

Preliminary Identification  
of  
Artificial Recharge Sites  
and  
Test Drilling Plan

San Geronio Pass Water Agency  
Groundwater Storage Project  
Beaumont Storage Unit

Memorandum Report

Prepared By

BOYLE ENGINEERING CORPORATION

September 8, 1989



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## PROGRAM DESCRIPTION

Several sites have been identified as potential candidates for artificial recharge locations within the Beaumont Storage Unit. This memorandum report describes those sites and presents a preliminary assessment of the appropriate recharge technologies for each site. A recommended test drilling plan is also specified to provide necessary information on the hydrogeologic characteristics of the project area.

This plan for investigating the subsurface geology will provide data on the extent of confining clay layers that may inhibit recharge of the main production aquifer.

This report recommends that Test Well 1 be drilled at this time to provide supporting information for use in correlation with existing well logs. It is also recommended that this drill hole be completed as a test well for subsequent injection testing. This information will provide the basis for the reconnaissance investigation report for groundwater storage in the Beaumont Storage Unit. The reconnaissance investigation report will provide the basis for recommending the detailed feasibility investigation that will be required to develop the project report and CEQA documentation that will permit the phased construction program for the groundwater storage project.

The enclosed plate shows the location of the candidate recharge sites with probable recharge technology, required water delivery facilities, existing wells and recommended test wells.

There are four potential water sources currently under consideration for replenishment of the Beaumont Storage Unit. These are local runoff from Noble and Little San Gorgonio Creeks, imported exchange water from Mill Creek, imported State Project Water, and local reclaimed water. It is planned that all four of these sources of water will be utilized to recharge the basin in the identified project area.

A preliminary identification of the types of delivery facilities for each site is also presented.

Description of Potential Artificial Recharge Sites

*RCFCWCD In-Channel Spreading Basin Sites.* Two sites, which may be among the easiest to develop for artificial recharge, are located within Riverside County Flood Control and Water Conservation District (RCFCWCD) flood control channels. One is the Noble Creek channel and the other is the Little San Geronio Creek channel. Both are located between Cherry Valley Boulevard and Orchard Avenue. The only facilities required for these sites are impoundment dikes and cleaning facilities. Source water would be native runoff from the creeks or water piped from the proposed Reach II Untreated Feeder System through distribution pipelines up Live Oak Avenue and across Orchard Street to the upstream ends of the channels. A pumping station would be required to boost imported water to these facilities during periods when the delivery pipeline is flowing near design capacity. Percolation tests will be performed during the feasibility study to help determine their capacity to recharge water to the basin.

*RCFCWCD Right of Way Recharge Well Site.* This site is located within the RCFCWCD flood control channel right-of-way along Noble Creek between Cherry Valley Boulevard and Brookside Avenue. Recharge wells would be used at this site. Due to clogging in recharge wells the water would have to be treated prior to injection, but only to a level appropriate for injection. The level of treatment would vary depending on the source of water. Local stream runoff may require desilting, flocculation, sedimentation, and filtration treatment processes to sustain reasonable injection runs. Mill Creek water and State project water may only require flocculation and filtration or direct filtration alone.

The treatment requirements for injection of these supplies will require treatability investigations. It is anticipated that these will include bench scale, pilot plant and demonstration level testing to determine cost effective and appropriate treatment process trains for injection of these supplies.

The spacing of the recharge wells and location of the treatment facilities will be investigated in the feasibility study. The spacing of the wells is dependent upon their capacity and the characteristics of the aquifers in which water is recharged. The preliminary test well and injection test will provide valuable information for estimating the capacity of the wells and the spacing required between wells. One concept for the location of the treatment facilities is to construct desilting, flocculation and filtration basins within the right-of-way. Another alternative is to find a separate site for the treatment facilities and pipe treated water to the wells.

*Little San Gorgonio Creek Existing Spreading Grounds.* This site is located north of Orchard Street and is owned by the Beaumont-Cherry Valley Water District (BCVWD). The site has been identified as the location for a new debris basin by RCFCWCD. In the related joint SGPWA and RCFCWCD flood control and water conservation study, the size requirement for the debris basin and its location will be determined. If an alternative debris dam and basin site is available, the existing spreading basins may be better utilized for groundwater recharge. Another concern with this site is the location of Banning Fault, postulated to extend through this site. This fault possibly may impede the flow of subsurface water into the Beaumont Storage Unit if spread to far up Little San Gorgonio Creek. One of the goals of the subsurface investigation will be to more precisely locate the fault and determine if it is potential impediment to groundwater storage in this location.

*Beaumont-Cherry Valley Water District Property Spreading Basins.* BCVWD owns property adjacent to Little San Gorgonio Creek below Orchard Street and Vineland Street. The site has potential as a location for spreading basins.

*Riverside County Building Services Spreading Basins.* The County of Riverside owns property in the southeast corner of section 28. This property is the site of a sand and gravel operation. By finding an alternative sand and gravel site for the County this area could be made available for surface spreading if this method is found feasible for this location. BCVWD has a potential sand and gravel site which may be suitable for a swap. Water from the untreated feeder could be conveyed to the site via the Mountain View Storm Channel. Another potential source is storm runoff from the contributing watershed above the site.

#### Plan for Subsurface Investigation

In order to estimate the potential for recharging the Beaumont area groundwater basin, the subsurface geology must be investigated. The purpose of the investigation is to determine the existence and extent of any barriers to flow into the groundwater basin and to estimate the potential recharge capacity of injection wells. The plan is to drill up to six test/monitoring wells to explore the subsurface geology. The order of drilling is selected to investigate near the sites with the greatest potential for efficient recharge first. The lithology will be logged during drilling and electrical resistivity, specific conductance and caliper logs will be performed prior to installation of the casing. Cores will be pulled

through the indicated zones of clays for subsequent laboratory testing on permeability and gradation. The wells will be completed as monitoring wells. The location of the proposed test wells are shown on the attached plate, numbered according to the proposed drilling order.

Test Well No. 1 is located just upstream of the recharge well site and downstream of the in-channel spreading basin sites. The logging of this well will provide information on the thickness of the permeable and impermeable layers. This information will be used to determine the suitability of the area to surface recharge and make a preliminary estimate of the recharge capacity of an injection well. An injection test will be performed utilizing BCVWD supplies to verify the preliminary estimates and provide a more reliable estimate of the recharge capacity of a full size injection well. The well will be completed as a monitoring well that would later be used during actual full operations to monitor water levels and quality for the purpose of evaluating the effectiveness of recharging water using the in-channel spreading basins.

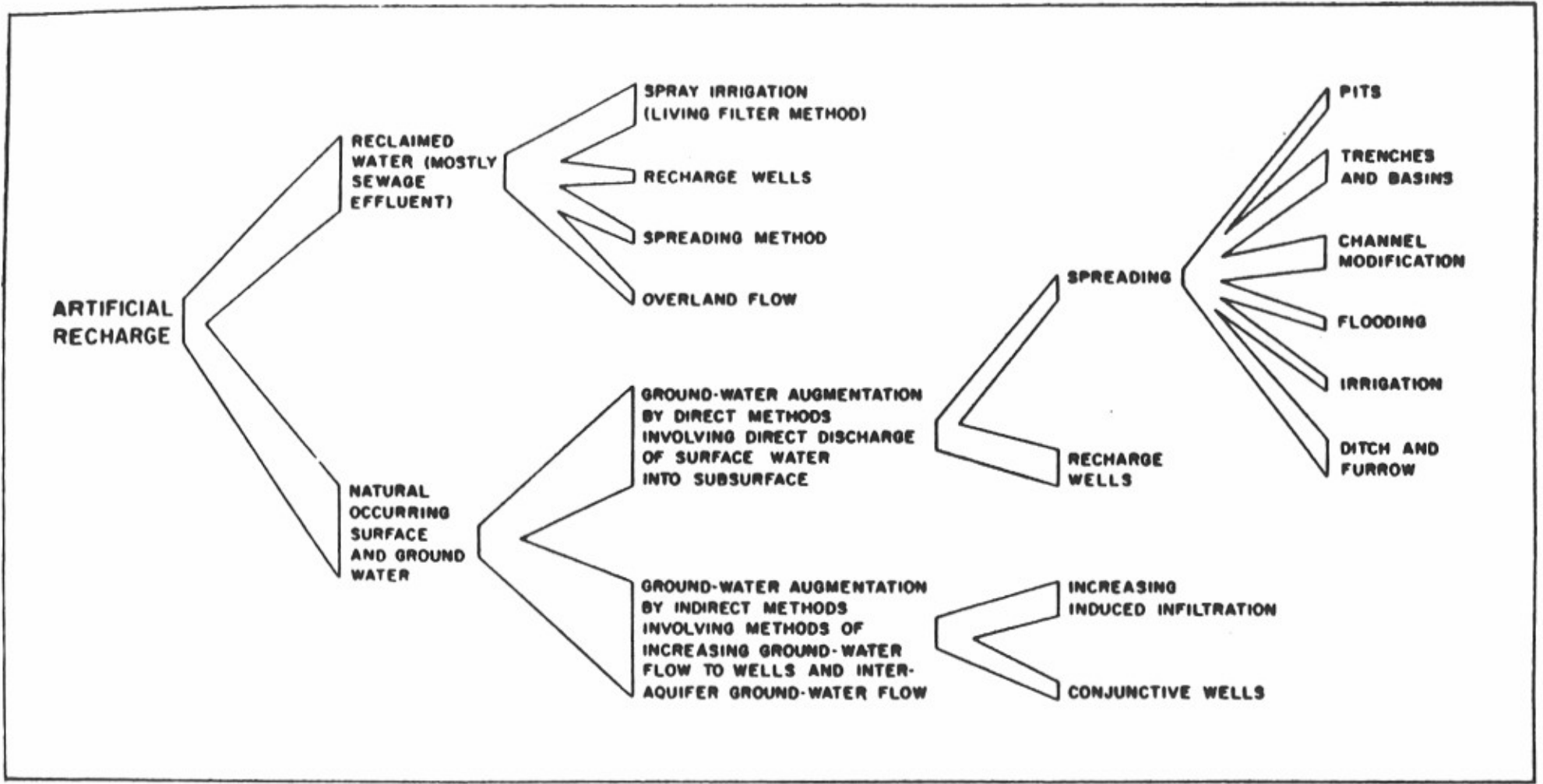
Test Well No. 2 is located in the middle of the existing spreading grounds. Test holes were drilled at this location in the past but were not drilled deep enough to either prove or disprove the existence of a fault down gradient of the location. The deep hole bottomed out approximately forty feet above the groundwater level in the main Beaumont Storage Unit, thus leaving open the question of whether the main aquifer extends up to this location. If there is evidence that the fault is up gradient of this location then completion of this well as a monitoring well will allow testing of the effectiveness of the spreading basins up-gradient in recharging the Beaumont area groundwater basin. A geological survey of the area will be performed prior to the drilling to identify any evidence of the fault in the area of the spreading grounds.

Test Well No. 3 is located down gradient of the BCVWD Property spreading basins site. This well will provide information on the existence of impermeable layers which may inhibit surface spreading at this site. As a monitoring well it would provide information as to the effectiveness of spreading at the site during percolation tests.

Test Well No. 4 is located on the up-stream end of the Noble Creek In-Channel spreading basins site. This well will provide information on the potential for surface spreading. It will also provide a means for testing the potential for spreading further upstream in Noble Creek.

Test Well No. 5 is located on the down-stream end of the recharge well site along Noble Creek. This well will provide information on the extent of the permeable layers identified with Test Well No. 1. As a monitoring well it provide an indication of the effectiveness of the recharge wells.

Test Well No. 6 is located in the southwest corner of the County of Riverside Building Services site. This well will provide information on the existence of layers which may inhibit surface spreading at the site. As a monitoring well it will provide an indication of the effectiveness of recharging the basin by spreading water at this site.



Flow Chart Showing Principal Methods of Artificial Recharge (Motts, et al., 1983)

## Some Factors to Consider for Artificial Recharge

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1. Availability of waste water
  2. Quantity of source water available
  3. Quality of source water available
  4. Resulting water quality (reactions with native water and aquifer materials)
  5. Clogging potential
  6. Underground storage space available
  7. Depth to underground storage space
  8. Transmission characteristics
  9. Topography/applicable methods (injection or infiltration)
  10. Legal/institutional constraints
  11. Costs
  12. Cultural/social considerations
- 

## Steps for a Site Specific Selection Process

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1. Outline the needs of the area and define the goals which will meet these needs.
  2. Identify site/sites available in the area.
  3. Identify factors pertinent to artificial recharge as a management option in reference to the area's needs.
  4. Perform importance weighting of factors relative to their significance in meeting the needs of the area.
  5. Define the actions necessary to evaluate each factor (pilot studies, laboratory tests, literature research).
  6. Arrange actions consecutively (some may be concurrent) in order of significance of the factors they evaluate.
  7. Perform actions to determine viability of artificial recharge at each site and eliminate sites as factors are encountered which indicate the site cannot support artificial recharge at the necessary level.
  8. Decide whether or not artificial recharge is applicable to meet the needs of the area at a minimum of one identified site.
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Factors Conducive to Favorable Artificial Recharge Operations by First-Level Approximation Methods (Motts, et al., 1983)

Hydrogeologic and Soils Factors Conducive to Favorable Artificial Recharge	Method Used for Determination of Artificial Recharge Factor
1. Soils and sediments of sufficient permeability to transmit recharged water to the zone of saturation and to prevent or retard clogging on a long-term basis	1. Study of geological and soils maps, generally coarse-grained stratified drift is covered by permeable soils such as the Hinkley Series and similar types.
2. A perennial source of surface water that is relatively silt-free and free from severe contamination, and provides sufficient surface flows in the dry weather months to prevent serious environmental problems resulting from excessive depletion of stream flows, down-stream loss of water supply, or drying up of important wetlands.	2. Determine size and area covered by stratified drift in recharge area.
3. Permeable sediments providing good hydrologic connection between artificial recharge site and well.	3. Character of stratified drift, coarse-grained drift generally has high permeability.
4. No confining beds between the ground surface and main zone of saturation.	4. Study of surficial geology to determine if lake beds or other confining beds are present. Generally, coarse-grained stratified drift has good hydrologic connections between surface and subsurface.
5. A zone of ground-water storage in the aquifer (such as a cone of depression) into which recharged water may be discharged. The thickness, extent, and hydrologic characteristics of the storage area are significant.	5. Determined from character of sediment penetrated by wells and analyses of existing geological maps. From aquifer characteristics, compute depth and extent of cone of depression from pumping wells.
6. Suitable geologic and geographic areas relatively free of development where artificial recharge methods could be utilized--such necessary structures as small diversion or check dams could be constructed.	6. Inspection of the most recent topographic maps for evidence of human development activities.

SAN GORGONIO PASS WATER AGENCY  
GROUND WATER STORAGE PROJECT  
TEST WELL PROJECT

DESCRIPTION

The test well will be located on Riverside Co. Flood Control and Water Conservation District property at the confluence of Noble Creek and Little San Gorgonio Creek adjacent to Cherry Valley Blvd. It is intended to provide subsurface hydrologic information which will assist the Agency in choosing the best method of ground water recharge in the area of the well. The two basic methods of recharge are surface spreading in stream channels or impoundments and underground injection through a well directly to the ground water. The test well is designed to penetrate the saturated zone to allow injection and to monitor the rate of mounding of the water. The formation samples and the geophysical logging will provide information on the existence of impermeable, subsurface strata that might inhibit the percolation of water from the surface to the water table below. The well can also be pumped or bailed to obtain water samples if desired.

The procedure for constructing the well is for the contractor to set up his mud rotary rig and drill approximately 100 ft. and install a 16" conductor pipe, grouted in place as a sanitary seal. A 6 to 8-inch pilot hole will be drilled to around 800 ft. or until the saturated zone is penetrated 50 ft. Core samples of the clay strata to evaluate formation permeability and formation samples of drill cuttings will be taken during this drilling. In addition a suite of geophysical logs will be made of the entire depth of the pilot hole. Cores will be sent to a laboratory for permeability testing and all samples will be sent for gradation analysis. The pilot hole will then be reamed to 12 3/4-inches in diameter. Based on the information collected during pilot hole drilling and logging the final depth and the amount of casing and well screen will be determined. When this is in the hole the selected gravel will be placed and a grout seal placed on top of the gravel to the surface. The well will be developed and disinfected. Wellhead facilities to protect the well casing from damage and unauthorized entry will be constructed.

At this time we estimate the total construction cost, including the well, laboratory and construction observation and administration fees to be \$130,000. The attached sheet contains a breakdown of these costs.



# Boyle Engineering Corporation

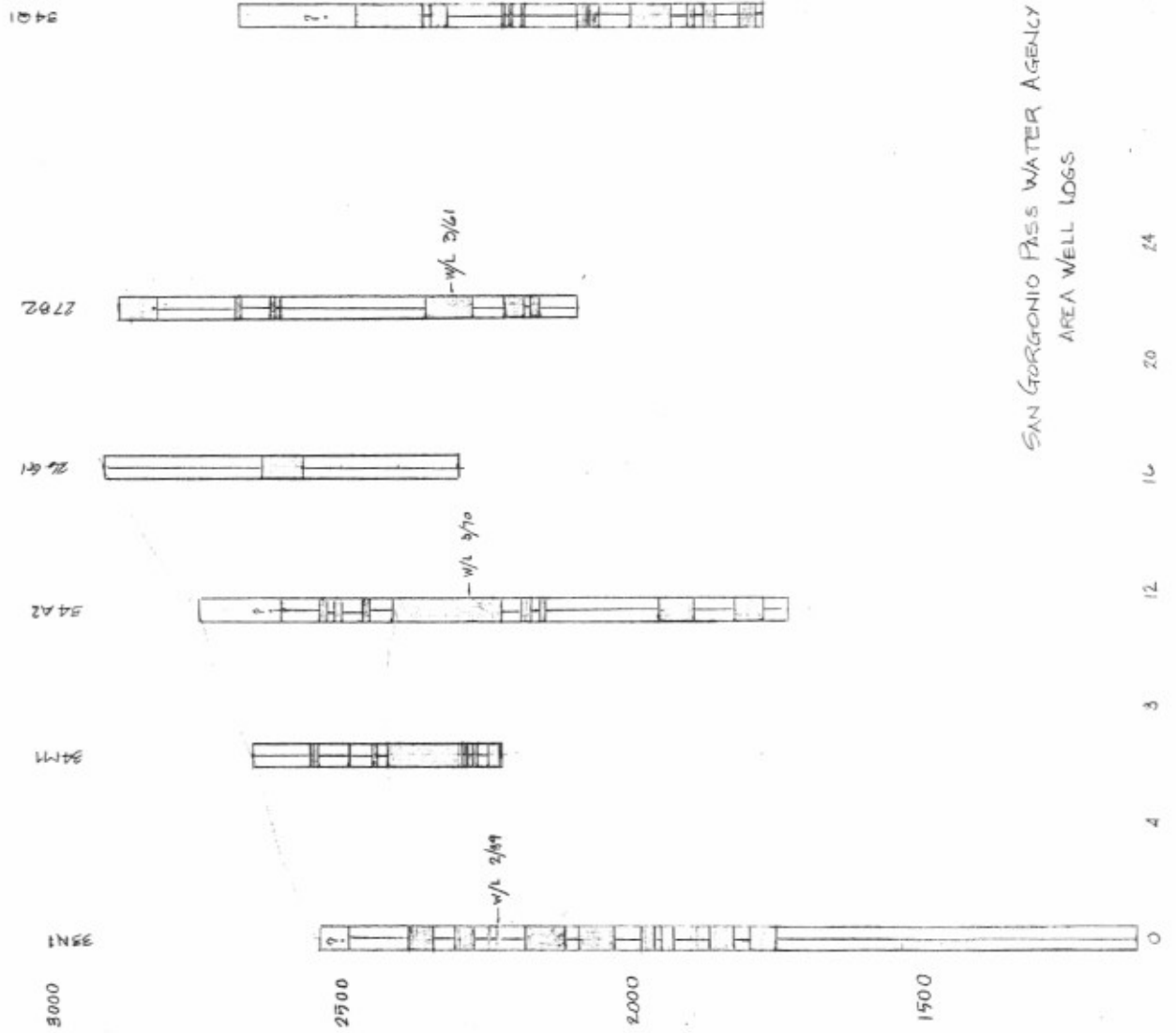
consulting engineers / architects

PROJECT SAN GORGONIO PASS W.A DATE 9-8-89

ACCOUNT # TEST WELL  
OC-527-102-01 BY MEF

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT COST	COST
1	MOBILIZATION - DEMOBILIZATION	LS	LS	LS	\$15,000
2	CONDUCTOR CASING	FT	100	100	10,000
3	PILOT HOLE	FT	800	18	14,400
4	GEOPHYSICAL LOGGING	LS	LS	LS	3,700
5	MONITORING WELL CASING/SCREEN	FT	800	15	12,000
6	GRAVEL PACK	CF	120	10	1,200
7	GROUT SEAL	CY	14	120	1,680
8	ALIGNMENT TEST	LS	LS	LS	500
9	WELL DEVELOPMENT	HR	8	115	920
10	WELL DISINFECTION	LS	LS	LS	400
11	WELL HEAD FACILITIES	LS	LS	LS	500
12	CORING	FT	150	34.50	5175
13	REAM PILOT HOLE	FT	800	20	16,000
	SUB TOTAL WELL				\$81,745
	15% CONTINGENCY				12,260
14	LABORATORY TESTING	LS	LS	LS	5,000
15	CONSTRUCTION ADMINISTRATION BY BEC	LS	LS	LS	30,500
	TOTAL				<u>\$129,505</u>

SAN GORGONIO PASS WATER AGENCY  
AREA WELL LOGS



NOT INCLUDED IN SCAN:

San Geronio Pass Water Agency

Preliminary Identification of Artificial Recharge Sites and Test Drilling  
Plan

Groundwater Storage Project  
Beaumont Storage Unit

24" x 36" Plate