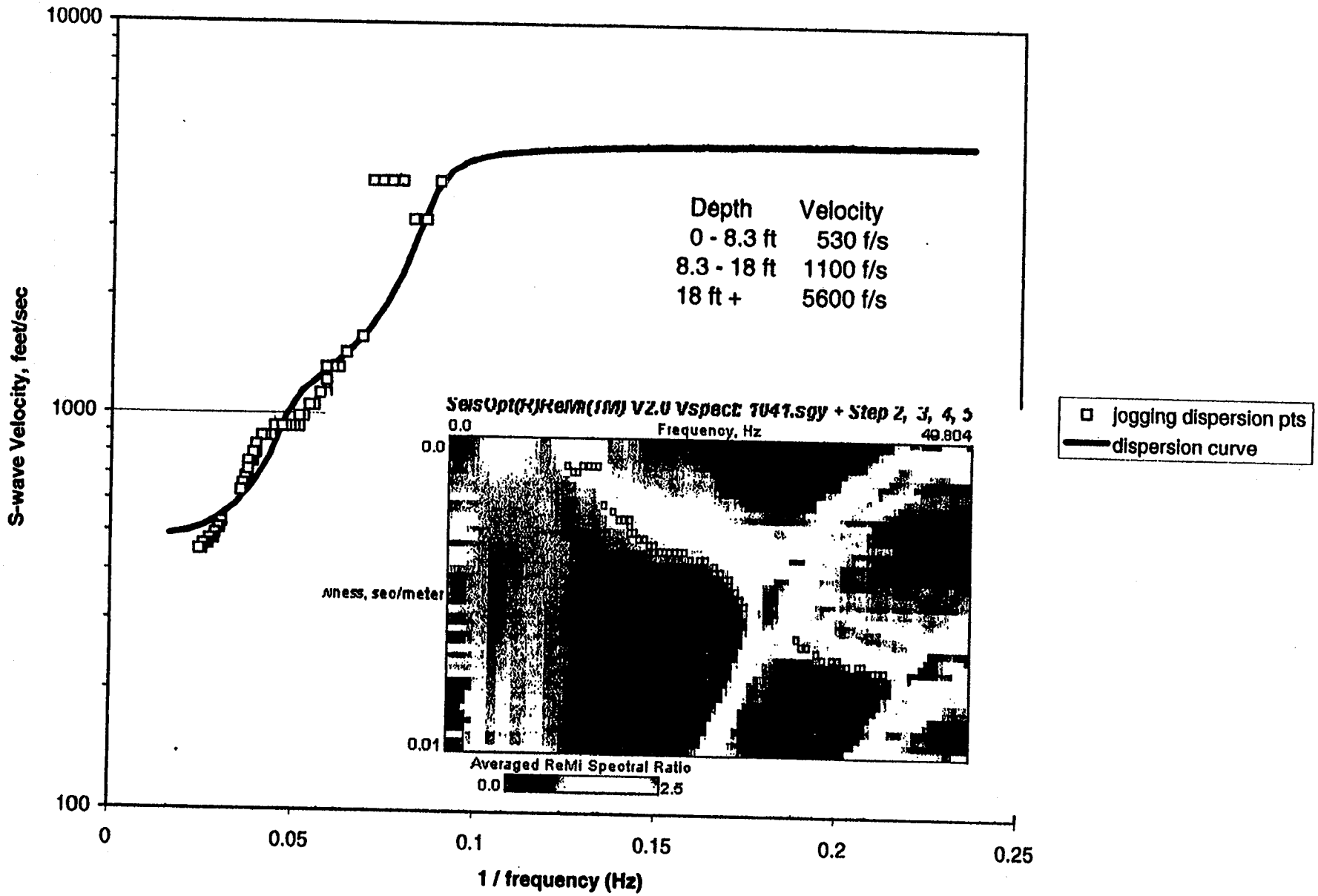
AMEC Job No. 3-117-001069



Refraction Microtremor Interpretation

Line 4
Test Pit 5

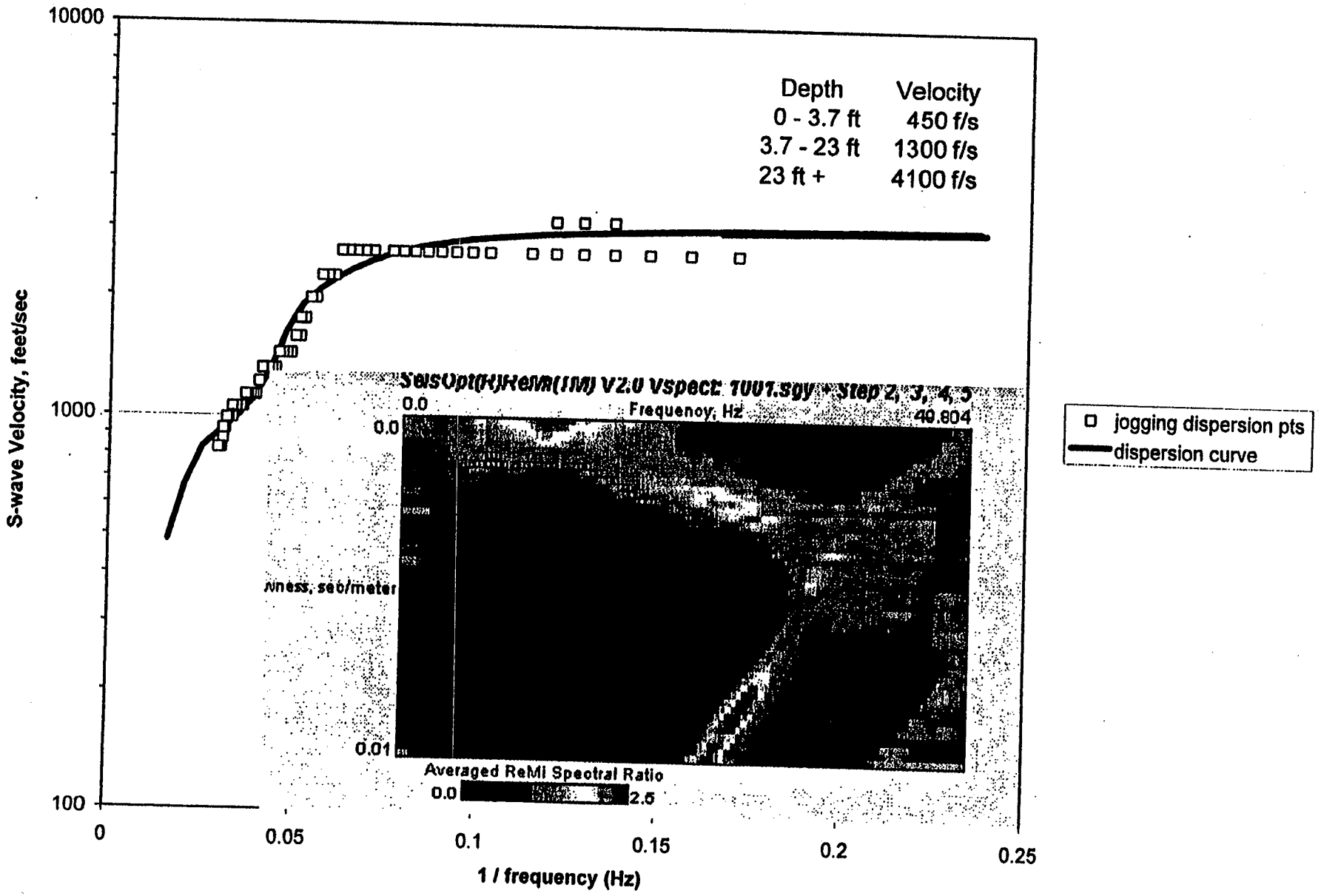
AMEC Job No. 3-117-001069



Refraction Microtremor Interpretation

Line 5
Test Pit 8

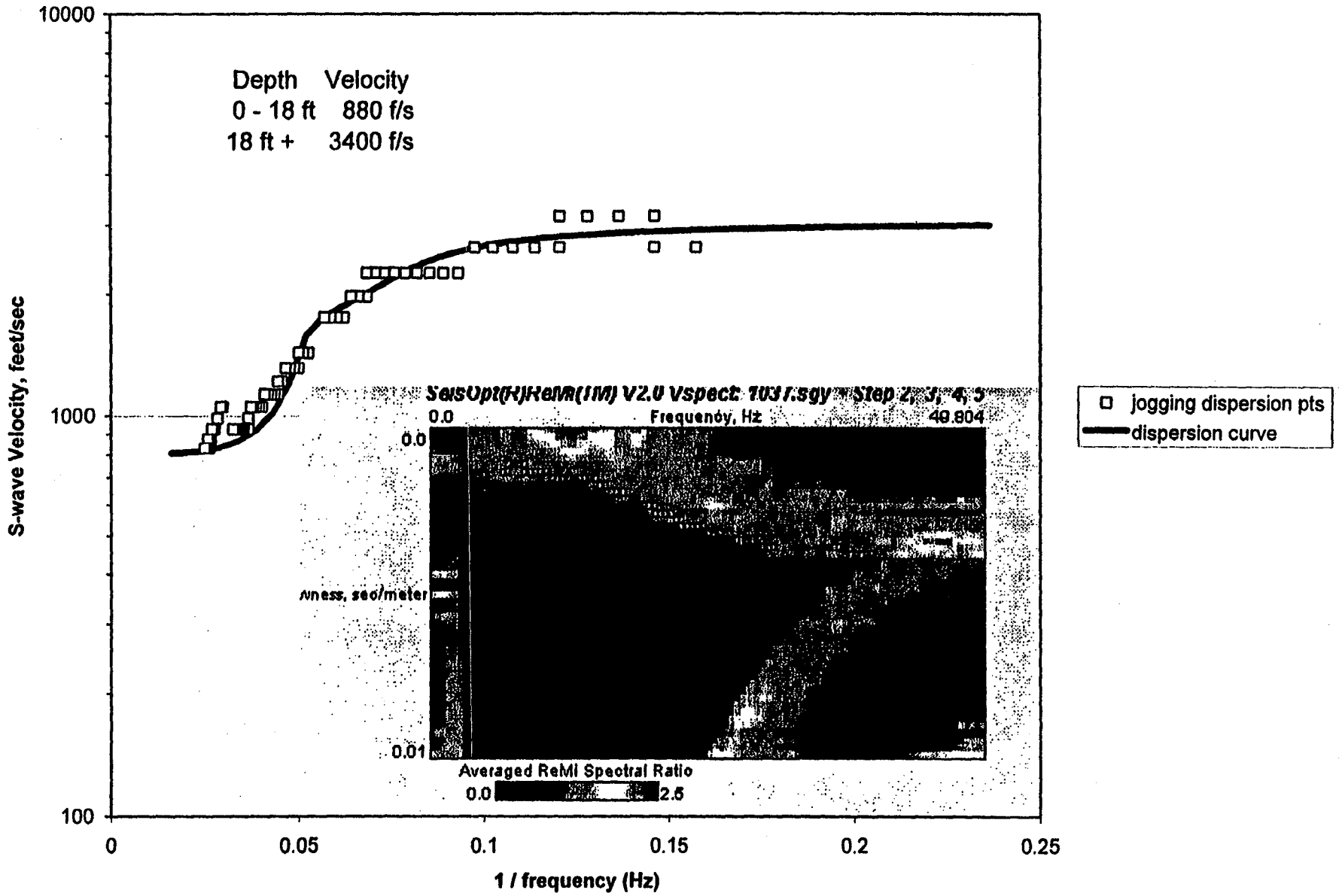
AMEC Job No. 3-117-001069

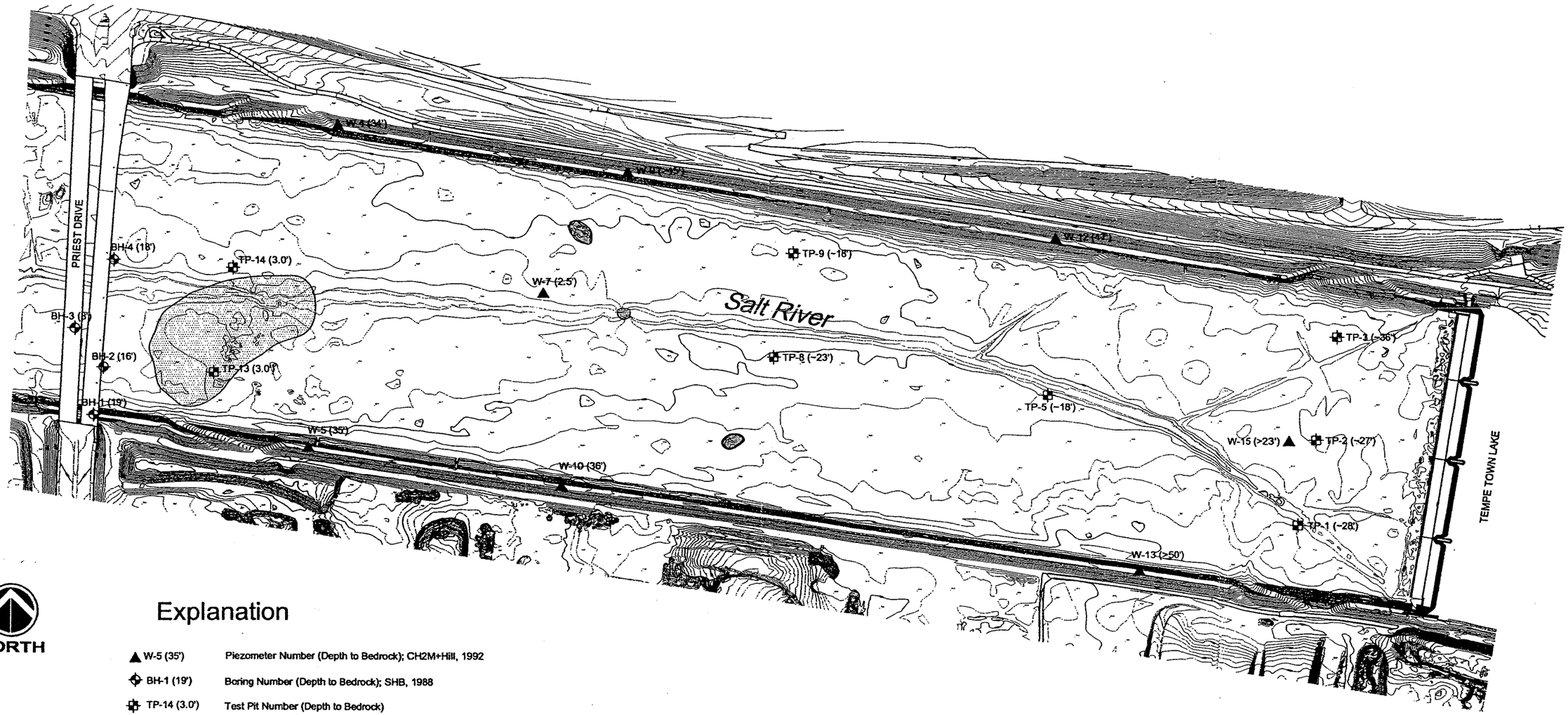


Refraction Microtremor Interpretation

Line 6
Test Pit 9

AMEC Job No. 3-117-001069





Explanation

▲ W-5 (35')	Piezometer Number (Depth to Bedrock); CH2M+Hill, 1992
⊕ BH-1 (19')	Boring Number (Depth to Bedrock); SHB, 1988
⊞ TP-14 (3.0')	Test Pit Number (Depth to Bedrock)
◯	Area with Exposed Rock Outcroppings

JOB NO.	3-117-001069
DESIGN:	TJF
DRAWN:	GWH
DATE:	10/2003
SCALE:	1" = 300'

SUMMARY OF BEDROCK DEPTHS
RIO SALADO HABITAT ENVIRONMENTAL RESTORATION PROJECT

TEMPE REACH - PHASE 2
TEMPE, ARIZONA

FIGURE 2

amec

Appendix B:
USGS Stream Gauge Information for Gauge No. 09512165

Water Resources

Data Category: Surface Water **Geographic Area:** Arizona GO

Calendar Year Streamflow Statistics for Arizona

USGS 09512165 Salt River At Priest Drive Near Phoenix, AZ

Available data for this site Surface-water: Annual streamflow statistics GO

Maricopa County, Arizona
Hydrologic Unit Code 15060106
Latitude 33°26'01", Longitude 111°57'37" NAD27
Gage datum 1,138. feet above sea level NGVD29

Output formats

HTML table of all data
Tab-separated data
Reselect output format

Year	Annual mean streamflow, in ft^3/s	Year	Annual mean streamflow, in ft^3/s	Year	Annual mean streamflow, in ft^3/s
1994	.47	**1997**	.000	**2000**	3.18
1995	1,097	**1998**	80.3	**2001**	2.38
1996	.000	**1999**	1.80		

Questions about data gs-w-az_NWISWeb_Data_Inquiries@usgs.gov

Feedback on this website gs-w-az_NWISWeb_Maintainer@usgs.gov

Top
Explanation of terms

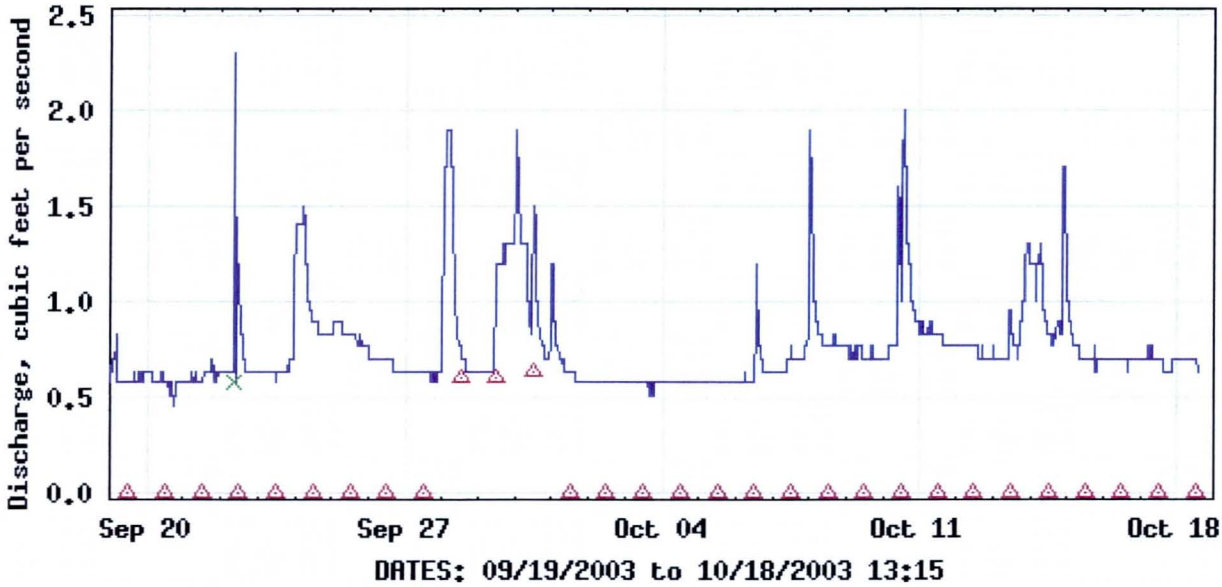
Surface Water data for Arizona: Calendar Year Streamflow Statistics
http://waterdata.usgs.gov/az/nwis/annual/calendar_year?

Retrieved on 2003-10-20 17:49:57 EDT

Department of the Interior, U.S. Geological Survey
USGS Water Resources of Arizona
Privacy Statement || Disclaimer || Accessibility
0.66 0.67 nadww01

USGS

USGS 09512165 Salt River At Priest Drive Near Phoenix, AZ



EXPLANATION

—— DISCHARGE

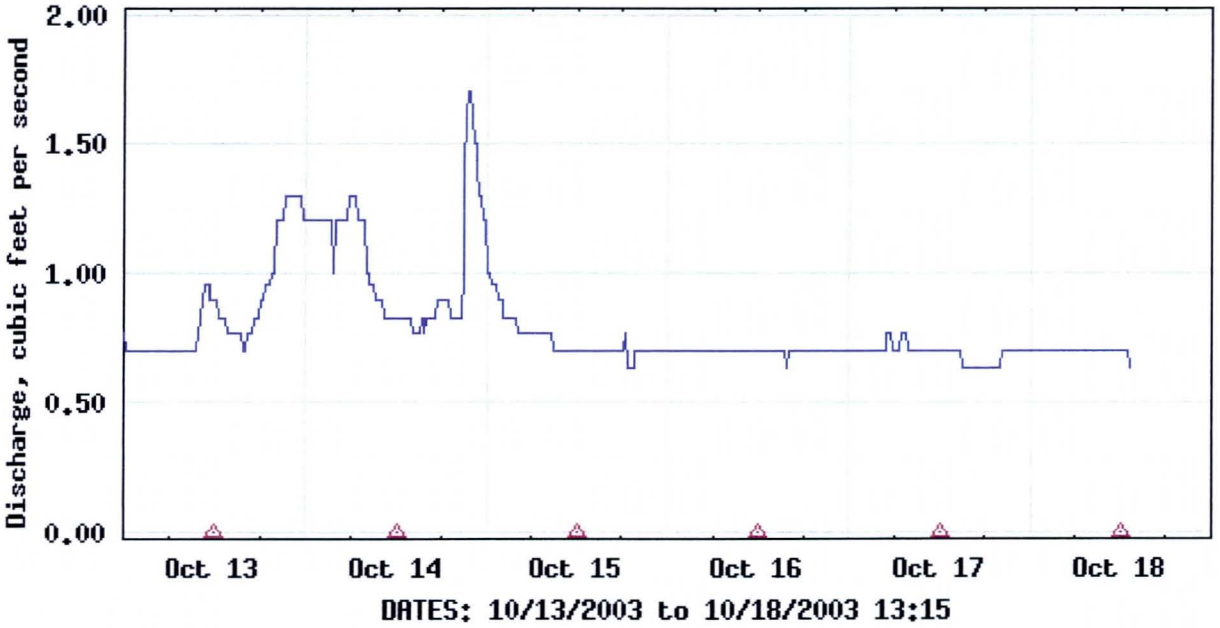
△ MEDIAN DAILY STREAMFLOW BASED ON 8 YEARS OF RECORD

× MEASURED Discharge

Provisional Data Subject to Revision

USGS

USGS 09512165 Salt River At Priest Drive Near Phoenix, AZ



EXPLANATION

—— DISCHARGE

△ MEDIAN DAILY STREAMFLOW BASED ON 8 YEARS OF RECORD

Provisional Data Subject to Revision

Appendix C:
Earthwork Calculations

EARTHCALC
INCORPORATED

TEMPE RIO SALADO,

NOVAK ENVIRONMENTAL Project number: 0311

Tuesday, March 02, 2004

P040055

Please note that we used the following assumptions for this project:

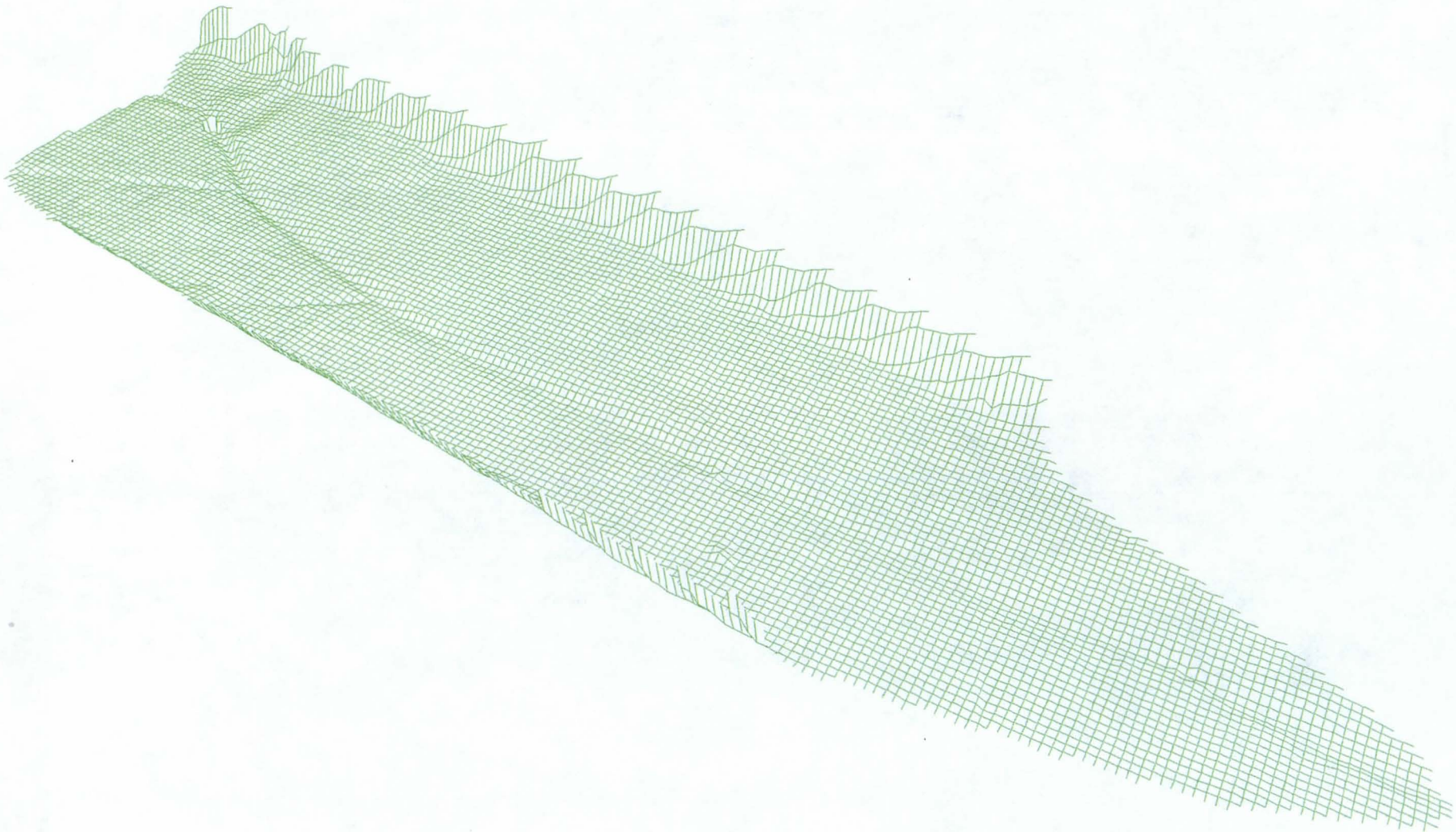
Stripping: No
Shrinkage: No

VOLUMES SUMMARY

Region	Total SF	Cut SF	Fill SF	Raw Cut CY	Raw Fill CY	Net Difference	Bal Chg/.1'
Total	2,337,211	1,258,737	1,078,474	31,309	27,904	3,405 Export	8,656

This report was based on plans dated 2/23/2004 and is for the exclusive use of NOVAK ENVIRONMENTAL. This report, the graphics and spreadsheets it contains, or any facsimile thereof, shall not be distributed to any other parties for any purpose. Earthcalc's liability is limited to NOVAK ENVIRONMENTAL and is limited to the purchase amount of this analysis. Earthcalc does not provide any electronic files unless agreed upon by Earthcalc in advance.

1(800) 765-1717 – www.earthcalc.com – earthcalc@earthcalc.com - fax 1(866) 653-0365



EARTHCALC INCORPORATED

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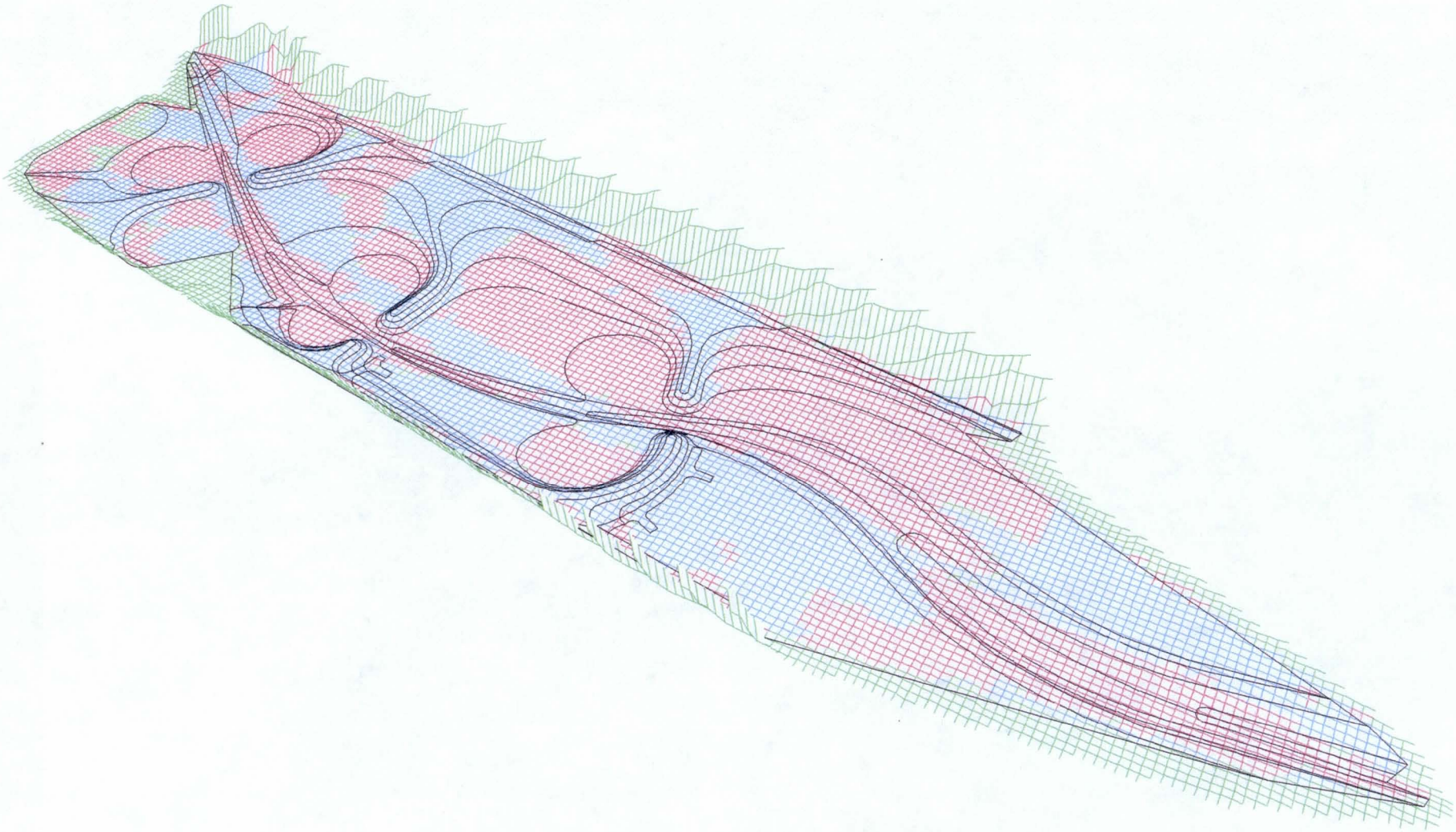
EXISTING

N

TEMPE RIO SALADO

P040055

3/2/04



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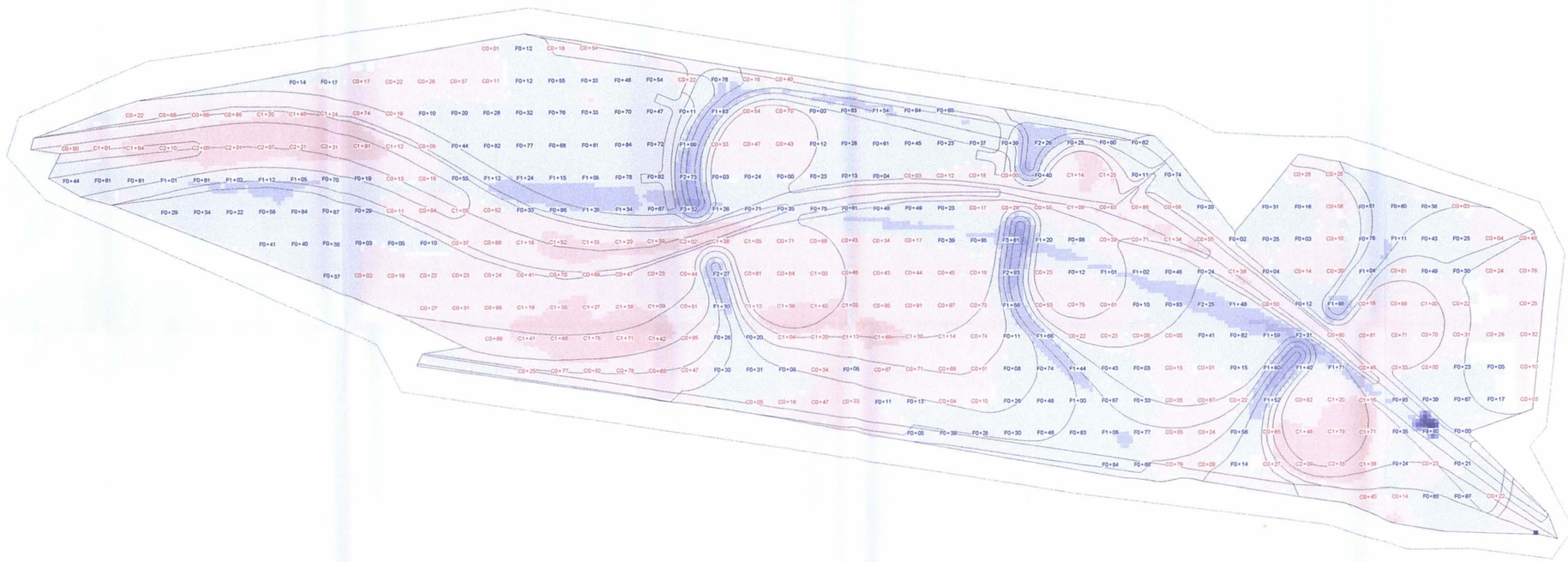
PROPOSED

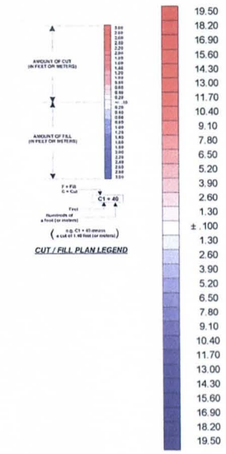
N

TEMPE RIO SALADO

P040055

3/2/04





CUT / FILL PLAN LEGEND

EARTHCALC INCORPORATED
1(800) 765-1717 - www.earthcalc.com - earthcalc@earthcalc.com - fax 1(866) 653-0365

0 150 300
SCALE

N

TEMPE RIO SALADO

P040055 3/2/04

Appendix D:
Irrigation Pump Information

Rain Bird CRE Series® Single Pump Booster System

Multi-Stage Centrifugal Pump
MLE, Integrated Variable Frequency Motor
Base, Electrical, and Plumbing Components

Packaged Water Booster Pump System Specification

Pump

The pump shall be of the vertical multi-stage centrifugal design. The pump shall be furnished as shown on the plans and installed in accordance with the recommendations of the manufacturer. The pump shall be capable of producing, or exceeding the maximum system demand point of 75 gallons per minute and 232 feet of head while operating at the maximum pump rpm.

The pump suction/discharge chamber, motor stool and pump shaft coupling shall be constructed of cast iron. The impellers, pump shaft, diffuser chambers, outer discharge sleeve, impeller seal rings and seal ring retainers shall be constructed of stainless steel. Optional materials for the suction/discharge chamber and motor stool liner shall be stainless steel.

The impellers shall be secured directly to the pump shaft by means of a splined shaft arrangement for pumps rated to a maximum of 115 gallons per minute or less. For pumps rated higher than a maximum of 115 gallons per minute, the impellers shall be secured to the shaft by means of a split cone and nut design. Shaft journal and chamber bearings shall be Tungsten Carbide and Ceramic (or optional bronze chamber bearings) for pumps rated to a maximum of 115 gallons per minute or less. For pumps rated higher than a maximum of 115 gallons per minute, the shaft journal and chamber bearings shall be Tungsten Carbide and Bronze (or optional Graflon® chamber bearings).

Motor

The motor shall be of the pulse width modulated, integrated motor/variable frequency drive design; the motor and drive designed and built by a single manufacturer. The variable frequency drive enclosure shall include a PI controller, dry-contact fault output relay contacts, analog, and digital inputs. The motor shall detect/protect itself against under voltage, over voltage, excessive phase shift (3 phase models), overload, sensor signal fault, and set-point signal fault. The motor/drive enclosure shall be rated IP55. The motor windings shall be class F rated.

The 3-phase motor set-point shall be set by either plus and minus buttons located on the variable frequency drive enclosure or through an optional hand-held controller which communicates with the PI controller via infrared signal. The hand-held controller shall be produced by the same manufacturer as the motor/drive. The hand-held controller shall provide a text LCD readout of alarms (faults), pump discharge pressure (psi), motor speed (rpm), instantaneous motor power input (kW), lifetime cumulative motor power consumption (kWh), and cumulative motor operating hours.

Installation settings for the hand held controller must include the ability to select/adjust/read the set-point, optional external set-point, with a read-out of the resulting actual set-point adjusted for the external set-point setting, control mode (internal PI controlled or uncontrolled), PI controller integral action time or system time (T_I) and PI reaction gain (K_p), activate/deactivate external set-point, activate/deactivate plus and minus set-point buttons on the variable frequency drive enclosure, the reaction mode of the digital input signal, and activate/deactivate low/zero-flow stop function, including delta H related to the stop function.

The hand-held controller must be able to enter a "Number" code into the single pump systems for pump system number identification (examples, pump system number "1", "2", etc.) and upload, store, and download motor/drive settings from and to other single pump systems of the same manufacturer. The hand-held controller must be able to transmit the motor/drive settings via infrared communication to a printer equipped to accept the infrared transmission. The 3-phase motor/drive must be job-site programmable

through a manufacturer supplied PC program for settings other than that possible through the hand-held controller.

The 1-phase motor set-point shall be set by a potentiometer mounted on the integrated variable frequency drive controller enclosure or a remotely located potentiometer, connected to the integrated variable frequency drive controller enclosure through a shielded control cable, the connection requiring a maximum of three signal/switch wires, plus a ground. Motor/drive operation settings must be through DIPswitches mounted in the integrated variable frequency drive enclosure. The motor/drive shall be job-site programmable through a PC program supplied by the system manufacturer for settings additional to the DIPswitch settings.

Base and Electrical

The pump shall be mounted on a fabricated stainless steel sheet base. The power connection terminal box shall be mounted on a bracket that is attached to the pump end. The power connection terminal box shall include a disconnect switch. Optional electrical accessories are available and mount in an optional larger power connection terminal box mounted on a larger pump base frame and control panel bracket.

The pump suction flange shall include a pressure switch to sense the presence of fluid (dry run protection), shall be electrically connected to the integrated variable frequency drive enclosure, and shall shut down the system when the fluid pressure drops below the switch limit. An optional, adjustable pressure switch must be available from the manufacturer.

A 4-20ma-pressure sensor, sized for proper application requirements, shall be installed on the discharge pipe and shall be electrically connected to the integrated variable frequency drive enclosure. An optional high-pressure shutdown switch must be available from the manufacturer.

Plumbing

The pump system shall include a stainless steel suction pipe with stainless steel isolation ball valve. The discharge pipe shall be stainless steel and include a port to install a pressure sensor and optional high-pressure shutdown switch and a port to install a pressure tank connection. A stainless steel isolation ball valve and stainless steel body/plastic check valve shall be installed on the pump discharge pipe.

Furnish Rain Bird CRE Series pump system or equivalent.

Rain Bird Corporation
Contractor Division
970 West Sierra Madre Avenue, Azusa, CA 91702
Phone: (626) 963-9311 Fax: (626) 812-3411

Rain Bird Corporation
Commercial Division
6991 East Southpoint Road, Tucson, AZ 85706
Phone: (520) 741-6100 Fax: (520) 741-6522

Rain Bird International, Inc.
145 North Grand Avenue, Glendora, CA 91741
Phone: (626) 963-9311 Fax: (626) 963-4287

Rain Bird Technical Service
(800) 247-3782 (U.S. only)

www.rainbird.com

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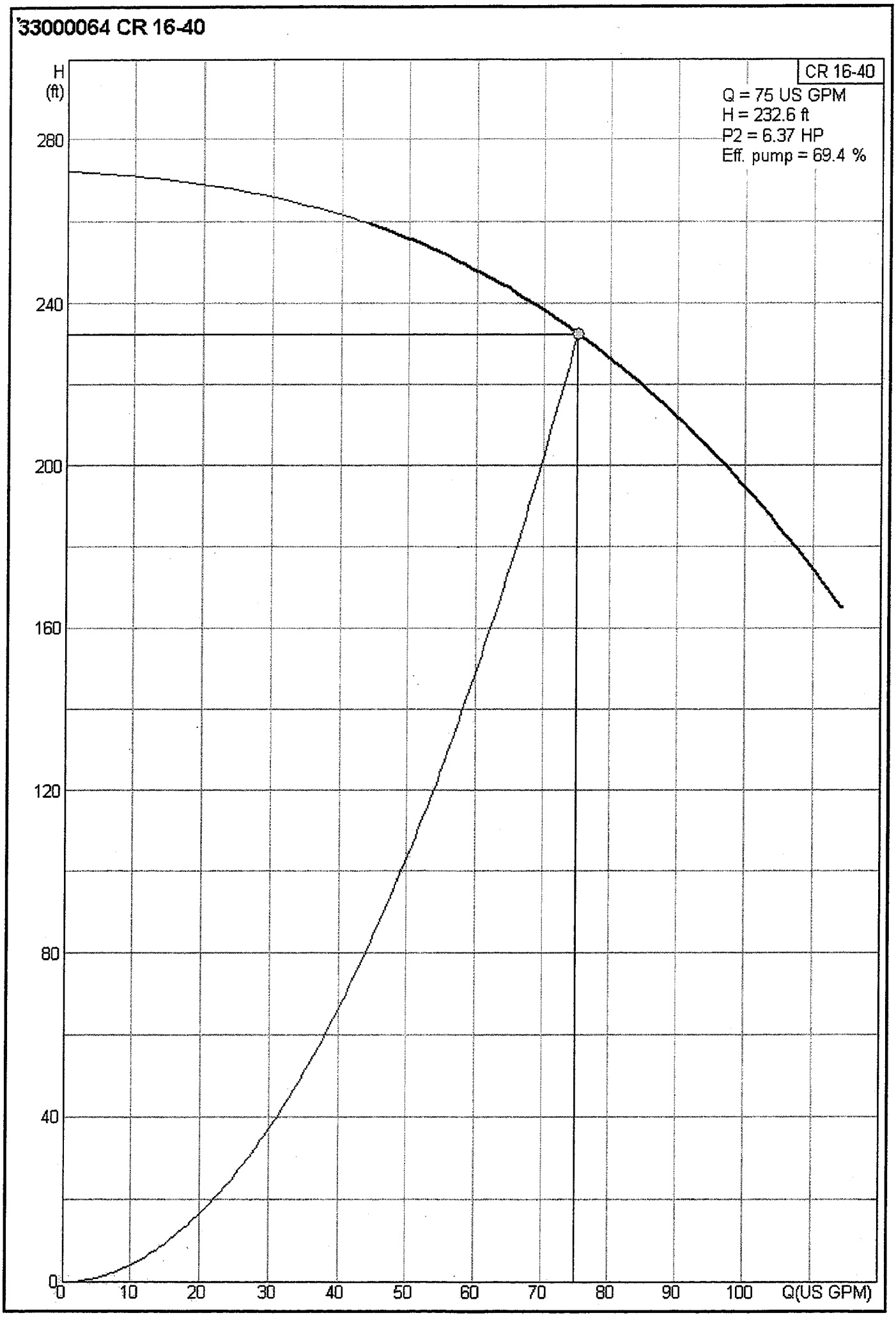


Rain Bird CRE Series Pump Stations feature Grundfos high-efficiency CR pumps with integrated variable frequency drive (VFD) motors and built-in proportional integral (PI) controls. The VFD automatically adjusts motor speed to meet a wide range of operating conditions. The CRE Series delivers variable pressure and flow while saving energy. System payback and IRR (internal rate of return) calculations versus fixed-speed systems are available from Rain Bird upon request. The pump, motor, VFD and PI are all integrated into one compact package, which is fully tested (to the customer's specified operating conditions) at the factory prior to shipment.

Advantages of Rain Bird Pump Stations include:

Reduced energy cost - Energy savings ranging from 15%-45% over other conventional fixed and variable speed pump systems.

Lower maintenance cost – Pressure Regulator Valves (PRVs) require periodic adjustment and maintenance, while variable speed systems do not. VFD pumps are not subjected to full speeds when flow requirements are low. This reduces pump wear and eliminates the need for high temperature dump valves to prevent seal damage.

Quiet – Variable speed systems reduce noise and the Rain Bird CRE Series is an industry leader in quiet, vibration-free operation. Also, the VFD eliminates the need for a PRV, thereby eliminating additional PRV noise.

Reliable – Advances in electronics have made VFDs very reliable and rugged. Our CRE Series pump stations are so reliable, Rain Bird offers twice the industry standard warranty with the lesser of 24 months from installation or 30 months from shipment.

Cost effective to buy and install – Prices for VFD systems are often less than PRV systems. Tank size is 5-10% of the size required for PRV systems - an important factor when an ASME tank is required. Variable frequency drive systems do not require time consuming PRV setup and periodic adjustments.

Space saving – Reduced tank and control panel size, as well as integrated variable frequency drives and vertical orientation saves valuable space.

Rain Bird CRE Series Standard Construction includes:

- **UL listing** of complete CRE Series pumping systems.
- Grundfos **integrated-motor-drive** (IMD) technology with power output of up to 10 HP. Includes integrated motor control panel with indicator lights and pressure set-point buttons.
- **Motor enclosure** class IP 55, TEFC.
- **Impellers** are 304 SS (stainless steel) laser welded construction, statically and dynamically balanced. Pump is vertical, multi-stage centrifugal.
- **Cartridge Shaft Seal** is a pre-assembled unit for quick, easy installation and replacement. Eliminates risk of damaging, loosing or contaminating seal faces or O-rings.
- **Suction and discharge piping** is 316SS material, schedule 40 wall thickness. Meets A530 ASTM standard specifications for specialized alloy steel pipe.

- **Lightning Arrester** provides Surge Lightning Advanced Protection (SLAP). Listed and approved by the Underwriters Laboratories and Canadian Standards Association. Parallel metal oxide varistors (MOV) from each line to grounded neutral provide increased protection capacity.
  Maximum Joule Rating = 4,380
  Maximum Surge Amperage = 48,000A
  Actual Clamping Voltage = 3,800 V @ 10,000A
- **Isolation valves** on both inlet and discharge sides. Full port heavy-duty forged brass with nickel-plated exterior and two-piece body. Chrome plated brass ball with Teflon seats and blow-out-proof stem. 600 psi non-shock wog, 150 psi swp. Conforms to specifications of MSS-SP-110 and threaded ends. Complies with ANSI B2.1 and ISO-9002.
- **Pressure Switch** on inlet side to prevent dry-run damage. Stainless steel diaphragm, BUNA-N seal, with aluminum port and housing. SPDT snap-action, UL listed. When the suction pressure drops to 3 psi, the pump shuts down and an alarm is indicated.
- **Pressure Transmitter** on discharge side designed for use in severe industrial environments. Encased in weather-resistant 316 stainless steel. Provides 4 - 20 mA output signal. Temperature compensated and laser calibrated device.
- **Pressure Gauges** of 304 stainless steel with vent plug and SS crimping ring. EPDM o-ring between case and connection. Welded case/socket connection. Glycerin liquid filled gauges with operating range -4°F to 140°F. Movement is stainless steel. Dial face is white aluminum with black lettering.
- **Flanges** on inlet and discharge sides are used to connect piping. Pump and counter flanges conform to ANSI B16.5 for American standard flanges.
- **Non-Return Valve** for one-way water flow is installed in pipe system between the two flanges. Valve casing is made of electro-coated cast iron. Valve cone, valve seat and other components are made of stainless steel. The valve has a spring-loaded valve cone and performs well even with water impurities.
- **Switch box** disconnect enclosure (NEMA 4/ IP66) has special locking system which integrates the door lock, operating lever, and door handle into one smooth operating system. Powder paint provides superior corrosion protection. UL and CSA approved. Supporting bracket is 304SS construction.
- **Safety Switch** designed for matched enclosure size, cable connections and electrical ratings. Reliable position indication. Several locking possibilities to maintain high safety. Safety tested according to IEC 60947-3.
- **Fault Pilot Light** is round-flush construction. Tamper-proof mounting and construction. UL listed, CSA certified, TUV approved, and CE marked. Super bright red LED illumination.
- **Diaphragm Bladder tank** includes heavy-duty butyl diaphragm and a unique, flexible polypropylene liner to prevent cracking, tearing, leakage, and corrosion. The diaphragm-type pressurized expansion tank reduces water hammer.
- **Vent plug** of 304SS for convenient priming and venting of air.
- **Bolts** used in the assembly of the pumping station are zinc plated to retard corrosion. The bolts meet SAE J429 Grade 1& 2 and ASTM A307 Grade A & B.

Rain Bird CRE Series Pump Stations can be customized with additional features to meet your unique technical specifications.

CRE Series Options include:

- **R100 remote control unit** designed for wireless communication with MLE motors. The R100 communicates with the motor via infrared light. The transmitter and receiver are incorporated in the motor control panel. The R100 gives you the ability to monitor and set up your pumping system to meet the specific needs of your application. The R100 infrared remote allows you to communicate with the motor to retrieve important pump and performance data and change system parameters.

- **Hewlett Packard 82240B Infrared Portable Printer.** Simply point the R100 at the printer, within 18 inches, and send the print command. The printer operates on four AA alkaline batteries. Obtain a hardcopy printout of all pump settings, power consumption, operating hours, RPM, and any fault indications.

- **Audible Alarms** (80 or 100 dB) are high-output devices to ensure operators are aware of any equipment fault. These alarms are NEMA 4X certified and UL approved. Alarms feature complete encapsulation of the electronics in epoxy, and also include stainless steel sound diaphragms to ensure operation in harsh environments. Shock and vibration resistant. Simply push button to silence.

- **Outdoors lid kit** for vertically mounted motors can be used to reduce condensation when the pump is not placed inside a protective enclosure. The motor terminal box can (when installed outdoors) develop internal condensation caused by cooling from radiation to the sky. Since the lid can become the coldest part in the terminal box, condensation will primarily take place underneath. The Outdoors lid kit is recommended to reduce this condensation effect.

- **Enclosures** with optional exhaust fans and heaters are designed with function, service, aesthetics and security in mind. Our aluminum enclosures are constructed of 1/8" think marine grade aluminum, while our fiberglass enclosures feature reinforced fiberglass strand construction with high gloss UV-inhibited gel coat finish. These enclosures are designed to blend with the landscape, while providing easy access to pumps and controls for maintenance. The enclosures provide convenient, affordable protection while the rugged construction provides security from vandalism or unauthorized access. Enclosures are anchored to a concrete slab with steel anchors and locked for security purposes. Power source for any accessories should be protected with a ground fault interrupting receptacle or circuit and be in accordance with local and national codes.

- **Enclosure Heaters** (when required) will protect pumps, piping and equipment from exterior temperatures to –30° F and be thermostatically controlled. UL listed self-regulating cables or wall mounted air heaters are sized to maintain the equipment at +40° F. The wall mounted heat source is mounted a minimum of 7" above the slab.

- **Enclosure Fans** (when required) are designed to prevent overheating of the pump, motor, controls and associated piping. The wall-mounted fan is thermostatically controlled and

weather protected with a louvered shutter. Inlet grills featured in the front door of the enclosure provide for airflow across the pump station and out the exhaust wall.

- **Transformers are** used to convert 208 or 230 volt; three phase power, to 460 volt, three-phase power. Three phase MLE motors require 460 volt, 3-phase power.

- **Phase Converter** is used to convert single-phase power to three-phase power. An example would be converting 230 volt, single phase, to 230 volt, three phase.

- **Low NPSH 1st Stage** lowers the NPSHR (Net Positive Suction Head Required) for a given pump model. This option may eliminate the need to order a larger pump. The result is lower initial cost and lower operating costs.

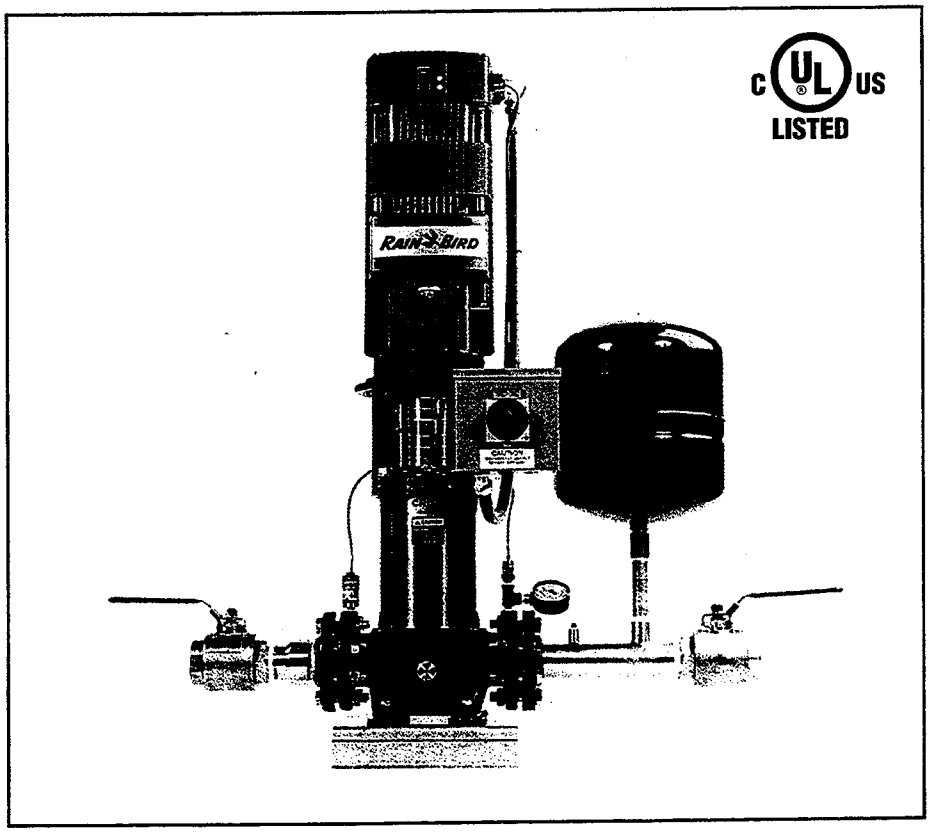
RAIN BIRD®

TECH SPECS

Commercial Pump Stations

CRE Series - Single Pump Systems

Our CRE Series offers the highest value and reliability of any irrigation pump system. Each packaged unit is factory tested prior to shipment for easy installation and start-up.



Features

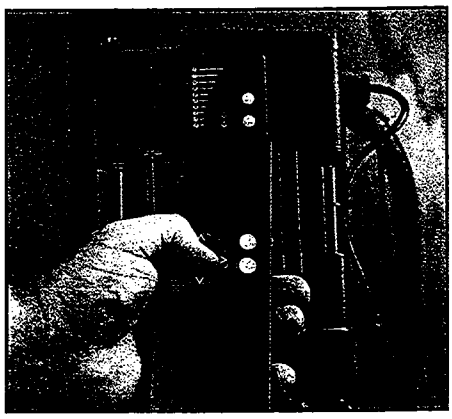
- Vertical, multi-stage, centrifugal return (CRE) pumps maximize performance, economy, and reliability.
- VFD (variable frequency drive) reduces energy costs up to 40% compared to constant speed systems.
- VFD automatically adjusts speed to maintain desired water pressure as flow varies.
- VFD has no moving parts and eliminates the expensive maintenance of PRV (pressure regulating valve) systems.
- Pumps with VFD last longer by adjusting workload to meet system requirements.
- Extremely quiet, low vibration operation.
- CRE Pump operating efficiencies up to 80%.
- Corrosion resistant stainless steel construction.
- Low NPSH required for excellent lift.
- Smooth, automated start and stop reduces water hammer.

Operating Range

Flow Range	1.2 - 450 gpm .3 - 102 m³/h .1 - 40 l/s
Head Range	0 - 500 ft 0 - 152 m
HP Range	1 - 10 hp .8 - 7.5 kw
Water Temperature Range	32° - 176° F 0° - 80° C
Maximum Working Pressure	360 psi 24 bar

Electrical Specifications

- Input Required:
  - 50/60 Hz
  - 1 Phase 208/230 Volt
  - 3 Phase 208/230/460 Volt



***Optional Remote Control** offers additional control features, secure access, data collection and print functions with an optional hand-held printer.*

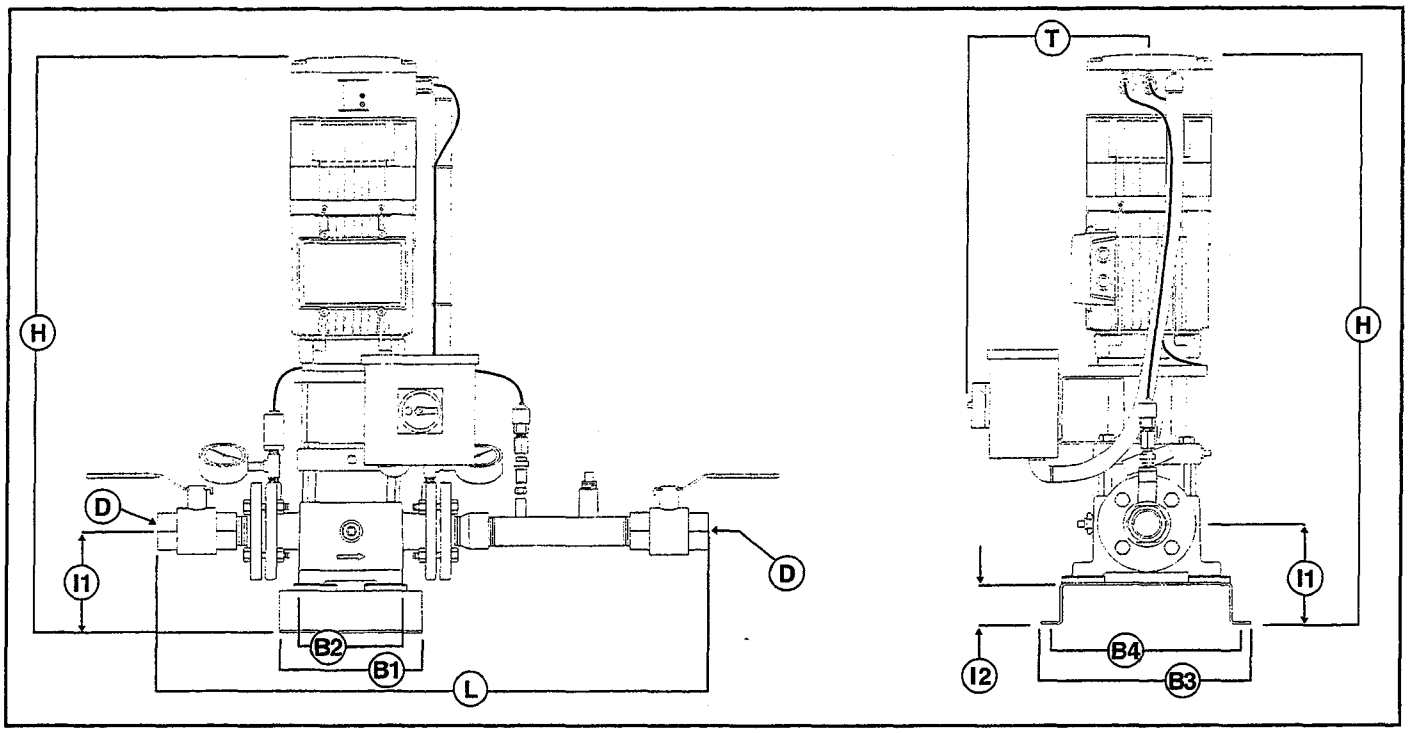
Nomenclature

CRE 32 - 3 - 2

- **Model** — CRE
- **Flow** — m³/hr
- **Stages** — 3
- **Reduced Dia. Stages** — 2

RAIN BIRD®

Dimensions

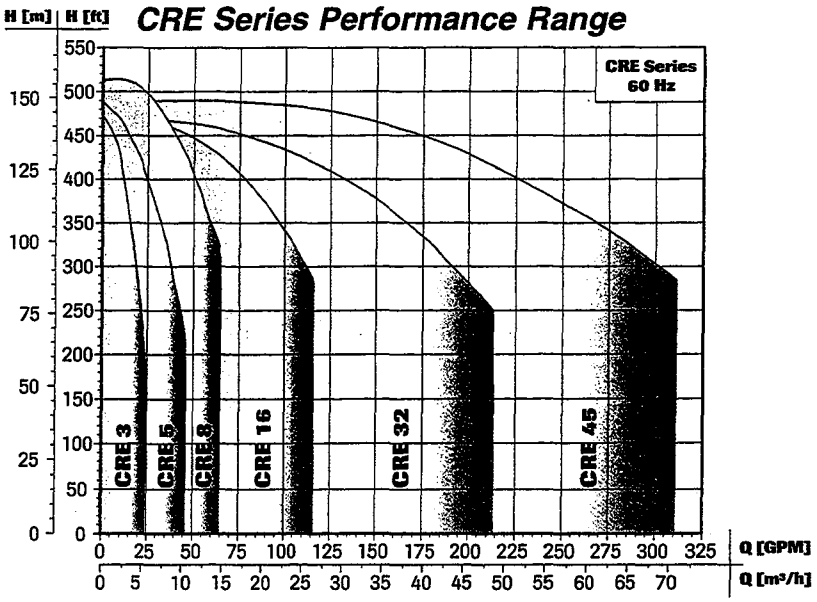


Dimensions and Weights *(Units are inches and pounds)*

Pump Model	Motor Horse Power	H	I1	I2	L	B1	B2	B3	B4	D	T	Ship Weight
CRE 3	1.0 - 1.5	25.2 - 41.6	4.8	2.8	31.8	8.0	5.5	11.8	7.5	1.3	12.0	200 - 295
CRE 5	1.0 - 5.0	21.2 - 49.0	4.8	2.8	31.8	8.0	5.5	11.8	7.5	1.3	12.0	210 - 310
CRE 8	1.5 - 7.5	35.5 - 52.7	6.3	2.4	36.8	11.4	7.5	15.5	14.5	1.5	12.0	240 - 360
CRE 16	5.0 - 10.0	44.2 - 47.7	6.3	2.4	36.8	11.4	7.5	15.5	14.5	2.0	12.0	330 - 370
CRE 32	3.0 - 10.0	37.8 - 47.4	4.1	*	41.5	*	*	*	*	2.5	12.5	275 - 380
CRE 45	7.5	44.0	5.5	*	45.8	*	*	*	*	3.0	12.5	365

Voltage: 1 x 208/230 up to 1.5 H.P. and 3 x 460 for all
** Baseplate not required for larger models*

CRE Series Performance Range



CONTACT: KEVIN JOHNSON WITH RAIN BIRD@(520) 975-8541 FOR PRICE QUOTATION AND DISTRIBUTION INFORMATION
QUOTE NUMBER & JOB NAME: PS500400638A - Tempe Town Lake
RAIN BIRD MODEL: CRE-16-40
MAXIMUM SYSTEM DEMAND (GPM): 75 gpm
INLET PRESSURE (PSI/FEET OF HEAD): Suction Lift
PRESSURE SET POINT-DISCHARGE PRESSURE (PSI/FEET OF HEAD): 80 psi / 185 ft. of head
PRESSURE BOOST (PSI/ FEET OF HEAD): 85 psi/ 196 ft. of head
MOTOR HORSE POWER (Hp): 7.5 hp
MOTOR POWER REQUIRED (PHASE/VOLTAGE): 3 phase/460v
JOB SITE POWER AVAILABLE: 3 phase, 460v
CURRENT DRAWN: 11 amps
TRANSFORMER REQUIRED: None
PHASE CONVERTER REQUIRED: None
ENCLOSURE: None
OPTIONS: Pump Fault Light, Lightning Protection, Larger Switch Panel, Pressure Tank, Suction Lift Prime Kit

Rain Bird CRE Series® Single Pump System

Multi-Stage Centrifugal Pump
MLE, Integrated Variable Frequency Motor
Base, Electrical, and Plumbing Components

Packaged Water Pump System Specification

Pump
The pump shall be of the vertical multi-stage centrifugal design. The pump shall be furnished as shown on the plans and installed in accordance with the recommendations of the manufacturer. The pump shall be a Rain Bird Model and capable of producing, or exceeding the maximum system demand point while operating at the maximum pump rpm.

The pump suction/discharge chamber, motor stool and pump shaft coupling shall be constructed of cast iron. The impellers, pump shaft, diffuser chambers, outer discharge sleeve, impeller seal rings and seal ring retainers shall be constructed of stainless steel. Optional materials for the suction/discharge chamber and motor stool liner shall be stainless steel.

The impellers shall be secured directly to the pump shaft by means of a splined shaft arrangement for pumps rated to a maximum of 115 gallons per minute or less. For pumps rated higher than a maximum of 115 gallons per minute, the impellers shall be secured to the shaft by means of a split cone and nut design. Shaft journal and chamber bearings shall be Tungsten Carbide and Ceramic (or optional bronze chamber bearings) for pumps rated to a maximum of 115 gallons per minute or less. For pumps rated higher than a maximum of 115 gallons per minute, the shaft journal and chamber bearings shall be Tungsten Carbide and Bronze (or optional Graflon® chamber bearings).

Motor
The motor shall be of the pulse width modulated, integrated motor/variable frequency drive design; the motor and drive designed and built by a single manufacturer. The variable frequency drive enclosure shall include a PI controller, dry-contact fault output relay contacts, analog, and digital inputs. The motor shall detect/protect itself against under voltage, over voltage, excessive phase shift (3 phase models), overload, sensor signal fault, and set-point signal fault. The motor/drive enclosure shall be rated IP55. The motor windings shall be class F rated.

The 3-phase motor set-point shall be set by either plus and minus buttons located on the variable frequency drive enclosure or through an optional hand-held controller which communicates with the PI controller via infrared signal. The hand-held controller shall be produced by the same manufacturer as the motor/drive. The hand-held controller shall provide a text LCD readout of alarms (faults), pump discharge pressure (psi), motor speed (rpm), instantaneous motor power input (kW), lifetime cumulative motor power consumption (kWh), and cumulative motor operating hours.

Installation settings for the hand held controller must include the ability to select/adjust/read the set-point, optional external set-point, with a read-out of the resulting actual set-point adjusted for the external set-point setting, control mode (internal PI controlled or uncontrolled), PI controller integral action time or system time (TI) and PI reaction gain (Kp), activate/deactivate external set-point, activate/deactivate plus and minus set-point buttons on the variable frequency drive enclosure, the reaction mode of the digital input signal, and activate/deactivate low/zero-flow stop function, including delta H related to the stop function.

The hand-held controller must be able to enter a "Number" code into the single pump systems for pump system number identification (examples, pump system number "1", "2", etc.) and upload, store, and download motor/drive settings from and to other single pump systems of the same manufacturer. The hand-held controller must be able to transmit the motor/drive settings via infrared communication to a printer equipped to accept the infrared transmission. The 3-phase motor/drive must be job-site programmable through a manufacturer supplied PC program for settings other than that possible through the hand-held controller.

The 1-phase motor set-point shall be set by a potentiometer mounted on the integrated variable frequency drive controller enclosure or a remotely located potentiometer, connected to the integrated variable frequency drive controller enclosure through a shielded control cable, the connection requiring a maximum of three signal/switch wires, plus a ground. Motor/drive operation settings must be through DIPswitches mounted in the integrated variable frequency drive enclosure. The motor/drive shall be job-site programmable through a PC program supplied by the system manufacturer for settings additional to the DIPswitch settings.

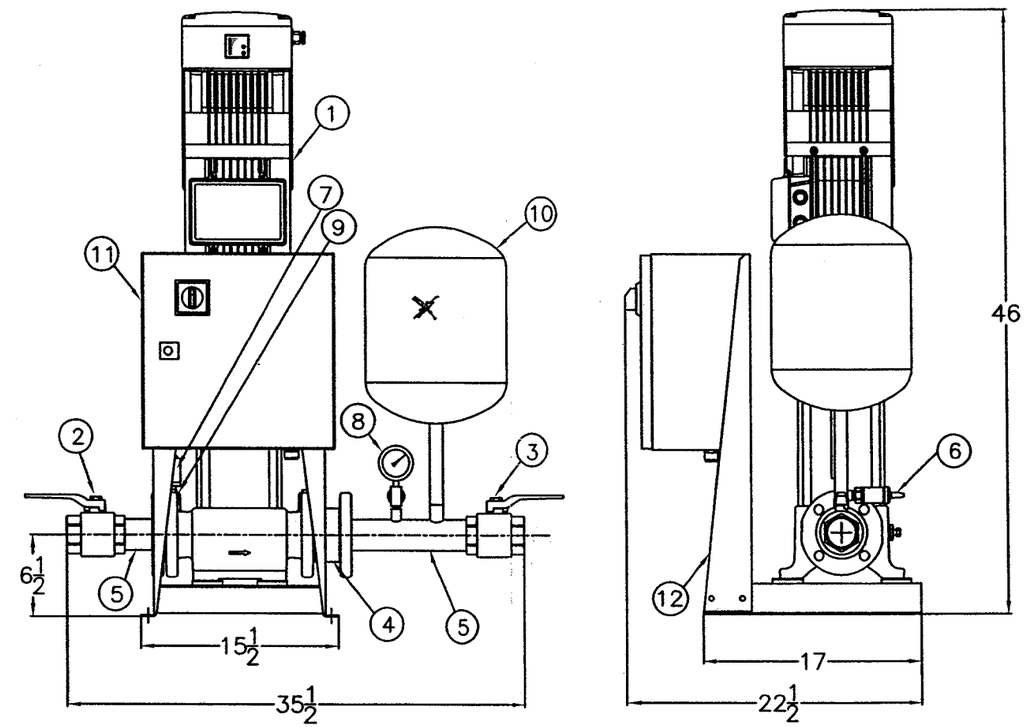
Base and Electrical
The pump shall be mounted on a fabricated stainless steel sheet base. The power connection terminal box shall be mounted on a bracket that is attached to the pump end. The power connection terminal box shall include a disconnect switch. Optional electrical accessories are available and mount in an optional larger power connection terminal box mounted on a larger pump base frame and control panel bracket.

The pump suction flange shall include a pressure switch to sense the presence of fluid (dry run protection), shall be electrically connected to the integrated variable frequency drive enclosure, and shall shut down the system when the fluid pressure drops below the switch limit. An optional, adjustable pressure switch must be available from the manufacturer.

A 4-20ma-pressure sensor, sized for proper application requirements, shall be installed on the discharge pipe and shall be electrically connected to the integrated variable frequency drive enclosure. An optional high-pressure shutdown switch must be available from the manufacturer.

Plumbing
The pump system shall include a stainless steel suction pipe with forged brass ball or butterfly isolation valve. The discharge pipe shall be stainless steel and include a port to install a pressure sensor and optional high-pressure shutdown switch and a port to install a pressure tank connection. A forged brass ball or butterfly isolation valve and a stainless steel body/plastic check valve shall be installed on the pump discharge pipe.

Furnish Rain Bird CRE Series pump system.



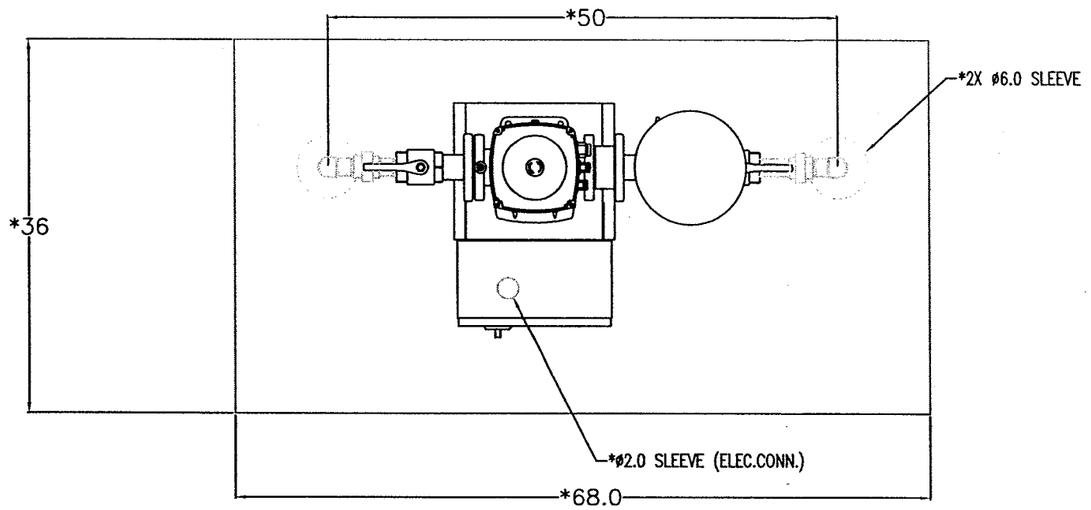
	ITEM	DECRIPTION
1	CRE PUMP	SEE WRITTEN SPECIFICATION
2	INLET ISOLATION VALVE	2" FULL PORT. ASTM CF8M/PTFE
3	DISCHARGE ISOLATION VALVE	2" FULL PORT. ASTM CF8M/PTFE
4	CHECK VALVE	POM / 316 SS / NBR
5	INLET/DISCHARGE MANIFOLD	316 SS
6	PRESSURE TRANSDUCER	4-20 mA SIGNAL, 316SS
7	INLET PRESSURE GAUGE	LIQUID FILLED, ABS/BRASS
8	DISCHARGE PRESSURE GAUGE	LIQUID FILLED, ABS/BRASS
9	PRESSURE SWITCH	304SS, 3PSI FIXED SET-POINT
10	TANK	4.4 GAL. PRESSURE TANK
11	SWITCH BOX	NEMA 3R, LOCKABLE IN OFF POSITION
12	SWITCH BOX SUPPORT BRACKET	304SS

RAIN BIRD CORPORATION
TUCSON, ARIZONA
COMMERCIAL MFG. DIVISION

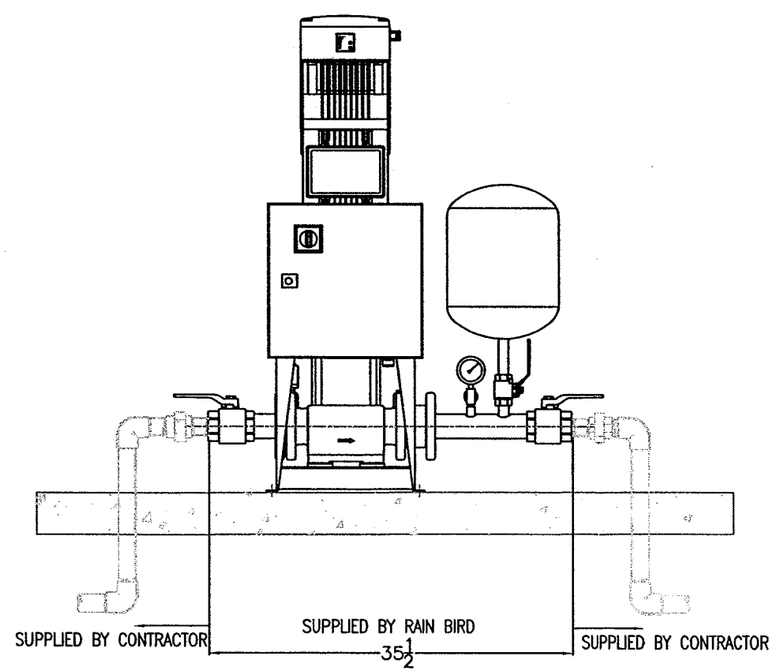
DRAWN R.S.	DATE 02/12/04	APPR. C.L.	DATE 02/12/04
CHECKED C.I	DATE 02/12/04	RELEASED BY: C.L.	DATE 02/12/04

DRAWING NUMBER
CRE16-40-7.5-3/60/460- 2
MODEL | Hp | ELECTRICAL | REV.

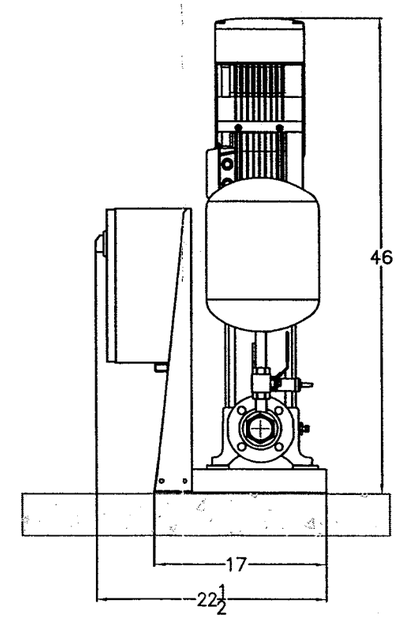
RAIN BIRD COMMERCIAL PUMP STATION SPECIFICATION PACKAGE
MODEL # CRE 16-40
PHASE: 3 VOLTAGE: 460 HP: 7.5



TOP VIEW



SIDE VIEW



END VIEW

RAIN BIRD PUMP STATION: CREX-16-40

* = DIMENSIONS FOR REFERENCE ONLY

Specifications

The packaged single pump booster system shall be a standard product of a single pump manufacturer. The manufacturer of the packaged pump system shall also be the manufacturer of the pump. Non standard, "one of a kind" packaged pump systems shall not be considered equal. The packaged water booster pump system shall be Rain Bird Model # _____ or approved equal.

The complete packaged booster pump system shall be certified and listed by UL for conformance to U.S. and Canadian Standards. Systems that have only the sub-assemblies certified and listed by UL for conformance to U.S. and Canadian Standards and/or UR and/or cUR recognized components shall not be considered equal.

The packaged pump system shall use advanced variable frequency drive and electronic controller technology to maintain a constant discharge pressure of _____ psi to a maximum flow of _____ gpm. Minimum supply pressure is _____ psi. Pump systems that use pump control valves or pressure reducing valves to maintain a constant water pressure shall not be considered equal.

The maximum duty point of the pump shall be _____ gpm @ _____ TDH. The pump efficiency shall be at least _____ % at the duty point..

The system power shall be _____ volts, ____ phase.

Pump

The pump shall be of the vertical multi-stage centrifugal design. The pump shall be furnished as shown on the plans and installed in accordance with the recommendations of the manufacturer. The pump shall be capable of producing, or exceeding the maximum system demand point of _____ gallons per minute and _____ feet of head while operating at the maximum pump rpm.

The pump suction/discharge chamber, motor stool and pump shaft coupling shall be constructed of cast iron. The impellers, pump shaft, diffuser chambers, outer discharge sleeve, impeller seal rings and seal ring retainers shall be constructed of stainless steel. Optional materials for the suction/discharge chamber and motor stool liner shall be stainless steel.

The impellers shall be secured directly to the pump shaft by means of a splined shaft arrangement for pumps rated to a maximum of 115 gallons per minute or less. For pumps rated higher than a maximum of 115 gallons per minute, the impellers shall be secured to the shaft by means of a split cone and nut design. Shaft journal and chamber bearings shall be Tungsten Carbide and Ceramic (or optional bronze chamber bearings) for pumps rated to a maximum of 115 gallons per minute or less. For pumps rated higher than a maximum of 115 gallons per minute, the shaft journal and chamber bearings shall be Tungsten Carbide and Bronze (or optional Graflon® chamber bearings).

Motor

The motor shall be of the pulse width modulated, integrated motor/variable frequency drive design; the motor and drive designed and built by a single manufacturer. The variable frequency drive enclosure shall include a PI controller, dry-contact fault output relay contacts, analog, and digital inputs. The motor shall detect/protect itself against under voltage, over voltage, excessive phase shift (3 phase models), overload, sensor signal fault, and set-point signal fault.

The motor/drive enclosure shall be rated IP55. The motor windings shall be class F rated. The 3-phase motor set-point shall be set by either plus and minus buttons located on the variable frequency drive enclosure or through an optional hand-held controller which communicates with the PI controller via infrared signal. The hand-held controller shall be produced by the same manufacturer as the motor/drive.

The hand-held controller shall provide a text LCD readout of alarms (faults), pump discharge pressure (psi), motor speed (rpm), instantaneous motor power input (kW), lifetime cumulative motor power consumption (kWh), and cumulative motor operating hours. Installation settings for the hand held controller must include the ability to select/adjust/read the set-point, optional external set-point, with a read-out of the resulting actual set-point adjusted for the external set-point setting, control mode (internal PI controlled or uncontrolled), PI controller integral action time or system time (TI) and PI reaction gain (Kp), activate/deactivate external set-point, activate/deactivate plus and minus set-point buttons on the variable frequency drive enclosure, the reaction mode of the digital input signal, and activate/deactivate low/zero-flow stop function, including delta H related to the stop function.

The hand-held controller must be able to enter a "Number" code into the single pump systems for pump system number identification (examples, pump system number "1", "2", etc.) and upload, store, and download motor/drive settings from and to other single pump systems of the same manufacturer. The hand-held controller must be able to transmit the motor/drive settings via infrared communication to a printer equipped to accept the infrared transmission. The 3-phase motor/drive must be job-site programmable through a manufacturer supplied PC program for settings other than that possible through the hand-held controller.

Electrical

The power connection terminal box shall be mounted on a bracket that is attached to the pump end. The power connection terminal box shall include a disconnect switch. Optional electrical accessories are available and mount in an optional larger power connection terminal box mounted on a larger pump base frame and control panel bracket.

The pump suction flange shall include a pressure switch to sense the presence of fluid (dry run protection), shall be electrically connected to the integrated variable frequency drive enclosure, and shall shut down the system when the fluid pressure drops below the switch limit. An optional, adjustable pressure switch must be available from the manufacturer.

A 4-20ma-pressure sensor, sized for proper application requirements, shall be installed on the discharge pipe and shall be electrically connected to the integrated variable frequency drive enclosure. An optional high-pressure shutdown switch must be available from the manufacturer.

continued on back

Specifications (continued)

Plumbing

The pump system shall include a stainless steel suction pipe with an isolation ball valve. The discharge pipe shall be stainless steel and include a port to install a pressure sensor and optional high-pressure shutdown switch and a port to install a pressure tank connection. An isolation ball valve and stainless steel body/plastic check valve shall be installed on the pump discharge pipe.

Furnish Rain Bird CRE Series pump system or equivalent.

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www.rainbird.com

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Appendix E:
Irrigation System Filter Information

Stainless Steel Sand Media Filtration Systems

SST

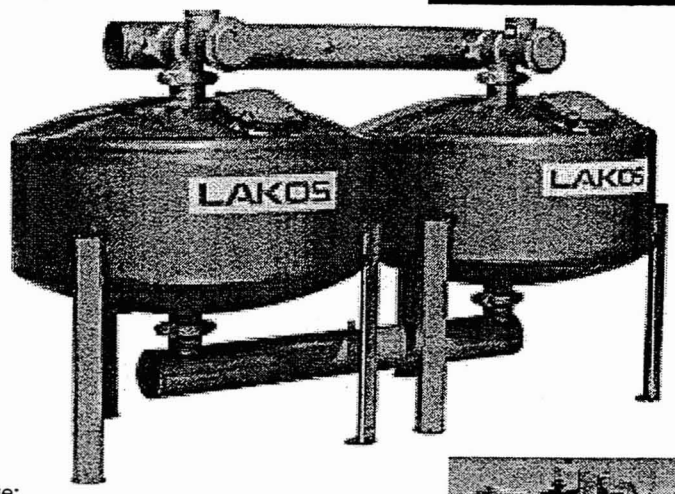
LAKOS SST Systems set the industry standard for operating performance, backwashing efficiency and the maximum use of sand media filtration surface area. Designed for the removal of small particles, organics & floating contaminants to protect drip & micro-irrigation systems. Capable of applications virtually wherever lightweight contaminants are a problem (ask about LAKOS Sand Separators for removing settleable sand, silt & grit particles).

Stainless steel tanks for optimum corrosion protection and long service life. Lightweight for shipping and installation handling.

Exclusive, precision-engineered underdrain system. Encourages optimum/even flow across the entire media surface area. No dead spots. Industry-best backwash characteristics for more thorough cleaning and longer operating cycles.

Time-saver installation package. Includes all the componentry for a complete and professional installation.

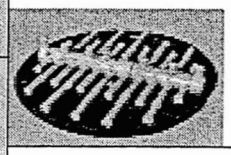
Underdrain design provides ideal flow characteristics; allows for single-grade media sand. Simplifies purchasing and installation.



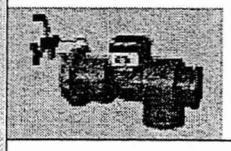
Flow range:
Standard systems up to 3140 US gpm
(715 m³/hr)

Choice of configurations for installation requirements & higher flow rates.

Ask also about:
LAKOS Sand Separators
LAKOS Pump Protection Separators
LAKOS Self-Cleaning Pump Intake Screens



Exclusive LAKOS Underdrain System. Internal v-slotting for maximum backwash performance. Zero flow-through pressure resistance for longer operating cycles & less backwashing. 15-Year Warranty.



LAKOS Backwash Valve. Proven the industry leader for performance and durability. Easy to service without system/piping disassembly.

Optional LAKOS BRS System. Reduces backwash water loss by 50% or more. Effective pre-filter to all makes of sand media filters, removing sand, grit & heavy particles. Ask LAKOS for details.

Specifications & Dimensions
Media Sand Options
Installation Configurations
Operation Details
Warranty

LAKOS®
Filtration & Separation Systems

Material Specifications

Filter Tanks

Stainless steel (304L) with grooved end connections at inlet & outlet. Top inspection port features bolt-on cover. Lower clean-out port is female coupling with plug.

Backwash Valves

Cast-iron body. Coated internal water-contact surfaces. Stainless steel shaft & guide bushing. Stainless steel disc with vulcanized Buna-N rubber to seal the backwash port.

Controller

Steel housing, water-resistant, key-lock. Solid-state timing. Operates from standard 110 VAC, 50/60 Hz. Consult factory for 220 VAC, 12 VDC battery or solar power.

Lateral/Underdrain Assembly

Header is schedule-40 PVC pipe. Slotted laterals feature PVC well screen with internal V-slotting; minimum collapse strength of 135 psi (9.3 bar).

Media Sand Options

Required media sand is **not** included with basic LAKOS Sand Media Filter System. The following information is provided for guideline & reference purposes only. Sand available from LAKOS and sources worldwide.

Filtration Requirement	Media Material
200 to 250 mesh/ 75 micron	#20 Crushed Silica
150 to 200 mesh/ 105 micron	#16 Crushed Silica
130 to 140 mesh/ 150 micron	#12 Crushed Silica

NOTE: LAKOS Sand Media Filters operate efficiently with single-grade sand media. No multi-grade layering required.

General Specifications

Model*	Flow Range** U.S. gpm	Flow Range** m^3/hr	System Manfold Inlet/Outlet Grooved Couplings	Media Sand Requirement*** (complete system) lbs.	Media Sand Requirement*** (complete system) kg	Maximum Filter Tank Pressure**** psi	Maximum Filter Tank Pressure**** bar	System Weight (without sand) lbs.	System Weight (without sand) kg	Filtration Area ft^2	Filtration Area m^2	Minimum Backwash Line Size
SST-1503-2	44-60	10-14	3-inch	300	181	100	7.0	136	62	2.4	.2	3-inch
SST-1803-2	60-90	14-20	3-inch	500	227	100	7.0	160	73	3.6	.3	3-inch
SST-2403-2	112-160	25-36	3-inch	900	408	100	7.0	220	100	6.2	.6	3-inch
SST-3004-2	180-250	41-57	4-inch	1000	454	100	7.0	400	181	10.0	1.0	3-inch
SST-3604-2	260-350	59-80	4-inch	1800	816	100	7.0	525	238	14.0	1.3	3-inch
SST-4806-2	440-625	100-142	6-inch	2600	1179	80	5.6	690	313	25.1	2.3	4-inch
SST-4806-3	650-940	148-213	6-inch	3900	1769	80	5.6	1075	488	37.7	3.5	4-inch
SST-4808-4	845-1240	192-282	8-inch	5200	2358	80	5.6	1490	676	50.2	4.6	4-inch
SST-4810-5	1050-1550	238-352	10-inch	6500	2948	80	5.6	1850	839	62.8	5.8	4-inch
SST-4810-6	1270-1870	288-425	10-inch	7800	3537	80	5.6	2200	998	75.4	7.0	4-inch
SST-4810-7	1475-2200	335-500	10-inch	2565	1165	80	5.6	2965	1345	87.9	8.1	4-inch
SST-4812-8	1685-2510	385-570	12-inch	2980	1350	80	5.6	3360	1525	100.4	9.2	4-inch
SST-4812-10	2105-3140	480-715	12-inch	3700	1680	80	5.6	4010	1820	125.6	11.6	4-inch

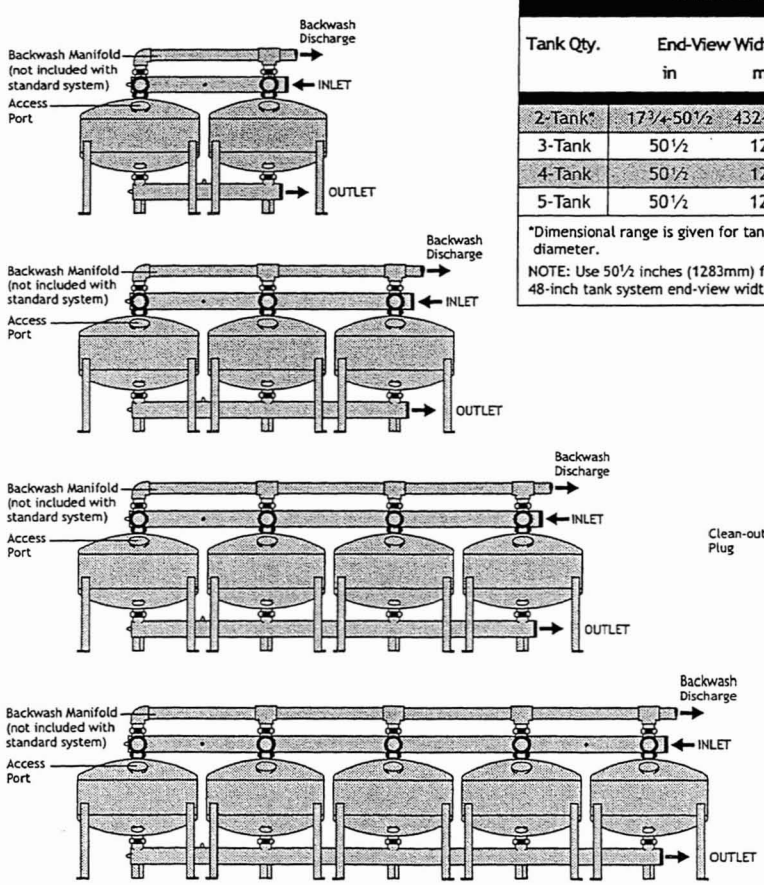
* Model numbers identify individual tank size/diameter (first two numbers), inlet/outlet size (second two numbers) and number of tanks per system (last number). Add an "A" at end of model number for an Automatic system. Add an "M" for a Manual system. NOTE: Standard automatic systems are AC operation. Consult factory for DC, battery-operated and solar-powered systems.

** Flow range based on a filtration range of 18-25 U.S. gpm/ft^2 (47-61 $m^3/hr/m^2$). Select a larger model if the water has an above-average quantity of particulates/organics.

*** NOTE: 100 lbs. = 1 cubic foot = 1 standard size bag of media sand.

**** For higher pressure requirements, please consult factory. Note: Recommended operating pressure range for proper actuation of LAKOS Backwash Valves is 20-80 psi (1.4-5.5 bar).

End-Feed Installation Configurations



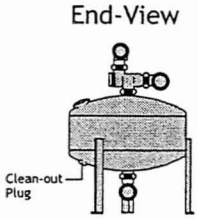
Dimensions

Tank Qty.	End-View Width in	End-View Width mm	Overall Length in	Overall Length mm
2-Tank*	17¾-50½	432-1283	33-100	838-2642
3-Tank	50½	1283	152	3962
4-Tank	50½	1283	204	5572
5-Tank	50½	1283	263	6833

*Dimensional range is given for tank sizes of 15-inch to 48-inch diameter.

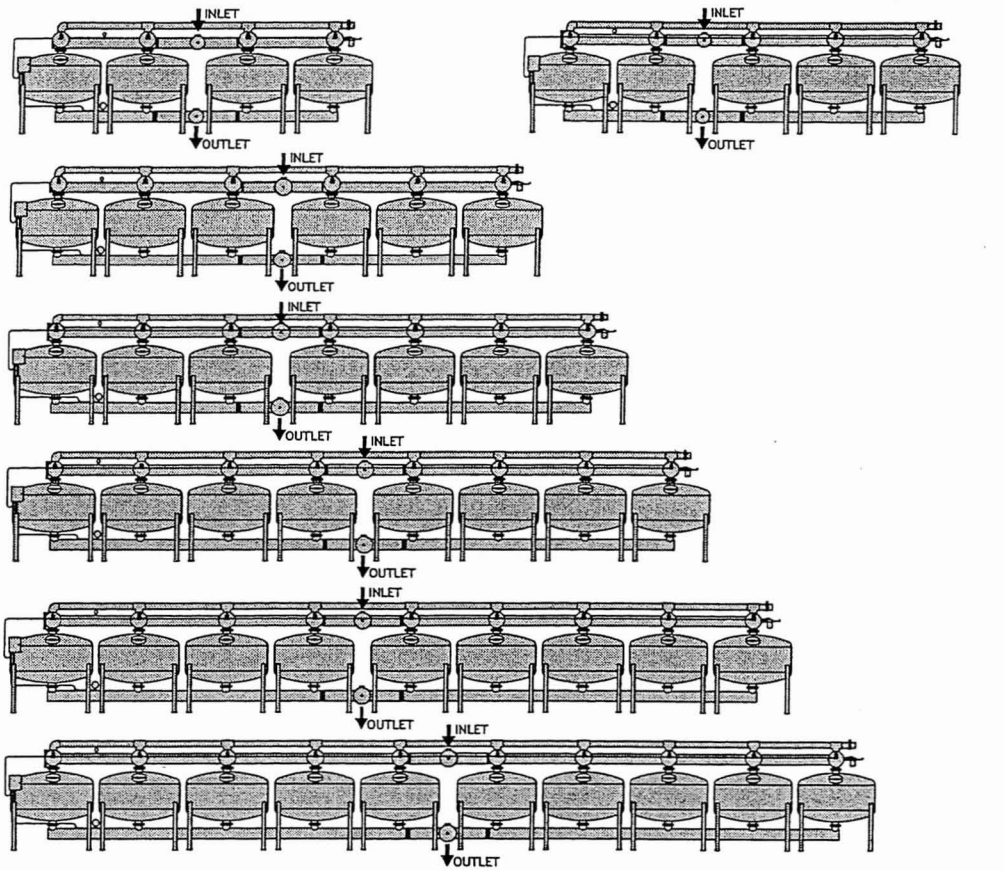
NOTE: Use 50½ inches (1283mm) for all End-Feed and Center-Feed 48-inch tank system end-view widths.

End-View



Center-Feed Installation Configurations

Diagrams illustrate 4-10 tank systems. Consult factory for other requirements.



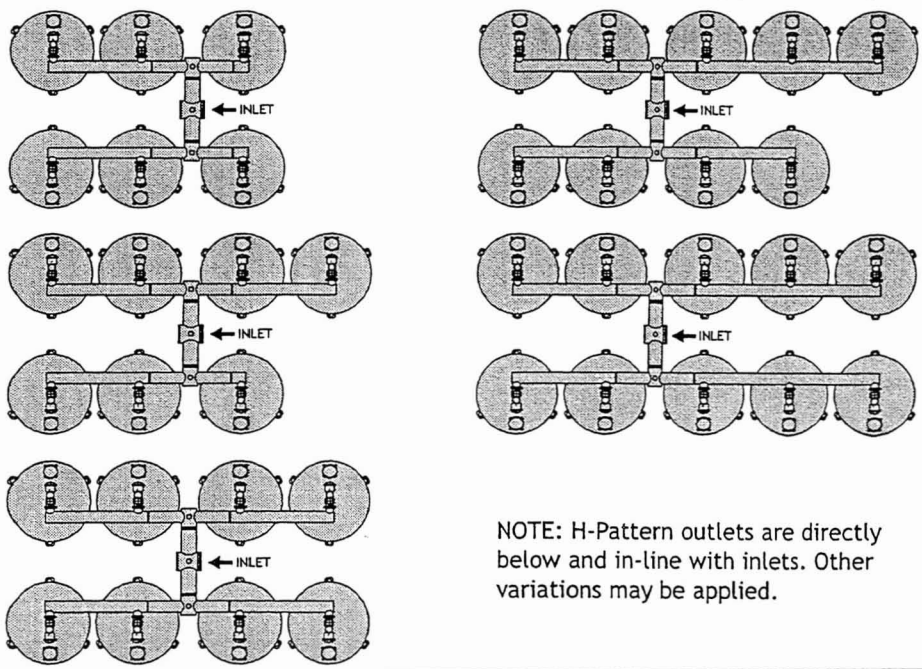
Dimensions

Tank Qty.	Overall Length in	mm
4-Tanks	211	5360
5-Tanks	263	6680
6-Tanks	315	8000
7-Tanks	367	9322
8-Tanks	419	10643
9-Tanks	471	11964
10-Tanks	523	13284

Overall Width (all 48-inch tank systems): 50½ inches (1283mm)

H-Pattern Installation Configurations

Diagrams illustrate 6-10 tank systems. Consult factory for other requirements.



NOTE: H-Pattern outlets are directly below and in-line with inlets. Other variations may be applied.

Dimensions

Tank Qty.	Overall Length in	mm
6-Tanks	159	4039
7-Tanks	211	5360
8-Tanks	211	5360
9-Tanks	263	6680
10-Tanks	263	6680

Overall Width (all 48-inch tank systems): 120 inches (3048mm)

Limited Warranty

All products manufactured and marketed by this corporation are warranted to be free of defects in material or workmanship for 12 months from date of installation; if installed 6 months or more after ship date, warranty shall be a maximum of 18 months from ship date.

If a fault develops, notify us, giving a complete description of the alleged malfunction. Include the model number(s), date of delivery and operating conditions of subject product(s). We will subsequently review this information and, at our option, supply you with either servicing data or shipping instruction and returned materials authorization. Upon prepaid receipt of subject product(s) at the instructed destination, we will then either repair or replace such product(s), at our option, and if determined to be a warranted defect, we will perform such necessary product repairs or replace such product(s) at our expense.

This limited warranty does not cover any products, damages or injuries resulting from misuse, neglect, normal expected wear, chemically-caused corrosion, improper installation or operation contrary to factory recommendation. Nor does it cover equipment that has been modified, tampered with or altered without authorization.

No other extended liabilities are stated or implied and this warranty in no event covers incidental or consequential damages, injuries or costs resulting from any such defective product(s).

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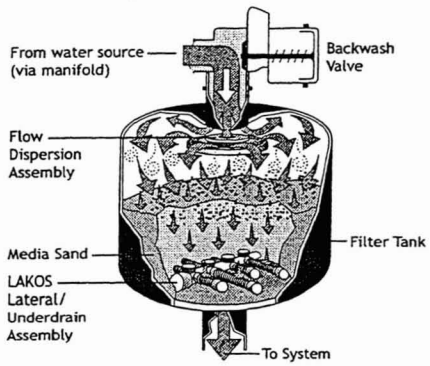
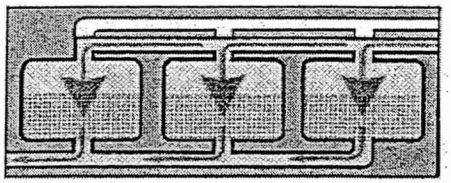
E-mail: info@lakos.com

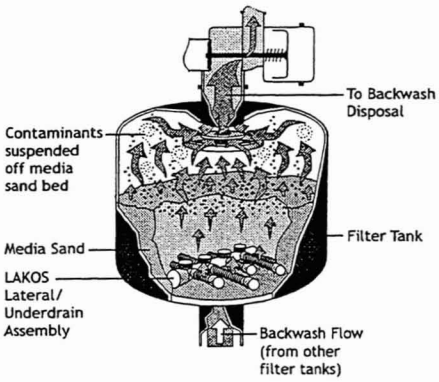
Operation



The Filtering Process

The filtering process engages the use of a specified sand media (see page 2) to trap foreign matter on the surface layer, allowing filtered water to percolate through the sand media and LAKOS internal v-slotted lateral assembly, discharging at the bottom of each tank to the outlet manifold.



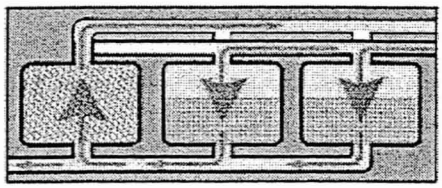


The Backwash Cycle

The backwash cycle flushes trapped debris from the sand media and out of the filter tanks. Each tank in a LAKOS System is flushed individually for maximum agitation of the sand media. Triggered by pressure differential, by elapsed time or manually, each tank's backwash valve is alternately activated into the backwash mode, which simultaneously interrupts inlet flow to that particular tank. Overall system pressure then directs partial system flow back into and through the tank's lateral assembly.

Flow continues for a prescribed period of time (typically one minute), suspending the foreign matter and carrying it out through the tank's top port (normal inlet) and out through the backwash valve and piping. The backwash valve then returns to its original position and restores the now "clean" filter tank to normal service.

NOTE: The LAKOS automatic controller provides a variable time delay between stations to avoid overlapping backwash cycles and maximize backwash efficiency.



The information, specifications and performance data stated in this literature are representative of engineering and production standards at the time of publication. Despite quality control, slight variations may occur due to manufacturing, product design improvements and/or sample selection. Actual data may also be revised without notice and you are encouraged to verify pertinent data with the manufacturer when appropriate.

LAKOS products are manufactured and sold under one or more of the following U.S. Patents: 3,289,608; 3,512,651; 3,568,837; 3,701,425; 3,947,364; 3,963,073; 4,027,481; 4,120,795; 4,123,800; 4,140,638; 4,147,630; 4,148,735; 4,305,825; 4,555,333; 5,320,747; 5,338,341; 5,368,735; 5,425,876; 5,571,416; 5,578,203; 5,622,545; 5,653,874; 5,894,995; 6,090,276; 6,143,175; 6,167,960, 6,202,543; Des. 327,693 and corresponding foreign patents. Other U.S. and foreign patents pending.

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LS-500D (Rev. 6/03)

LAKOS®
Filtration & Separation Systems

Appendix F:
Hydraulic Analysis of Proposed Low Flow Weirs and Infiltration Basins

CMG DRAINAGE ENGINEERING, INC.

CLINTON M. GLASS, P.E., PRESIDENT

4574 N. FIRST AVENUE, SUITE 100 TUCSON, AZ 85718 PHONE (520) 882-4244 FAX (520) 882-3006 EMAIL cmgde@cmgdrainage.com

July 7, 2004

Mr. Donald McGann, RLA
Ms. Karen Cesare, RLA
MA/NE Joint Venture
4574 North First Avenue, Suite 100
Tucson, Arizona 85718

RE: Hydraulic Analysis of Proposed Lowflow Weirs and Ponds, Rio Salado / Salt River Reach Downstream of Tempe Town Lake

Dear Mr. McGann and Ms. Cesare:

CMG Drainage Engineering, Inc has conducted an analysis of the hydraulic characteristics of the proposed lowflow weirs and ponds to be constructed within the Rio Salado / Salt River channel, downstream of the Tempe Town Lake. The analysis has been revised to respond to review comments provided to Novak/McGann by project reviewers. The study reach begins at the Tempe Town Lake on the east and extends west to Priest Drive (Figure 1). The proposed design consists of three ponding areas in series along the Rio Salado / Salt River bed (Figure 2). The purpose of these areas is to enhance retention and infiltration within the river bed, while providing appropriate moisture conditions for the establishment of riparian vegetation to be installed as a part of this project.

The ponding areas are to be constructed of native materials, while the weirs will be constructed of gabions. The weirs will each have a length of 120 feet, and will have a lowflow outlet which can be controlled through the use of a removable steel plate. A detail showing the general configuration of the basin and lowflow weir is attached with this letter (Figure 3).

Hydrologic Analysis

The study reach of the Rio Salado / Salt River is subject to three hydrologic regimes. The first regime is locally-generated runoff conveyed to the channel via storm drainage systems. An 8-foot diameter reinforced concrete pipe (RCP) storm drainage outlet is located near the east end of the study reach. This study did not analyze this storm drainage system in an attempt to determine the peak discharge which could be generated in this watershed and conveyed to the Rio Salado / Salt River study reach. For the purposes of this analysis, it was assumed that this pipe was flowing full at an assumed longitudinal slope of 0.005 feet per foot. The maximum capacity of this pipe was computed

to be approximately 700 cubic feet per second (cfs). Our analysis assumes a 3-hour, triangular storm hydrograph, with the peak discharge occurring 30 minutes after the start of runoff. The recession limb is uniform and comprises the remainder of the storm hydrograph.

The second regime is regionally-generated runoff conveyed to the study reach by the Salt River upstream of the Tempe Town Lake. This study did not analyze the hydrology associated with flooding along the Salt River. It is likely that during a flooding event along the Salt River, the improvements associated with this project, including the proposed basins and lowflow weirs, will be significantly damaged or destroyed.

The third regime is runoff generated within the watershed draining to the Tempe Town Lake which overtops the dam and is conveyed within the Rio Salado / Salt River channel. Review comments offered indicate that this condition may exist for rainfalls equal to or in excess of 1 inch in the Scottsdale area. Gaging station data provided indicate that flows in excess of 1,400 cfs have occurred at least three times in the last five years.

Hydrologic computations, including pipe capacity and the assumed triangular hydrograph, are attached with this letter.

Basin Routing

A HEC-1 model was prepared to route the storm hydrograph through the study reach, based on basin and lowflow weir physical characteristics provided by Novak Environmental, Inc. The proposed basin configuration was modeled under three conditions, assumed peak "operational" discharge, assumed "maximum" discharge, and assumed typical discharge. The assumed "operational" discharge is defined as the maximum discharge at which approximately 6 inches of freeboard can be provided in the proposed basins. The assumed "maximum" discharge is defined as the maximum discharge at which the basins do not overtop. These discharges were determined through a trial and error solution because the water surface elevations in the ponding areas are dependant on the water surface elevation in the downstream basin. The downstream weir (Basin 3) was assumed to have an unsubmerged discharge to the downstream Rio Salado / Salt River channel, while the upstream two weirs (Basins 1 and 2) operate in a submerged condition during the assumed peak discharge. The computed peak outflow and peak water surface elevation for each basin are summarized in Tables 1 and 2.

The assumed typical discharge is 5 cfs and is assumed to be continuous, based on information provided by Novak Environmental, Inc. All three weirs were assumed to operate in an unsubmerged condition for the typical discharge. Several other parameters

were evaluated for each basin under the assumed typical discharge condition, including residence time, and time to drain basin with the gate removed. The outflow, continuous water surface elevation, residence time, and time to drain for each basin is summarized in

Table 1: Routing Summary Table – Operational Discharge (1,200 cfs)

Basin ID	Peak Qin (cfs)	Peak Qout (cfs)	Peak Water Surface Elevation (ft)
Basin 1	1,200	1,021	1129.78
Basin 2	1,021	991	1127.71
Basin 3	991	964	1125.70

Table 2: Routing Summary Table – Maximum Discharge (1,300 cfs)

Basin ID	Peak Qin (cfs)	Peak Qout (cfs)	Peak Water Surface Elevation (ft)
Basin 1	1,300	1,154	1130.33
Basin 2	1,154	1,119	1128.16
Basin 3	1,119	1,092	1125.88

Table 3. The computation of these parameters neglects flow through the gabion lowflow weir and infiltration to the Rio Salado / Salt River bed. These computations assume a continuous inflow of 5 cfs, but should the flow to the basin cease, it is anticipated that the basins will drain relatively quickly, via drainage through the gabion lowflow weirs, via infiltration to the channel bed, and via evapotranspiration.

Table 3: Routing Summary Table – Assumed Continuous Discharge

Basin ID	Peak Qin (cfs)	Peak Qout (cfs)	Peak Water Surface Elevation (ft)	Hydraulic Residence Time (hr)	Time to Drain Basin (hr)
Basin 1	5	5	1127.09	2.4	4.0
Basin 2	5	5	1125.17	2.4	4.0
Basin 3	5	5	1123.83	2.9	4.8

Scour Analysis

The proposed basin and weir configuration was analyzed to determine the flow velocities in the vicinity of the proposed weirs to determine weir and berm stabilization measures. The proposed stabilization measures will be designed to protect against scour associated with the computed "maximum" capacity (1,300 cfs, defined previously), but will not afford protection against regional flooding along the Salt River.

Scour downstream of the proposed lowflow weirs was determined using the methodology described in *Engineering Analysis of Fluvial Systems* (Simons, Li & Associates, 1982). In this methodology, the design scour is comprised of general scour (Zgs), anti-dune trough depth (Za), lowflow thalweg depth (Zlft), and local scour due to the drop over the weir (Zls). A factor of safety of 1.3 is applied to the sum of the scour components to derive the total design scour depth. The proposed lowflow weir should be founded at least 5.8 feet below the flowline elevation of the channel at the downstream side of the weir (Figure 3). The gabion weir structure should have a 10-foot key-in to the proposed berms on either side of the proposed lowflow weir.

Riprap bank protection will be provided on the upstream and downstream sides of the proposed berm at the lowflow weirs to resist bank erosion (Figure 3). The maximum velocity in the vicinity of the proposed weirs is 8.0 feet per second (fps), indicating that 9-inch d50 riprap should be used. The riprap section should have a minimum thickness of 18 inches and should be underlain by filter fabric.

I hope this letter and the attached figures and computations are adequate for you to complete the design of this project. If you need additional information, please call.

Sincerely,

Richard L. Belt, P.E.

Registered Professional Engineer (Civil)
CERTIFICATE NO.
35791
RICHARD LEVIN
BELT III
DATE SIGNED
ARIZONA U.S.A.

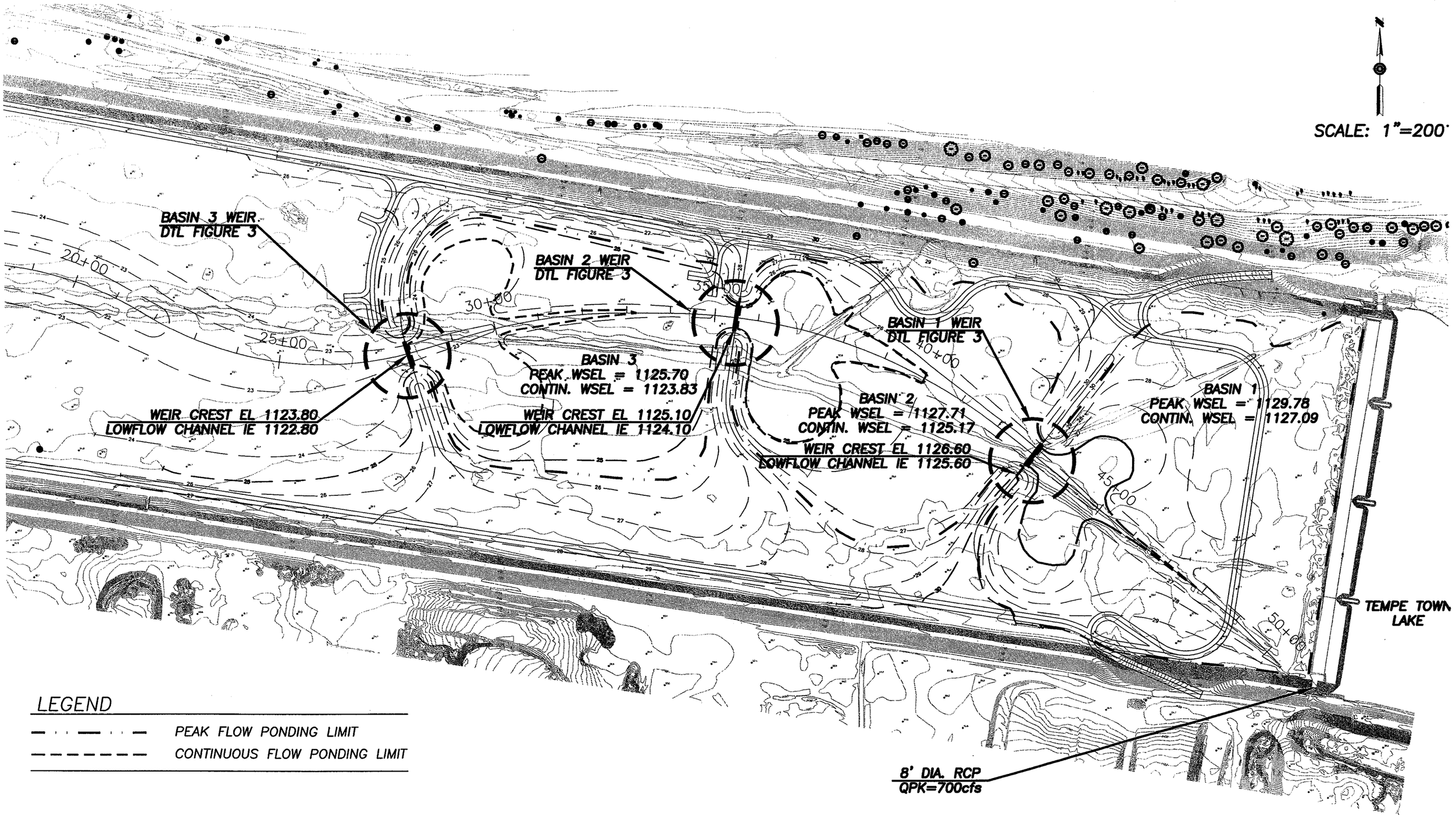
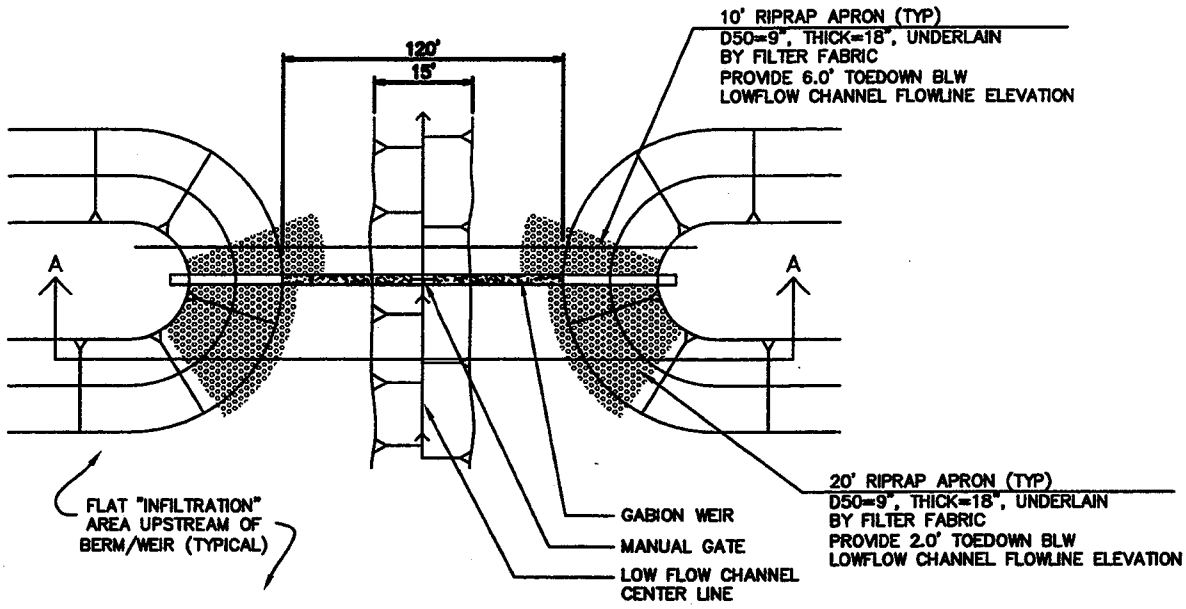
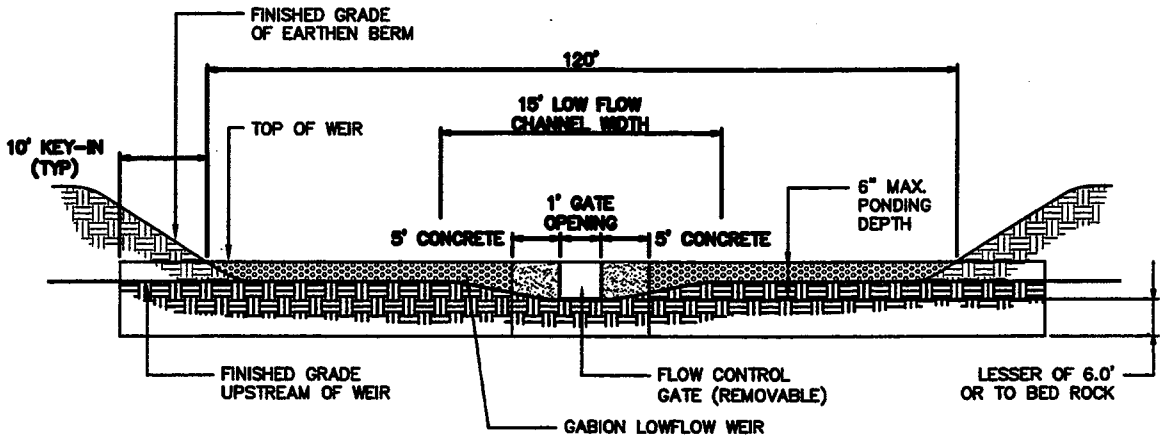


FIGURE 2:
LOWFLOW BASIN AND WEIR PLAN



1 PARTIAL PLAN AT BERM / WEIR
SCALE: N.T.S.



2 BERM / WEIR SECTION AA
SCALE: N.T.S.

FIGURE 3:
WEIR DETAIL

Rio Salado

DETENTION BASIN-1

ELEVATION	DEPTH	AREA	VOLUME
(ft)	(ft)	(sq-ft)	(ac-ft)
1126.0	0.0	4749.5	0.0000
1127.0	1.0	115312.7	1.3781
1128.0	2.0	257735.4	5.6601
1129.0	3.0	437354.9	13.6387
1130.0	4.0	552229.7	24.9975

DETENTION BASIN-2

ELEVATION	DEPTH	AREA	VOLUME
(ft)	(ft)	(sq-ft)	(ac-ft)
1125.0	0.0	80413.3	0.0000
1126.0	1.0	155625.3	2.7094
1127.0	2.0	281296.7	7.7245
1128.0	3.0	397141.5	15.5119

DETENTION BASIN-3

ELEVATION	DEPTH	AREA	VOLUME
(ft)	(ft)	(sq-ft)	(ac-ft)
1123.0	0.0	5973.5	0.0000
1124.0	1.0	124394.6	1.4964
1125.0	2.0	319949.10	6.5968
1126.0	3.0	385012.9	14.6886
1127.0	4.0	461551.6	24.4059

RIO SALADO 6.29.04

→ REVISED LOWFLOW WEIR LENGTH

→ 120 ft PER MEETING 6/28/04 W/ NOVAK / McGANN.

- DETERMINE "OPERATIONAL" CAPACITY → Q w/ +/- 6" FB
- DETERMINE "MAXIMUM" CAPACITY → Q w/ ¢ FB.

→ WEIR EL & LOWFLOW CONFIG TO REMAIN FOR INITIAL SUBMITTAL

- BASIN 3 → WEIR EL 23.8
  - ASSUME SOME SUBMERGENCE → 0.1 ft.

STG	Q_{out}
22.8	0
23.3	0
23.8	1
24	$Q = 2.8(120)(24-23.9)^{3/2} = 10.6$ / $= 3.0(120)(0.2)^{3/2} = 32$
25	$Q = 2.8(120)(25-23.9)^{3/2} = 388$ / $= 3.0(120)(1.2)^{3/2} = 473$
26	$Q = 2.8(120)(26-23.9)^{3/2} = 1023$ / $= 3.0(120)(2.2)^{3/2} = 1175$
27	$Q = 2.8(120)(27-23.9)^{3/2} = 1834$ / $= 3.0(120)(3.2)^{3/2} = 206$

- ASSUME OPERATIONAL CAPACITY → +/- 1500 cfs
  MAX. CAPACITY → +/- 1800 cfs.

RIO SALIDO 6.29.04

2 OF

D/S WSEL → 26.54 (1200) ; 25.72 (1200)

- BASIN 2 → SUBMERGED FLOW ; C = 2.8

WEIR EL 25.1

STG	Q OUT			
24.1	0			
24.6	0			
25.1	0	1700	1200	1400
26	0	0	61	5
27	$Q = 2.8(120)(27-26.54)^{3/2} =$	105	510	366
28	$Q = 2.8(120)(28-26.54)^{3/2} =$	593.	1187	994
		1300		
		9		
		382		
		1015		

- BASIN 1 → D/S WSEL → 27.89 (1200)

SUBMERGED FLOW

WEIR EL. 26.6

STG	Q OUT		
25.6	0		
26.1	0		
26.6	0		
27	0	1200	1300
28	$Q = 2.8(120)(28-27.89)^{3/2} =$	12.3 55	0
29	$Q = 2.8(120)(29-27.89)^{3/2} =$	343 ~~447~~ 498	336
30	$Q = 2.8(120)(30-27.89)^{3/2} =$	1030 ~~1467~~ 1172	950

Rio Salado

6.29.04

3 of

- Q = 1700 cfs.

	WEIR EL	WSEL	TOB
BSN 1	26.60	OVERTOPS	30
BSN 2	25.1	OVERTOPS	28
BSN 3	23.8	26.54	27

- Q = 1200 cfs. → MAX. OPERATIONAL CAPACITY

BSN 1	26.6	29.78	30
BSN 2	25.1	27.71	28
BSN 3	23.8	25.70	27

Q = 1400 cfs.

BSN 1	26.6	OVERTOPS	30
BSN 2	25.1	OVERTOPS	28
BSN 3	23.8	25.94	27

RIO SALADO 6.29.04

4 of

- Q = 1300 cfs. ← MAX. CAPACITY

	WEIR	WSEL	TOB
BSN 1	26.6		30
BSN 2	25.1		28
BSN 3	23.8	25.91	27

```
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 *                                   *                    *                                   *
 *   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   29JUN04  TIME  10:08:07   *                    *           (916) 756-1104          *
 *                                   *                    *                                   *
 *************************************                    *************************************
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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

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1                                                HEC-1 INPUT                                                PAGE  1

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

        1           ID   RIO SALADO, DOWNSTREAM OF TEMPE TOWN LAKE, 15 MAR 2004
        2           ID   REVISED JUNE 29, 2004
        3           ID   FILE : 4013BSN1
                    *
        4           IT       5 29JUN04    1645      40
        5           IO       0       1
        6           IN       5
                    *
        7           KM   ASSUME OVERFLOW FROM TEMPE TOWN LAKE, QMAX=1,200
        8           KM   ASSUME TRIANGULAR HYDROGRAPH SHAPE
        9           QI       0     200     400     600     800    1000    1200    1160    1120    1080
       10           QI    1040    1000     960     920     880     820     780     740     700     660
       11           QI     620     580     540     500     460     420     380     340     300     360
       12           QI     320     280     240     200     160     120      80      40       5       5
                    *

       13           KK  BSN1
       14           KM    BASIN 1
       15           KM    UPSTREAM BASIN STORAGE ROUTING
       16           KM    THE FOLLOWING STORAGE ROUTING PARAMETERS WERE DERIVED FROM BASIN/CHANNEL
       17           KM    DESIGN PROVIDE BY NOVAK ENVIRONMENTAL 28 JUN 2004
       18           KM    ASSUME SUBMERGED FLOW OVER WEIR, COEFF=2.8, H = HU/S-HD/S
       19           RS       1    STOR       0
       20           SV       0     0.1    1.00    1.38    5.66   13.64    25.0
       21           SE  1125.6  1126.1  1126.6    1127    1128    1129    1130
       22           SQ       0       0       0     0.0      55     498    1172
                    *

       23           KK  BSN2
       24           KM    BASIN 2
       25           KM    MID-BASIN STORAGE ROUTING
       26           KM    THE FOLLOWING STORAGE ROUTING PARAMETERS WERE DERIVED FROM BASIN/CHANNEL
       27           KM    DESIGN PROVIDE BY NOVAK ENVIRONMENTAL 28 JUN 2004
       28           KM    ASSUME SUBMERGED FLOW OVER WEIR, COEFF=2.8, H = HU/S-HD/S
       29           RS       1    STOR       0
       30           SV       0     0.1   1.000    2.71    7.72   15.51
       31           SE  1124.1  1124.6  1125.1    1126    1127    1128
       32           SQ       0       0     0.0      61     510    1187
                    *

       33           KK  BSN3
       34           KM    BASIN 3
       35           KM    DOWNSTREAM BASIN STORAGE ROUTING
       36           KM    THE FOLLOWING STORAGE ROUTING PARAMETERS WERE DERIVED FROM BASIN/CHANNEL
       37           KM    DESIGN PROVIDE BY NOVAK ENVIRONMENTAL 28 JUN 2004
       38           KM    ASSUME UNSUBMERGED FLOW OVER WEIR, COEFF=3.0, WEIR LENGTH = 120'
       39           RS       1    STOR       0
       40           SV       0     0.1   1.197    1.50    6.60   14.69   24.41
       41           SE  1122.8  1123.3  1123.8    1124    1125    1126    1127
       42           SQ       0       0     1.0    32.0     473    1175    2061
       43           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       *
```


OPERATIONAL CAPACITY

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* RUN DATE   29JUN04  TIME  10:08:07   *                                          *          (916) 756-1104          *
*                                      *                                          *                                  *
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                        RIO SALADO, DOWNSTREAM OF TEMPE TOWN LAKE, 15 MAR 2004
                        REVISED JUNE 29, 2004
                        FILE : 4013BSN1

  5 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          0  PRINT CONTROL
                      IPLOT          1  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE     29JUN 4  STARTING DATE
                      ITIME       1645  STARTING TIME
                         NQ         40  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     29JUN 4  ENDING DATE
                     NDTIME       2000  ENDING TIME
                     ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE    3.25 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
                          ASSUME OVERFLOW FROM TEMPE TOWN LAKE, QMAX=1,200
                          ASSUME TRIANGULAR HYDROGRAPH SHAPE

  6 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          5  TIME INTERVAL IN MINUTES
                     JXDATE     29JUN 4  STARTING DATE
                     JXTIME       1645  STARTING TIME

               SUBBASIN RUNOFF DATA

  0 BA          SUBBASIN CHARACTERISTICS
                      TAREA        .00  SUBBASIN AREA

                                                    ***
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*****************************************************************************************************************************
                                                HYDROGRAPH AT STATION   BSN1
*****************************************************************************************************************************
                                 *                                 *                                 *
  DA MON HRMN  ORD      FLOW     *  DA MON HRMN  ORD      FLOW    *  DA MON HRMN  ORD      FLOW    *  DA MON HRMN  ORD      FLOW
                                 *                                 *                                 *
  29 JUN 1645    1        0.     *  29 JUN 1735   11     1040.    *  29 JUN 1825   21      620.    *  29 JUN 1915   31      320.
  29 JUN 1650    2      200.     *  29 JUN 1740   12     1000.    *  29 JUN 1830   22      580.    *  29 JUN 1920   32      280.
  29 JUN 1655    3      400.     *  29 JUN 1745   13      960.    *  29 JUN 1835   23      540.    *  29 JUN 1925   33      240.
  29 JUN 1700    4      600.     *  29 JUN 1750   14      920.    *  29 JUN 1840   24      500.    *  29 JUN 1930   34      200.
  29 JUN 1705    5      800.     *  29 JUN 1755   15      880.    *  29 JUN 1845   25      460.    *  29 JUN 1935   35      160.
  29 JUN 1710    6     1000.     *  29 JUN 1800   16      820.    *  29 JUN 1850   26      420.    *  29 JUN 1940   36      120.
  29 JUN 1715    7     1200.     *  29 JUN 1805   17      780.    *  29 JUN 1855   27      380.    *  29 JUN 1945   37       80.
  29 JUN 1720    8     1160.     *  29 JUN 1810   18      740.    *  29 JUN 1900   28      340.    *  29 JUN 1950   38       40.
  29 JUN 1725    9     1120.     *  29 JUN 1815   19      700.    *  29 JUN 1905   29      300.    *  29 JUN 1955   39        5.
  29 JUN 1730   10     1080.     *  29 JUN 1820   20      660.    *  29 JUN 1910   30      360.    *  29 JUN 2000   40        5.
                                 *                                 *                                 *
*****************************************************************************************************************************
```

```
 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR       3.25-HR
+   (CFS)       (HR)
                              (CFS)
+    1200.       .50              564.         564.         564.         564.
                            (INCHES)        .000         .000         .000         .000
                             (AC-FT)        152.         152.         152.         152.

                         CUMULATIVE AREA =     .00 SQ MI


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


            **************
            *            *
  13 KK     *    BSN1    *
            *            *
            **************
                          BASIN 1
```

UPSTREAM BASIN STORAGE ROUTING
THE FOLLOWING STORAGE ROUTING PARAMETERS WERE DERIVED FROM BASIN/CHANNEL
DESIGN PROVIDE BY NOVAK ENVIRONMENTAL 28 JUN 2004
ASSUME SUBMERGED FLOW OVER WEIR, COEFF=2.8, H = HU/S-HD/S

HYDROGRAPH ROUTING DATA

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

 20 SV            STORAGE         .0        .1       1.0       1.4       5.7      13.6      25.0

 21 SE          ELEVATION    1125.60   1126.10   1126.60   1127.00   1128.00   1129.00   1130.00

 22 SQ          DISCHARGE         0.        0.        0.        0.       55.      498.     1172.

                                                                  ***
```

****

HYDROGRAPH AT STATION BSN1

****

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
29	JUN	1645	1	0.	.0	1125.6	29	JUN	1755	15	956.	21.4	1129.7	29	JUN	1905	29	402.	11.9	1128.8
29	JUN	1650	2	0.	.7	1126.4	29	JUN	1800	16	920.	20.7	1129.6	29	JUN	1910	30	379.	11.5	1128.7
29	JUN	1655	3	17.	2.7	1127.3	29	JUN	1805	17	879.	20.1	1129.6	29	JUN	1915	31	366.	11.3	1128.7
29	JUN	1700	4	66.	5.9	1128.0	29	JUN	1810	18	839.	19.4	1129.5	29	JUN	1920	32	345.	10.9	1128.7
29	JUN	1705	5	269.	9.5	1128.5	29	JUN	1815	19	798.	18.7	1129.4	29	JUN	1925	33	318.	10.4	1128.6
29	JUN	1710	6	472.	13.2	1128.9	29	JUN	1820	20	758.	18.0	1129.4	29	JUN	1930	34	286.	9.8	1128.5
29	JUN	1715	7	683.	16.8	1129.3	29	JUN	1825	21	718.	17.4	1129.3	29	JUN	1935	35	252.	9.2	1128.4
29	JUN	1720	8	852.	19.6	1129.5	29	JUN	1830	22	678.	16.7	1129.3	29	JUN	1940	36	216.	8.6	1128.4
29	JUN	1725	9	950.	21.3	1129.7	29	JUN	1835	23	638.	16.0	1129.2	29	JUN	1945	37	179.	7.9	1128.3
29	JUN	1730	10	1001.	22.1	1129.7	29	JUN	1840	24	598.	15.3	1129.1	29	JUN	1950	38	141.	7.2	1128.2
29	JUN	1735	11	1021.	22.5	1129.8	29	JUN	1845	25	558.	14.7	1129.1	29	JUN	1955	39	103.	6.5	1128.1
29	JUN	1740	12	1021.	22.4	1129.8	29	JUN	1850	26	518.	14.0	1129.0	29	JUN	2000	40	71.	6.0	1128.0
29	JUN	1745	13	1007.	22.2	1129.8	29	JUN	1855	27	479.	13.3	1129.0							
29	JUN	1750	14	984.	21.8	1129.7	29	JUN	1900	28	441.	12.6	1128.9							

****

```
  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      3.25-HR
+   (CFS)       (HR)
                            (CFS)
+    1021.       .83                542.         542.         542.         542.
                         (INCHES)   .000         .000         .000         .000
                          (AC-FT)   146.         146.         146.         146.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR        72-HR      3.25-HR
+  (AC-FT)      (HR)
      22.        .83                 14.          14.          14.          14.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                     6-HR        24-HR        72-HR      3.25-HR
+   (FEET)      (HR)
   1129.78       .83             1128.89      1128.89      1128.89      1128.89

                         CUMULATIVE AREA =      .00 SQ MI
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*** ***

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            **************
            *            *
 23 KK      *    BSN2    *
            *            *
            **************
```

BASIN 2
MID-BASIN STORAGE ROUTING
THE FOLLOWING STORAGE ROUTING PARAMETERS WERE DERIVED FROM BASIN/CHANNEL
DESIGN PROVIDE BY NOVAK ENVIRONMENTAL 28 JUN 2004
ASSUME SUBMERGED FLOW OVER WEIR, COEFF=2.8, H = HU/S-HD/S

HYDROGRAPH ROUTING DATA

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

 30 SV            STORAGE         .0        .1       1.0       2.7       7.7      15.5

 31 SE          ELEVATION    1124.10   1124.60   1125.10   1126.00   1127.00   1128.00
```

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 32 SQ          DISCHARGE          0.        0.        0.       61.      510.     1187.
                                                                 ***
```

HYDROGRAPH AT STATION BSN2

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
29	JUN	1645	1	0.	.0	1124.1	29	JUN	1755	15	981.	13.1	1127.7	29	JUN	1905	29	466.	7.2	1126.9
29	JUN	1650	2	0.	.0	1124.1	29	JUN	1800	16	961.	12.9	1127.7	29	JUN	1910	30	430.	6.8	1126.8
29	JUN	1655	3	0.	.1	1124.4	29	JUN	1805	17	933.	12.6	1127.6	29	JUN	1915	31	403.	6.5	1126.8
29	JUN	1700	4	0.	.3	1124.7	29	JUN	1810	18	899.	12.2	1127.6	29	JUN	1920	32	381.	6.3	1126.7
29	JUN	1705	5	16.	1.4	1125.3	29	JUN	1815	19	862.	11.8	1127.5	29	JUN	1925	33	358.	6.0	1126.7
29	JUN	1710	6	131.	3.5	1126.2	29	JUN	1820	20	823.	11.3	1127.5	29	JUN	1930	34	331.	5.7	1126.6
29	JUN	1715	7	342.	5.8	1126.6	29	JUN	1825	21	784.	10.9	1127.4	29	JUN	1935	35	302.	5.4	1126.5
29	JUN	1720	8	542.	8.1	1127.0	29	JUN	1830	22	744.	10.4	1127.3	29	JUN	1940	36	270.	5.0	1126.5
29	JUN	1725	9	707.	10.0	1127.3	29	JUN	1835	23	705.	10.0	1127.3	29	JUN	1945	37	236.	4.7	1126.4
29	JUN	1730	10	831.	11.4	1127.5	29	JUN	1840	24	665.	9.5	1127.2	29	JUN	1950	38	200.	4.3	1126.3
29	JUN	1735	11	914.	12.4	1127.6	29	JUN	1845	25	625.	9.0	1127.2	29	JUN	1955	39	163.	3.8	1126.2
29	JUN	1740	12	963.	12.9	1127.7	29	JUN	1850	26	585.	8.6	1127.1	29	JUN	2000	40	127.	3.4	1126.1
29	JUN	1745	13	986.	13.2	1127.7	29	JUN	1855	27	545.	8.1	1127.1							
29	JUN	1750	14	991.	13.2	1127.7	29	JUN	1900	28	506.	7.7	1127.0							

```
 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR       3.25-HR
+   (CFS)       (HR)
                            (CFS)
+    991.       1.08                529.         529.         529.         529.
                         (INCHES)   .000         .000         .000         .000
                          (AC-FT)   142.         142.         142.         142.

 PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR        72-HR       3.25-HR
+  (AC-FT)      (HR)
      13.       1.08                  8.           8.           8.           8.

 PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                     6-HR        24-HR        72-HR       3.25-HR
+   (FEET)      (HR)
  1127.71      1.08              1126.78      1126.78      1126.78      1126.78

                        CUMULATIVE AREA =      .00 SQ MI
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            **************
            *            *
 33 KK      *    BSN3    *
            *            *
            **************
                          BASIN 3
                          DOWNSTREAM BASIN STORAGE ROUTING
                          THE FOLLOWING STORAGE ROUTING PARAMETERS WERE DERIVED FROM BASIN/CHANNEL
                          DESIGN PROVIDE BY NOVAK ENVIRONMENTAL 28 JUN 2004
                          ASSUME UNSUBMERGED FLOW OVER WEIR, COEFF=3.0, WEIR LENGTH = 120'

              HYDROGRAPH ROUTING DATA

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

 40 SV            STORAGE         .0        .1       1.2       1.5       6.6      14.7      24.4

 41 SE          ELEVATION     1122.80   1123.30   1123.80   1124.00   1125.00   1126.00   1127.00

 42 SQ          DISCHARGE          0.        0.        1.       32.      473.     1175.     2061.
                                                                 ***
```

HYDROGRAPH AT STATION BSN3

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
29	JUN	1645	1	0.	.0	1122.8	29	JUN	1755	15	958.	12.2	1125.7	29	JUN	1905	29	532.	7.3	1125.1
29	JUN	1650	2	0.	.0	1122.8	29	JUN	1800	16	964.	12.3	1125.7	29	JUN	1910	30	494.	6.8	1125.0
29	JUN	1655	3	0.	.0	1122.8	29	JUN	1805	17	956.	12.2	1125.7	29	JUN	1915	31	458.	6.4	1125.0
29	JUN	1700	4	0.	.0	1122.8	29	JUN	1810	18	938.	12.0	1125.7	29	JUN	1920	32	428.	6.1	1124.9
29	JUN	1705	5	0.	.1	1123.1	29	JUN	1815	19	911.	11.6	1125.6	29	JUN	1925	33	401.	5.8	1124.8

29 JUN 1710	6	0.	.6	1123.5	*	29 JUN 1820	20	880.	11.3	1125.6	*	29 JUN 1930	34	375.	5.5	1124.8
29 JUN 1715	7	70.	1.9	1124.1	*	29 JUN 1825	21	845.	10.9	1125.5	*	29 JUN 1935	35	348.	5.2	1124.7
29 JUN 1720	8	241.	3.9	1124.5	*	29 JUN 1830	22	808.	10.5	1125.5	*	29 JUN 1940	36	320.	4.8	1124.7
29 JUN 1725	9	417.	6.0	1124.9	*	29 JUN 1835	23	769.	10.0	1125.4	*	29 JUN 1945	37	289.	4.5	1124.6
29 JUN 1730	10	579.	7.8	1125.2	*	29 JUN 1840	24	730.	9.6	1125.4	*	29 JUN 1950	38	256.	4.1	1124.5
29 JUN 1735	11	714.	9.4	1125.3	*	29 JUN 1845	25	691.	9.1	1125.3	*	29 JUN 1955	39	222.	3.7	1124.4
29 JUN 1740	12	817.	10.6	1125.5	*	29 JUN 1850	26	651.	8.7	1125.3	*	29 JUN 2000	40	187.	3.3	1124.4
29 JUN 1745	13	890.	11.4	1125.6	*	29 JUN 1855	27	612.	8.2	1125.2	*					
29 JUN 1750	14	935.	11.9	1125.7	*	29 JUN 1900	28	572.	7.7	1125.1	*					
					*						*					

****

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	3.25-HR
964.	1.25	(CFS)	517.	517.	517.	517.
		(INCHES)	.000	.000	.000	.000
		(AC-FT)	139.	139.	139.	139.

PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	3.25-HR
12.	1.25	7.	7.	7.	7.

PEAK STAGE (FEET)	TIME (HR)	MAXIMUM AVERAGE STAGE 6-HR	24-HR	72-HR	3.25-HR
1125.70	1.25	1124.83	1124.83	1124.83	1124.83

CUMULATIVE AREA = .00 SQ MI

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	BSN1	1200.	.50	564.	564.	564.	.00		
ROUTED TO	BSN1	1021.	.83	542.	542.	542.	.00		
								1129.78	.83
ROUTED TO	BSN2	991.	1.08	529.	529.	529.	.00		
								1127.71	1.08
ROUTED TO	BSN3	964.	1.25	517.	517.	517.	.00		
								1125.70	1.25

*** 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   07JUL04  TIME  15:05:34  *                                    *          (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   RIO SALADO, DOWNSTREAM OF TEMPE TOWN LAKE, 15 MAR 2004
             2          ID   REVISED JUNE 29, 2004
             3          ID   FILE : 4013BSN1
                        *
             4          IT       5 29JUN04    1645      40
             5          IO       0       1
             6          IN       5
                        *
             7          KM   ASSUME OVERFLOW FROM TEMPE TOWN LAKE, QMAX=1,300
             8          KM   ASSUME TRIANGULAR HYDROGRAPH SHAPE
             9          QI       0     215     430     645     860    1075    1300    1300    1300    1262
            10          QI    1217    1172    1127    1082    1037     992     953     908     863     818
            11          QI     773     728     683     632     587     542     497     452     407     362
            12          QI     317     272     227     182     137      92      37       5       5       5
                        *

            13          KK  BSN1
            14          KM    BASIN 1
            15          KM    UPSTREAM BASIN STORAGE ROUTING
            16          KM    THE FOLLOWING STORAGE ROUTING PARAMETERS WERE DERIVED FROM BASIN/CHANNEL
            17          KM    DESIGN PROVIDE BY NOVAK ENVIRONMENTAL 28 JUN 2004
            18          KM    ASSUME SUBMERGED FLOW OVER WEIR, COEFF=2.8, H = HU/S-HD/S
            19          RS       1    STOR       0
            20          SV       0     0.1    1.00    1.38    5.66   13.64    25.0
            21          SE  1125.6  1126.1  1126.6    1127    1128    1129    1130
            22          SQ       0       0       0     0.0       0     336     950
                        *

            23          KK  BSN2
            24          KM    BASIN 2
            25          KM    MID-BASIN STORAGE ROUTING
            26          KM    THE FOLLOWING STORAGE ROUTING PARAMETERS WERE DERIVED FROM BASIN/CHANNEL
            27          KM    DESIGN PROVIDE BY NOVAK ENVIRONMENTAL 28 JUN 2004
            28          KM    ASSUME SUBMERGED FLOW OVER WEIR, COEFF=2.8, H = HU/S-HD/S
            29          RS       1    STOR       0
            30          SV       0     0.1   1.000    2.71    7.72   15.51
            31          SE  1124.1  1124.6  1125.1    1126    1127    1128
            32          SQ       0       0     0.0       9     382    1015
                        *

            33          KK  BSN3
            34          KM    BASIN 3
            35          KM    DOWNSTREAM BASIN STORAGE ROUTING
            36          KM    THE FOLLOWING STORAGE ROUTING PARAMETERS WERE DERIVED FROM BASIN/CHANNEL
            37          KM    DESIGN PROVIDE BY NOVAK ENVIRONMENTAL 28 JUN 2004
            38          KM    ASSUME UNSUBMERGED FLOW OVER WEIR, COEFF=3.0, WEIR LENGTH = 120'
            39          RS       1    STOR       0
            40          SV       0     0.1   1.197    1.50    6.60   14.69   24.41
            41          SE  1122.8  1123.3  1123.8    1124    1125    1126    1127
            42          SQ       0       0     1.0    32.0     473    1175    2061
            43          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         *
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Maximum Capacity

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* RUN DATE   07JUL04  TIME  15:05:34   *                                                    *          (916) 756-1104          *
*                                      *                                                    *                                  *
****************************************                                                    ************************************
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                        RIO SALADO, DOWNSTREAM OF TEMPE TOWN LAKE, 15 MAR 2004
                        REVISED JUNE 29, 2004
                        FILE : 4013BSN1

  5 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          0  PRINT CONTROL
                      IPLOT          1  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE     29JUN 4  STARTING DATE
                      ITIME       1645  STARTING TIME
                         NQ         40  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     29JUN 4  ENDING DATE
                     NDTIME       2000  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE    3.25 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
                          ASSUME OVERFLOW FROM TEMPE TOWN LAKE, QMAX=1,300
                          ASSUME TRIANGULAR HYDROGRAPH SHAPE

  6 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          5  TIME INTERVAL IN MINUTES
                     JXDATE     29JUN 4  STARTING DATE
                     JXTIME       1645  STARTING TIME

               SUBBASIN RUNOFF DATA

  0 BA          SUBBASIN CHARACTERISTICS
                      TAREA        .00  SUBBASIN AREA

                                                    ***
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*****************************************************************************************************************************
                                                HYDROGRAPH AT STATION   BSN1
*****************************************************************************************************************************
                                 *                                 *                                 *
  DA MON HRMN  ORD      FLOW     *  DA MON HRMN  ORD      FLOW     *  DA MON HRMN  ORD      FLOW     *  DA MON HRMN  ORD      FLOW
                                 *                                 *                                 *
  29 JUN 1645    1        0.     *  29 JUN 1735   11     1217.     *  29 JUN 1825   21      773.     *  29 JUN 1915   31      317.
  29 JUN 1650    2      215.     *  29 JUN 1740   12     1172.     *  29 JUN 1830   22      728.     *  29 JUN 1920   32      272.
  29 JUN 1655    3      430.     *  29 JUN 1745   13     1127.     *  29 JUN 1835   23      683.     *  29 JUN 1925   33      227.
  29 JUN 1700    4      645.     *  29 JUN 1750   14     1082.     *  29 JUN 1840   24      632.     *  29 JUN 1930   34      182.
  29 JUN 1705    5      860.     *  29 JUN 1755   15     1037.     *  29 JUN 1845   25      587.     *  29 JUN 1935   35      137.
  29 JUN 1710    6     1075.     *  29 JUN 1800   16      992.     *  29 JUN 1850   26      542.     *  29 JUN 1940   36       92.
  29 JUN 1715    7     1300.     *  29 JUN 1805   17      953.     *  29 JUN 1855   27      497.     *  29 JUN 1945   37       37.
  29 JUN 1720    8     1300.     *  29 JUN 1810   18      908.     *  29 JUN 1900   28      452.     *  29 JUN 1950   38        5.
  29 JUN 1725    9     1300.     *  29 JUN 1815   19      863.     *  29 JUN 1905   29      407.     *  29 JUN 1955   39        5.
  29 JUN 1730   10     1262.     *  29 JUN 1820   20      818.     *  29 JUN 1910   30      362.     *  29 JUN 2000   40        5.
                                 *                                 *                                 *
*****************************************************************************************************************************
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```
 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR      3.25-HR
+   (CFS)      (HR)
                          (CFS)
+   1300.       .50                654.         654.         654.         654.
                         (INCHES)   .000         .000         .000         .000
                          (AC-FT)   176.         176.         176.         176.

                       CUMULATIVE AREA =     .00 SQ MI
```

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

            **************
            *            *
  13 KK     *    BSN1    *
            *            *
            **************
                        BASIN 1
```

UPSTREAM BASIN STORAGE ROUTING
THE FOLLOWING STORAGE ROUTING PARAMETERS WERE DERIVED FROM BASIN/CHANNEL
DESIGN PROVIDE BY NOVAK ENVIRONMENTAL 28 JUN 2004
ASSUME SUBMERGED FLOW OVER WEIR, COEFF=2.8, H = HU/S-HD/S

HYDROGRAPH ROUTING DATA

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

 20 SV            STORAGE          .0        .1       1.0       1.4       5.7      13.6      25.0

 21 SE          ELEVATION     1125.60   1126.10   1126.60   1127.00   1128.00   1129.00   1130.00

 22 SQ          DISCHARGE          0.        0.        0.        0.        0.      336.      950.
                                                                  ***

WARNING --- ROUTED OUTFLOW (   1001.) IS GREATER THAN MAXIMUM OUTFLOW (    950.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1089.) IS GREATER THAN MAXIMUM OUTFLOW (    950.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1136.) IS GREATER THAN MAXIMUM OUTFLOW (    950.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1154.) IS GREATER THAN MAXIMUM OUTFLOW (    950.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1153.) IS GREATER THAN MAXIMUM OUTFLOW (    950.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1138.) IS GREATER THAN MAXIMUM OUTFLOW (    950.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1113.) IS GREATER THAN MAXIMUM OUTFLOW (    950.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1082.) IS GREATER THAN MAXIMUM OUTFLOW (    950.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1048.) IS GREATER THAN MAXIMUM OUTFLOW (    950.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1011.) IS GREATER THAN MAXIMUM OUTFLOW (    950.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (    972.) IS GREATER THAN MAXIMUM OUTFLOW (    950.) IN STORAGE-OUTFLOW TABLE
```

HYDROGRAPH AT STATION BSN1

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
29	JUN	1645	1	0.	.0	1125.6	29	JUN	1755	15	1113.	28.0	1130.3	29	JUN	1905	29	528.	17.2	1129.3
29	JUN	1650	2	0.	.7	1126.5	29	JUN	1800	16	1082.	27.4	1130.2	29	JUN	1910	30	483.	16.4	1129.2
29	JUN	1655	3	0.	3.0	1127.4	29	JUN	1805	17	1048.	26.8	1130.2	29	JUN	1915	31	438.	15.5	1129.2
29	JUN	1700	4	37.	6.5	1128.1	29	JUN	1810	18	1011.	26.1	1130.1	29	JUN	1920	32	393.	14.7	1129.1
29	JUN	1705	5	218.	10.8	1128.6	29	JUN	1815	19	972.	25.4	1130.0	29	JUN	1925	33	348.	13.9	1129.0
29	JUN	1710	6	425.	15.3	1129.1	29	JUN	1820	20	930.	24.6	1130.0	29	JUN	1930	34	309.	13.0	1128.9
29	JUN	1715	7	664.	19.7	1129.5	29	JUN	1825	21	888.	23.9	1129.9	29	JUN	1935	35	271.	12.1	1128.8
29	JUN	1720	8	864.	23.4	1129.9	29	JUN	1830	22	845.	23.1	1129.8	29	JUN	1940	36	232.	11.2	1128.7
29	JUN	1725	9	1001.	25.9	1130.1	29	JUN	1835	23	801.	22.2	1129.8	29	JUN	1945	37	189.	10.2	1128.6
29	JUN	1730	10	1089.	27.6	1130.2	29	JUN	1840	24	756.	21.4	1129.7	29	JUN	1950	38	147.	9.1	1128.4
29	JUN	1735	11	1136.	28.4	1130.3	29	JUN	1845	25	710.	20.6	1129.6	29	JUN	1955	39	111.	8.3	1128.3
29	JUN	1740	12	1154.	28.8	1130.3	29	JUN	1850	26	664.	19.7	1129.5	29	JUN	2000	40	84.	7.7	1128.3
29	JUN	1745	13	1153.	28.8	1130.3	29	JUN	1855	27	619.	18.9	1129.5							
29	JUN	1750	14	1138.	28.5	1130.3	29	JUN	1900	28	574.	18.0	1129.4							

```
 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR       3.25-HR
+   (CFS)       (HR)
                          (CFS)
+    1154.       .92                   625.         625.         625.         625.
                          (INCHES)    .000         .000         .000         .000
                           (AC-FT)    168.         168.         168.         168.

 PEAK STORAGE  TIME                         MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR        72-HR       3.25-HR
+  (AC-FT)      (HR)
      29.       .92                    18.          18.          18.          18.

 PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR        72-HR       3.25-HR
+   (FEET)      (HR)
  1130.33       .92                1129.31      1129.31      1129.31      1129.31

                          CUMULATIVE AREA =      .00 SQ MI
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                *            *
 23 KK          *    BSN2    *
                *            *
                **************
                                BASIN 2
                                MID-BASIN STORAGE ROUTING
                                THE FOLLOWING STORAGE ROUTING PARAMETERS WERE DERIVED FROM BASIN/CHANNEL
                                DESIGN PROVIDE BY NOVAK ENVIRONMENTAL 28 JUN 2004
                                ASSUME SUBMERGED FLOW OVER WEIR, COEFF=2.8, H = HU/S-HD/S

                HYDROGRAPH ROUTING DATA

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

 30 SV              STORAGE          .0        .1       1.0       2.7       7.7      15.5

 31 SE            ELEVATION     1124.10   1124.60   1125.10   1126.00   1127.00   1128.00

 32 SQ            DISCHARGE          0.        0.        0.        9.      382.     1015.

                                                                  ***

WARNING --- ROUTED OUTFLOW (   1038.) IS GREATER THAN MAXIMUM OUTFLOW (   1015.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1089.) IS GREATER THAN MAXIMUM OUTFLOW (   1015.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1113.) IS GREATER THAN MAXIMUM OUTFLOW (   1015.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1119.) IS GREATER THAN MAXIMUM OUTFLOW (   1015.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1109.) IS GREATER THAN MAXIMUM OUTFLOW (   1015.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1090.) IS GREATER THAN MAXIMUM OUTFLOW (   1015.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1063.) IS GREATER THAN MAXIMUM OUTFLOW (   1015.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (   1032.) IS GREATER THAN MAXIMUM OUTFLOW (   1015.) IN STORAGE-OUTFLOW TABLE
*****************************************************************************************************************************
                                                HYDROGRAPH AT STATION   BSN2
*****************************************************************************************************************************
                                          *                                          *
 DA MON HRMN ORD  OUTFLOW  STORAGE   STAGE * DA MON HRMN ORD  OUTFLOW  STORAGE   STAGE * DA MON HRMN ORD  OUTFLOW  STORAGE   STAGE
                                          *                                          *
 29 JUN 1645   1       0.       .0  1124.1 * 29 JUN 1755  15    1119.     16.8  1128.2 * 29 JUN 1905  29     609.     10.5  1127.4
 29 JUN 1650   2       0.       .0  1124.1 * 29 JUN 1800  16    1109.     16.7  1128.1 * 29 JUN 1910  30     564.     10.0  1127.3
 29 JUN 1655   3       0.       .0  1124.1 * 29 JUN 1805  17    1090.     16.4  1128.1 * 29 JUN 1915  31     519.      9.4  1127.2
 29 JUN 1700   4       0.       .1  1124.6 * 29 JUN 1810  18    1063.     16.1  1128.1 * 29 JUN 1920  32     474.      8.8  1127.1
 29 JUN 1705   5       0.      1.0  1125.1 * 29 JUN 1815  19    1032.     15.7  1128.0 * 29 JUN 1925  33     429.      8.3  1127.1
 29 JUN 1710   6      37.      3.1  1126.1 * 29 JUN 1820  20     997.     15.3  1128.0 * 29 JUN 1930  34     385.      7.8  1127.0
 29 JUN 1715   7     244.      5.9  1126.6 * 29 JUN 1825  21     958.     14.8  1127.9 * 29 JUN 1935  35     346.      7.2  1126.9
 29 JUN 1720   8     462.      8.7  1127.1 * 29 JUN 1830  22     918.     14.3  1127.8 * 29 JUN 1940  36     308.      6.7  1126.8
 29 JUN 1725   9     668.     11.2  1127.5 * 29 JUN 1835  23     877.     13.8  1127.8 * 29 JUN 1945  37     268.      6.2  1126.7
 29 JUN 1730  10     832.     13.3  1127.7 * 29 JUN 1840  24     834.     13.3  1127.7 * 29 JUN 1950  38     227.      5.6  1126.6
 29 JUN 1735  11     955.     14.8  1127.9 * 29 JUN 1845  25     790.     12.7  1127.6 * 29 JUN 1955  39     187.      5.1  1126.5
 29 JUN 1740  12    1038.     15.8  1128.0 * 29 JUN 1850  26     745.     12.2  1127.6 * 29 JUN 2000  40     150.      4.6  1126.4
 29 JUN 1745  13    1089.     16.4  1128.1 * 29 JUN 1855  27     700.     11.6  1127.5 *
 29 JUN 1750  14    1113.     16.7  1128.2 * 29 JUN 1900  28     655.     11.1  1127.4 *
                                          *                                          *
*****************************************************************************************************************************

 PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR       3.25-HR
+   (CFS)       (HR)
                                 (CFS)
+    1119.      1.17                  608.         608.         608.         608.
                             (INCHES)   .000         .000         .000         .000
                              (AC-FT)   163.         163.         163.         163.

 PEAK STORAGE   TIME                         MAXIMUM AVERAGE STORAGE
                                        6-HR        24-HR        72-HR       3.25-HR
+  (AC-FT)      (HR)
       17.      1.17                   10.          10.          10.          10.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                        6-HR        24-HR        72-HR       3.25-HR
+   (FEET)      (HR)
   1128.16      1.17                1127.10      1127.10      1127.10      1127.10

                          CUMULATIVE AREA =      .00 SQ MI


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

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 33 KK      *    BSN3    *
            *            *
            **************
                          BASIN 3
                          DOWNSTREAM BASIN STORAGE ROUTING
                          THE FOLLOWING STORAGE ROUTING PARAMETERS WERE DERIVED FROM BASIN/CHANNEL
                          DESIGN PROVIDE BY NOVAK ENVIRONMENTAL 28 JUN 2004
                          ASSUME UNSUBMERGED FLOW OVER WEIR, COEFF=3.0, WEIR LENGTH = 120'

              HYDROGRAPH ROUTING DATA

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

 40 SV            STORAGE          .0        .1       1.2       1.5       6.6      14.7      24.4

 41 SE          ELEVATION     1122.80   1123.30   1123.80   1124.00   1125.00   1126.00   1127.00

 42 SQ          DISCHARGE          0.        0.        1.       32.      473.      1175.     2061.

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HYDROGRAPH AT STATION BSN3

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DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
29	JUN	1645	1	0.	.0	1122.8	29	JUN	1755	15	1061.	13.4	1125.8	29	JUN	1905	29	684.	9.0	1125.3
29	JUN	1650	2	0.	.0	1122.8	29	JUN	1800	16	1085.	13.7	1125.9	29	JUN	1910	30	639.	8.5	1125.2
29	JUN	1655	3	0.	.0	1122.8	29	JUN	1805	17	1092.	13.7	1125.9	29	JUN	1915	31	594.	8.0	1125.2
29	JUN	1700	4	0.	.0	1122.8	29	JUN	1810	18	1085.	13.7	1125.9	29	JUN	1920	32	549.	7.5	1125.1
29	JUN	1705	5	0.	.0	1122.8	29	JUN	1815	19	1068.	13.5	1125.8	29	JUN	1925	33	504.	7.0	1125.0
29	JUN	1710	6	0.	.1	1123.3	29	JUN	1820	20	1043.	13.2	1125.8	29	JUN	1930	34	459.	6.4	1125.0
29	JUN	1715	7	1.	1.1	1123.8	29	JUN	1825	21	1013.	12.8	1125.8	29	JUN	1935	35	416.	5.9	1124.9
29	JUN	1720	8	160.	3.0	1124.3	29	JUN	1830	22	979.	12.4	1125.7	29	JUN	1940	36	375.	5.5	1124.8
29	JUN	1725	9	345.	5.1	1124.7	29	JUN	1835	23	941.	12.0	1125.7	29	JUN	1945	37	335.	5.0	1124.7
29	JUN	1730	10	531.	7.3	1125.1	29	JUN	1840	24	902.	11.5	1125.6	29	JUN	1950	38	295.	4.5	1124.6
29	JUN	1735	11	698.	9.2	1125.3	29	JUN	1845	25	860.	11.1	1125.6	29	JUN	1955	39	255.	4.1	1124.5
29	JUN	1740	12	835.	10.8	1125.5	29	JUN	1850	26	818.	10.6	1125.5	29	JUN	2000	40	215.	3.6	1124.4
29	JUN	1745	13	940.	12.0	1125.7	29	JUN	1855	27	774.	10.1	1125.4							
29	JUN	1750	14	1014.	12.8	1125.8	29	JUN	1900	28	729.	9.6	1125.4							

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  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR      3.25-HR
+   (CFS)       (HR)
                              (CFS)
+    1092.      1.33          595.        595.        595.        595.
                        (INCHES)        .000        .000        .000        .000
                         (AC-FT)        160.        160.        160.        160.

 PEAK STORAGE   TIME                        MAXIMUM AVERAGE STORAGE
                                      6-HR       24-HR       72-HR      3.25-HR
+  (AC-FT)      (HR)
       14.      1.33                    8.          8.          8.          8.

  PEAK STAGE    TIME                        MAXIMUM AVERAGE STAGE
                                      6-HR       24-HR       72-HR      3.25-HR
+   (FEET)      (HR)
   1125.88      1.33               1124.93     1124.93     1124.93     1124.93

                        CUMULATIVE AREA =     .00 SQ MI
```

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	BSN1	1300.	.50	654.	654.	654.	.00		
+	ROUTED TO	BSN1	1154.	.92	625.	625.	625.	.00		
+									1130.33	.92
+	ROUTED TO	BSN2	1119.	1.17	608.	608.	608.	.00		
+									1128.16	1.17
+	ROUTED TO	BSN3	1092.	1.33	595.	595.	595.	.00		
+									1125.88	1.33

*** 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   07JUL04  TIME  14:54:58  *                                    *           (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   RIO SALADO, DOWNSTREAM OF TEMPE TOWN LAKE, 15 MAR 2004
    2           ID   REVISED JUNE 29, 2004
    3           ID   FILE : 4013BSN1
                *
    4           IT       5 29JUN04    1645     300
    5           IO       0       1
    6           IN       5
                *
    7           KM   ASSUME CONTINUOUS INFLOW,
    8           QI       0       5       5       5       5       5       5       5       5       5
    9           QI       5       5       5       5       5       5       5       5       5       5
   10           QI       5       5       5       5       5       5       5       5       5       5
   11           QI       5       5       5       5       5       5       5       5       5       5
   12           QI       5       5       5       5       5       5       5       5       5       5
   13           QI       5       5       5       5       5       5       5       5       5       5
   14           QI       5       5       5       5       5       5       5       5       5       5
   15           QI       5       5       5       5       5       5       5       5       5       5
   16           QI       5       5       5       5       5       5       5       5       5       5
   17           QI       5       5       5       5       5       5       5       5       5       5
   18           QI       5       5       5       5       5       5       5       5       5       5
   19           QI       5       5       5       5       5       5       5       5       5       5
   20           QI       5       5       5       5       5       5       5       5       5       5
   21           QI       5       5       5       5       5       5       5       5       5       5
   22           QI       5       5       5       5       5       5       5       5       5       5
   23           QI       5       5       5       5       5       5       5       5       5       5
   24           QI       5       5       5       5       5       5       5       5       5       5
   25           QI       5       5       5       5       5       5       5       5       5       5
   26           QI       5       5       5       5       5       5       5       5       5       5
   27           QI       5       5       5       5       5       5       5       5       5       5
   28           QI       5       5       5       5       5       5       5       5       5       5
   29           QI       5       5       5       5       5       5       5       5       5       5
   30           QI       5       5       5       5       5       5       5       5       5       5
   31           QI       5       5       5       5       5       5       5       5       5       5
   32           QI       5       5       5       5       5       5       5       5       5       5
   33           QI       5       5       5       5       5       5       5       5       5       5
                *

   34           KK  BSN1
   35           KM    BASIN 1
   36           KM    UPSTREAM BASIN STORAGE ROUTING
   37           KM    THE FOLLOWING STORAGE ROUTING PARAMETERS WERE DERIVED FROM BASIN/CHANNEL
   38           KM    DESIGN PROVIDE BY NOVAK ENVIRONMENTAL 28 JUN 2004
   39           KM    ASSUME SUBMERGED FLOW OVER WEIR, COEFF=2.8, H = HU/S-HD/S
   40           RS       1    STOR       0
   41           SV       0     0.1    1.00    1.38    5.66   13.64    25.0
   42           SE  1125.6  1126.1  1126.6    1127    1128    1129    1130
   43           SQ       0       0       0     0.0      55     498    1172
                *

   44           KK  BSN2
   45           KM    BASIN 2
   46           KM    MID-BASIN STORAGE ROUTING
   47           KM    THE FOLLOWING STORAGE ROUTING PARAMETERS WERE DERIVED FROM BASIN/CHANNEL
   48           KM    DESIGN PROVIDE BY NOVAK ENVIRONMENTAL 28 JUN 2004
   49           KM    ASSUME SUBMERGED FLOW OVER WEIR, COEFF=2.8, H = HU/S-HD/S
1                                                HEC-1 INPUT                                                    PAGE  2
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CONTIN. CAPACITY

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

  50          RS       1    STOR       0
  51          SV       0     0.1   1.000    2.71    7.72   15.51
  52          SE  1124.1  1124.6  1125.1    1126    1127    1128
  53          SQ       0       0     0.0      61     510    1187
              *

  54          KK  BSN3
  55          KM    BASIN 3
  56          KM    DOWNSTREAM BASIN STORAGE ROUTING
  57          KM    THE FOLLOWING STORAGE ROUTING PARAMETERS WERE DERIVED FROM BASIN/CHANNEL
  58          KM    DESIGN PROVIDE BY NOVAK ENVIRONMENTAL 28 JUN 2004
  59          KM    ASSUME UNSUBMERGED FLOW OVER WEIR, COEFF=3.0, WEIR LENGTH = 120'
  60          RS       1    STOR       0
  61          SV       0     0.1   1.197    1.50    6.60   14.69   24.41
  62          SE  1122.8  1123.3  1123.8    1124    1125    1126    1127
  63          SQ       0       0     1.0    32.0     473    1175    2061
  64          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   07JUL04  TIME  14:54:58*                                    *         (916) 756-1104            *
*                                   *                                    *                                   *
*************************************                                    *************************************

                        RIO SALADO, DOWNSTREAM OF TEMPE TOWN LAKE, 15 MAR 2004
                        REVISED JUNE 29, 2004
                        FILE : 4013BSN1

  5 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          0  PRINT CONTROL
                      IPLOT          1  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE     29JUN 4  STARTING DATE
                      ITIME       1645  STARTING TIME
                         NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     30JUN 4  ENDING DATE
                     NDTIME       1740  ENDING TIME
                     ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   24.92 HOURS

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

  6 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          5  TIME INTERVAL IN MINUTES
                     JXDATE     29JUN 4  STARTING DATE
                     JXTIME       1645  STARTING TIME

               SUBBASIN RUNOFF DATA

  0 BA          SUBBASIN CHARACTERISTICS
                      TAREA        .00  SUBBASIN AREA

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HYDROGRAPH AT STATION BSN1

DA MON HRMN	ORD	FLOW	DA MON HRMN	ORD	FLOW	DA MON HRMN	ORD	FLOW	DA MON HRMN	ORD	FLOW
29 JUN 1645	1	0.	29 JUN 2300	76	5.	30 JUN 0515	151	5.	30 JUN 1130	226	5.
29 JUN 1650	2	5.	29 JUN 2305	77	5.	30 JUN 0520	152	5.	30 JUN 1135	227	5.
29 JUN 1655	3	5.	29 JUN 2310	78	5.	30 JUN 0525	153	5.	30 JUN 1140	228	5.
29 JUN 1700	4	5.	29 JUN 2315	79	5.	30 JUN 0530	154	5.	30 JUN 1145	229	5.
29 JUN 1705	5	5.	29 JUN 2320	80	5.	30 JUN 0535	155	5.	30 JUN 1150	230	5.
29 JUN 1710	6	5.	29 JUN 2325	81	5.	30 JUN 0540	156	5.	30 JUN 1155	231	5.
29 JUN 1715	7	5.	29 JUN 2330	82	5.	30 JUN 0545	157	5.	30 JUN 1200	232	5.
29 JUN 1720	8	5.	29 JUN 2335	83	5.	30 JUN 0550	158	5.	30 JUN 1205	233	5.
29 JUN 1725	9	5.	29 JUN 2340	84	5.	30 JUN 0555	159	5.	30 JUN 1210	234	5.
29 JUN 1730	10	5.	29 JUN 2345	85	5.	30 JUN 0600	160	5.	30 JUN 1215	235	5.
29 JUN 1735	11	5.	29 JUN 2350	86	5.	30 JUN 0605	161	5.	30 JUN 1220	236	5.

29 JUN 1740	12	5.	*	29 JUN 2355	87	5.	*	30 JUN 0610	162	5.	*	30 JUN 1225	237	5.
29 JUN 1745	13	5.	*	30 JUN 0000	88	5.	*	30 JUN 0615	163	5.	*	30 JUN 1230	238	5.
29 JUN 1750	14	5.	*	30 JUN 0005	89	5.	*	30 JUN 0620	164	5.	*	30 JUN 1235	239	5.
29 JUN 1755	15	5.	*	30 JUN 0010	90	5.	*	30 JUN 0625	165	5.	*	30 JUN 1240	240	5.
29 JUN 1800	16	5.	*	30 JUN 0015	91	5.	*	30 JUN 0630	166	5.	*	30 JUN 1245	241	5.
29 JUN 1805	17	5.	*	30 JUN 0020	92	5.	*	30 JUN 0635	167	5.	*	30 JUN 1250	242	5.
29 JUN 1810	18	5.	*	30 JUN 0025	93	5.	*	30 JUN 0640	168	5.	*	30 JUN 1255	243	5.
29 JUN 1815	19	5.	*	30 JUN 0030	94	5.	*	30 JUN 0645	169	5.	*	30 JUN 1300	244	5.
29 JUN 1820	20	5.	*	30 JUN 0035	95	5.	*	30 JUN 0650	170	5.	*	30 JUN 1305	245	5.
29 JUN 1825	21	5.	*	30 JUN 0040	96	5.	*	30 JUN 0655	171	5.	*	30 JUN 1310	246	5.
29 JUN 1830	22	5.	*	30 JUN 0045	97	5.	*	30 JUN 0700	172	5.	*	30 JUN 1315	247	5.
29 JUN 1835	23	5.	*	30 JUN 0050	98	5.	*	30 JUN 0705	173	5.	*	30 JUN 1320	248	5.
29 JUN 1840	24	5.	*	30 JUN 0055	99	5.	*	30 JUN 0710	174	5.	*	30 JUN 1325	249	5.
29 JUN 1845	25	5.	*	30 JUN 0100	100	5.	*	30 JUN 0715	175	5.	*	30 JUN 1330	250	5.
29 JUN 1850	26	5.	*	30 JUN 0105	101	5.	*	30 JUN 0720	176	5.	*	30 JUN 1335	251	5.
29 JUN 1855	27	5.	*	30 JUN 0110	102	5.	*	30 JUN 0725	177	5.	*	30 JUN 1340	252	5.
29 JUN 1900	28	5.	*	30 JUN 0115	103	5.	*	30 JUN 0730	178	5.	*	30 JUN 1345	253	5.
29 JUN 1905	29	5.	*	30 JUN 0120	104	5.	*	30 JUN 0735	179	5.	*	30 JUN 1350	254	5.
29 JUN 1910	30	5.	*	30 JUN 0125	105	5.	*	30 JUN 0740	180	5.	*	30 JUN 1355	255	5.
29 JUN 1915	31	5.	*	30 JUN 0130	106	5.	*	30 JUN 0745	181	5.	*	30 JUN 1400	256	5.
29 JUN 1920	32	5.	*	30 JUN 0135	107	5.	*	30 JUN 0750	182	5.	*	30 JUN 1405	257	5.
29 JUN 1925	33	5.	*	30 JUN 0140	108	5.	*	30 JUN 0755	183	5.	*	30 JUN 1410	258	5.
29 JUN 1930	34	5.	*	30 JUN 0145	109	5.	*	30 JUN 0800	184	5.	*	30 JUN 1415	259	5.
29 JUN 1935	35	5.	*	30 JUN 0150	110	5.	*	30 JUN 0805	185	5.	*	30 JUN 1420	260	5.
29 JUN 1940	36	5.	*	30 JUN 0155	111	5.	*	30 JUN 0810	186	5.	*	30 JUN 1425	261	5.
29 JUN 1945	37	5.	*	30 JUN 0200	112	5.	*	30 JUN 0815	187	5.	*	30 JUN 1430	262	5.
29 JUN 1950	38	5.	*	30 JUN 0205	113	5.	*	30 JUN 0820	188	5.	*	30 JUN 1435	263	5.
29 JUN 1955	39	5.	*	30 JUN 0210	114	5.	*	30 JUN 0825	189	5.	*	30 JUN 1440	264	5.
29 JUN 2000	40	5.	*	30 JUN 0215	115	5.	*	30 JUN 0830	190	5.	*	30 JUN 1445	265	5.
29 JUN 2005	41	5.	*	30 JUN 0220	116	5.	*	30 JUN 0835	191	5.	*	30 JUN 1450	266	5.
29 JUN 2010	42	5.	*	30 JUN 0225	117	5.	*	30 JUN 0840	192	5.	*	30 JUN 1455	267	5.
29 JUN 2015	43	5.	*	30 JUN 0230	118	5.	*	30 JUN 0845	193	5.	*	30 JUN 1500	268	5.
29 JUN 2020	44	5.	*	30 JUN 0235	119	5.	*	30 JUN 0850	194	5.	*	30 JUN 1505	269	5.
29 JUN 2025	45	5.	*	30 JUN 0240	120	5.	*	30 JUN 0855	195	5.	*	30 JUN 1510	270	5.
29 JUN 2030	46	5.	*	30 JUN 0245	121	5.	*	30 JUN 0900	196	5.	*	30 JUN 1515	271	5.
29 JUN 2035	47	5.	*	30 JUN 0250	122	5.	*	30 JUN 0905	197	5.	*	30 JUN 1520	272	5.
29 JUN 2040	48	5.	*	30 JUN 0255	123	5.	*	30 JUN 0910	198	5.	*	30 JUN 1525	273	5.
29 JUN 2045	49	5.	*	30 JUN 0300	124	5.	*	30 JUN 0915	199	5.	*	30 JUN 1530	274	5.
29 JUN 2050	50	5.	*	30 JUN 0305	125	5.	*	30 JUN 0920	200	5.	*	30 JUN 1535	275	5.
29 JUN 2055	51	5.	*	30 JUN 0310	126	5.	*	30 JUN 0925	201	5.	*	30 JUN 1540	276	5.
29 JUN 2100	52	5.	*	30 JUN 0315	127	5.	*	30 JUN 0930	202	5.	*	30 JUN 1545	277	5.
29 JUN 2105	53	5.	*	30 JUN 0320	128	5.	*	30 JUN 0935	203	5.	*	30 JUN 1550	278	5.
29 JUN 2110	54	5.	*	30 JUN 0325	129	5.	*	30 JUN 0940	204	5.	*	30 JUN 1555	279	5.
29 JUN 2115	55	5.	*	30 JUN 0330	130	5.	*	30 JUN 0945	205	5.	*	30 JUN 1600	280	5.
29 JUN 2120	56	5.	*	30 JUN 0335	131	5.	*	30 JUN 0950	206	5.	*	30 JUN 1605	281	5.
29 JUN 2125	57	5.	*	30 JUN 0340	132	5.	*	30 JUN 0955	207	5.	*	30 JUN 1610	282	5.
29 JUN 2130	58	5.	*	30 JUN 0345	133	5.	*	30 JUN 1000	208	5.	*	30 JUN 1615	283	5.
29 JUN 2135	59	5.	*	30 JUN 0350	134	5.	*	30 JUN 1005	209	5.	*	30 JUN 1620	284	5.
29 JUN 2140	60	5.	*	30 JUN 0355	135	5.	*	30 JUN 1010	210	5.	*	30 JUN 1625	285	5.
29 JUN 2145	61	5.	*	30 JUN 0400	136	5.	*	30 JUN 1015	211	5.	*	30 JUN 1630	286	5.
29 JUN 2150	62	5.	*	30 JUN 0405	137	5.	*	30 JUN 1020	212	5.	*	30 JUN 1635	287	5.
29 JUN 2155	63	5.	*	30 JUN 0410	138	5.	*	30 JUN 1025	213	5.	*	30 JUN 1640	288	5.
29 JUN 2200	64	5.	*	30 JUN 0415	139	5.	*	30 JUN 1030	214	5.	*	30 JUN 1645	289	5.
29 JUN 2205	65	5.	*	30 JUN 0420	140	5.	*	30 JUN 1035	215	5.	*	30 JUN 1650	290	5.
29 JUN 2210	66	5.	*	30 JUN 0425	141	5.	*	30 JUN 1040	216	5.	*	30 JUN 1655	291	5.
29 JUN 2215	67	5.	*	30 JUN 0430	142	5.	*	30 JUN 1045	217	5.	*	30 JUN 1700	292	5.
29 JUN 2220	68	5.	*	30 JUN 0435	143	5.	*	30 JUN 1050	218	5.	*	30 JUN 1705	293	5.
29 JUN 2225	69	5.	*	30 JUN 0440	144	5.	*	30 JUN 1055	219	5.	*	30 JUN 1710	294	5.
29 JUN 2230	70	5.	*	30 JUN 0445	145	5.	*	30 JUN 1100	220	5.	*	30 JUN 1715	295	5.
29 JUN 2235	71	5.	*	30 JUN 0450	146	5.	*	30 JUN 1105	221	5.	*	30 JUN 1720	296	5.
29 JUN 2240	72	5.	*	30 JUN 0455	147	5.	*	30 JUN 1110	222	5.	*	30 JUN 1725	297	5.
29 JUN 2245	73	5.	*	30 JUN 0500	148	5.	*	30 JUN 1115	223	5.	*	30 JUN 1730	298	5.
29 JUN 2250	74	5.	*	30 JUN 0505	149	5.	*	30 JUN 1120	224	5.	*	30 JUN 1735	299	5.
29 JUN 2255	75	5.	*	30 JUN 0510	150	5.	*	30 JUN 1125	225	5.	*	30 JUN 1740	300	5.
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PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	24.92-HR
+ (CFS)	(HR)					
		(CFS)				
+ 5.	.08		5.	5.	5.	5.
		(INCHES)	.000	.000	.000	.000
		(AC-FT)	2.	10.	10.	10.

CUMULATIVE AREA = .00 SQ MI

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              *            *
  34 KK       *    BSN1    *
              *            *
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BASIN 1
UPSTREAM BASIN STORAGE ROUTING
THE FOLLOWING STORAGE ROUTING PARAMETERS WERE DERIVED FROM BASIN/CHANNEL
DESIGN PROVIDE BY NOVAK ENVIRONMENTAL 28 JUN 2004
ASSUME SUBMERGED FLOW OVER WEIR, COEFF=2.8, H = HU/S-HD/S

HYDROGRAPH ROUTING DATA

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

41 SV            STORAGE         .0       .1      1.0      1.4      5.7     13.6     25.0

42 SE          ELEVATION     1125.60  1126.10  1126.60  1127.00  1128.00  1129.00  1130.00

43 SQ          DISCHARGE         0.       0.       0.       0.      55.     498.     1172.
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HYDROGRAPH AT STATION BSN1

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DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
29	JUN	1645	1	0.	.0	1125.6	*	30	JUN	0105	101	5.	1.8	1127.1	*	30	JUN	0925	201	5.	1.8	1127.1
29	JUN	1650	2	0.	.0	1125.7	*	30	JUN	0110	102	5.	1.8	1127.1	*	30	JUN	0930	202	5.	1.8	1127.1
29	JUN	1655	3	0.	.1	1125.9	*	30	JUN	0115	103	5.	1.8	1127.1	*	30	JUN	0935	203	5.	1.8	1127.1
29	JUN	1700	4	0.	.1	1126.0	*	30	JUN	0120	104	5.	1.8	1127.1	*	30	JUN	0940	204	5.	1.8	1127.1
29	JUN	1705	5	0.	.1	1126.1	*	30	JUN	0125	105	5.	1.8	1127.1	*	30	JUN	0945	205	5.	1.8	1127.1
29	JUN	1710	6	0.	.2	1126.1	*	30	JUN	0130	106	5.	1.8	1127.1	*	30	JUN	0950	206	5.	1.8	1127.1
29	JUN	1715	7	0.	.2	1126.1	*	30	JUN	0135	107	5.	1.8	1127.1	*	30	JUN	0955	207	5.	1.8	1127.1
29	JUN	1720	8	0.	.2	1126.2	*	30	JUN	0140	108	5.	1.8	1127.1	*	30	JUN	1000	208	5.	1.8	1127.1
29	JUN	1725	9	0.	.3	1126.2	*	30	JUN	0145	109	5.	1.8	1127.1	*	30	JUN	1005	209	5.	1.8	1127.1
29	JUN	1730	10	0.	.3	1126.2	*	30	JUN	0150	110	5.	1.8	1127.1	*	30	JUN	1010	210	5.	1.8	1127.1
29	JUN	1735	11	0.	.3	1126.2	*	30	JUN	0155	111	5.	1.8	1127.1	*	30	JUN	1015	211	5.	1.8	1127.1
29	JUN	1740	12	0.	.4	1126.2	*	30	JUN	0200	112	5.	1.8	1127.1	*	30	JUN	1020	212	5.	1.8	1127.1
29	JUN	1745	13	0.	.4	1126.3	*	30	JUN	0205	113	5.	1.8	1127.1	*	30	JUN	1025	213	5.	1.8	1127.1
29	JUN	1750	14	0.	.4	1126.3	*	30	JUN	0210	114	5.	1.8	1127.1	*	30	JUN	1030	214	5.	1.8	1127.1
29	JUN	1755	15	0.	.5	1126.3	*	30	JUN	0215	115	5.	1.8	1127.1	*	30	JUN	1035	215	5.	1.8	1127.1
29	JUN	1800	16	0.	.5	1126.3	*	30	JUN	0220	116	5.	1.8	1127.1	*	30	JUN	1040	216	5.	1.8	1127.1
29	JUN	1805	17	0.	.5	1126.3	*	30	JUN	0225	117	5.	1.8	1127.1	*	30	JUN	1045	217	5.	1.8	1127.1
29	JUN	1810	18	0.	.6	1126.4	*	30	JUN	0230	118	5.	1.8	1127.1	*	30	JUN	1050	218	5.	1.8	1127.1
29	JUN	1815	19	0.	.6	1126.4	*	30	JUN	0235	119	5.	1.8	1127.1	*	30	JUN	1055	219	5.	1.8	1127.1
29	JUN	1820	20	0.	.6	1126.4	*	30	JUN	0240	120	5.	1.8	1127.1	*	30	JUN	1100	220	5.	1.8	1127.1
29	JUN	1825	21	0.	.7	1126.4	*	30	JUN	0245	121	5.	1.8	1127.1	*	30	JUN	1105	221	5.	1.8	1127.1
29	JUN	1830	22	0.	.7	1126.4	*	30	JUN	0250	122	5.	1.8	1127.1	*	30	JUN	1110	222	5.	1.8	1127.1
29	JUN	1835	23	0.	.7	1126.5	*	30	JUN	0255	123	5.	1.8	1127.1	*	30	JUN	1115	223	5.	1.8	1127.1
29	JUN	1840	24	0.	.8	1126.5	*	30	JUN	0300	124	5.	1.8	1127.1	*	30	JUN	1120	224	5.	1.8	1127.1
29	JUN	1845	25	0.	.8	1126.5	*	30	JUN	0305	125	5.	1.8	1127.1	*	30	JUN	1125	225	5.	1.8	1127.1
29	JUN	1850	26	0.	.8	1126.5	*	30	JUN	0310	126	5.	1.8	1127.1	*	30	JUN	1130	226	5.	1.8	1127.1
29	JUN	1855	27	0.	.9	1126.5	*	30	JUN	0315	127	5.	1.8	1127.1	*	30	JUN	1135	227	5.	1.8	1127.1
29	JUN	1900	28	0.	.9	1126.6	*	30	JUN	0320	128	5.	1.8	1127.1	*	30	JUN	1140	228	5.	1.8	1127.1
29	JUN	1905	29	0.	.9	1126.6	*	30	JUN	0325	129	5.	1.8	1127.1	*	30	JUN	1145	229	5.	1.8	1127.1
29	JUN	1910	30	0.	1.0	1126.6	*	30	JUN	0330	130	5.	1.8	1127.1	*	30	JUN	1150	230	5.	1.8	1127.1
29	JUN	1915	31	0.	1.0	1126.6	*	30	JUN	0335	131	5.	1.8	1127.1	*	30	JUN	1155	231	5.	1.8	1127.1
29	JUN	1920	32	0.	1.1	1126.7	*	30	JUN	0340	132	5.	1.8	1127.1	*	30	JUN	1200	232	5.	1.8	1127.1
29	JUN	1925	33	0.	1.1	1126.7	*	30	JUN	0345	133	5.	1.8	1127.1	*	30	JUN	1205	233	5.	1.8	1127.1
29	JUN	1930	34	0.	1.1	1126.7	*	30	JUN	0350	134	5.	1.8	1127.1	*	30	JUN	1210	234	5.	1.8	1127.1
29	JUN	1935	35	0.	1.2	1126.8	*	30	JUN	0355	135	5.	1.8	1127.1	*	30	JUN	1215	235	5.	1.8	1127.1
29	JUN	1940	36	0.	1.2	1126.8	*	30	JUN	0400	136	5.	1.8	1127.1	*	30	JUN	1220	236	5.	1.8	1127.1
29	JUN	1945	37	0.	1.2	1126.8	*	30	JUN	0405	137	5.	1.8	1127.1	*	30	JUN	1225	237	5.	1.8	1127.1
29	JUN	1950	38	0.	1.3	1126.9	*	30	JUN	0410	138	5.	1.8	1127.1	*	30	JUN	1230	238	5.	1.8	1127.1
29	JUN	1955	39	0.	1.3	1126.9	*	30	JUN	0415	139	5.	1.8	1127.1	*	30	JUN	1235	239	5.	1.8	1127.1
29	JUN	2000	40	0.	1.3	1126.9	*	30	JUN	0420	140	5.	1.8	1127.1	*	30	JUN	1240	240	5.	1.8	1127.1
29	JUN	2005	41	0.	1.4	1127.0	*	30	JUN	0425	141	5.	1.8	1127.1	*	30	JUN	1245	241	5.	1.8	1127.1
29	JUN	2010	42	0.	1.4	1127.0	*	30	JUN	0430	142	5.	1.8	1127.1	*	30	JUN	1250	242	5.	1.8	1127.1
29	JUN	2015	43	1.	1.4	1127.0	*	30	JUN	0435	143	5.	1.8	1127.1	*	30	JUN	1255	243	5.	1.8	1127.1
29	JUN	2020	44	1.	1.5	1127.0	*	30	JUN	0440	144	5.	1.8	1127.1	*	30	JUN	1300	244	5.	1.8	1127.1
29	JUN	2025	45	1.	1.5	1127.0	*	30	JUN	0445	145	5.	1.8	1127.1	*	30	JUN	1305	245	5.	1.8	1127.1
29	JUN	2030	46	2.	1.5	1127.0	*	30	JUN	0450	146	5.	1.8	1127.1	*	30	JUN	1310	246	5.	1.8	1127.1
29	JUN	2035	47	2.	1.5	1127.0	*	30	JUN	0455	147	5.	1.8	1127.1	*	30	JUN	1315	247	5.	1.8	1127.1
29	JUN	2040	48	2.	1.5	1127.0	*	30	JUN	0500	148	5.	1.8	1127.1	*	30	JUN	1320	248	5.	1.8	1127.1
29	JUN	2045	49	2.	1.6	1127.0	*	30	JUN	0505	149	5.	1.8	1127.1	*	30	JUN	1325	249	5.	1.8	1127.1
29	JUN	2050	50	3.	1.6	1127.0	*	30	JUN	0510	150	5.	1.8	1127.1	*	30	JUN	1330	250	5.	1.8	1127.1
29	JUN	2055	51	3.	1.6	1127.1	*	30	JUN	0515	151	5.	1.8	1127.1	*	30	JUN	1335	251	5.	1.8	1127.1
29	JUN	2100	52	3.	1.6	1127.1	*	30	JUN	0520	152	5.	1.8	1127.1	*	30	JUN	1340	252	5.	1.8	1127.1
29	JUN	2105	53	3.	1.6	1127.1	*	30	JUN	0525	153	5.	1.8	1127.1	*	30	JUN	1345	253	5.	1.8	1127.1
29	JUN	2110	54	3.	1.6	1127.1	*	30	JUN	0530	154	5.	1.8	1127.1	*	30	JUN	1350	254	5.	1.8	1127.1
29	JUN	2115	55	3.	1.7	1127.1	*	30	JUN	0535	155	5.	1.8	1127.1	*	30	JUN	1355	255	5.	1.8	1127.1
29	JUN	2120	56	4.	1.7	1127.1	*	30	JUN	0540	156	5.	1.8	1127.1	*	30	JUN	1400	256	5.	1.8	1127.1
29	JUN	2125	57	4.	1.7	1127.1	*	30	JUN	0545	157	5.	1.8	1127.1	*	30	JUN	1405	257	5.	1.8	1127.1
29	JUN	2130	58	4.	1.7	1127.1	*	30	JUN	0550	158	5.	1.8	1127.1	*	30	JUN	1410	258	5.	1.8	1127.1
29	JUN	2135	59	4.	1.7	1127.1	*	30	JUN	0555	159	5.	1.8	1127.1	*	30	JUN	1415	259	5.	1.8	1127.1
29	JUN	2140	60	4.	1.7	1127.1	*	30	JUN	0600	160	5.	1.8	1127.1	*	30	JUN	1420	260	5.	1.8	1127.1
29	JUN	2145	61	4.	1.7	1127.1	*	30	JUN	0605	161	5.	1.8	1127.1	*	30	JUN	1425	261	5.	1.8	1127.1
29	JUN	2150	62	4.	1.7	1127.1	*	30	JUN	0610	162	5.	1.8	1127.1	*	30	JUN	1430	262	5.	1.8	1127.1
29	JUN	2155	63	4.	1.7	1127.1	*	30	JUN	0615	163	5.	1.8	1127.1	*	30	JUN	1435	263	5.	1.8	1127.1
29	JUN	2200	64	4.	1.7	1127.1	*	30	JUN	0620	164	5.	1.8	1127.1	*	30	JUN	1440	264	5.	1.8	1127.1
29	JUN	2205	65	4.	1.7	1127.1	*	30	JUN	0625	165	5.	1.8	1127.1	*	30	JUN	1445	265	5.	1.8	1127.1
29	JUN	2210	66	4.	1.7	1127.1	*	30	JUN	0630	166	5.	1.8	1127.1	*	30	JUN	1450	266	5.	1.8	1127.1
29	JUN	2215	67	4.	1.7	1127.1	*	30	JUN	0635	167	5.	1.8	1127.1	*	30	JUN	1455	267	5.	1.8	1127.1
29	JUN	2220	68	5.	1.7	1127.1	*	30	JUN	0640	168	5.	1.8	1127.1	*	30	JUN	1500	268	5.	1.8	1127.1
29	JUN	2225	69	5.	1.7	1127.1	*	30	JUN	0645	169	5.	1.8	1127.1	*	30	JUN	1505	269	5.	1.8	1127.1
29	JUN	2230	70	5.	1.7	1127.1	*	30	JUN	0650	170	5.	1.8	1127.1	*	30	JUN	1510	270	5.	1.8	1127.1
29	JUN	2235	71	5.	1.7	1127.1	*	30	JUN	0655	171	5.	1.8	1127.1	*	30	JUN	1515	271	5.	1.8	1127.1
29	JUN	2240	72	5.	1.7	1127.1	*	30	JUN	0700	172	5.	1.8	1127.1	*	30	JUN	1520	272	5.	1.8	1127.1

29 JUN 2245	73	5.	1.7	1127.1	*	30 JUN 0705	173	5.	1.8	1127.1	*	30 JUN 1525	273	5.	1.8	1127.1
29 JUN 2250	74	5.	1.7	1127.1	*	30 JUN 0710	174	5.	1.8	1127.1	*	30 JUN 1530	274	5.	1.8	1127.1
29 JUN 2255	75	5.	1.7	1127.1	*	30 JUN 0715	175	5.	1.8	1127.1	*	30 JUN 1535	275	5.	1.8	1127.1
29 JUN 2300	76	5.	1.8	1127.1	*	30 JUN 0720	176	5.	1.8	1127.1	*	30 JUN 1540	276	5.	1.8	1127.1
29 JUN 2305	77	5.	1.8	1127.1	*	30 JUN 0725	177	5.	1.8	1127.1	*	30 JUN 1545	277	5.	1.8	1127.1
29 JUN 2310	78	5.	1.8	1127.1	*	30 JUN 0730	178	5.	1.8	1127.1	*	30 JUN 1550	278	5.	1.8	1127.1
29 JUN 2315	79	5.	1.8	1127.1	*	30 JUN 0735	179	5.	1.8	1127.1	*	30 JUN 1555	279	5.	1.8	1127.1
29 JUN 2320	80	5.	1.8	1127.1	*	30 JUN 0740	180	5.	1.8	1127.1	*	30 JUN 1600	280	5.	1.8	1127.1
29 JUN 2325	81	5.	1.8	1127.1	*	30 JUN 0745	181	5.	1.8	1127.1	*	30 JUN 1605	281	5.	1.8	1127.1
29 JUN 2330	82	5.	1.8	1127.1	*	30 JUN 0750	182	5.	1.8	1127.1	*	30 JUN 1610	282	5.	1.8	1127.1
29 JUN 2335	83	5.	1.8	1127.1	*	30 JUN 0755	183	5.	1.8	1127.1	*	30 JUN 1615	283	5.	1.8	1127.1
29 JUN 2340	84	5.	1.8	1127.1	*	30 JUN 0800	184	5.	1.8	1127.1	*	30 JUN 1620	284	5.	1.8	1127.1
29 JUN 2345	85	5.	1.8	1127.1	*	30 JUN 0805	185	5.	1.8	1127.1	*	30 JUN 1625	285	5.	1.8	1127.1
29 JUN 2350	86	5.	1.8	1127.1	*	30 JUN 0810	186	5.	1.8	1127.1	*	30 JUN 1630	286	5.	1.8	1127.1
29 JUN 2355	87	5.	1.8	1127.1	*	30 JUN 0815	187	5.	1.8	1127.1	*	30 JUN 1635	287	5.	1.8	1127.1
30 JUN 0000	88	5.	1.8	1127.1	*	30 JUN 0820	188	5.	1.8	1127.1	*	30 JUN 1640	288	5.	1.8	1127.1
30 JUN 0005	89	5.	1.8	1127.1	*	30 JUN 0825	189	5.	1.8	1127.1	*	30 JUN 1645	289	5.	1.8	1127.1
30 JUN 0010	90	5.	1.8	1127.1	*	30 JUN 0830	190	5.	1.8	1127.1	*	30 JUN 1650	290	5.	1.8	1127.1
30 JUN 0015	91	5.	1.8	1127.1	*	30 JUN 0835	191	5.	1.8	1127.1	*	30 JUN 1655	291	5.	1.8	1127.1
30 JUN 0020	92	5.	1.8	1127.1	*	30 JUN 0840	192	5.	1.8	1127.1	*	30 JUN 1700	292	5.	1.8	1127.1
30 JUN 0025	93	5.	1.8	1127.1	*	30 JUN 0845	193	5.	1.8	1127.1	*	30 JUN 1705	293	5.	1.8	1127.1
30 JUN 0030	94	5.	1.8	1127.1	*	30 JUN 0850	194	5.	1.8	1127.1	*	30 JUN 1710	294	5.	1.8	1127.1
30 JUN 0035	95	5.	1.8	1127.1	*	30 JUN 0855	195	5.	1.8	1127.1	*	30 JUN 1715	295	5.	1.8	1127.1
30 JUN 0040	96	5.	1.8	1127.1	*	30 JUN 0900	196	5.	1.8	1127.1	*	30 JUN 1720	296	5.	1.8	1127.1
30 JUN 0045	97	5.	1.8	1127.1	*	30 JUN 0905	197	5.	1.8	1127.1	*	30 JUN 1725	297	5.	1.8	1127.1
30 JUN 0050	98	5.	1.8	1127.1	*	30 JUN 0910	198	5.	1.8	1127.1	*	30 JUN 1730	298	5.	1.8	1127.1
30 JUN 0055	99	5.	1.8	1127.1	*	30 JUN 0915	199	5.	1.8	1127.1	*	30 JUN 1735	299	5.	1.8	1127.1
30 JUN 0100	100	5.	1.8	1127.1	*	30 JUN 0920	200	5.	1.8	1127.1	*	30 JUN 1740	300	5.	1.8	1127.1

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PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	24.92-HR
+ (CFS)	(HR)					
		(CFS)				
+ 5.	12.67		5.	4.	4.	4.
		(INCHES)	.000	.000	.000	.000
		(AC-FT)	2.	9.	9.	9.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	24.92-HR
+ (AC-FT)	(HR)				
2.	9.17	2.	2.	2.	2.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	24.92-HR
+ (FEET)	(HR)				
1127.09	11.00	1127.09	1127.04	1127.00	1127.00

CUMULATIVE AREA = .00 SQ MI

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              *            *
  44 KK       *    BSN2    *
              *            *
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BASIN 2
MID-BASIN STORAGE ROUTING
THE FOLLOWING STORAGE ROUTING PARAMETERS WERE DERIVED FROM BASIN/CHANNEL
DESIGN PROVIDE BY NOVAK ENVIRONMENTAL 28 JUN 2004
ASSUME SUBMERGED FLOW OVER WEIR, COEFF=2.8, H = HU/S-HD/S

HYDROGRAPH ROUTING DATA

50 RS STORAGE ROUTING

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

51 SV	STORAGE	.0	.1	1.0	2.7	7.7	15.5
52 SE	ELEVATION	1124.10	1124.60	1125.10	1126.00	1127.00	1128.00
53 SQ	DISCHARGE	0.	0.	0.	61.	510.	1187.

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HYDROGRAPH AT STATION BSN2

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DA MON HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA MON HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA MON HRMN	ORD	OUTFLOW	STORAGE	STAGE
29 JUN 1645	1	0.	.0	1124.1	*	30 JUN 0105	101	5.	1.1	1125.2	*	30 JUN 0925	201	5.	1.1	1125.2
29 JUN 1650	2	0.	.0	1124.1	*	30 JUN 0110	102	5.	1.1	1125.2	*	30 JUN 0930	202	5.	1.1	1125.2
29 JUN 1655	3	0.	.0	1124.1	*	30 JUN 0115	103	5.	1.1	1125.2	*	30 JUN 0935	203	5.	1.1	1125.2

29	JUN	1700	4	0.	.0	1124.1	*	30	JUN	0120	104	5.	1.1	1125.2	*	30	JUN	0940	204	5.	1.1	1125.2
29	JUN	1705	5	0.	.0	1124.1	*	30	JUN	0125	105	5.	1.1	1125.2	*	30	JUN	0945	205	5.	1.1	1125.2
29	JUN	1710	6	0.	.0	1124.1	*	30	JUN	0130	106	5.	1.1	1125.2	*	30	JUN	0950	206	5.	1.1	1125.2
29	JUN	1715	7	0.	.0	1124.1	*	30	JUN	0135	107	5.	1.1	1125.2	*	30	JUN	0955	207	5.	1.1	1125.2
29	JUN	1720	8	0.	.0	1124.1	*	30	JUN	0140	108	5.	1.1	1125.2	*	30	JUN	1000	208	5.	1.1	1125.2
29	JUN	1725	9	0.	.0	1124.1	*	30	JUN	0145	109	5.	1.1	1125.2	*	30	JUN	1005	209	5.	1.1	1125.2
29	JUN	1730	10	0.	.0	1124.1	*	30	JUN	0150	110	5.	1.1	1125.2	*	30	JUN	1010	210	5.	1.1	1125.2
29	JUN	1735	11	0.	.0	1124.1	*	30	JUN	0155	111	5.	1.1	1125.2	*	30	JUN	1015	211	5.	1.1	1125.2
29	JUN	1740	12	0.	.0	1124.1	*	30	JUN	0200	112	5.	1.1	1125.2	*	30	JUN	1020	212	5.	1.1	1125.2
29	JUN	1745	13	0.	.0	1124.1	*	30	JUN	0205	113	5.	1.1	1125.2	*	30	JUN	1025	213	5.	1.1	1125.2
29	JUN	1750	14	0.	.0	1124.1	*	30	JUN	0210	114	5.	1.1	1125.2	*	30	JUN	1030	214	5.	1.1	1125.2
29	JUN	1755	15	0.	.0	1124.1	*	30	JUN	0215	115	5.	1.1	1125.2	*	30	JUN	1035	215	5.	1.1	1125.2
29	JUN	1800	16	0.	.0	1124.1	*	30	JUN	0220	116	5.	1.1	1125.2	*	30	JUN	1040	216	5.	1.1	1125.2
29	JUN	1805	17	0.	.0	1124.1	*	30	JUN	0225	117	5.	1.1	1125.2	*	30	JUN	1045	217	5.	1.1	1125.2
29	JUN	1810	18	0.	.0	1124.1	*	30	JUN	0230	118	5.	1.1	1125.2	*	30	JUN	1050	218	5.	1.1	1125.2
29	JUN	1815	19	0.	.0	1124.1	*	30	JUN	0235	119	5.	1.1	1125.2	*	30	JUN	1055	219	5.	1.1	1125.2
29	JUN	1820	20	0.	.0	1124.1	*	30	JUN	0240	120	5.	1.1	1125.2	*	30	JUN	1100	220	5.	1.1	1125.2
29	JUN	1825	21	0.	.0	1124.1	*	30	JUN	0245	121	5.	1.1	1125.2	*	30	JUN	1105	221	5.	1.1	1125.2
29	JUN	1830	22	0.	.0	1124.1	*	30	JUN	0250	122	5.	1.1	1125.2	*	30	JUN	1110	222	5.	1.1	1125.2
29	JUN	1835	23	0.	.0	1124.1	*	30	JUN	0255	123	5.	1.1	1125.2	*	30	JUN	1115	223	5.	1.1	1125.2
29	JUN	1840	24	0.	.0	1124.1	*	30	JUN	0300	124	5.	1.1	1125.2	*	30	JUN	1120	224	5.	1.1	1125.2
29	JUN	1845	25	0.	.0	1124.1	*	30	JUN	0305	125	5.	1.1	1125.2	*	30	JUN	1125	225	5.	1.1	1125.2
29	JUN	1850	26	0.	.0	1124.1	*	30	JUN	0310	126	5.	1.1	1125.2	*	30	JUN	1130	226	5.	1.1	1125.2
29	JUN	1855	27	0.	.0	1124.1	*	30	JUN	0315	127	5.	1.1	1125.2	*	30	JUN	1135	227	5.	1.1	1125.2
29	JUN	1900	28	0.	.0	1124.1	*	30	JUN	0320	128	5.	1.1	1125.2	*	30	JUN	1140	228	5.	1.1	1125.2
29	JUN	1905	29	0.	.0	1124.1	*	30	JUN	0325	129	5.	1.1	1125.2	*	30	JUN	1145	229	5.	1.1	1125.2
29	JUN	1910	30	0.	.0	1124.1	*	30	JUN	0330	130	5.	1.1	1125.2	*	30	JUN	1150	230	5.	1.1	1125.2
29	JUN	1915	31	0.	.0	1124.1	*	30	JUN	0335	131	5.	1.1	1125.2	*	30	JUN	1155	231	5.	1.1	1125.2
29	JUN	1920	32	0.	.0	1124.1	*	30	JUN	0340	132	5.	1.1	1125.2	*	30	JUN	1200	232	5.	1.1	1125.2
29	JUN	1925	33	0.	.0	1124.1	*	30	JUN	0345	133	5.	1.1	1125.2	*	30	JUN	1205	233	5.	1.1	1125.2
29	JUN	1930	34	0.	.0	1124.1	*	30	JUN	0350	134	5.	1.1	1125.2	*	30	JUN	1210	234	5.	1.1	1125.2
29	JUN	1935	35	0.	.0	1124.1	*	30	JUN	0355	135	5.	1.1	1125.2	*	30	JUN	1215	235	5.	1.1	1125.2
29	JUN	1940	36	0.	.0	1124.1	*	30	JUN	0400	136	5.	1.1	1125.2	*	30	JUN	1220	236	5.	1.1	1125.2
29	JUN	1945	37	0.	.0	1124.1	*	30	JUN	0405	137	5.	1.1	1125.2	*	30	JUN	1225	237	5.	1.1	1125.2
29	JUN	1950	38	0.	.0	1124.1	*	30	JUN	0410	138	5.	1.1	1125.2	*	30	JUN	1230	238	5.	1.1	1125.2
29	JUN	1955	39	0.	.0	1124.1	*	30	JUN	0415	139	5.	1.1	1125.2	*	30	JUN	1235	239	5.	1.1	1125.2
29	JUN	2000	40	0.	.0	1124.1	*	30	JUN	0420	140	5.	1.1	1125.2	*	30	JUN	1240	240	5.	1.1	1125.2
29	JUN	2005	41	0.	.0	1124.1	*	30	JUN	0425	141	5.	1.1	1125.2	*	30	JUN	1245	241	5.	1.1	1125.2
29	JUN	2010	42	0.	.0	1124.1	*	30	JUN	0430	142	5.	1.1	1125.2	*	30	JUN	1250	242	5.	1.1	1125.2
29	JUN	2015	43	0.	.0	1124.1	*	30	JUN	0435	143	5.	1.1	1125.2	*	30	JUN	1255	243	5.	1.1	1125.2
29	JUN	2020	44	0.	.0	1124.1	*	30	JUN	0440	144	5.	1.1	1125.2	*	30	JUN	1300	244	5.	1.1	1125.2
29	JUN	2025	45	0.	.0	1124.2	*	30	JUN	0445	145	5.	1.1	1125.2	*	30	JUN	1305	245	5.	1.1	1125.2
29	JUN	2030	46	0.	.0	1124.2	*	30	JUN	0450	146	5.	1.1	1125.2	*	30	JUN	1310	246	5.	1.1	1125.2
29	JUN	2035	47	0.	.0	1124.3	*	30	JUN	0455	147	5.	1.1	1125.2	*	30	JUN	1315	247	5.	1.1	1125.2
29	JUN	2040	48	0.	.1	1124.4	*	30	JUN	0500	148	5.	1.1	1125.2	*	30	JUN	1320	248	5.	1.1	1125.2
29	JUN	2045	49	0.	.1	1124.4	*	30	JUN	0505	149	5.	1.1	1125.2	*	30	JUN	1325	249	5.	1.1	1125.2
29	JUN	2050	50	0.	.1	1124.5	*	30	JUN	0510	150	5.	1.1	1125.2	*	30	JUN	1330	250	5.	1.1	1125.2
29	JUN	2055	51	0.	.1	1124.6	*	30	JUN	0515	151	5.	1.1	1125.2	*	30	JUN	1335	251	5.	1.1	1125.2
29	JUN	2100	52	0.	.1	1124.6	*	30	JUN	0520	152	5.	1.1	1125.2	*	30	JUN	1340	252	5.	1.1	1125.2
29	JUN	2105	53	0.	.1	1124.6	*	30	JUN	0525	153	5.	1.1	1125.2	*	30	JUN	1345	253	5.	1.1	1125.2
29	JUN	2110	54	0.	.2	1124.6	*	30	JUN	0530	154	5.	1.1	1125.2	*	30	JUN	1350	254	5.	1.1	1125.2
29	JUN	2115	55	0.	.2	1124.7	*	30	JUN	0535	155	5.	1.1	1125.2	*	30	JUN	1355	255	5.	1.1	1125.2
29	JUN	2120	56	0.	.2	1124.7	*	30	JUN	0540	156	5.	1.1	1125.2	*	30	JUN	1400	256	5.	1.1	1125.2
29	JUN	2125	57	0.	.2	1124.7	*	30	JUN	0545	157	5.	1.1	1125.2	*	30	JUN	1405	257	5.	1.1	1125.2
29	JUN	2130	58	0.	.3	1124.7	*	30	JUN	0550	158	5.	1.1	1125.2	*	30	JUN	1410	258	5.	1.1	1125.2
29	JUN	2135	59	0.	.3	1124.7	*	30	JUN	0555	159	5.	1.1	1125.2	*	30	JUN	1415	259	5.	1.1	1125.2
29	JUN	2140	60	0.	.3	1124.7	*	30	JUN	0600	160	5.	1.1	1125.2	*	30	JUN	1420	260	5.	1.1	1125.2
29	JUN	2145	61	0.	.3	1124.7	*	30	JUN	0605	161	5.	1.1	1125.2	*	30	JUN	1425	261	5.	1.1	1125.2
29	JUN	2150	62	0.	.4	1124.8	*	30	JUN	0610	162	5.	1.1	1125.2	*	30	JUN	1430	262	5.	1.1	1125.2
29	JUN	2155	63	0.	.4	1124.8	*	30	JUN	0615	163	5.	1.1	1125.2	*	30	JUN	1435	263	5.	1.1	1125.2
29	JUN	2200	64	0.	.4	1124.8	*	30	JUN	0620	164	5.	1.1	1125.2	*	30	JUN	1440	264	5.	1.1	1125.2
29	JUN	2205	65	0.	.5	1124.8	*	30	JUN	0625	165	5.	1.1	1125.2	*	30	JUN	1445	265	5.	1.1	1125.2
29	JUN	2210	66	0.	.5	1124.8	*	30	JUN	0630	166	5.	1.1	1125.2	*	30	JUN	1450	266	5.	1.1	1125.2
29	JUN	2215	67	0.	.5	1124.8	*	30	JUN	0635	167	5.	1.1	1125.2	*	30	JUN	1455	267	5.	1.1	1125.2
29	JUN	2220	68	0.	.6	1124.9	*	30	JUN	0640	168	5.	1.1	1125.2	*	30	JUN	1500	268	5.	1.1	1125.2
29	JUN	2225	69	0.	.6	1124.9	*	30	JUN	0645	169	5.	1.1	1125.2	*	30	JUN	1505	269	5.	1.1	1125.2
29	JUN	2230	70	0.	.6	1124.9	*	30	JUN	0650	170	5.	1.1	1125.2	*	30	JUN	1510	270	5.	1.1	1125.2
29	JUN	2235	71	0.	.7	1124.9	*	30	JUN	0655	171	5.	1.1	1125.2	*	30	JUN	1515	271	5.	1.1	1125.2
29	JUN	2240	72	0.	.7	1124.9	*	30	JUN	0700	172	5.	1.1	1125.2	*	30	JUN	1520	272	5.	1.1	1125.2
29	JUN	2245	73	0.	.7	1124.9	*	30	JUN	0705	173	5.	1.1	1125.2	*	30	JUN	1525	273	5.	1.1	1125.2
29	JUN	2250	74	0.	.7	1125.0	*	30	JUN	0710	174	5.	1.1	1125.2	*	30	JUN	1530	274	5.	1.1	1125.2
29	JUN	2255	75	0.	.8	1125.0	*	30	JUN	0715	175	5.	1.1	1125.2	*	30	JUN	1535	275	5.	1.1	1125.2
29	JUN	2300	76	0.	.8	1125.0	*	30	JUN	0720	176	5.	1.1	1125.2	*	30	JUN	1540	276	5.	1.1	1125.2
29	JUN	2305	77	0.	.8	1125.0	*	30	JUN	0725	177	5.	1.1	1125.2	*	30	JUN	1545	277	5.	1.1	1125.2
29	JUN	2310	78	0.	.9	1125.0	*	30	JUN	0730	178	5.	1.1	1125.2	*	30	JUN	1550	278	5.	1.1	1125.2
29	JUN	2315	79	0.	.9	1125.1	*	30	JUN	0735	179	5.	1.1	1125.2	*	30	JUN	1555	279	5.	1.1	1125.2
29	JUN	2320	80	0.	.9	1125.1	*	30	JUN	0740	180	5.	1.1	1125.2	*	30	JUN	1600	280	5.	1.1	1125.2
29	JUN	2325	81	0.	1.0	1125.1	*	30	JUN	0745	181	5.	1.1	1125.2	*	30	JUN	1605	281	5.	1.1	1125.2
29	JUN	2330	82	0.	1.0	1125.1	*	30	JUN	0750	182	5.	1.1	1125.2	*	30	JUN	1610	282	5.	1.1	1125.2
29	JUN	2335	83	1.	1.0	1125.1	*	30	JUN	0755	183	5.	1.1	1125.2	*	30	JUN	1615	283	5.	1.1	1125.2
29	JUN	2340	84	2.	1.1	1125.1	*	30	JUN	0800	184	5.	1.1	1125.2	*	30	JUN	1620	284	5.	1.1	1125.2
29	JUN	2345	85	3.	1.1	1125.1	*	30	JUN	0805	185	5.	1.1	1125.2	*	30	JUN	1625	285	5.	1.1	1125.2
29	JUN	2350	86	3.	1.1	1125.1	*	30	JUN	0810	186	5.	1.1	1125.2	*	30	JUN	1630	286	5.	1.1	1125.2
29	JUN	2355	87	4.	1.1	1125.2	*	30	JUN	0815	187	5.	1.1	1125.2	*	30	JUN	1635	287	5.	1.1	1125.2
30	JUN	0000	88	4.	1.1	1125.2	*	30	JUN	0820	188	5.	1.1	1125.2	*	30	JUN	1640	288	5.	1.1	1125.2
30	JUN	0005	89	4.	1.1	1125.2	*	30	JUN	0825	189	5.	1.1	1125.2	*	30	JUN	1645	289	5.	1.1	1125.2
30	JUN	0010	90	4.	1.1	1125.2	*	30	JUN	0830	190	5.	1.1	1125.2	*	30	JUN	1650	290	5.	1.1	1125.2
30	JUN	0015	91	4.	1.1	1125.2	*	30	JUN	0835	191	5.	1.1	1125.2	*	30	JUN	1655	291	5.	1.1	1125.2
30	JUN	0020	92	5.	1.1	1125.2	*	30	JUN	0840	192	5.	1.1	1125.2	*	30	JUN	1700	292	5.	1.1	1125.2
30	JUN	0025	93	5.	1.1	1125.2	*	30	JUN	0845	193	5.	1.1	1125.2	*	30	JUN	1705	293	5.	1.1	1125.2
30	JUN	0030	94	5.	1.1	1125.2	*	30	JUN	0850	194	5.	1.1	1125.2	*	30	JUN	1710	294	5.	1.1	1125.2
30	JUN	0035	95	5.	1.1	1125.2	*	30	JUN	0855	195	5.	1.1	1125.2	*	30	JUN	1715	295	5.	1.1	1125.2
30	JUN	0040	96	5.	1.1	1125.2	*	30	JUN	0900	196	5.	1.1	1125.2	*	30	JUN	1720	296	5.	1.1	1125.2
30	JUN	0045	97	5.	1.1	1125.2	*	30	JUN	0905	197	5.	1.1	1125.2	*	30	JUN	1725	297	5.	1.1	1125.2
30	JUN	0050	98	5.	1.1	1125.2	*	30	JUN	0910	198	5.	1.1	1125.2	*	30	JUN	1730	298	5.	1.1	1125.2

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
30	JUN	0055	99	5.	1.1	1125.2	*	30	JUN	0915	199	5.	1.1	1125.2	*	30	JUN	1735	299	5.	1.1	1125.2
30	JUN	0100	100	5.	1.1	1125.2	*	30	JUN	0920	200	5.	1.1	1125.2	*	30	JUN	1740	300	5.	1.1	1125.2

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 PEAK FLOW     TIME                                 MAXIMUM AVERAGE FLOW
                                        6-HR          24-HR          72-HR        24.92-HR
+   (CFS)      (HR)
                           (CFS)
+        5.    12.00                      5.             4.             4.              4.
                         (INCHES)      .000           .000           .000            .000
                          (AC-FT)        2.             7.             7.              7.

PEAK STORAGE   TIME                                MAXIMUM AVERAGE STORAGE
                                        6-HR          24-HR          72-HR        24.92-HR
+  (AC-FT)     (HR)
         1.    9.08                       1.             1.             1.              1.

 PEAK STAGE    TIME                                MAXIMUM AVERAGE STAGE
                                        6-HR          24-HR          72-HR        24.92-HR
+   (FEET)     (HR)
    1125.17   10.08                  1125.17        1125.00        1124.97         1124.97

                          CUMULATIVE AREA =       .00 SQ MI

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

              **************
              *            *
  54 KK       *    BSN3    *
              *            *
              **************

                          BASIN 3
                          DOWNSTREAM BASIN STORAGE ROUTING
                          THE FOLLOWING STORAGE ROUTING PARAMETERS WERE DERIVED FROM BASIN/CHANNEL
                          DESIGN PROVIDE BY NOVAK ENVIRONMENTAL 28 JUN 2004
                          ASSUME UNSUBMERGED FLOW OVER WEIR, COEFF=3.0, WEIR LENGTH = 120'

               HYDROGRAPH ROUTING DATA

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

  61 SV            STORAGE          .0        .1       1.2       1.5       6.6      14.7      24.4

  62 SE          ELEVATION     1122.80   1123.30   1123.80   1124.00   1125.00   1126.00   1127.00

  63 SQ          DISCHARGE          0.        0.        1.       32.      473.     1175.     2061.

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                                           HYDROGRAPH AT STATION    BSN3

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DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
29	JUN	1645	1	0.	.0	1122.8	*	30	JUN	0105	101	0.	.5	1123.5	*	30	JUN	0925	201	5.	1.2	1123.8
29	JUN	1650	2	0.	.0	1122.8	*	30	JUN	0110	102	0.	.5	1123.5	*	30	JUN	0930	202	5.	1.2	1123.8
29	JUN	1655	3	0.	.0	1122.8	*	30	JUN	0115	103	0.	.6	1123.5	*	30	JUN	0935	203	5.	1.2	1123.8
29	JUN	1700	4	0.	.0	1122.8	*	30	JUN	0120	104	0.	.6	1123.5	*	30	JUN	0940	204	5.	1.2	1123.8
29	JUN	1705	5	0.	.0	1122.8	*	30	JUN	0125	105	0.	.6	1123.5	*	30	JUN	0945	205	5.	1.2	1123.8
29	JUN	1710	6	0.	.0	1122.8	*	30	JUN	0130	106	1.	.7	1123.6	*	30	JUN	0950	206	5.	1.2	1123.8
29	JUN	1715	7	0.	.0	1122.8	*	30	JUN	0135	107	1.	.7	1123.6	*	30	JUN	0955	207	5.	1.2	1123.8
29	JUN	1720	8	0.	.0	1122.8	*	30	JUN	0140	108	1.	.7	1123.6	*	30	JUN	1000	208	5.	1.2	1123.8
29	JUN	1725	9	0.	.0	1122.8	*	30	JUN	0145	109	1.	.8	1123.6	*	30	JUN	1005	209	5.	1.2	1123.8
29	JUN	1730	10	0.	.0	1122.8	*	30	JUN	0150	110	1.	.8	1123.6	*	30	JUN	1010	210	5.	1.2	1123.8
29	JUN	1735	11	0.	.0	1122.8	*	30	JUN	0155	111	1.	.8	1123.6	*	30	JUN	1015	211	5.	1.2	1123.8
29	JUN	1740	12	0.	.0	1122.8	*	30	JUN	0200	112	1.	.8	1123.6	*	30	JUN	1020	212	5.	1.2	1123.8
29	JUN	1745	13	0.	.0	1122.8	*	30	JUN	0205	113	1.	.9	1123.7	*	30	JUN	1025	213	5.	1.2	1123.8
29	JUN	1750	14	0.	.0	1122.8	*	30	JUN	0210	114	1.	.9	1123.7	*	30	JUN	1030	214	5.	1.2	1123.8
29	JUN	1755	15	0.	.0	1122.8	*	30	JUN	0215	115	1.	.9	1123.7	*	30	JUN	1035	215	5.	1.2	1123.8
29	JUN	1800	16	0.	.0	1122.8	*	30	JUN	0220	116	1.	1.0	1123.7	*	30	JUN	1040	216	5.	1.2	1123.8
29	JUN	1805	17	0.	.0	1122.8	*	30	JUN	0225	117	1.	1.0	1123.7	*	30	JUN	1045	217	5.	1.2	1123.8
29	JUN	1810	18	0.	.0	1122.8	*	30	JUN	0230	118	1.	1.0	1123.7	*	30	JUN	1050	218	5.	1.2	1123.8
29	JUN	1815	19	0.	.0	1122.8	*	30	JUN	0235	119	1.	1.0	1123.7	*	30	JUN	1055	219	5.	1.2	1123.8
29	JUN	1820	20	0.	.0	1122.8	*	30	JUN	0240	120	1.	1.1	1123.7	*	30	JUN	1100	220	5.	1.2	1123.8
29	JUN	1825	21	0.	.0	1122.8	*	30	JUN	0245	121	1.	1.1	1123.8	*	30	JUN	1105	221	5.	1.2	1123.8
29	JUN	1830	22	0.	.0	1122.8	*	30	JUN	0250	122	1.	1.1	1123.8	*	30	JUN	1110	222	5.	1.2	1123.8
29	JUN	1835	23	0.	.0	1122.8	*	30	JUN	0255	123	1.	1.2	1123.8	*	30	JUN	1115	223	5.	1.2	1123.8
29	JUN	1840	24	0.	.0	1122.8	*	30	JUN	0300	124	1.	1.2	1123.8	*	30	JUN	1120	224	5.	1.2	1123.8
29	JUN	1845	25	0.	.0	1122.8	*	30	JUN	0305	125	2.	1.2	1123.8	*	30	JUN	1125	225	5.	1.2	1123.8
29	JUN	1850	26	0.	.0	1122.8	*	30	JUN	0310	126	4.	1.2	1123.8	*	30	JUN	1130	226	5.	1.2	1123.8
29	JUN	1855	27	0.	.0	1122.8	*	30	JUN	0315	127	4.	1.2	1123.8	*	30	JUN	1135	227	5.	1.2	1123.8
29	JUN	1900	28	0.	.0	1122.8	*	30	JUN	0320	128	5.	1.2	1123.8	*	30	JUN	1140	228	5.	1.2	1123.8
29	JUN	1905	29	0.	.0	1122.8	*	30	JUN	0325	129	5.	1.2	1123.8	*	30	JUN	1145	229	5.	1.2	1123.8

29	JUN	1910	30	0.	.0	1122.8	*	30	JUN	0330	130	5.	1.2	1123.8	*	30	JUN	1150	230	5.	1.2	1123.8
29	JUN	1915	31	0.	.0	1122.8	*	30	JUN	0335	131	5.	1.2	1123.8	*	30	JUN	1155	231	5.	1.2	1123.8
29	JUN	1920	32	0.	.0	1122.8	*	30	JUN	0340	132	5.	1.2	1123.8	*	30	JUN	1200	232	5.	1.2	1123.8
29	JUN	1925	33	0.	.0	1122.8	*	30	JUN	0345	133	5.	1.2	1123.8	*	30	JUN	1205	233	5.	1.2	1123.8
29	JUN	1930	34	0.	.0	1122.8	*	30	JUN	0350	134	5.	1.2	1123.8	*	30	JUN	1210	234	5.	1.2	1123.8
29	JUN	1935	35	0.	.0	1122.8	*	30	JUN	0355	135	5.	1.2	1123.8	*	30	JUN	1215	235	5.	1.2	1123.8
29	JUN	1940	36	0.	.0	1122.8	*	30	JUN	0400	136	5.	1.2	1123.8	*	30	JUN	1220	236	5.	1.2	1123.8
29	JUN	1945	37	0.	.0	1122.8	*	30	JUN	0405	137	5.	1.2	1123.8	*	30	JUN	1225	237	5.	1.2	1123.8
29	JUN	1950	38	0.	.0	1122.8	*	30	JUN	0410	138	5.	1.2	1123.8	*	30	JUN	1230	238	5.	1.2	1123.8
29	JUN	1955	39	0.	.0	1122.8	*	30	JUN	0415	139	5.	1.2	1123.8	*	30	JUN	1235	239	5.	1.2	1123.8
29	JUN	2000	40	0.	.0	1122.8	*	30	JUN	0420	140	5.	1.2	1123.8	*	30	JUN	1240	240	5.	1.2	1123.8
29	JUN	2005	41	0.	.0	1122.8	*	30	JUN	0425	141	5.	1.2	1123.8	*	30	JUN	1245	241	5.	1.2	1123.8
29	JUN	2010	42	0.	.0	1122.8	*	30	JUN	0430	142	5.	1.2	1123.8	*	30	JUN	1250	242	5.	1.2	1123.8
29	JUN	2015	43	0.	.0	1122.8	*	30	JUN	0435	143	5.	1.2	1123.8	*	30	JUN	1255	243	5.	1.2	1123.8
29	JUN	2020	44	0.	.0	1122.8	*	30	JUN	0440	144	5.	1.2	1123.8	*	30	JUN	1300	244	5.	1.2	1123.8
29	JUN	2025	45	0.	.0	1122.8	*	30	JUN	0445	145	5.	1.2	1123.8	*	30	JUN	1305	245	5.	1.2	1123.8
29	JUN	2030	46	0.	.0	1122.8	*	30	JUN	0450	146	5.	1.2	1123.8	*	30	JUN	1310	246	5.	1.2	1123.8
29	JUN	2035	47	0.	.0	1122.8	*	30	JUN	0455	147	5.	1.2	1123.8	*	30	JUN	1315	247	5.	1.2	1123.8
29	JUN	2040	48	0.	.0	1122.8	*	30	JUN	0500	148	5.	1.2	1123.8	*	30	JUN	1320	248	5.	1.2	1123.8
29	JUN	2045	49	0.	.0	1122.8	*	30	JUN	0505	149	5.	1.2	1123.8	*	30	JUN	1325	249	5.	1.2	1123.8
29	JUN	2050	50	0.	.0	1122.8	*	30	JUN	0510	150	5.	1.2	1123.8	*	30	JUN	1330	250	5.	1.2	1123.8
29	JUN	2055	51	0.	.0	1122.8	*	30	JUN	0515	151	5.	1.2	1123.8	*	30	JUN	1335	251	5.	1.2	1123.8
29	JUN	2100	52	0.	.0	1122.8	*	30	JUN	0520	152	5.	1.2	1123.8	*	30	JUN	1340	252	5.	1.2	1123.8
29	JUN	2105	53	0.	.0	1122.8	*	30	JUN	0525	153	5.	1.2	1123.8	*	30	JUN	1345	253	5.	1.2	1123.8
29	JUN	2110	54	0.	.0	1122.8	*	30	JUN	0530	154	5.	1.2	1123.8	*	30	JUN	1350	254	5.	1.2	1123.8
29	JUN	2115	55	0.	.0	1122.8	*	30	JUN	0535	155	5.	1.2	1123.8	*	30	JUN	1355	255	5.	1.2	1123.8
29	JUN	2120	56	0.	.0	1122.8	*	30	JUN	0540	156	5.	1.2	1123.8	*	30	JUN	1400	256	5.	1.2	1123.8
29	JUN	2125	57	0.	.0	1122.8	*	30	JUN	0545	157	5.	1.2	1123.8	*	30	JUN	1405	257	5.	1.2	1123.8
29	JUN	2130	58	0.	.0	1122.8	*	30	JUN	0550	158	5.	1.2	1123.8	*	30	JUN	1410	258	5.	1.2	1123.8
29	JUN	2135	59	0.	.0	1122.8	*	30	JUN	0555	159	5.	1.2	1123.8	*	30	JUN	1415	259	5.	1.2	1123.8
29	JUN	2140	60	0.	.0	1122.8	*	30	JUN	0600	160	5.	1.2	1123.8	*	30	JUN	1420	260	5.	1.2	1123.8
29	JUN	2145	61	0.	.0	1122.8	*	30	JUN	0605	161	5.	1.2	1123.8	*	30	JUN	1425	261	5.	1.2	1123.8
29	JUN	2150	62	0.	.0	1122.8	*	30	JUN	0610	162	5.	1.2	1123.8	*	30	JUN	1430	262	5.	1.2	1123.8
29	JUN	2155	63	0.	.0	1122.8	*	30	JUN	0615	163	5.	1.2	1123.8	*	30	JUN	1435	263	5.	1.2	1123.8
29	JUN	2200	64	0.	.0	1122.8	*	30	JUN	0620	164	5.	1.2	1123.8	*	30	JUN	1440	264	5.	1.2	1123.8
29	JUN	2205	65	0.	.0	1122.8	*	30	JUN	0625	165	5.	1.2	1123.8	*	30	JUN	1445	265	5.	1.2	1123.8
29	JUN	2210	66	0.	.0	1122.8	*	30	JUN	0630	166	5.	1.2	1123.8	*	30	JUN	1450	266	5.	1.2	1123.8
29	JUN	2215	67	0.	.0	1122.8	*	30	JUN	0635	167	5.	1.2	1123.8	*	30	JUN	1455	267	5.	1.2	1123.8
29	JUN	2220	68	0.	.0	1122.8	*	30	JUN	0640	168	5.	1.2	1123.8	*	30	JUN	1500	268	5.	1.2	1123.8
29	JUN	2225	69	0.	.0	1122.8	*	30	JUN	0645	169	5.	1.2	1123.8	*	30	JUN	1505	269	5.	1.2	1123.8
29	JUN	2230	70	0.	.0	1122.8	*	30	JUN	0650	170	5.	1.2	1123.8	*	30	JUN	1510	270	5.	1.2	1123.8
29	JUN	2235	71	0.	.0	1122.8	*	30	JUN	0655	171	5.	1.2	1123.8	*	30	JUN	1515	271	5.	1.2	1123.8
29	JUN	2240	72	0.	.0	1122.8	*	30	JUN	0700	172	5.	1.2	1123.8	*	30	JUN	1520	272	5.	1.2	1123.8
29	JUN	2245	73	0.	.0	1122.8	*	30	JUN	0705	173	5.	1.2	1123.8	*	30	JUN	1525	273	5.	1.2	1123.8
29	JUN	2250	74	0.	.0	1122.8	*	30	JUN	0710	174	5.	1.2	1123.8	*	30	JUN	1530	274	5.	1.2	1123.8
29	JUN	2255	75	0.	.0	1122.8	*	30	JUN	0715	175	5.	1.2	1123.8	*	30	JUN	1535	275	5.	1.2	1123.8
29	JUN	2300	76	0.	.0	1122.8	*	30	JUN	0720	176	5.	1.2	1123.8	*	30	JUN	1540	276	5.	1.2	1123.8
29	JUN	2305	77	0.	.0	1122.8	*	30	JUN	0725	177	5.	1.2	1123.8	*	30	JUN	1545	277	5.	1.2	1123.8
29	JUN	2310	78	0.	.0	1122.8	*	30	JUN	0730	178	5.	1.2	1123.8	*	30	JUN	1550	278	5.	1.2	1123.8
29	JUN	2315	79	0.	.0	1122.8	*	30	JUN	0735	179	5.	1.2	1123.8	*	30	JUN	1555	279	5.	1.2	1123.8
29	JUN	2320	80	0.	.0	1122.8	*	30	JUN	0740	180	5.	1.2	1123.8	*	30	JUN	1600	280	5.	1.2	1123.8
29	JUN	2325	81	0.	.0	1122.8	*	30	JUN	0745	181	5.	1.2	1123.8	*	30	JUN	1605	281	5.	1.2	1123.8
29	JUN	2330	82	0.	.0	1122.8	*	30	JUN	0750	182	5.	1.2	1123.8	*	30	JUN	1610	282	5.	1.2	1123.8
29	JUN	2335	83	0.	.0	1122.8	*	30	JUN	0755	183	5.	1.2	1123.8	*	30	JUN	1615	283	5.	1.2	1123.8
29	JUN	2340	84	0.	.0	1122.9	*	30	JUN	0800	184	5.	1.2	1123.8	*	30	JUN	1620	284	5.	1.2	1123.8
29	JUN	2345	85	0.	.0	1123.0	*	30	JUN	0805	185	5.	1.2	1123.8	*	30	JUN	1625	285	5.	1.2	1123.8
29	JUN	2350	86	0.	.1	1123.1	*	30	JUN	0810	186	5.	1.2	1123.8	*	30	JUN	1630	286	5.	1.2	1123.8
29	JUN	2355	87	0.	.1	1123.2	*	30	JUN	0815	187	5.	1.2	1123.8	*	30	JUN	1635	287	5.	1.2	1123.8
30	JUN	0000	88	0.	.1	1123.3	*	30	JUN	0820	188	5.	1.2	1123.8	*	30	JUN	1640	288	5.	1.2	1123.8
30	JUN	0005	89	0.	.1	1123.3	*	30	JUN	0825	189	5.	1.2	1123.8	*	30	JUN	1645	289	5.	1.2	1123.8
30	JUN	0010	90	0.	.2	1123.3	*	30	JUN	0830	190	5.	1.2	1123.8	*	30	JUN	1650	290	5.	1.2	1123.8
30	JUN	0015	91	0.	.2	1123.3	*	30	JUN	0835	191	5.	1.2	1123.8	*	30	JUN	1655	291	5.	1.2	1123.8
30	JUN	0020	92	0.	.2	1123.4	*	30	JUN	0840	192	5.	1.2	1123.8	*	30	JUN	1700	292	5.	1.2	1123.8
30	JUN	0025	93	0.	.3	1123.4	*	30	JUN	0845	193	5.	1.2	1123.8	*	30	JUN	1705	293	5.	1.2	1123.8
30	JUN	0030	94	0.	.3	1123.4	*	30	JUN	0850	194	5.	1.2	1123.8	*	30	JUN	1710	294	5.	1.2	1123.8
30	JUN	0035	95	0.	.3	1123.4	*	30	JUN	0855	195	5.	1.2	1123.8	*	30	JUN	1715	295	5.	1.2	1123.8
30	JUN	0040	96	0.	.3	1123.4	*	30	JUN	0900	196	5.	1.2	1123.8	*	30	JUN	1720	296	5.	1.2	1123.8
30	JUN	0045	97	0.	.4	1123.4	*	30	JUN	0905	197	5.	1.2	1123.8	*	30	JUN	1725	297	5.	1.2	1123.8
30	JUN	0050	98	0.	.4	1123.4	*	30	JUN	0910	198	5.	1.2	1123.8	*	30	JUN	1730	298	5.	1.2	1123.8
30	JUN	0055	99	0.	.4	1123.5	*	30	JUN	0915	199	5.	1.2	1123.8	*	30	JUN	1735	299	5.	1.2	1123.8
30	JUN	0100	100	0.	.5	1123.5	*	30	JUN	0920	200	5.	1.2	1123.8	*	30	JUN	1740	300	5.	1.2	1123.8
							*								*							

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PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	24.92-HR
+ (CFS)	(HR)					
		(CFS)				
+ 5.	12.00		5.	3.	3.	3.
		(INCHES)	.000	.000	.000	.000
		(AC-FT)	2.	6.	6.	6.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	24.92-HR
+ (AC-FT)	(HR)				
1.	10.83	1.	1.	1.	1.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	24.92-HR
+ (FEET)	(HR)				
1123.83	11.00	1123.83	1123.52	1123.50	1123.50

CUMULATIVE AREA = .00 SQ MI

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	BSN1	5.	.08	5.	5.	5.	.00		
+	ROUTED TO	BSN1	5.	12.67	5.	4.	4.	.00		
+									1127.09	11.00
+	ROUTED TO	BSN2	5.	12.00	5.	4.	4.	.00		
+									1125.17	10.08
+	ROUTED TO	BSN3	5.	12.00	5.	3.	3.	.00		
+									1123.83	11.00

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

RIO SALADO

3.24.04

1 of 1

- HYDRAULIC RESIDENCE TIME

HRT = $\forall / Q$; Q = 5 cfs CONTINUOUS DISCHARGE

BASIN 1 : $\forall$ = 43560 cf BLW WEIR / 5 cfs = 2.4 hrs

BASIN 2 : $\forall$ = 43560 cf BLW WEIR / 5 cfs = 2.4 hrs

BASIN 3 : $\forall$ = 52141 cf BLW WEIR / 5 cfs = 2.9 hrs

- TIME TO DRAIN BASIN

Q_{pk} THROUGH LOWFLOW OUTLET = 3 cfs

BASIN 1 : $\forall$ = 43560 cf / 3 cfs = 4.0 hrs

BASIN 2 : $\forall$ = 43560 cf / 3 cfs = 4.0 hrs

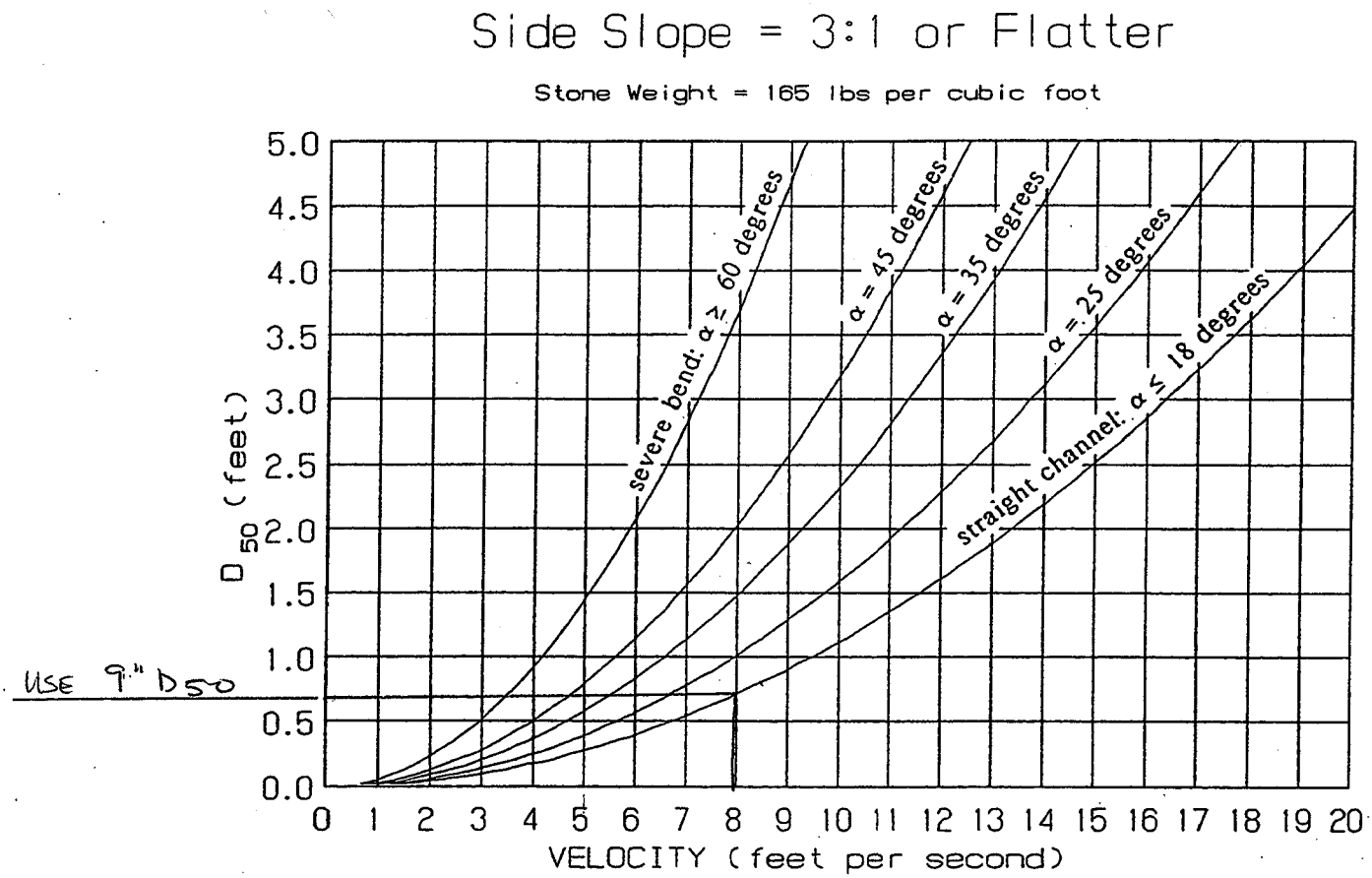
BASIN 3 : $\forall$ = 52141 cf / 3 cfs = 4.8 hrs

Scour Calculations **July 7, 2004**

PROJECT NAME: **RIO SALADO - TEMPE TOWN LAKE TO PRIEST DRIVE**
CROSS-SECTION AND LOCATION: **35.50**

INPUT PARAMETERS:			
Factor of Safety :	1.30		
Discharge (Q):	1300.00	cfs	
Channel Bottom Width (b):	120.00	ft	
Average Velocity (V_m):	8.02	ft/s	General Scour, Antidune Trough
Maximum Depth of Flow (Y_{max}):	2.90	ft	
Hydraulic Depth of Flow (Y_h):	2.18	ft	
Energy Slope (S_e):	0.006	ft/ft	
Low Flow Thalweg Depth:	1.00	ft	
Alpha (a):	0.00	deg.	Bend Scour
Pier width (normal to flow) (b_p):	0.00	ft	Pier Scour
Upstream Froude Number (F_u):	0.00		
Pier Shape Reduction Factor	1.0	Table 6.1	(default = 1)
Slope Angle of Abutment Face(Theta a):	0.00		Encroachment Scour
Encroachment Length (a_e):	0.00	ft	
Upstream Froude Number (F_u):	0.00		
Drop Height (h)	1.00	ft	Vertical Drop Scour
Downstream depth of flow (Y)	1.10	ft	

SCOUR CALCULATIONS:			
General Scour (Z_{gs}):	0.66944	ft	
	0.66944	**ft**	if negative use zero
Anti-dune Trough Depth (Z_a):	**0.8811895**	**ft**	
Low-flow Thalweg Depth (Z_{lft}):	**1.00**	**ft**	
Bend Scour Depth (Z_{bs}):	-3.18437	ft	
	0	**ft**	if negative use zero
Total Local Scour Depth (Z_{ls}):	**1.9319101**	**ft**	
Pier Scour Depth (Z_{lsp}):	0	ft	
Encroachment Scour Depth (Z_{lse}):	0	ft	
Vertical Drop Scour Depth (Z_{lss}):	1.9319101	ft	
Long-term Aggradation/Degredation:	0.00	ft	
Calculated Scour Depth	5.83	ft	includes Long-term Agg/deg.
Design Scour Depth	**5.83**	**ft**	3.0 ft min. design scour depth



SOURCE: SIMONS, LI & ASSOCIATES, INC. (1988)

FIGURE 9.1

RIPRAP DESIGN CHART