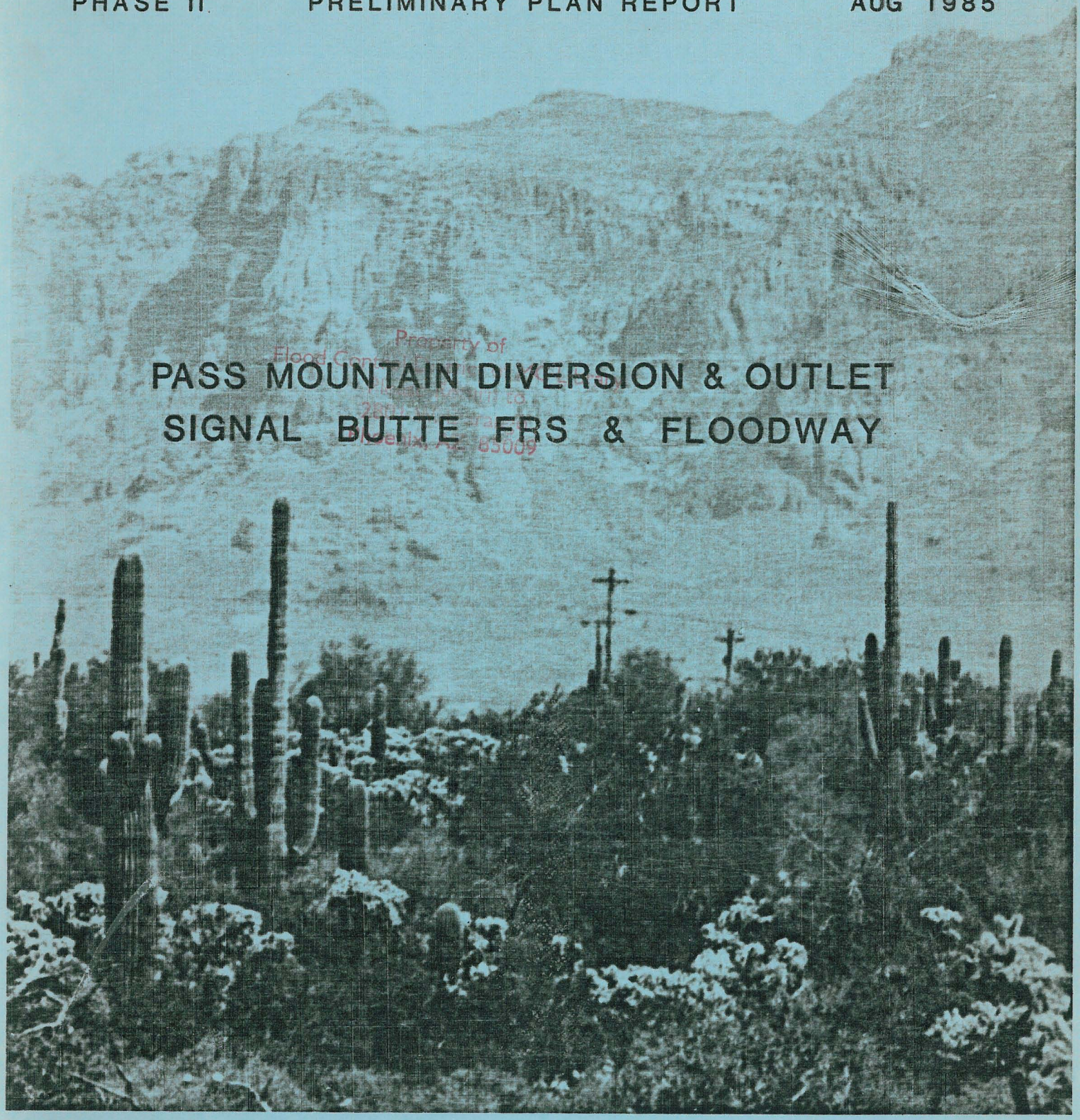
LANDSCAPE REHABILITATION

PHASE II PRELIMINARY PLAN REPORT AUG 1985



PASS MOUNTAIN DIVERSION & OUTLET
SIGNAL BUTTE FRS & FLOODWAY

Property of
Flood Control District of Maricopa County
3020 N. 27th Ave.
Phoenix, Ariz. 85009

ROGERS GLADWIN & HARMONY, INC.
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Buckhorn – Mesa Watershed
Maricopa & Pinal Counties, Arizona

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

United States
Department of
Agriculture

Soil
Conservation
Service

201 East Indianola
Suite 200
Phoenix, Arizona 85012

August 29, 1985

Dan Sagramoso, P.E.
Chief Engineer and General Manager
Flood Control District of Maricopa County
3335 West Durango Street
Phoenix, Arizona 85009

RE: Pass Mountain Diversion and Outlet, Signal Butte FRS and Floodway Landscape-Phase II-Preliminary Plan, Buckhorn-Mesa WPP, Arizona

Dear Dan:

Attached are three copies of the revised Phase II-Preliminary Plan Report and three sets of bluelines for the Maricopa County Park Commission and your review and comment.

We would appreciate receiving both sets of comments (yours and the Park Commission) by September 13, 1985, so the corrections can be made and the A&E Landscape Architect may proceed with Phase III-Construction Documents.

Sincerely,

Robert B. Crawford

Acting For

Verne M. Bathurst
State Conservationist

Enclosures

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2801 W. Durango
Phoenix, AZ 85009

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Introduction

INTRODUCTION

Project Description

The Buckhorn-Mesa Watershed containing the Pass Mt. Diversion and Outlet and the Signal Butte FRS and Floodway is located in eastern Maricopa and northwestern Pinal Counties, in the south central portion of Arizona. The site is 25 miles east of Phoenix. It includes the northeastern quadrant of Mesa and the northern portion of Apache Junction. Floodwaters drain from the Usery, Goldfield, and Superstition Mountains onto a wide alluvial fan which spreads south and southeast into the valley.

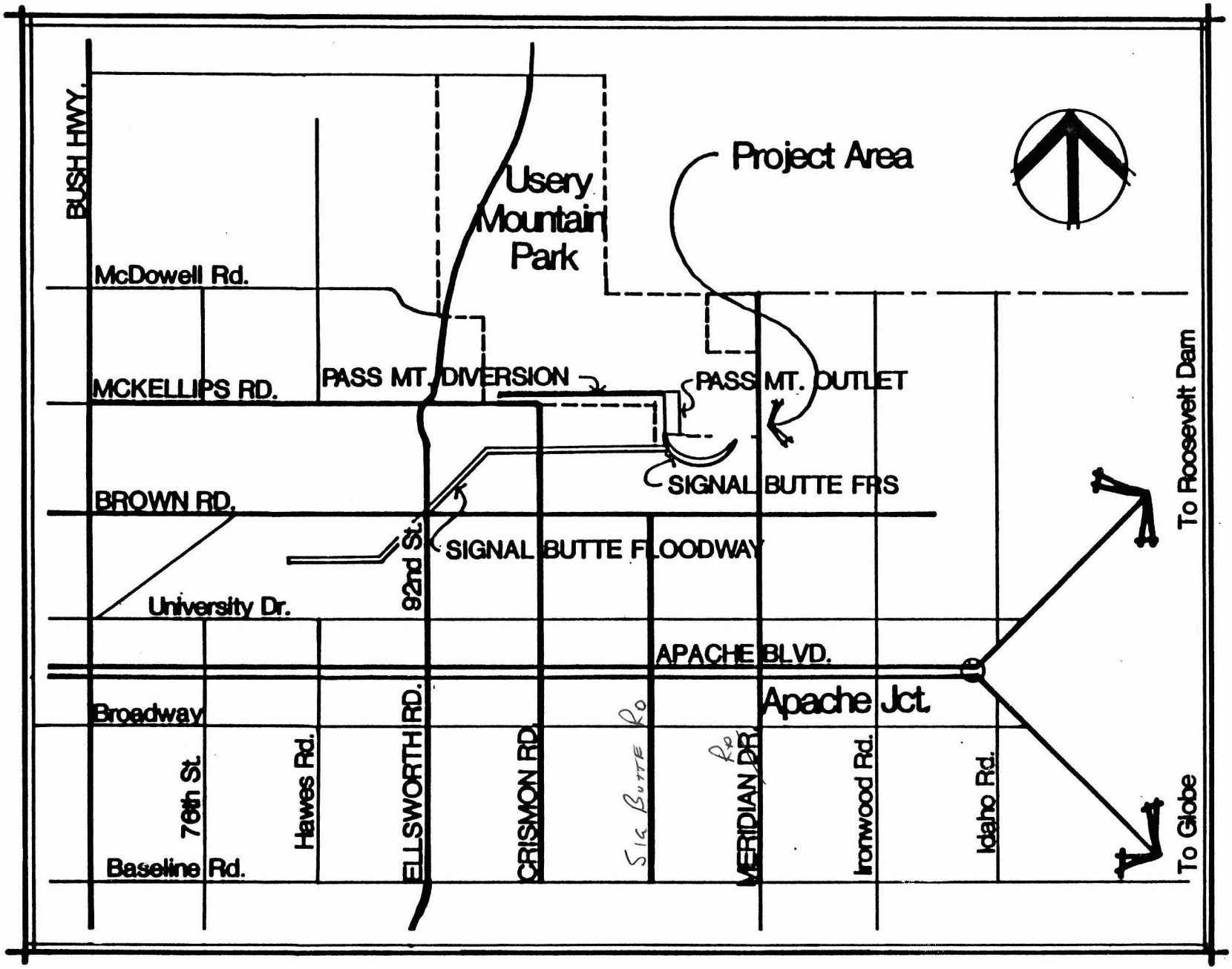
Project components consist of one planned floodwater diversion channel-the Pass Mountain Diversion, which conducts water to an outlet structure - Pass Mountain Outlet. Floodwaters carried by the Pass Mountain structures empty into the Signal Butte Floodwater Retarding Structure (FRS). An existing channel- Signal Butte Floodway - transmits floodwaters from Signal Butte FRS to the Spook Hill Flood Control Project for eventual release into the Salt River. Fig.1.

Pass Mountain Diversion

Pass Mountain Diversion will be a linear, earthen channel and dike, located within the southern boundary of Usery Mountain Recreation Area. The channel will vary in width from 12 to 50 feet and collect runoff from mountain slopes to the north. Collected water will flow over two grouted rock crest drops toward Pass Mountain Outlet. A 14 foot wide maintenance road will run on top of the elevated dike paralleling the channel, with access ramps into the channel bottom. Five vegetative outlets will supply water to riparian vegetation in existing washes south of the structure. A fence along the park boundary will limit access to the diversion structure.

Pass Mountain Outlet

Pass Mountain Outlet will be a series of four grouted rock energy dissipators connecting Pass Mountain Diversion to Signal Butte FRS. The outlet functions to slow water velocity over a steep gradient and prevent erosion. Floodwaters flow over a crest drop onto a wide, vegetated outlet zone. Fourteen foot wide maintenance roads run along both sides of the structure with ramps providing access to the outlet zones. Access to the outlet is controlled by the park boundary fence to the west.



LOCATION MAP

Figure 1

Signal Butte FRS

Signal Butte FRS will be a reservoir-type earthen dam, approximately 1.33 miles long. The FRS will collect and retard flood waters from Pass Mountain Outlet, the mountain slopes from the north and future flood control projects from the east. The dam will have a maximum height of 37 feet as it spans a drainage valley south of Usery Mountain Recreation Area and north of the SRP powerline transmission corridor. At the base of the dam is a large sediment and retarding pool within the construction borrow pit. An 18 foot wide maintenance road runs on top of the dam. The principal spillway on the west end of the dam releases into Signal Butte Floodway. An emergency spillway on the east will release overflow into an existing wash. A gated outlet at the center of the dam will release water into an existing wash south of the dam.

Signal Butte Floodway

Signal Butte Floodway is an existing channel approximately three miles long, transporting water released from Signal Butte FRS to the Spook Hill flood control project. The floodway bisects a developing residential area with some of the residences in close proximity to the project right-of-way. The channel has earthen and concrete lined sections. Earthen lined channel sections are protected by rip rap where there is a change in alignment. This section of the channel is paralleled on both sides by a 14 foot maintenance road on elevated dikes. The channel is concrete lined in the sections where velocities are high. The maintenance road on the concrete lined section is on an elevated dike on the north side, and adjacent to the top of the concrete channel on the south side. A rip rapped section of rock near the mid point of the channel provides the transition from earthen channel to concrete lined channel. Grouted spillway aprons are provided at points where existing washes drain into the channel. Vegetative outlets provide water for some riparian vegetation downstream from the channel. Existing roads cross the channel on bridge culverts at three points, the most significant being the intersection of Ellsworth Road and Brown Road. The channel is fenced on all sides to prevent access by off-road vehicles. Gates at road crossings provide access for maintenance vehicles. The channel empties into the Spook Hill project at a large grouted rock energy basin. A large waste area adjacent to the basin will be used for disposal of sediment trapped in the basin.

These four project components function together to provide a complete flood control system. The purpose of this flood control project is to reduce floodwater damage and provide erosion control for land that is valuable for anticipated urban development, agriculture and rangeland. The project will provide flood control for the Buckhorn-Mesa watershed and the Central Arizona Aquaduct, as well as minimizing floodwaters to the Apache Junction/Gilbert and Williams/Chandler Watersheds.

Study Methods

Rogers, Gladwin & Harmony, Inc., was retained by the Soil Conservation Service (SCS) to develope landscape rehabilitation methods by which the recommendations of the Landscape Resources Report (LRR) can be implemented using landscape architectural solutions. The purpose of landscape rehabilitation is to restore the landscape to a healthy condition or useful capacity and is to be accomplished mainly through the use of vegetation and earthform treatments. Potential alternatives resulted from the opportunities and constraints presented by rehabilitating the flood control channel.

Design alternatives were evaluated and tested by a combination of meetings with SCS staff and experts in revegetation/landscape rehabilitation methods, field evaluation and inventory of existing conditions, and product research. Further input was obtained from other agencies' experience with similar projects. A public hearing and conferences with concerned agencies and organizations will be conducted prior to development of final plans and specifications.

Study Team

The design report, preliminary working drawings and preliminary cost estimate were accomplished by a team of Rogers, Gladwin & Harmony landscape architects with report production support from staff. The following presents the study team's responsibilities.

Technical Staff

Principal-in-Charge	Robert Gladwin, ASLA
Project Manager	Jeff Johnson
Project Planner	Jody Darden
Support Staff	Richard Wise
	Mark Novak
Report Production	Susan Schau

Summary of Phase II Work

The second phase of this project consists of the determination of methods by which strategies and techniques for landscape rehabilitation developed in Phase I can be implemented. These are presented as a body of work consisting of preliminary landscape rehabilitation plans, accompanied by a bid schedule and cost estimate. These items and our design considerations are described in this preliminary design report.

Due to the strong visual impact of flood control project construction, three major considerations have been identified as crucial to the success of the landscape rehabilitation portion of this project. All of these relate to minimizing the visual impact of construction and reducing erosion. These involve 1) preservation of existing vegetation wherever possible, 2) shaping of structures to blend in with local topography, and 3) the use of vegetation native to the project area for revegetation of areas affected by construction.

Preservation of as much existing vegetation as possible limits environmental damage which must be repaired, often at substantial costs and under adverse climatic conditions. Therefore, construction limits must be clearly identified prior to commencing construction operations. These limits should be fenced or flagged. Any violations by the contractor should carry a fine and/or restoration work at no cost to S C S.

The linearity and angularity of flood control structures provide a strong contrast with surrounding topography and comprise a significant visual impact upon the landscape. Revegetation provides only partial mitigation of this impact in that it recreates prevailing color and texture. The basic form remains. Shaping the structure to reflect local topography completes mitigation of the visual impact. In the case of the borrow pit behind Signal Butte FRS, grading to leave islands of undisturbed vegetation breaks up an otherwise extensive denuded area. It also provides seed sources within the basin to aid reestablishment of vegetation.

Currently, landscape rehabilitation techniques are implemented after the design and construction of flood control structures is completed. Problems such as vegetation preservation and mitigation of the visual and environmental impacts are created during construction. These could be avoided through a coordination of engineering and landscape design efforts. It is not always necessary to

clear the entire right-of-way, nor is it necessary to clear areas which will remain at existing grades. Strictly enforced construction limits control this problem.

Because it is cost efficient to perform all grading operations during initial construction, grading techniques for mitigating adverse visual impacts should be incorporated into the engineering plans.

The use of native vegetation for revegetating project structures is important for two reasons. First, it provides visual continuity with the surrounding area. Second, it is known that the species selected can become established, thrive, and reproduce under climatic conditions common in the area. For this reason, species which occur naturally in the project area were given highest priority for use in revegetation on this project.

Summary of Data

SUMMARY OF DATA

Research Data

Soils

Soils in the project area were mapped by the SCS in 1982. Construction material for Pass Mountain Diversion will consist of Pinamt-Tremant Complex (1 to 10% slopes), which is a fine to skeletal loamy soil, and Ebon Very Gravelly Loam. Pass Mountain Outlet and Signal Butte FRS will be constructed with material from the Pinamt-Tremant Complex. Small areas of Antho-Carrizo-Maripo Complex, a sandy loam, occur along two watercourses.

Weather

Temperature and precipitation data were collected for Falcon Field, six miles west of the project area, and Stewart Mountain, 10 miles northeast of the project area. These data reflect the mild winters, hot summers and bimodal rainfall pattern typical of the area. Mean monthly temperatures range from 50.6 F (January) to 87.3 F (July) at Falcon Field. Rainfall occurs mostly during two distinct rainy seasons. The summer rainy season is characterized by localized thunderstorm cells which produce brief but intense periods of rainfall. Winter storms are more widespread and prolonged, with less rainfall intensity. Slightly more rain falls during the summer rainy season than during the winter rainy season, however, summer rainfall is largely unavailable due to rapid runoff and high temperatures.

Vegetative Outlets

Construction of flood control structures causes a marked decrease in vegetation density for about 1200 to 1500 feet downslope from the structure. This is due to the reduction of runoff both in watercourses and on interfluves. The decrease in vegetation density is dependent on the drought tolerance of local plant species and soil conditions. This effect is minimized when some water is allowed to pass through the structure. SCS staff familiar with vegetative outlets predict less flow in channels downstream from structures during normal rainfall events, and more flow for longer duration during flood events. Check dams and retarding basins in downstream channels will help prevent channel scour and increase runoff infiltration into soils below channels. When construction of this project is complete, there will be three types of vegetative outlets in use on the project. This provides the opportunity to monitor their effectiveness and determine which is most successful.

Flood Control District of Maricopa County

When completed, the flood control structures will be operated and maintained by the Flood Control District of Maricopa County. Landscape rehabilitation techniques are designed, in part, to facilitate maintenance concerns, especially in the area of erosion control. Seed mixes were designed to limit invasion of undesirable plant species by providing a solid cover of acceptable species.

Information regarding the success of seed mix components and plant survival during inundation was collected from FCDMC. These data were used in the selection of seed mix components for this project. The following seed mix was aerial broadcast on Spook Hill FRS following erosion repair in September, 1980. Irrigation by impact spray heads was used. The degree of success of establishment is indicated at the far right.

Shrubs	
Atriplex canescens - Four-winged saltbush	S
Atriplex lentiformis - Quail bush	S
Atriplex polycarpa - Desert saltbush	S
Baccharis sarothroides - Desert broom	VS
Cassia covesii - Desert senna	S
Encelia farinosa - Brittlebush	VS
Franseria deltoidea - Triangle-leaf bursage	VS
Larrea divaricata - Creosote	S
Grasses	
Eragrostis lehmanniana - Lehman's lovegrass	NS
Sporobolus cryptandrus - Sand dropseed	NS
Wildflowers	
Baileya multiradiata - Desert marigold	S
Dichelostemma pulchellum - Blue dicks	NS
Eschscholzia mexicana - Mexican poppy	NS
Lupinus sparsiflorus - Arizona lupine	S
Orthocarpus purpurascens - Owl's clover	NS

VS = very successful
S = successful
NS = not successful

According to a study published in June, 1980, inundation for a period of only a few days had a dramatic impact on desert perennials at Cave Buttes Dam. This impact can be categorized as 1) total mortality, 2) partial survival, in which plants were partially destroyed but resprouted from the base, and 3) total survival.

Total Mortality: includes all lowland shrubs and cacti.

Cercidium microphyllum - Foothill palo verde
Larrea divaricata - Cresote bush
Ambrosia deltoidea - Triangle leaf bursage

Encelia farinosa - Brittlebush
Krameria grayi - White ratany
Opuntia acanthocarpa - Buckhorn cholla
Echinocereus englemannii - Hedgehog cactus

Partial Survival: mostly from basal resprouting

Cercidium floridum - Blue palo verde
Prosopis velutina - Mesquite
Lycium andersonnii - Wolfberry
Baccharis glutinosa - Seep willow
Olneya tesota - Ironwood
Carnegiea gigantea - Saguaro (only if inundated no more than about one foot deep)

Total Survival

Acacia greggii - Catclaw acacia
Celtis reticulata - Hackberry
Morus alba - Mulberry
Zizyphus obtusifolia - Graythorn

Other experience has indicated an ability to withstand inundation in the following species:

Parkinsonia aculeata - Mexican palo verde
Atriplex spp. - Saltbush
Most grasses and forbs

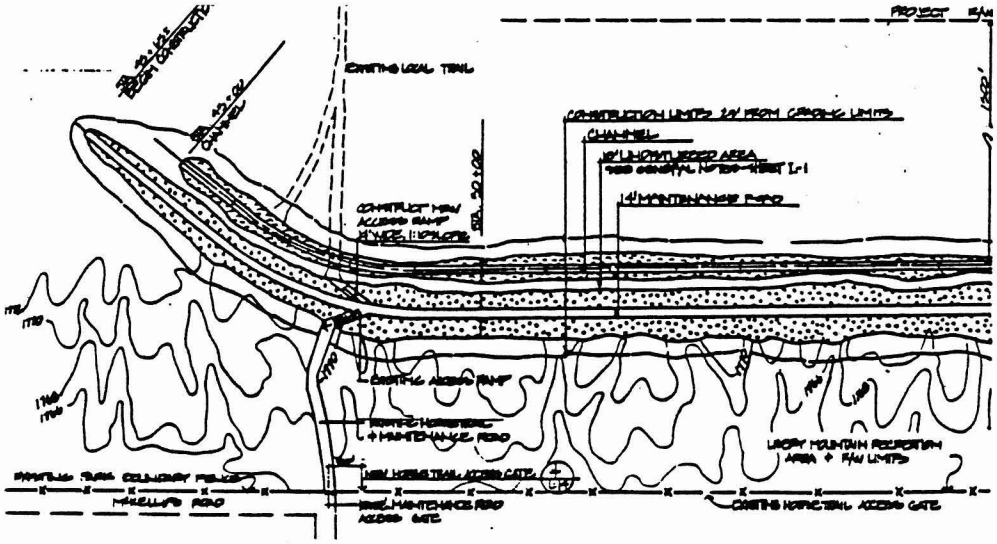
If inundation is more prolonged, a higher mortality rate will be seen in all categories. A more rapid reduction in size of the flood control pool will result in higher survival rates.

Maricopa County Parks and Recreation

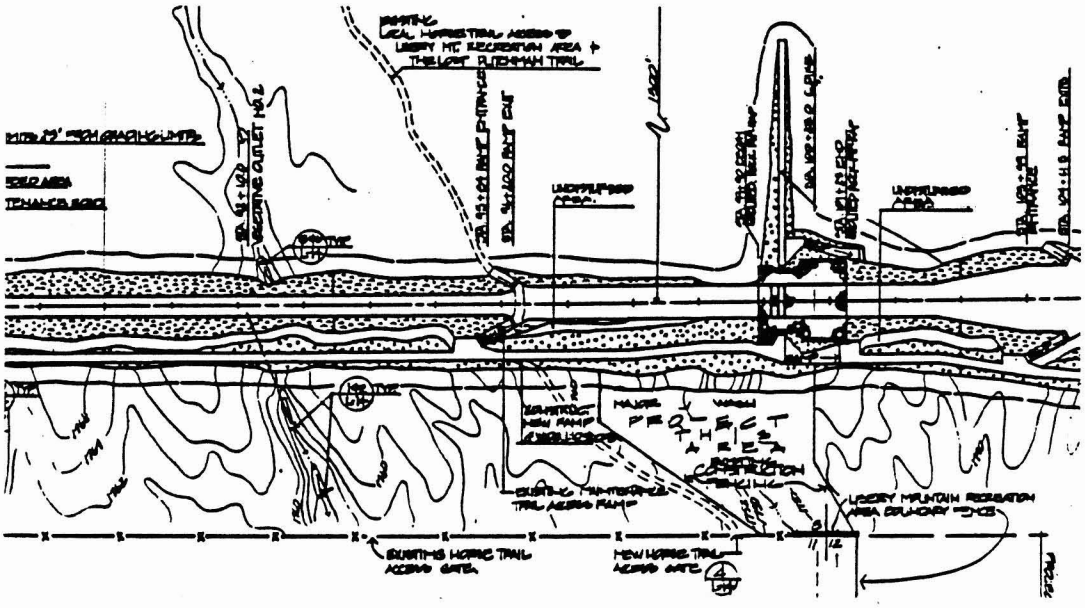
Coordination with the Maricopa County Parks and Recreation Department was required to facilitate trail access across flood control structures into Usery Mountain Recreation Area. A total of 5 access gates through the park boundary fence will be provided. Two of these are existing. Ramps will be provided to facilitate access across structures. Location of access routes was determined by location of existing trails, and location of trails proposed by the Master Plan for Usery Mountain Recreation Area. Figs. 2 and 3.

Maricopa County Department of Transportation

Two major roadway projects are planned for the vicinity of the project area. The Red Mountain Parkway will connect Apache Junction with Phoenix across northern Mesa and Tempe. A portion of this road runs adjacent to and south of Pass Mountain Diversion, and crosses Pass Mountain Outlet via a bridge. The revegetated Pass Mountain Diversion will help mitigate the road's impact on Usery Mountain Recreation



See Drawing L-1



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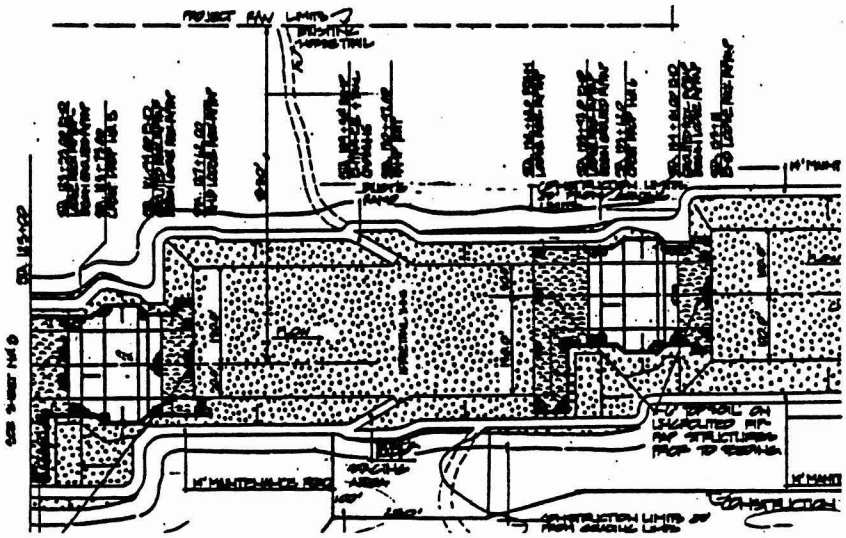
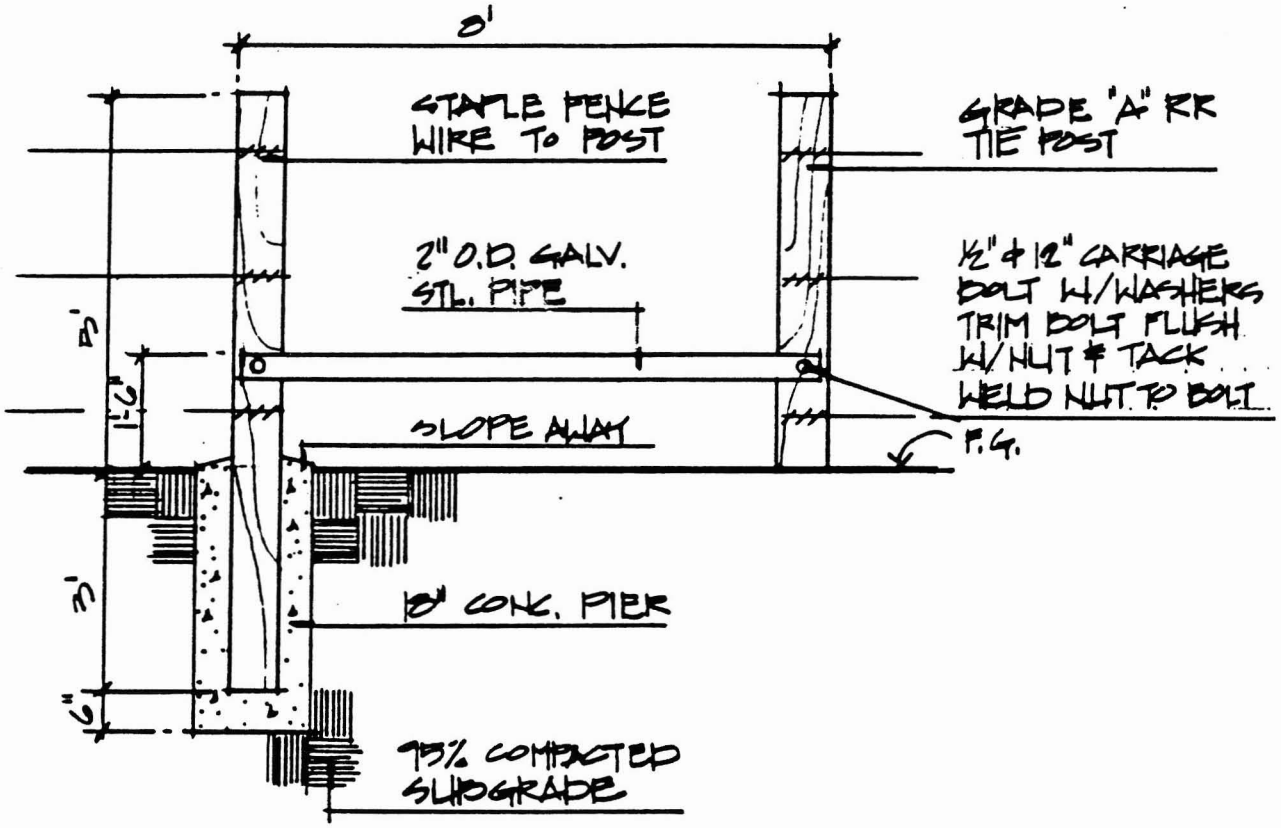


See Drawing L-4

HORSE TRAIL ACCESS LOCATIONS

Figure 2



4 Horse Gate

SCALE: 3/8" = 1'-0"

HORSE ACCESS GATE

Figure 3

mitigate the road's impact on Usery Mountain Recreation Area. Construction is expected to take place between the years 2000 and 2005. Long range transportation plans call for widening Ellsworth Road to 4 lanes. Construction is not expected until about 2015.

The intersection of Ellsworth and Brown Roads is an area where container plantings will be used to screen views of Signal Butte Floodway. Traffic safety considerations preclude the placement of plant material in areas where views of cross traffic are blocked. Because the intersection is controlled by a 4-way stop, shorter sight distance requirements are necessary. An allowance for visibility 100 feet from the intersection from the point at which a car stops was used in the development of planting plans. No obstructions will be placed between 18 inches and 5 feet above grade within the sight distance visibility triangle.

Consultants

The availability and cost of seed for various species were obtained form local seed suppliers. Information regarding suitability and cost of application of various seeding mulching methods was generated from meetings and phone conversations with representatives of Hubbs Brothers Seed Company and Western Seed Company. The following costs were developed for use on this project:

*	Soil preparation (ripping or chiseling)	$ 100/acre
*	Seed drilling	$1,325/acre
*	Dry seed broadcasting with straw mulch	$1,750/acre
*	Dry seed broadcasting with gravel mulch	$5,225/acre

Three methods of concrete coloring were investigated. Two of these are surface stain treatments, while the other involves integral color pigments which are added to the concrete prior to pouring. Eonite is an oxidizing chemical which can be applied to rock or concrete to produce a weathered appearance. Kemiko is an acid based stain for use on concrete. The following is a comparison of the properties of each stain:

Eonite	Kemiko
* uniform color	* camouflaged, non-uniform appearance
* will not penetrate concrete sealer, requires pre-treatment (either acid etch or sandblast)	* penetrates concrete sealers
* requires application of sealer	* requires removal of residue and application of sealer
* cost: $.34/sq. ft. (two coats) plus pretreatment	* cost: $.98/sq.ft.

A meeting with W. Gerald Matlock of the Irrigation and Water Management Institute, University of Arizona, was held to discuss microcatchment techniques for use in revegetation. Methods suggested included:

1. Retention berms 8 to 12 inches in height to trap runoff downslope of structures.
2. Use of a land imprinter could reduce the potential for wind erosion on roughened soil surfaces.
3. Runoff is a resource. Don't allow concentration of runoff. Direct it into planted areas and keep flow velocity as slow as possible.
4. Remove and stockpile topsoil for use on structure slopes.

On Site Meetings

A meeting was held with John York, SCS biologist, to discuss non-irrigated revegetation techniques as they apply to this project. The key points covered include:

1. Concentration of soil moisture is the key to successful revegetation without irrigation. Soil moisture concentrates at the lower portion of slopes with vegetation becomming established there first. Some methods of increasing plant available soil moisture include collector ditches at the bases of slopes, dozer basins, boulder pockets and tilling soil to create a roughened surface.
2. Vegetative outlets are not sized hydraulically--they only release "some" water into downstream washes. For vegetative outlets to function reliably, there must be positive flow into the inlet. Some form of soil stabilization is required at the inlet to reduce siltation. Slow the flow downstream of the outlet to increase runoff infiltration and soil moisture. A grouted basin at the outlet can provide water for wildlife as well as helping to prevent erosion.
3. Check dams have been proven successful in enhancing vegetation in area washes. Pay careful attention to the design of details and specifications for this and similar items to prevent overly complicated plan interpretations by construction cost estimators.
4. There is no need to clear the entire right-of-way. Carefully evaluate the areas needed for construction and access. Fence all areas not required for construction and access, and impose penalties on the contractor for damage to these areas. Limiting unnecessary destruction of native vegetation will reduce the cost of mitigating environmental impacts caused by construction of this project.

5. Adding color to concrete and grouted structures will reduce their visual impact. Use colors to match those of adjacent undisturbed soils.
6. Preserving islands of undisturbed vegetation within the FRS borrow pit will provide seed sources to aid in revegetation.

Field Reconnaisance Data

Inventory of Existing Vegetation

As discussed in the Landscape Resources Report, the vegetation occurring in the project area is typical of the Palo Verde-Bursage-Saguaro Association of the Arizona Upland Subdivision of the Sonoran Desertscrub. An inventory of the project area species elements and their relative densities was conducted to help determine seed mix components and application rates. The following list groups plants by growth form and includes notes regarding their frequency of occurance and preferred habitat, if any.

Trees

Acacia greggii - Catclaw acacia: occasional, along washes.
Cercidium floridum - Blue palo verde: occasional, along washes.
C. microphyllum - Foothill palo verde: dominant tree species, abundant along washes and on interfluves.
Olneya tesota - Ironwood: common in interfluves and along washes.
Prosopis juliflora var. velutina - Mesquite: common along washes and lower moist habitats.

Shrubs

Ambrosia ambrosiodes - Canyon ragweed: occasional along and in washes.
A. deltoidea - Triangle leaf bursage: dominant understory plant throughout project area.
Atriplex canescens - Four wing saltbush: occasional on interfluves.
Baccharis sarothroides - Desert broom: common along roadways and on disturbed soils.
Calliandra eriophylla - Fairy duster: occasional on rocky soils.
Celtis pallida - Desert hackberry: occasional along washes.
Dyssodia sp. - Dyssodia (probably D. acerosa): common on gravelly flats.
Encelia farinosa - Brittlebush: common throughout project area, becoming dominant on rocky slopes.
Ephedra trifurca - Mormon tea: occasional on interfluves.
Happlopappus tenuisecta - Burroweed: common on gravelly flats and interfluves.
Jatropha cardiophylla - Limber bush: occasional beneath trees and large shrubs.

Justicia californica - Desert honeysuckle: occasional mainly on interfluves.
Krameria grayi - White ratany: common to occasional on interfluves.
Larrea divaricata - Creosote bush: common to occasional throughout project area.
Lycium berlandieri - Wolfberry: occasional on sandy or silty soils.
Psilostrophe cooperi - Paper daisy: occasional on interfluves and disturbed areas.
Simmondsia chinensis - Jojoba: common throughout project area.
Zinnia acerosa - Desert zinnia: common on interfluves.
Zizyphus obtusifolia - Graythorn: occasional throughout project area.

Cacti and Succulents

Carnegiea gigantea - Saguaro: common on rocky soils.
Echinocereus engelmannii - Hedgehog cactus: occasional on rocky soils on interfluves.
Ferocactus wislizenii - Barrel cactus: common on rocky soils on interfluves.
Fouquieria splendens - Ocotillo: common to occasional on interfluves.
Mammillaria microcarpa - Fish hook pin cushion: occasional on interfluves, under shrubs or trees.
Opuntia bigelovii - Teddybear cholla: occasional in stands on rocky southerly oriented slopes.
O. fulgida - Chainfruit cholla: common on interfluves.
O. pheacantha major - Prickly pear: common to occasional.
O.p. discata - Engelmann prickly pear: common on interfluves.
O. spinosior - Cane cholla: occasional on interfluves.
O. versicolor - Staghorn cholla: occasional on interfluves.

Grasses and Forbes

Note: the following are found throughout the project area. Inventory was taken during winter season. Summer annuals are assumed to be typical of the area.

Amsinckia tessellata - Fiddleneck.
Argemone corymbosa - Prickly poppy.
Aristida spp. - Three awn
Baileya multiradiata - Desert marigold.
Bouteloua spp. - Grama grass.
Bromus rubens - Red brome.
Calycoseris wrightii - White tackstem.
Descurainia spp. - Tansy mustard.
Erigeron divergens - Fleabane daisy.
Eriogonum spp. - Buckwheat.
Erodium cicutarium - Filaree.
Eschscholzia californica - California poppy.
Euphorbia polycarpa - Prostrate spurge.
Isomeris arborea - Bladderpod.

Lupinus spp. - Lupine.
Muhlenbergia porteri - Bush muhly.
Orthocarpus purpurascens - Owl clover.
Penstemon eatonii - Firecracker penstemon.
P. palmeri - Palmer penstemon.
Plantago insularis - Indian wheat.
Salvia columberiae - Chia.
Schismus spp. - Mediterranean grass.
Sphaeralcea spp. - Globe mallow.
Sporobulos airoides - Alkali sacaton.

Land Use

Present land use in the project area consists of low density residential and undeveloped park land. Residential development is expected to increase in the area, although it is expected to remain at a low density. The area's present rural character is expected to remain relatively unchanged.

Existing Conditions on Signal Butte Floodway

The right-of-way for this structure has been completely cleared and will require extensive revegetation. Seven vegetative outlets have been constructed across the floodway. Four of these, located along the earthen channel, are siphons. It is unknown whether these will carry water across the floodway at any time except during major storm events. The outlets should be monitored to determine at what point they begin to flow. In order to maintain vegetation along existing channels below the floodway, a 10 to 25 year storm event should cause water to flow in the channels. Should this not occur, reconstruction of the outlets should be considered. An alternative to reconstruction would be to channel runoff from the right-of-way into the washes.

The remaining three vegetative outlets consist of an 8 inch iron pipe spanning the concrete channel and running through the dikes. Some problems exist at the inlets. Two inlets are perched above the flowline of the adjacent wash and are conducting little or no water across the channel. The other inlet is lower than the adjacent wash flowline and is becoming clogged with silt.

Existing Conditions on the Remainder of the Site

Pass Mountain Diversion and Outlet will be constructed within a portion of Usery Mountain Recreation Area which has been set aside as a natural area. This area consists of relatively undisturbed Sonoran desert vegetation. Preservation of this unique resource will help maintain the visual quality of the project area.

Summary of Criteria & Design Recommendations

SUMMARY OF CRITERIA AND DESIGN RECOMMENDATIONS

Project Goals

The goals of this project are to mitigate the impact of the flood control structures on the environment and to rehabilitate the landscape using landscape architectural solutions, thereby restoring the landscape to healthy condition and useful capacity. Landscape rehabilitation treatments have been developed in response to two key elements of this study. These are 1) priority areas for landscape rehabilitation as identified by the visual analysis, and 2) a set of objectives designed to achieve the stated goals of this project.

Landscape Treatment Priorities

In the Visual Analysis portion of the Landscape Resources Report, priority areas requiring special landscape design attention were defined. The analysis involved identification, rating and mapping of visual resource quality (VRQ), landscape use (LU) and visibility (VIS) within a project boundary extending 2000 feet outside of the right of way. The highest priority within each category is as follows:

1. VRQ3 - Landscapes which are unique, distinctive or provide diversity. Areas of VRQ3 include the Usery Mountain Recreation Area and the slopes of hills in the area.

2. LU3 - Identifies land uses which are unique or locally important. These include the Usery Mountain Recreation Area, hill slopes and washes containing significant riparian vegetation.

3. VIS3 - These are areas which are estimated to have many viewers, especially those with high expectations such as residents or tourists, as well as having foreground views. Areas identified as VIS3 are those visible from local roads or trails and houses within 1000 feet of a flood control structure, and the Usery Mountain Recreation Area.

Discussion of Priorities

An overlay analysis of the three categories identified the spatial extent of the treatment priorities within the study area. The portions of the flood control structures which lie within areas designated as high priority are the Pass

Mountain Diversion and Outlet, the north slope of the FRS, the FRS basin and the portions of Signal Butte Floodway adjacent to residences, roads and major washes. All of the remaining structures lie within areas designated as medium priority. No areas were designated as having a low priority. High priority areas will recieve treatments designed for that specific area to mitigate a specific impact, i.e., the reshaping of the FRS basin. All other areas will recieve more uniformly applied treatments designed to reduce visibility and erosion.

Landscape Treatments for High Priority Areas

1. Preserve existing vegetation in and adjacent to highly visible areas. Negotiate an agreement with the general contractor to avoid entering the 18 foot undisturbed strip at the Pass Mountain Diversion except as absolutely necessary for construction access. Areas so required should be designated prior to commencing construction. Provide construction fencing at especially significant stands of native vegetation to protect and retain them for visual screening.

2. Provide mounding and variable slope grading to reduce the visual contrast of the structure with the surrounding terrain in the most highly visible areas.

3. Shape the FRS basin to resemble a natural depression. Preserve existing vegetation within 50 feet of the centerlines of designated washes. This will help to break up the large expanse of denuded area and to provide a seed source to aid revegetation. Fig. 5

4. Provide texture on highly visible structure slopes by applying gravel mulch. Fig. 6

5. Enhance riparian vegetation with the use of retarding basins and check dams. Fig. 7 and 8.

6. Apply a chemical surface stain to existing concrete structures adjacent to road crossings to reduce contrast with surrounding soil color.

7. Install container plantings to screen views from road crossings. Figs. 9 and 10.

Landscape Rehabilitation Objectives

1. Preserve Existing Vegetation.

Limiting the disturbance of vegetation in areas not required

for access or construction may be the most significant accomplishment of this project.

Recommendations

A. Delineate and enforce strict construction limits to protect as much existing vegetation as possible. Staking and flagging should be provided at all clearing and grubbing limits prior to any construction operations. Especially sensitive or critical areas should be fenced with a single strand of smooth wire on T-posts. The contractor should be held liable for the cost of rehabilitating any vegetation or soil disturbed outside these limits.

B. Existing vegetation along major watercourses in the FRS basin should be preserved to provide seed sources to aid the reestablishment of vegetation in the basin. Delineate and mark with flagging as described above an area 50 feet either side of the centerline of the wash to be protected.

2. Reduce Visual Impact of Structures.

Flood control structures have a large scale and strong linearity foreign to the existing landscape. The visual impact of these forms can be ameliorated by modifying their surfaces to imitate natural contours, by softening and rounding their angular appearance, by encouraging plants to grow in front of them to provide screening, and by using textures and colors in concrete structures which match those of the adjacent soils.

It is imperative that grading modifications be accomplished during the construction of the structures because of cost-effectiveness, efficiency, and the immediate mitigation of the visual impact of the structures. This treatment should be regarded as intrinsic to the structures' form and not cosmetic treatment.

Recommendations

A. Vary the side slopes of the diversion structure and the flood retention structure to reflect and blend with the surrounding contours. Select areas to recieve this treatment based on priority for landscape rehabilitation. Ensure that structure slopes do not extend beyond the right-of-way line. This work should be accomplished during and as part of the structure construction operations.

B. Grade smooth transitions between slopes to reduce the angularity of the structures.

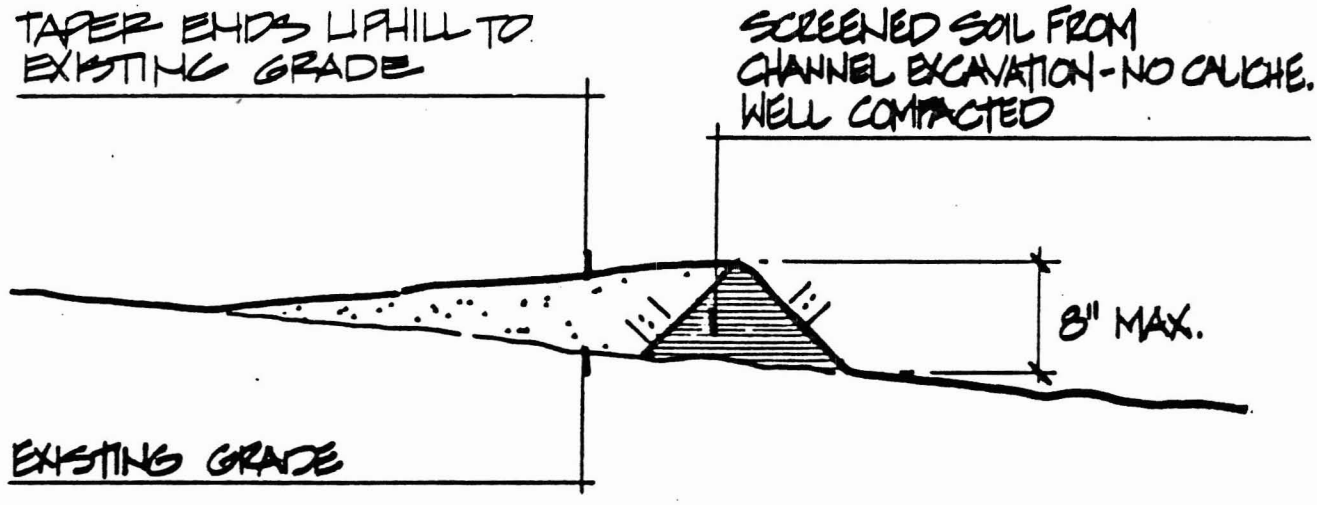
C. Screen the structures by installing retention berms to trap water run off from the structure slopes, thereby enhancing vegetative growth. Retention berms can be installed as part of operations and maintenance by the local sponsor. Fig. 4

D. Treat new concrete and grouted structures with integral color pigment to match the surrounding soils.

E. Treat selected existing concrete and grouted structures with stain or paint. Paint has a short life and it requires higher preparation, application, and maintenance costs. Several brands of stains are available, and it is recommended they be tested and compared to determine the ease of preparation and application, durability, cost, and resulting color. Select the structures to be treated based on landscape rehabilitation priority.

F. Grade the FRS borrow pit to create the appearance of a natural basin. The borrow pit should be ripped and left in a rough condition to provide better conditions for seed germination. Fig. 5

G. Grade spoil and waste fill areas to reflect surrounding terrain. This work will be performed by the local sponsor as part of operations and maintenance.



LOCATE AT MAJOR TREE & SHRUB GROUPS AS DIRECTED BY THE ENGINEER

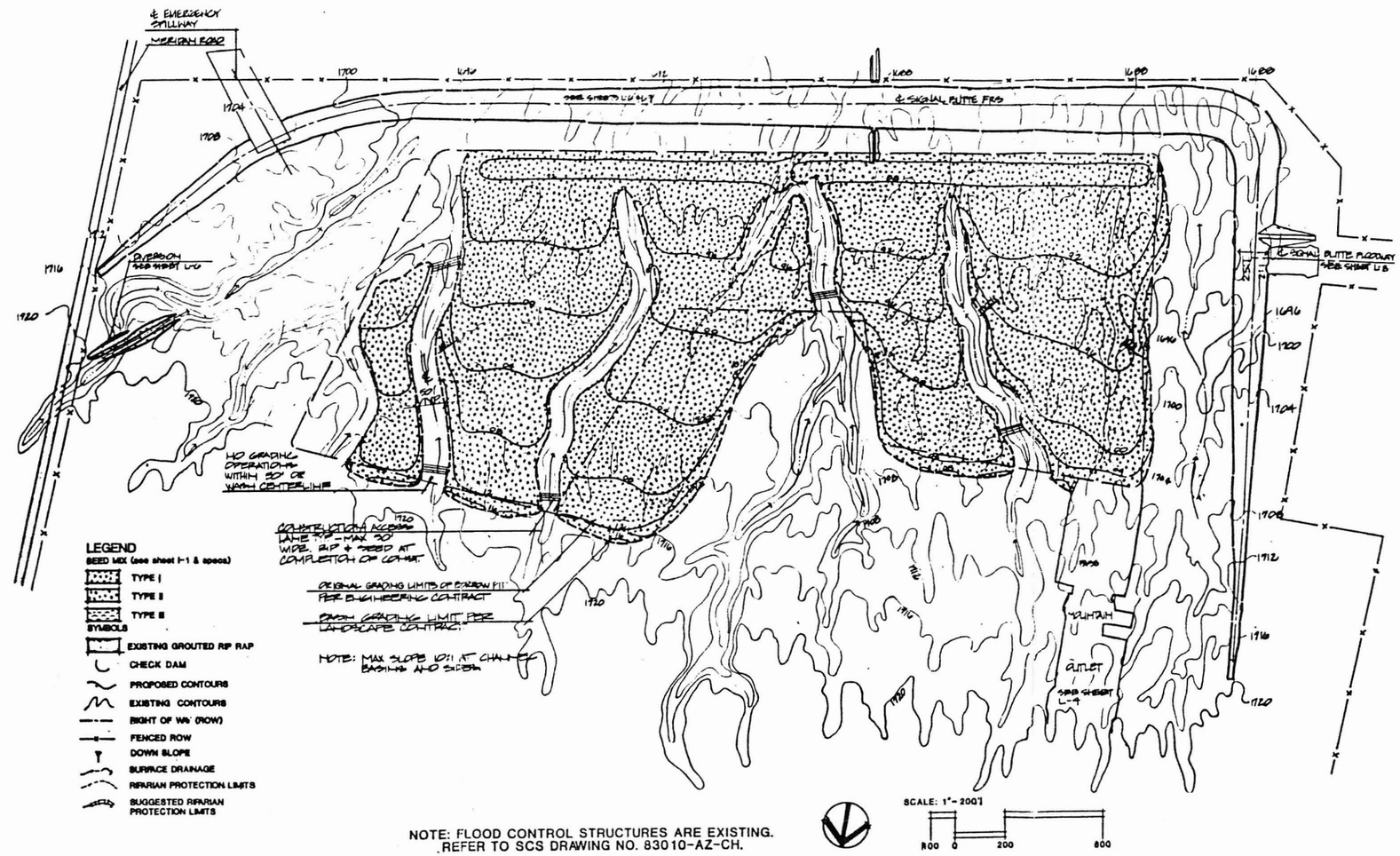
TO BE INSTALLED DURING OPERATIONS & MAINTENANCE.

3 Water Retention Berm

NOT TO SCALE

RETENTION BERM

Figure 4



FRS BORROW PIT

Figure 5

3. Replant Disturbed Areas With Vegetation Indigenous to the Project Area.

To promote visual continuity and consistency with the surrounding ecosystem, plant selection is based on an inventory of existing vegetation species and their population densities. The following are general criteria for the selection of plants and seed mixes.

The following criteria were used in the selection of seed mixes for specific areas of the project.

Seed Mix I: General right-of-way revegetation.

A. Reestablish species found in areas adjacent to the right-of-way.

B. Use seed rates which approximate the existing species densities and proportions.

C. Recommended seed list:

Cercidium microphyllum - Foothill palo verde
Ambrosia deltoides - Triangle-leaf bursage
Encelia farinosa - Brittlebush
Aristida purpurea - Purple three awn
Bouteloua eriopoda - Black grama
Schismus barbatus - Mediterranean grass
Sphaeralcea ambigua - Globe mallow

Seed mix II: Structure side slopes, Pass Mountain Outlet and the FRS Borrow Pit.

A. Use no large rooted plants which could weaken structural integrity of the dike structures.

B. Use grasses to preclude potential erosion damage.

C. Recommended seed list:

Atriplex canescens - Four wing salt bush
Encelia farinosa - Brittlebush
Ambrosia deltoides - Triangle-leaf bursage
Schismus barbatus - Mediterranean grass
Bouteloua eriopoda - Black grama
Sphaeralcea ambigua - Globe mallow

Seed mix III: Earthen channel banks

A. Limit hydraulic resistance.

B. Preclude potential erosion damage.

C. Recommended seed list:

Bouteloua eriopoda - Black grama
Aristida purpurea - Purple three awn
Schismus barbatus - Mediterranean grass
Sphaeralcea ambigua - Globe mallow

A number of seed mix application methods were evaluated for possible use on this project. Methods were analyzed in terms of cost, controllability, and suitability to project conditions. The aerial broadcast method was employed on the Spook Hill Project. It is most suitable for covering large areas with a single seed mix. Because of the necessity to employ different mixes for different conditions and desired effects, aerial broadcast was not deemed suitable for use due to difficulties in control of application.

Hydromulching is most useful on erodable slopes and areas with difficult access. It is a two step process. The first application consists of a slurry of seed, fertilizer and mulch, followed by a second application of mulch with a muciloid tackifier. This method is the most costly, and does not ensure good contact between seeds and the soil.

Dry seeding, in which seed is mechanically distributed without mulch, fertilizer and tackifer, is suited to areas where the soil surface has been left roughened. This method can be used with either a straw or gravel mulch.

Seed drilling is useful in flatter areas. A range drill is used to punch the seed into the seed bed, insuring better seed contact with the soil.

The following seed mix application methods are recommended for use on this project:

A. Seed Drilling. The seed bed will be prepared by ripping or chiseling and will be left in a roughened condition. Seed will then be applied using a range drill. This method will be used on all right of way flats and in the FRS borrow pit. Depth bands and packer wheels should be fitted on the range drill. This will ensure placement of seed at the optimal depth and provide good seed/soil contact.

B. Dry Seeding. The seed bed is prepared as for seed drilling. Seed is applied by broadcasting. Straw mulch is then spread over the seedbed and crimped to secure in place. Straw mulch will not be applied to areas where seed is applied over rock mulch. This

method will be used on structure and channel slopes.

Recommendations

A. Select plant species for their soil erosion control potential.

B. Use species indigenous to the project area.

C. If seed for indigenous species cannot be obtained, use another member of its genus having similar characteristics.

D. Consider as native the introduced species which have naturalized in the area.

E. Use plants which exist in similar habitats in the area, yet are not found in the project area.

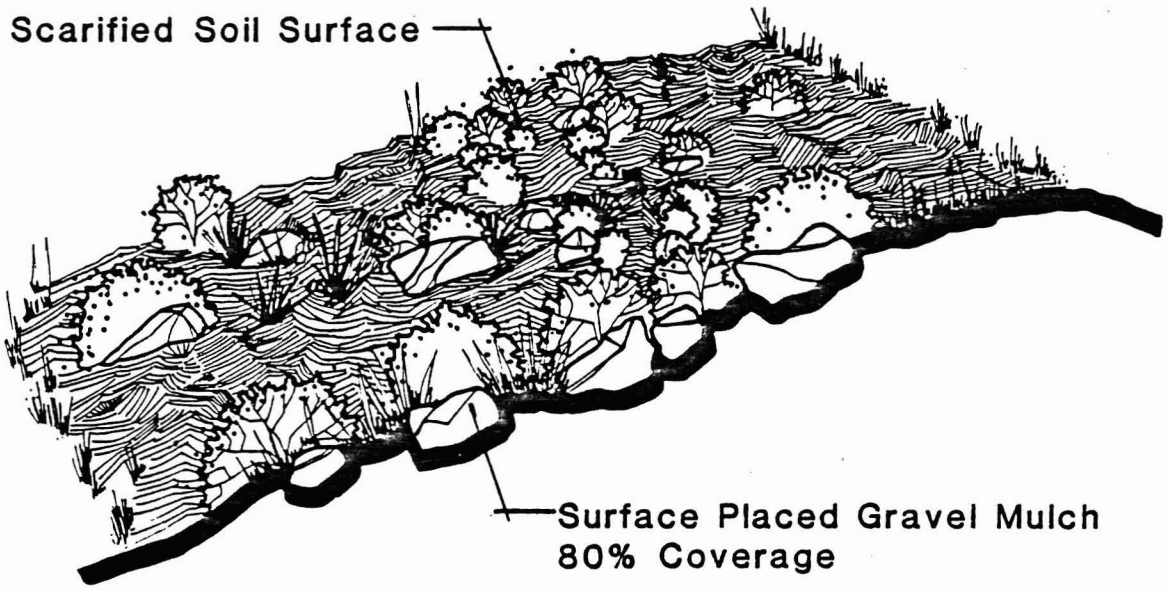
F. Boost normal application rates of seed in areas of most critical soil moisture levels to compensate for not using irrigation.

G. Conduct seeding operations between October 15 and March 15 to take advantage of favorable moisture and temperature conditions prevalent during the winter season.

H. Four mulch materials are recommended for use on this project. Wood fiber cellulose mulch, which has been nitrogen stabilized, is in common use and has proven cost effective on all types of projects. Milorganite, a sewage sludge by-product, should also be considered for use on this project because it provides nutrients in addition to having a moisture retentive capacity. Wood fiber and Milorganite are best for use in hydromulching. Mulches for dry seeding include straw and pit run gravel. Straw is a low cost material which is readily available. Pit run gravel varies in size from fines to 15 inch boulders. This material can be spread at a coverage rate of about 80%, and is a low cost method of creating boulder pockets, Fig. 6. Dry seeding operations should be done prior to application of straw mulch, or after application of gravel mulch.

I. A landscape establishment/maintenance period of 90 days from date of final acceptance by SCS is recommended. The landscape contractor will be required to provide all labor and materials,

including seed, container plants, topsoil, water, herbicides and other chemicals necessary to promote plant establishment. He should also provide and guarantee a minimum stand of plants on seeded areas, repair and reseed areas showing erosion damage due to poor seed germination, and check and maintain all retention berms, vegetative outlet basins and check dams. Inspections should be made every 30 days to ensure timely compliance with these requirements.



BOULDER POCKETS

Figure 6

4. Create Soil and Hydrologic Conditions Promoting Plant Establishment without Supplemental Irrigation.

Because supplementary irrigation will not be used to aid in reestablishing vegetation on this project, conservation of soil moisture and creation of microenvironments suitable for seed germination are critical. The retention of surface runoff has been identified as the key to the success of non-irrigated revegetation. The following techniques are recommended to help assure successful revegetation of the areas affected by construction of the flood control structures.

Recommendations

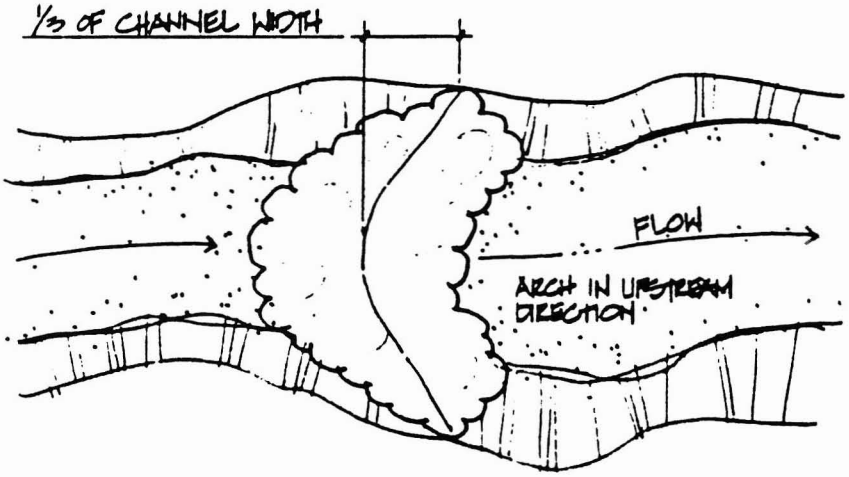
A. Soil surface modification techniques provide microcatchments to enhance soil moisture and improve tilth for seed establishment. All right-of-way flats on the Signal Butte Floodway, the bottom of the Pass Mountain Outlet and the FRS Borrow Pit should be ripped or chiseled and left in a roughened condition to help in the establishment of vegetation.

B. The application of pit run gravel mulch to structure slopes is recommended to provide microcatchments as described above. The mulch will trap some runoff, increasing soil moisture, and provide shady microhabitats to aid seed germination. Gravel mulch also provides texture, helping to reduce the visual impact of the structure.

C. Spoil material collected in the channels can be removed for mounding on the floodway right-of-way and for use as topsoil, subject to the results of soil analysis. This work can be performed by the local sponsor as part of operations and maintenance.

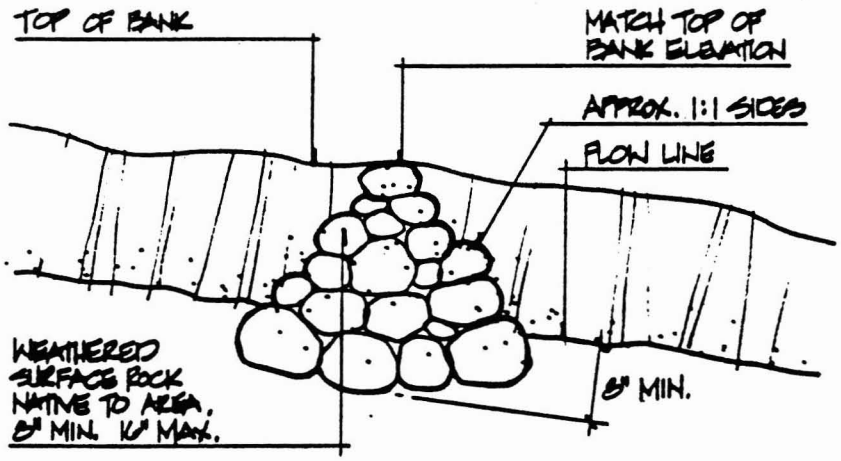
D. All soil material to be used in seedbed preparation will be tested and analyzed for pH, nitrate-nitrogen, phosphorous, total salts, free lime content, percent clay and percent gravel. To facilitate the establishment of vegetation on non-grouted rip-rap, a 6 inch layer of soil will be applied to these structures. This will fill some of the voids in the rip-rap and help aid in seed germination.

E. Topsoil, where applied to structure slopes, should



1 Check Dam – Plan

NOT TO SCALE



2 Check Dam – Section

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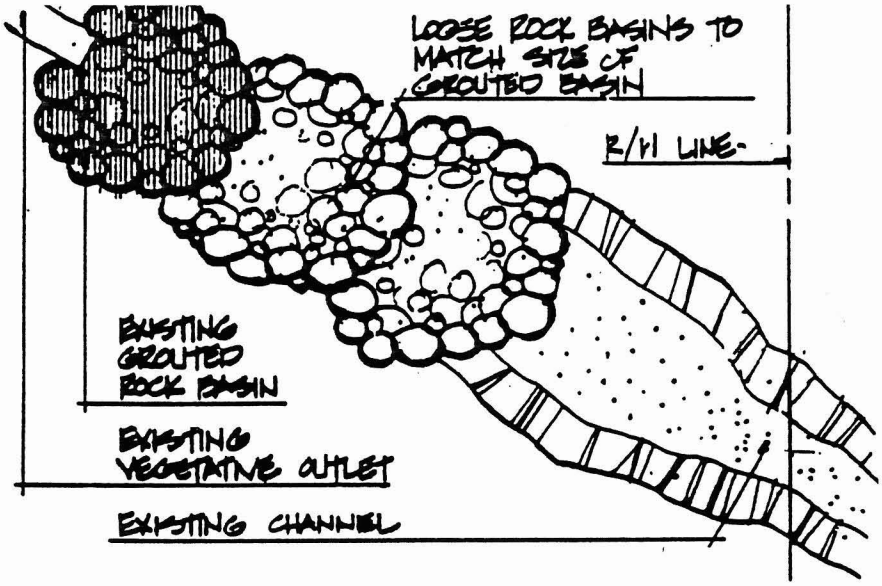
CHECK DAMS

Figure 7



5 Vegetative Outlet Retarding Basins – Plan

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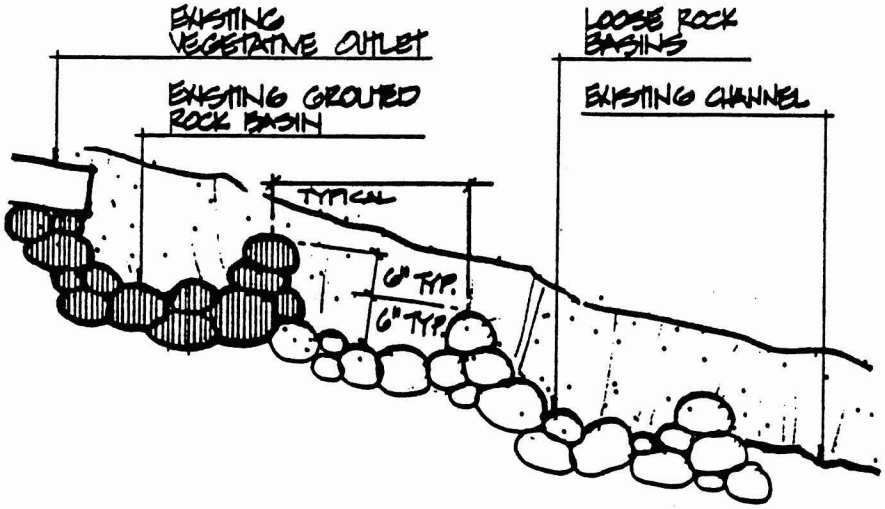

6 Vegetative Outlet Retarding Basins – Section

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RETARDING BASINS

Figure 8

6. Maintain Wildlife Habitat and Enhance Potential Open Space where Possible.

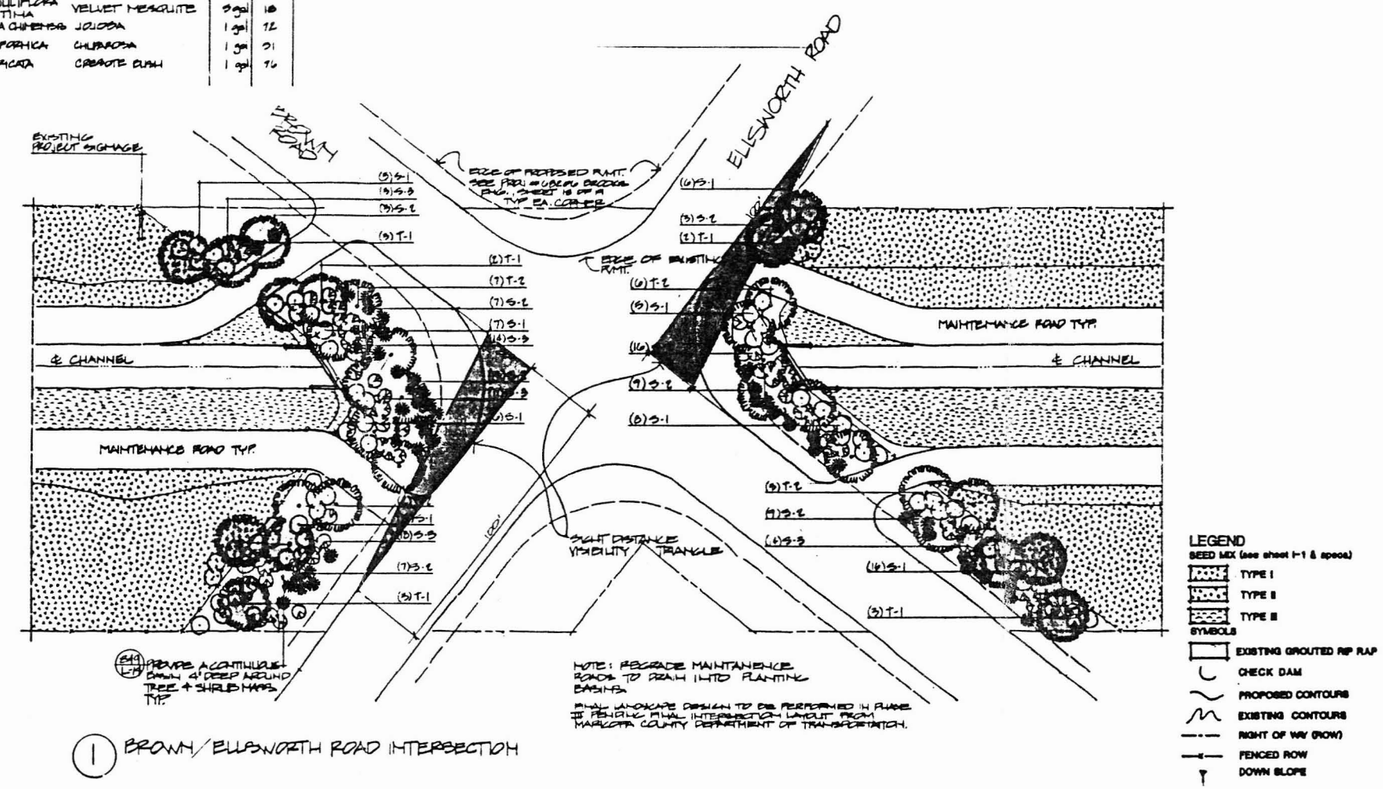
Construction of flood control projects in rural or undeveloped areas removes large amounts of food and cover producing plants from animal habitats. Revegetation efforts will help restore essential food and cover.

Construction of flood control structures hampers free and safe movement of wildlife across the structures. Maintenance access ramps will help provide the necessary access across the structures.

Revegetation of the project right-of-way will provide a permanent greenbelt through the project area. This is an especially important feature in an area which is undergoing rapid urbanization.

PLANT MATERIALS SCHEDULE

SYMBOL	KEY	BOTANICAL NAME	COMMON NAME	SIZE	QUAN.
	T-1	CERCIDIUM FLORIDUM	BLUE PALO VERDE	5 gal	10
	T-2	PROSOPIS JULIFLORA VAR. VELUTINA	VELVET MESQUITE	5 gal	18
	S-1	SIMMONDSIA CHINENSIS	JOJOBA	1 gal	12
	S-2	JUSTICA CALIFORNICA	CHUPAROSA	1 gal	21
	S-3	LARREA DIVARICATA	CREOSOTE BUSH	1 gal	16



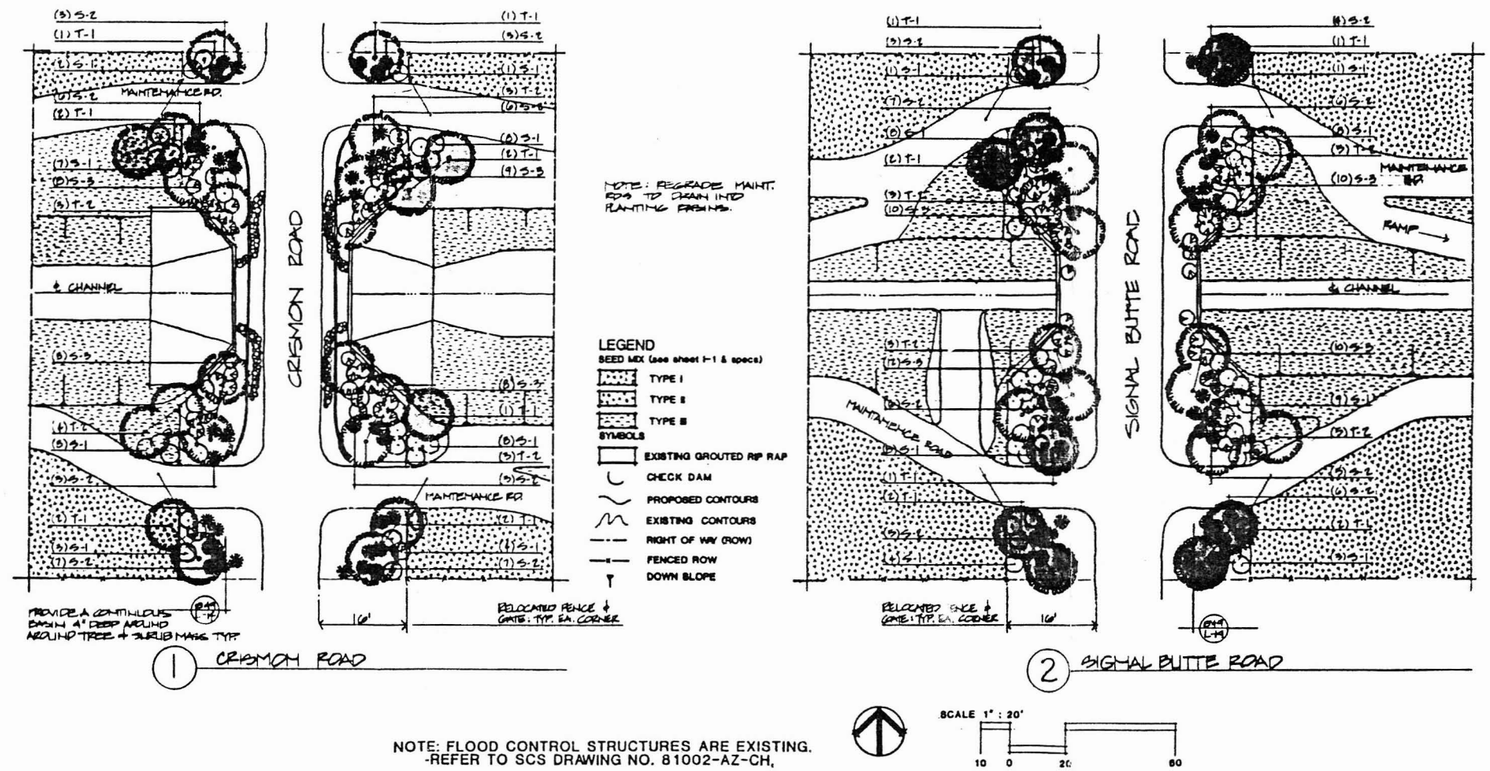
NOTE: FLOOD CONTROL STRUCTURES ARE EXISTING.
REFER TO SCS DRAWING NO. 81002-AZ-CH.

ROAD CROSSING - ELLSWORTH & BROWN

Figure 9

PLANT MATERIALS SCHEDULE

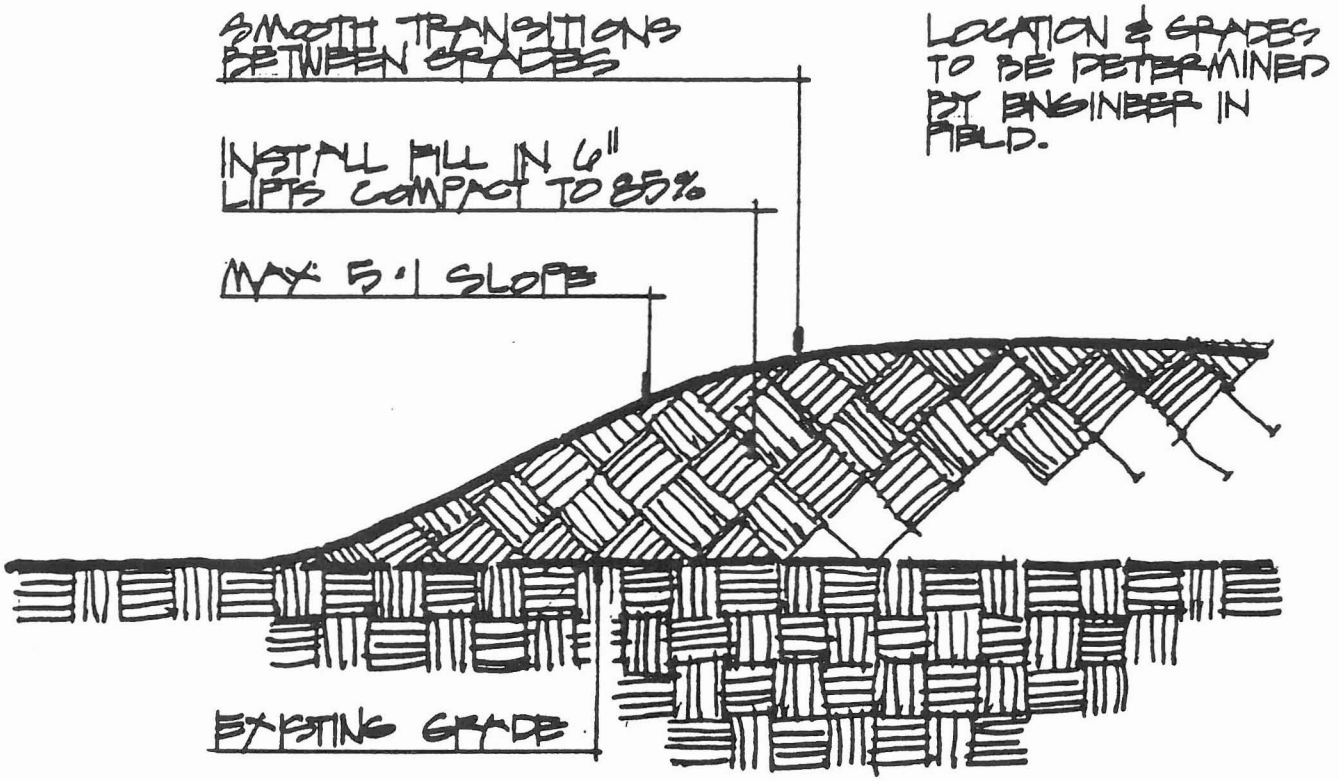
SYMBOL	KEY	BOTANICAL NAME	COMMON NAME	(1) SIZE	(1) QUAN	(2) SIZE	(2) QUAN
	T-1	CERCIDIUM FLORIDUM	BLUE PALO VERDE	5 gal	11	5 gal	9
	T-2	PROSOPIS JULIFLORA VAR. VELUTINA	VELVET MESQUITE	5 gal	13	5 gal	16
	S-1	SIMMONDSIA CHINENSIS	JOJOBA	1 gal	41	1 gal	42
	S-2	JUSTICIA CALIFORNICA	CHUPAROSA	1 gal	50	1 gal	42
	S-3	LARREA DIVARICATA	CREOSOTE BUSH	1 gal	33	1 gal	42



NOTE: FLOOD CONTROL STRUCTURES ARE EXISTING.
-REFER TO SCS DRAWING NO. 81002-AZ-CH,

ROAD CROSSING - CRISMON & SIGNAL BUTTE

Figure 10



10 Landscape Berm

NOT TO SCALE

SIGNAL BUTTE FLOODWAY LANDSCAPE BERM

Figure 11

Appendix

BID SCHEDULE & COST ESTIMATE

ITEM NO	SPEC NO	WORK OR MATERIAL	QUANTITY	UNIT	PRICE	TOTAL
A. BASE BID						
1	8	Mobilization	1	LS		$ 13,500
2	6	Seeding:				
		*Ripping & Seed Drilling	124.4	AC	1425	177,298
		*Dry Seeding & Straw Mulching	53.6	AC	1750	93,730
3		Container Plants				
		5 Gal	80	EA	31	2,480
		1 Gal	437	EA	12	5,244
4		6" to 10" Salt River Rock	13,600	SF	0.25	3,400
5		Landscaping Establishment 90 days	1	LS		8,500
6	91	Fence Relocation Signal Butte & Crimson Rds.	1	LS		3,500
7		Gates: Horse Access	3	EA	250	750
8		Trail Access Ramps	2	EA	500	1,000
9		Check Dams	10	EA	350	3,500
10		Retarding Basins	7	EA	350	2,450
11		Landscape Grading	73	AC	1,600	116,800
12		Rock Mulch (50% coverage in Pass Mtn. Outlet	8.3	AC	2,250	18,675
13		Swale at conc. channel	5850	LF	0.16	936
14		Concrete Staining	72,000	SF	1.10	79,200
		TOTAL BASE BID				530,963

B. ADDITIVE ALTERNATES

1	Rock Mulch at Priority Areas	3.22	AC	3,764	12,120
2	Rock Mulch on all Structure Slopes	30.65	AC	3,764	115,367

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