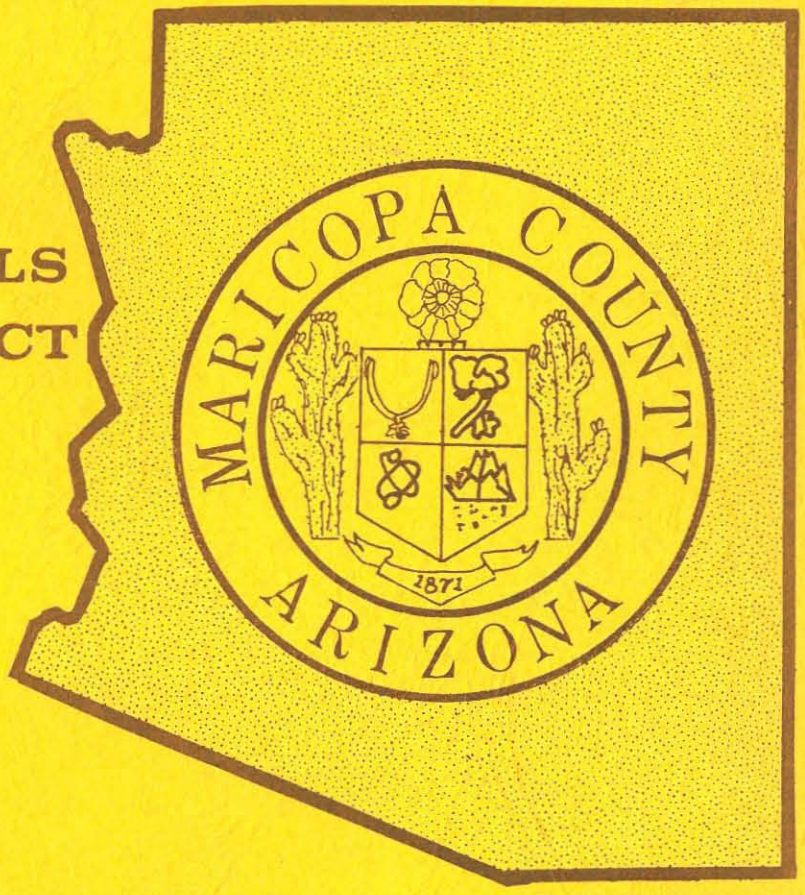
REPORT

AREA SANITARY SEWER STUDY

DESERT FOOTHILLS SANITARY DISTRICT



Carefree, Arizona 1972

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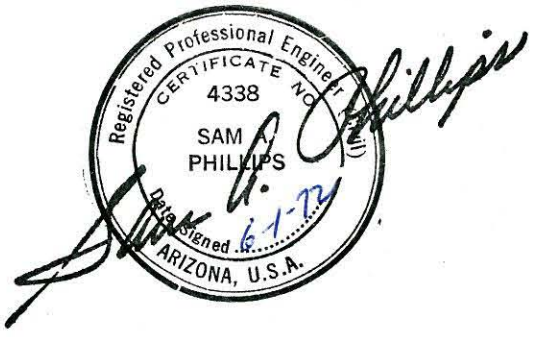

HENNINGSON, DURHAM & RICHARDSON
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Suite 1222
100 West Clarendon
Phoenix, Arizona 85013

June 1, 1972

Desert Foothills Sanitary District
Carefree, Arizona

Re: Area Sanitary Sewer Study & Report

Attn: Board of Directors

Gentlemen:

In accordance with the Engineering Agreement dated December 6, 1971 we are submitting herewith our report on the study of the sanitary sewer systems, both existing and proposed, for the Carefree area.

The conclusions and recommendations are summarized in the "Topical Summary" preceding the main body of this report.

This study was prepared with the specific needs and wishes of the Desert Foothills Sanitary District in mind. We appreciate the opportunity to serve the citizens of the Carefree area through this report. The report should provide the necessary information and data for the orderly expansion of existing wastewater collection and treatment systems, and for development of necessary new systems to properly serve the immediate and future development of the Carefree area.

Yours very truly,

HENNINGSON, DURHAM & RICHARDSON, INC. of ARIZONA

Sam A. Phillips, Vice President

SAP/kh

Registered Professional Engineer (Civil) No. 4338 SAM A. PHILLIPS Date Signed 6-1-72 ARIZONA, U.S.A.

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SECTION I.

TOPICAL SUMMARY

This report presents the results of the study and evaluation of the waste water collection and disposal requirements of the Carefree area. The study included an evaluation of the existing systems and development of plans for incorporating them into an expanded Sanitary District for operation and maintenance. In addition, the developed areas of Carefree were studied and plans developed for sewer service to those areas for which sewerage costs did not appear to be completely prohibitive.

Within the area studied, limits for expansion of the Desert Foothills Sanitary District were established. These limits were based on the evaluation of foreseeable need, assuming that present growth trends remain constant. Some of the development in the area consists of large lots (multiple acres) situated in very rough terrain and it is unlikely that these areas can be served economically by a central sewer system. Such areas were therefore deleted from the proposed District expansion.

Most of the development in the Carefree area was originally planned with the premise that individual sewage disposal systems would be used. Because of this many plats were laid out without sewer easements, and with no particular regard for drainage patterns. This has resulted, in some cases, in a necessity to acquire right-of-way along lot lines, or even across lots in order to obtain drainage. This is discussed in Section V.

The study area was divided into drainage areas and each separate area was studied on the basis of flow patterns, collection and treatment requirements, construction costs, and proportionate cost sharing. These are summarized in Section IV, Section VI and Tables I and II.

Recommendations for additions and modifications to existing systems and the estimated construction costs are detailed in Section V and VI. All of the construction costs are based on prevailing prices in effect as of the date of this report. Based on present inflationary trends, it can be expected that the estimated prices will increase between 8% and 10% per year.

COST SUMMARY

TOTAL LATERAL SEWER COSTS - - - - - - - - - -	$1,610,632.50
TOTAL TRUNK SEWER AND FORCE MAIN COSTS -	886,031.88
NEW WASTE WATER TREATMENT COSTS - - - - -	278,472.50
TOTAL CONSTRUCTION COSTS - - - - - - - - - - - - - - - - -	$2,775,136.88

SECTION II

INTRODUCTION

1. Background

The Carefree community is located in the general vicinity of the intersection of Scottsdale Road and Cave Creek Road, approximately twenty miles north of Scottsdale. The general development has been slanted mostly toward larger lots and exclusive, high quality construction. A great deal of emphasis has been placed on retaining the natural desert resort atmosphere.

Because of the nature of the terrain which is typical rugged desert with large boulder areas and underlying rock formations, sanitary waste disposal has become a problem. As the population density has increased, the problem has become more and more acute.

2. Purpose and Scope

The purpose of this report was to present the results of a study of the Carefree community area waste disposal requirements, and to make recommendations for the ultimate service of the area by sanitary sewers. The study also included the following general essential areas of information.

a. Description and location of all existing waste collection, treatment and disposal facilities.

b. Evaluation of necessary Sanitary District expansion.

c. Description and location of necessary property and easements for accomplishment of a workable sewerage system or systems to serve the area.

d. Outline of necessary costs for the required improvements, and their description.

e. Evaluation of funding procedures required for the project and preparation of a suggested time table for development of the project.

3. Report Area

Although the entire Cave Creek-Carefree area was considered, the Cave Creek community was eliminated from the study area primarily because of the distances involved; however, Cave Creek should be considered separately in any event, since the problems in that area are much different from those of the Carefree area.

Those areas north of Rawler Wash(also called Galloway Wash) and the extension of Sundance Trail were evaluated, but were not considered for detailed study or inclusion within the proposed Sanitary District expansion because the large acreage lots and deep washes would have required unfeasibly high construction costs for the small population served. The area studied in detail was confined to the developed portions on both sides of Stage Coach Pass, Scottsdale Road, Boulder Drive, Cave Creek Road and Carefree Drive. (See Plates No. 1 and 2.)

SECTION III

AREA DEVELOPMENT

1. Past Growth

The entire history of the Carefree area spans only a little over 15 years, and most of the significant development has occurred within the past ten years. Major development began near the Scottsdale Road, Cave Creek Road intersection and has spread mostly eastward to both the north and south of Cave Creek Road. Considerable residential development is clustered around the Desert Forest and Boulder Carefree Golf Courses. Some significant commercial development has occurred in the triangle formed by the intersection of Scottsdale and Cave Creek Roads. Growth in general has been steady and both residential and commercial construction has been of very high quality.

2. Future Growth

There is insufficient data available to make any statistically sound forecast of population growth. It is obvious, however, that the area has attracted an above average type of development and property values have soared. It appears probable that the rapid rate of growth seen in the past ten years will continue or even increase in the immediate future. This likelyhood would undoubtedly be even greater if the proposed sewer improvements become a reality.

SECTION IV.

AREA ANALYSIS

1. Discussion of Drainage Areas.

Due to the irregular topography of the Carefree Community District, the report area was separated into individual drainage areas, the boundaries of which followed existing natural drainage lines. By dividing the total project in this manner, a fair and equitable method for assessing properties within each contributing area can be obtained.

The individual areas are designated by numbers 1 through 10 on Plate 3 in the Appendix. In each of the areas indicated, a collection system has been established to convey the contributed waste flows to a central point, if one does not already exist.

AREA 1

This drainage area consists mainly of the "downtown" portion of Carefree near the Cave Creek Road, Scottsdale Road intersection. The area is served by an existing sewer system which delivers to a recently installed pumping station. The collected wastes are pumped to an existing Walker Process Waste Treatment Plant located near the Desert Forest Golf Club. (See Plate No. 1). The sanitary flows in this area are derived primarily from commercial establishments. The existing pump station is functioning properly and has more than adequate capacity for anticipated future flows.

AREA 2.

Area 2 comprises all of the Desert Foothills Sanitary District, and surrounds Area 1 on three sides. There are no existing sewers serving the area at this time. Approximately 60% of the anticipated flow is expected to be derived from residential units. The other 40% will be from commercial units not presently included in Area 1.

A complete sewer system to serve the area is shown on Plate 3, and in greater detail on Plate No. 6. It will be noted that most of the waste from the area will flow by gravity to points where it can enter the existing system in Area 1, however, the lots in the northeast corner will be served by a system draining to a proposed new pump station which will lift the wastes and deliver them to a manhole in the proposed sewer on Sundance Trail. This is necessary because of the lower elevation of the lots involved.

The sewer system shown on Plate No. 6 will be discussed in more detail in Section V under " Proposed Sewerage Systems".

AREA 3

This area is situated along the northern border of the proposed expanded Sanitary District and consists of all of Carefree Too and part of the Carefree Fore Subdivisions. There are no existing sewers in the area.

All of the sewers proposed to serve this area will drain by gravity to the new sewage treatment facility which will be located in Tract "A" of Carefree Too Subdivision See Plates No. 3 and 8. Units in this area are primarily residential.

AREA 4

This area is comprised of the remainder of Carefree Fore Subdivision and extends along the area north of the Desert Forest Golf Course. The area is bounded on the east by Pima Road. There are no sewers serving this area at the present time. The units are primarily residential.

There are two separate collection systems proposed to serve this area. The system serving the eastern half will drain by gravity directly to the existing Walker Process Waste Treatment Plant. The system serving the western half will drain to a new proposed pumping Station designated as Pump Station No. 4 (See Plate No. 3). The waste will be lifted and pumped into the existing Walker Process Treatment Plant.

AREA 5

This area lies along the north side of Cave Creek Road between Tranquil Trail and Pima Road. There are no sewers presently serving this area.

Most of the area is proposed to be served by a system paralleling the north side of Cave Creek which will deliver into the proposed Area 2 system. Several lots along Mule Train Road will be served by a short collection system which will deliver into the existing system in Area 6. (See Plate No. 3)

AREA 6

This area is immediately to the east of Carefree Inn Estates and is bounded on the east by Mule Train Road and on the north by Carefree Drive. See Plates No. 3 and 7. Most of the developable lots are either served or can be served by an existing collection system. The system delivers the collected waste water from the area to an existing pump station (No. 3) located in the northwest corner of the area. The collected wastes are lifted and delivered to the existing Walker Process Waste Water Treatment Plant.

AREA 7

This area is the largest of the drainage areas, extending completely across the center of the proposed Sanitary District area, mostly between Cave Creek Road and Stage Coach Pass. (See Plate No. 3). There are no existing sewers in Area 7.

The proposed sewage collection system to serve this area will provide drainage generally from the southeast to the northwest, and will deliver the collected wastes to a new pump station, No. 5 located on Lazy Burro Road just north of Holiday Lane. This pump station will lift the collected sewage and deliver it by force main to the proposed new waste water treatment plant in Tract "A". This system, when it is installed, will also receive the waste from the existing collection system in Area 7A.

AREA 7A.

This area consists of seven lots just west of Stage Coach Pass and Peaceful Place. The area is served by an existing collection system which delivers the waste water to a septic tank and tile field installation which is located on a portion of Lot 516. The existing system is difficult to evaluate, since septic tanks give very little evidence of trouble until they fail completely. The collection system appears to be adequately sized and in good condition. It is expected that when the sewerage system is installed to serve Area 7, the septic tank- tile field system will be abandoned and the system connected to the new sewer near Lot 523. (See Plate No. 3).

AREA 8

Area 8 consists of 17 lots and a portion of undeveloped land just west of Stage Coach Pass and north of Black Mountain Road. The 17 subdivision lots are served by an existing sewer system which flows by gravity to a septic tank and tile field system on Lot No. 658.

The sewer appears to be adequate, however the same comments apply to the septic tank and tile field system as were made for Area 7a.

It is recommended that this sytem be combined with Area 9 when sewers are installed in that Area, and the combined wastes lifted by a pump station to the waste water treatment plant located in Area 10. (See Plates No. 3 and 7.)

AREA 9

This is the area east of Stage Coach Pass and north of Black Mountain Road. The area is not served by sewers at the present time. The sewer along Stage Coach Pass is not accessible to this area because the lots are at a lower elevation and drainage is generally away from Stage Coach Pass. A collection system draining from north to south is proposed to collect the waste from the area and deliver it to a new pump station (No. 6) to be located in Lot No. 658. The combined waste water from Areas 8 and 9 will be lifted and delivered to the existing Defiance Waste Water Treatment Plant located in Area 10. (See Plate No. 3)

AREA 10

This is the area developed around the Boulders Carefree Golf Course just south of Stage Coach Pass and east of Scottsdale Road. This area has already been planned for sewer service in its entirety. Two separate sewerage systems are presently in operation to serve the Boulders Carefree Units 1 and 2 subdivision. There are two existing Defiance package type waste water treatment plants in operation. The plant serving Unit Two discharges treated waste water through a force main into a small lake used to irrigate the golf course. The effluent from the plant serving Unit One is discharged into an underground seepage bed system. The developers of the area have recently awarded contracts for the expansion of both waste water treatment plants to 40,000 gpd capacity. (See Plate No. 4)

Both of the Boulders Carefree systems appear to be adequate in size and in excellent operating condition. Both treatment plants were in service and operating well at the time of writing this report.

There appears to be more than adequate future capacity available to treat the collected wastes from Areas 8 and 9 in the Area 10 treatment plant system. Both of the treatment plants are modular in design and can be readily expanded.

2. Establishment of Trunk and Lateral Sewer Systems.

In order to insure fair and equitable distribution of costs to each property owner within a particular contributing area those portions of the proposed sewer system which should be classified as trunk sewers have been described. These trunks generally extend from the collection point to the point in the area upstream where lateral service from the lots may be connected. Before service to each of the areas can be developed the above mentioned trunk sewers must be installed.

All remaining branch lines in each area which have not been classed as trunks are designated to be lateral sewers. These sewers carry the sanitary flows from the individual lots to the trunk sewers.

3 Methods of Assessment

In analyzing the distribution of costs for the completed sewage facilities to be installed in the proposed Sanitary District, it is essential to develop a plan which will insure that each property owner is assessed his fair and just share .

It is reasonable to expect the property owner to pay the costs for his plumbing service line stubbed from the lateral sewer, and to share the costs for the lateral sewer system extended for service to his property and the trunk sewer system extended for connection to his lateral system. In addition, if the trunk flows require pumping facilities to deliver these flows to the waste water treatment facilities, the property owners should be required to share in the costs for these facilities as well.

The lateral systems include the individual service taps. Costs for the lateral systems are directly for the benefit of the property owner and, therefore, can be distributed on a unit cost basis.

The costs for the trunk system with any necessary pumping facilities, and the prorated share of cost for new waste treatment plant facilities should be assessed directly to the property owners on the basis of the proportion of area owned, and the probable rate of sewage flow. For this reason, costs per acre have been calculated in Table I based on these considerations.

SECTION V.

SEWERAGE SYSTEMS

A. EXISTING SEWER SYSTEMS

1. Discussion of Collection Systems

Several areas within the report boundary are served by existing sewer systems and provisions for waste water treatment facilities have been included. In each case, the existing sewer pipe systems are designed adequately for full development of the areas they serve. The pipe lines and manhole structures appear to be in good operating condition. These sewer systems are shown on Plates 4 through 7 in the Appendix.

2. Sewage Pumping Stations

All of the existing sewage pumping stations are of sufficient capacity to meet present requirements, and with a few modifications can be made to meet future requirements. The data for each is as follows:

Pump Station	Data
No. 1	Wet Well Capacity:Approximately 423 gal.
	Pumps-Gorman-Rupp Model T3A 3B 2 ea. 10 H.P. 1740 RPM 75 GPM @ 125' T.D.H.
	Pump Speed Variable to 2140 RPM
	Force Main- 4"

No. 3	Smith-Loveless 7'Diameter Station Pumps- 2 ea. 15 HP Model 482 250 GPM @ 80' TDH Force Main - 6"
Effluent- Walker Process Plant	Wet Well Capacity-Unknown-Est. 1000 gal. Pumps- 2 ea. Peerless 4" Model 2B Vertical Sewage 175 GPM @ Approx. 80' TDH Force Main - 6"
Effluent-Defiance Plant in Area 10	Wet Well Capacity-Approximately 1300 gal. Pumps- 2 ea. Peerless Centrifugal 5HP 3450 RPM 100 GPM @ 101 TDH Force Main- 6"

All of the existing pumping stations will be adapted to meet future flows of the District. This will be discussed in more detail in Part B of Section V of the report. Without exception the stations are in good operating condition and are functioning as designed.

3. Sewage Treatment Plants

Presently there are three facilities that provide primary and secondary waste treatment in the study area. The oldest treatment plant in length of service is located in Area 6. The plant is a circular steel structure manufactured by Walker-Process Corporation. According to the manufacturer's specifications, by the contact stablization process of treatment, this plant is capable of treating 100,000 gallons of sewage daily. It is approaching 10 years of age and is presently serving Areas 1 and 6 of the study area. The calculated flows from these areas indicate that the plant is processing approximately 50% of its total capacity. From visual inspection, the plant appears to require renovation work in order to permit it to function at its design capacity. Plant effluent is presently being pumped through a force main to the lake on the Desert Forest Golf Course where it is further used for irrigation and sprinkling purposes.

The other two facilities, located in Area 10, are expandable treatment plants manufactured by Defiance, Inc. These plants were installed, and are under contract for expansion, to serve both the existing and future flows of Area 10. Effluent from one plant is pumped via a force main to the lake on the Boulders Golf Course. The treated water is further used for irrigation and sprinkling purposes. The other plant discharges to an underground

seepage bed. The master plan for the area indicates that effluent from the expanded plants will also be pumped to the lake on the golf course and will be ultimately used for irrigation also.

B. PROPOSED SEWER SYSTEMS

1. Design of Sewer Pipe

Although detailed design of the proposed sewer pipe systems is beyond the scope of this report, there were some factors affecting pipe flow that had to be considered in order to achieve a functional system and to maintain estimated economic trench depths. The factors involved the pipe size, depth, slope, flow, and cleansing velocity .

In the design of gravity flow in pipes, the Manning Formula was used. It is as follows:

$$Q = A \times \frac{1.486}{n} \times R^{2/3} \times 5^{1/2}$$

in which "A" is the area of the Pipe, "S" is the slope ratio, and "R" is the hydraulic radius . The coefficient of roughness "n" was assumed to be 0.013, or typical for new pipe systems.

All sewers, both trunk and lateral, are proposed to be 8 inches diameter size. Design flows calculated in this report do not exceed the capacity of an 8 inch pipe installed on a minimum acceptable slope.

Minimum slope for an 8 inch sewer pipe was set at 0.32 percent. With this slope, cleansing velocities in accordance with recommendations of the Maricopa County Health Department can be maintained.

The lateral pipe systems for all areas except Area 5 were extended through lots that are generally contiguous . The charges for the installation of these sewers can therefore be assessed against the individual lots with every lot owner paying his fair share of the costs.

In Area 5 this is not the case. The lateral pipe systems extending along Carefree Airport Road and along Cave Creek Road eastward from the intersection of the Airport Road do not serve contiguous areas, but were planned and are shown on Plate 3 for purposes of clarity. The installation of these two lateral sewers is not contemplated until there is significant demand for service in the Airport area and vicinity.

The costs for these sewers are planned to be distributed among the benefitted property owners on a fair share basis. It is not planned to assess the other development units in Area 5 for the costs of the above lateral sewers.

2. Design of related sanitary structures.

The existing pipe lines, manhole structures and pumping plants were found to be in generally satisfactory operating condition. There were no special provisions made for protecting exposed surfaces against attack from corrosive sewage gases. Existing sewage flows were observed to be in the

moderate temperature range. This condition minimizes the development of corrosion of exposed surfaces.

From review of the above, it can be expected that all exposed surfaces of the Sanitary Structures proposed in this Report will require no special protection from corrosive attack.

The structures proposed in this Study are at depths which are above the ground water table and therefore no special waterproofing measures will be required.

3. Sewage Pumping Stations.

There are five new sewage lift stations proposed for the District in addition to the existing pumping plants listed under paragraph A(2) of this Report. The pumping requirements for the new stations, based on ultimate development design are as follows:

Pump Station	Data	
	Maximum Flow	Total Dynamic Head
2	10 GPM	15 Feet
4	65 GPM	10 Feet
5	105 GPM	110 Feet
6	50 GPM	110 Feet
Effluent Lift New Treatment Plant	190 GPM	80 Feet

When the District is ultimately developed, it is planned to direct pump station effluents in the following manner:

Pump Station 1-	Into gravity sewer system of Area 3
Pump Station 2-	Into gravity sewer system of Area 2
Pump Station 3-	No Change- Into Existing Walker-Process Treatment Plant
Pump Station 4-	Into Headworks of Existing Walker-Process Treatment Plant.
Pump Station 5-	Into Headworks of New Wastewater Treatment Plant.
Pump Station 6-	Into Headworks of Existing Defiance Treatment Plant- Area 10
Effluent Lift Station New Wastewater Treatment Plant-	Into wet well of existing Effluent Lift Station at Walker-Process Treatment Plant.
Effluent Lift Station Walker-Process Treatment Plant-	Into Lake of Desert Forest Golf Course
Effluent Lift Station Defiance Treatment Plant Area 10-	Into Lake of Boulders Golf Course

Saturated development will impose new pumping requirements on Station 1. When this development occurs maximum design flow will be 240 GPM at 60 feet TDH. Reference to manufacturers pump curves indicates that the existing pumps could be altered to attain a maximum speed of 2140 RPM.

By increasing the pump speed to approximately 1800 RPM, the pump capacity approaches 275 GPM at 60 feet TDH.

The existing pumping station is therefore capable of meeting the ultimate design requirements by adjusting the pump speed. It will be necessary however, to increase the size of the force main from 4" to 6" diameter and to provide additional wet well storage capacity.

Calculation of pumping requirements for flow from the ultimate development of the areas served by the Walker-Process Treatment Plant indicates that the effluent lift station will need a capacity of up to 250 GPM at approximately 80 feet TDH. When this development stage is reached, the lift station pumps will have to be modified to increase their output from their present capacity of 175 GPM. The present wet well capacity of the plant is estimated to be approximately 1000 gallons; however, it was planned to incorporate additional wet well storage when the ultimate development requirements are reached.

It was planned to provide standby pumping capacity for each facility by the use of dual pumps, each capable of pumping the design flow for reasonable periods of time. This would permit repair or replacement of one pump without interruption of service. Mobile power generating plants are planned for emergency use at the key pumping stations, in the event of a power failure or accidental loss of electrical service. Emergency generating units are

planned at pump stations 1, 4, 5 and the Effluent Station of the Walker-Process Plant.

4. Sewage Treatment Plants.

The new Wastewaster Treatment Plant located on Tract "A" in Area 3 was planned for a design loading of 270,000 gallons per day. Since this flow rate may not be experienced for a number of years, it was planned to install an expandable pre-fabricated wastewater treatment plant utilizing the extended aeration process of treatment. As flows develop, this type plant could be expanded to the ultimate loading by adding necessary components and utilizing the step aeration or if necessary, contact stabilization process.

For odor control, the new Plant and the existing Walker-Process Plant should be enclosed in suitable structures that will simulate a residential appearance and be acceptable in the area.

When both treatment plants become fully loaded, it will be necessary to dispose of excess sludge. Sludge handling facilities will therefore be provided at both of the above treatment plants.

The combined effluents from both plants will contribute approximately 362,000 gallons per day flow to the Desert Forest Golf Course Lake. This lake has a surface area of approximately 54,000 square feet and a depth of approximately 10 feet. Total storage capacity calculates to be approximately

3,400,000 gallons. By maintaining a 3 foot freeboard on the lake, approximately 4 days of storage at maximum flow rate will be available. During normal weather conditions, all of the effluent will be used for irrigation of the golf course.

In Area 10, effluent from the two Defiance Waste Treatment Plants will be pumped to the lake on the Boulder Carefree Golf Course, in a similar manner. Lake capacity and disposal area on the golf course is approximately the same as at the Desert Forest Course.

SECTION VI

COST ESTIMATES

1. Estimating Criteria for Cost Figures.

Unit cost figures for a waste collection and treatment system must be realistic and reliable in order to achieve a feasible and successful financing program for the District. The construction costs outlined in this report are substantiated by reliable construction Firms whose primary line of work involves installation of sanitary systems in the State of Arizona. The costs include an item for rock excavation, since excavation of this type is expected throughout the entire proposed Sanitary District.

2. Estimates of Costs for Total System

All estimates of costs pertaining to each drainage area system are listed in the appendix. They are detailed for trunk sewer and pumping facilities installations, and for lateral sewer installations for each area. Also included separately are detailed cost estimates for all new treatment facilities and for modifications or additions to existing facilities.

In the estimates for the trunk and lateral systems in each area, an item for asphaltic concrete pavement replacement was included for the full length of all sewer pipes within street rights-of-way. A 3 feet trench width was assumed.

The detailed Lateral Sewer costs for each area include an item for a 4 inch diameter service stub for each property served.

3. Rights-of-Way

Due to the existence of numerous deep washes throughout the Study Area and other topographic considerations previously discussed, it was necessary to locate considerable portions of the pipe systems on private properties. Since the sewers involved are of direct benefit to these properties, there was no allowance made for right-of-way acquisition in the cost estimates. All of the new pumping plants proposed for the District are planned to be located within existing utility easement limits or street rights-of-way.

The new wastewater treatment plant was planned to be located on Tract "A" in Area 3. This tract must be acquired by the Sanitary District, in order to provide a site for the plant. Access is provided by an existing easement along the north tract line westward to the intersection of Tranquil and Sundance Trails.

Plate No. 3 indicates only a schematic location for the sanitary sewer systems. The final design will be based on a detailed field survey of the area, and construction of the pipe lines may require revisions in alignment that will call for revised or additional easements across properties within the District.

4. Annexation

It should be noted at this point that since there is already an existing Sanitary District in operation, the machinery for annexation of the areas proposed to be served also exists. For this reason, no costs for annexation have been included in the estimates, since they would be nominal and could be included as a part of the normal operating budget. The procedure for annexation is defined in the statutes, and will not be repeated here.

SECTION VII

FINANCE PROGRAMS

1. Sources of Funds Available.

Assistance in funding the project outlined in this Report may be obtained from grants and other assistance programs administered by agencies of Federal Government. The project would almost certainly qualify for grants available from the Air & Water Division of the Enviro-mental Protection Agency under Public Law 660 of the Federal Water Pollution Control Act.

Since the project may be classified as one within a rural area with less than a total population of 5500, it might qualify for assistance from the Farmers Home Administration-U.S. Department of Agriculture. This agency administers a bond purchase guarantee program as well as grants-in-aid under certain conditions.

It does not appear that the project would be eligible for assistance from the Department of Housing and Urban Development, since it does not meet their criteria for an urban area.

2. Discussion of Bonding Programs.

Under Public Law 660, the EPA may allocate a grant to the District to cover 33 percent of the costs to install all trunk sewers, sewage pumping facilities, force main sewer, and wastewater treatment plant facilities.

Table II in the appendix includes an alternate prorata share schedule for each of the assessment areas if the 33 percent grant is made available to the District.

Under the Farmers Home Administration Program, if the project qualifies the Administration may guarantee the sale of Revenue and General Obligation Bonds issued by the Sanitary District. If these bonds do not sell in the market, or if the interest rate is higher than 5 percent, the FHA may purchase them at 5 percent interest for base periods up to 40 years duration.

The FHA also has Grants available that could provide funds covering 50 percent of the project construction costs not covered by EPA. This fund program, however, is restricted to areas where property values are low compared to improvement assessments. In the Carefree Community, property valuations are sufficiently high to probably disqualify the Project for a Grant from this source. An application should be filed, however, since each application is considered on an individual merit basis.

SECTION VIII

CONCLUSIONS AND RECOMMENDATIONS

1. Conclusions

It is concluded as a result of this study that:

A. Extensive trunk and lateral sewer installations will be required to serve the full development of the Carefree Community. Because of the presence of many deep and irregular washes, and the fact that the subdivisions were not originally planned for sewers, much of the sewer system required will locate on private property.

B. The presence of rock in virtually every part of the area will result in project construction costs which are considerably higher than those of normal sanitary sewer projects of comparable size.

C. The existence of numerous privately owned and operated sewage collection and treatment systems in the area is undesirable not only to public health authorities but to the owners of the systems and the property owners as well.

D. Since population density at this point is relatively low, it does not appear likely that an integrated sewage collection and disposal system can be constructed to serve the entire study area at one time.

2. Recommendations

In view of the conclusions above, the following recommendations are made:

A. To adequately control waste water pollution in the Carefree Area, the waste water collection and treatment facilities should be expanded in accordance with the master plan outlined in this report.

B. The sub areas delineated on Plate 3 of this study should be served by separate trunk and lateral sewers which will deliver wastes either directly by gravity, or by pumping, to central treatment facilities, and the users in each area should share directly in the construction costs for trunks and laterals, and for pump stations, force mains, and new treatment facilities where they are required to serve the area.

C. New waste treatment systems should be installed in phases, as contributed waste flows increase, since it would not be economical to construct all of these facilities at once.

D. In the interest of economy, as much of the sewer system as possible should be constructed at the earliest possible time. However, since it appears unlikely that the required annexations, bond issues, procurement of rights-of-way, etc. could be accomplished in one step, annexation and construction should be considered on the following schedule:

PHASE	TIME PERIOD	PROJECT WORK
I (See Plate No. 6)	Immediate	1. Annex Areas 1, 2, 6, 7A, 8 and 10 to District.
NOTE: Total Cost for Phase I, if implemented immediately would be $282,235.		2. Install sanitary sewer system in Area 2.
		3. Refurbish Walker-Process Plant and provide Plant Enclosure.
II	1975-1980	1. Annex Areas 3, 4 to District.
		2. Install Sanitary Sewer System in Areas 3 and 4 including full pumping facilities.
		3. Install first stage new Wastewater Treatment Plant complete with enclosure.
		4. Modify Pump Station and install 6" Force Main.
III	1980-1985	1. Annex Area 7 to District.
		2. Install Sanitary Sewer System in Area 7 & 7A.
		3. Install 2nd Stage New Wastewater treatment Plant.

IV.	1985-1990	1. Annex Areas 5 and 9 to District. 2. Install Sanitary Sewer System, Areas 5 and 9. 3. Modify Defiance Plant-Boulders Project.

Beyond Phase I construction, if the District elects to develop in phases as listed above, unit assessment will increase in proportion to the effect of inflation on the overall construction costs.

CAREFREE SANITARY SEWER STUDY
ESTIMATED CONSTRUCTION COSTS

AREA 2 UNITS- (Residential 35, Multi Family 3, Commercial 12)

ITEM	DESCRIPTION	EST. QUANTITIES	UNIT	UNIT PRICE	AMOUNT
A.	TRUNK SEWER-	Ho Road. From Pump Station along Alley to Cave Creek Road.			
1.	8" V.C.P	650	L.F.	$3.50	$2,275.00
2.	Manholes	3	Ea.	500.00	1,500.00
3.	Asphaltic Concrete Pavement Replacement	1795	S.Y.	8.00	14,360.00
4.	Rock Excavation	1850	L.F.	9.00	16,650.00
5.	Trench Backfill	5475	L.F.	2.50	13,687.50
6.	Pump Station No. 2	1	L.S.		2,500.00
7.	Modify Pump Station No. 1	1	L.S.		1,000.00
8.	3" A.C.P. Force Main	1200	L.F.	3.50	4,200.00
9.	6" A.C.P. Force Main	2325	L.F.	5.00	11,625.00
	TOTAL TRUNK SEWER AND PUMPING FACILITIES.....				$67,797.50
B.	LATERAL SEWER				
1.	8" V.C.P.	9110	L.F.	$3.50	$31,885.00
2.	Manholes	37	Ea.	500.00	18,500.00
3.	Asphaltic Concrete Pavement Replacement	1450	S.Y.	8.00	11,600.00
4.	Rock Excavation	9110	L.F.	9.00	81,990.00
5.	Trench Backfill	9110	L.F.	2.50	22,775.00
6.	4" V.C.P. Services	50	Ea.	150.00	7,500.00
	TOTAL LATERAL SEWER.....				$174,250.00

CAREFREE SANITARY SEWER STUDY
ESTIMATED CONSTRUCTION COSTS

AREA 3 (68 Units)

ITEM	DESCRIPTION	EST. QUANTITIES	UNIT	UNIT PRICE	AMOUNT
A.	TRUNK SEWER	From New Treatment Plant to Serene Street and Pleasant Place From New Treatment Plant to Carefree Drive and Rocking Chair Road.			
1.	8" V.C.P.	3630	L.F.	$3.50	$12,705.00
2.	Manholes	13	Ea.	500.00	6,500.00
3.	Asphaltic Concrete Pavement Replacement	800	S.Y.	8.00	6,400.00
4.	Rock Excavation	3630	L.F.	9.00	32,670.00
5.	Trench Backfill	3630	L.F.	2.50	9,075.00
	TOTAL TRUNK SEWER				$67,350.00
B.	LATERAL SEWER				
1.	8" V.C.P.	7530	L.F.	$3.50	$26,355.00
2.	Manholes	29	Ea.	500.00	14,500.00
3.	Asphaltic Concrete Pavement Replacement	2510	S.Y.	8.00	20,080.00
4.	Rock Excavation	7530	L.F.	9.00	67,770.00
5.	Trench Backfill	7530	L.F.	2.50	18,825.00
6.	4" V.C.P. Services	68	Ea.	150.00	10,200.00
	TOTAL LATERAL SEWER				$157,730.00

CAREFREE SANITARY SEWER STUDY
ESTIMATED CONSTRUCTION COSTS

AREA 4 (133 Units)

ITEM	DESCRIPTION	EST. QUANTITIES	UNIT	UNIT PRICE	AMOUNT
A.	TRUNK SEWER-	From Pump Station through end of Tee Time Drive to Red Robin Court, to Serene Street and northwest corner Lot 21. From Pump Station east along and in Carefree Drive to northwest corner Lot 970.			
1.	8" V.C.P.	6580	L.F.	$3.50	$23,030.00
2.	Manholes	30	Ea.	500.00	15,000.00
3.	Asphaltic Concrete Pavement Replacement	975	S.Y.	8.00	7,800.00
4.	Rock Excavation	6580	L.F.	9.00	59,220.00
5.	Trench Backfill	6580	L.F.	2.50	16,450.00
6.	Pump Station No. 4	1	L.S.		5,500.00
7.	4" A.C.P. Force Main	200	L.F.	4.00	800.00
	TOTAL TRUNK SEWER AND PUMPING FACILITIES.....				$127,800.00
B.	LATERAL SEWER				
1.	8" V.C.P.	12150	L.F.	$3.50	$42,525.00
2.	Manholes	47	Ea.	500.00	23,500.00
3.	Asphaltic Concrete Pavement Replacement	3030	S.Y.	8.00	24,240.00
4.	Rock Excavation	12150	L.F.	9.00	109,350.00
5.	Trench Backfill	12150	L.F.	2.50	30,375.00
6.	4" V.C.P. Services	133	Ea.	150.00	19,950.00
	TOTAL LATERAL SEWER.....				$249,940.00

CAREFREE SANITARY SEWER STUDY
ESTIMATED CONSTRUCTION COSTS

AREA 5 (68 Residential Units) = (416 Multi-Family Units) +(200 Commercial units) + (5 Industrial Units)

ITEM	DESCRIPTION	EST. QUANTITIES	UNIT	UNIT PRICE	AMOUNT
A.	TRUNK SEWER	From connection to Area 2 along Cave Creek Road to entrance to Carefree Air Park Estates.			
1.	8" V.C.P.	4230	L.F.	$3.50	$14,805.00
2.	Manholes	14	Ea.	500.00	7,000.00
3.	Asphaltic Concrete Pavement Replacement	430	S.Y.	8.00	3,440.00
4.	Rock Excavation	4230	L.F.	9.00	38,070.00
5.	Trench Backfill	4230	L.F.	2.50	10,575.00
	TOTAL TRUNK SEWER				$73,890.00
B.	LATERAL SEWER				
1.	8" V.C.P.	5480	L.F.	$3.50	$19,180.00
2.	Manholes	18	Ea.	500.00	9,000.00
3.	Asphaltic Concrete Pavement Replacement	1270	S.Y.	8.00	10,160.00
4.	Rock Excavation	5480	L.F.	9.00	49,320.00
5.	Trench Backfill	5480	L.F.	2.50	13,700.00
6.	4" V.C.P. Services	48	Ea.	150.00	7,200.00
	TOTAL LATERAL SEWER				$108,560.00

CAREFREE SANITARY SEWER STUDY
ESTIMATED CONSTRUCTION COSTS

AREA 7 (213 Units) + (School)

ITEM	DESCRIPTION	EST. QUANTITIES	UNIT	UNIT PRICE	AMOUNT
A.	TRUNK SEWER	From Pump Station along Lazy Burro Road, Bivouac Trail, Scottsdale Road, Long Rifle Road to Six Gun. From Bivouac Trail and Bloody Basin Road along Bloody Basin Road to Nonchalant Avenue.			
1.	8" V.C.P	7580	L.F.	$3.50	$26,530.00
2.	Manholes	30	Ea.	500.00	15,000.00
3.	Asphaltic Concrete Pavement Replacement	2430	S.Y.	8.00	19,440.00
4.	Rock Excavation	13130	L.F.	9.00	118,170.00
5.	Trench Backfill	13130	L.F.	2.50	32,825.00
6.	Pump Station No. 5	1	L.S.		15,000.00
7.	6" A.C.P. Force Main	5550	L.F.	5.00	27,750.00
	TOTAL TRUNK SEWER AND PUMPING FACILITIES.....				$254,715.00
B.	LATERAL SEWER				
1.	8" V.C.P.	27100	L.F.	$3.50	$94,850.00
2.	Manholes	77	Ea.	500.00	38,500.00
3.	Asphaltic Concrete Pavement Replacement	5730	S.Y.	8.00	45,840.00
4.	Rock Excavation	27100	L.F.	9.00	243,900.00
5.	Trench Backfill	27100	L.F.	2.50	67,750.00
6.	4" V.C.P. Services	215	Ea.	150.00	32,250.00
	TOTAL LATERAL SEWER				$523,090.00

CAREFREE SANITARY SEWER STUDY
ESTIMATED CONSTRUCTION COSTS

AREA 7A (7 Units)

ITEM	DESCRIPTION	EST. QUANTITIES	UNIT	UNIT PRICE	AMOUNT
A.	MODIFY TRUNK OUTFALL				
1.	Abandon Septic Tank and Leach Field Facilities; connect to System in Area 7			L.S.	$1,000.00
	TOTAL MODIFICATIONS				$1,000.00

AREA 8 (17 Units)

A.	MODIFY TRUNK OUTFALL				
1.	Abandon Septic Tank and Leach Field Facilities; connect to Wet Well Pump Station No. 6			L.S.	$1,500.00
	TOTAL MODIFICATIONS				$1,500.00

CAREFREE SANITARY SEWER STUDY
ESTIMATED CONSTRUCTION COSTS

AREA 9 (76 Units)

ITEM	DESCRIPTION	EST. QUANTITIES	UNIT	UNIT PRICE	AMOUNT
A.	TRUNK SEWER	From Pump Station along Black Mountain Road to While Away Road, North along Scottsdale Road to vicinity of Resting Road.			
1.	8" V.C.P.	4480	L.F.	$3.50	$15,680.00
2.	Manholes	20	Ea.	500.00	10,000.00
3.	Asphaltic Concrete Pavement Replacement	770	S.Y.	8.00	6,160.00
4.	Rock Excavation	8255	L.F.	9.00	74,295.00
5.	Trench Backfill	12030	L.F.	2.50	30,075.00
6.	Pump Station No. 6	1	L.S.		10,000.00
7.	4" A.C.P. Force Main	7550	L.F.	4.00	30,200.00
	TOTAL TRUNK SEWER AND PUMPING FACILITIES.....				$176,410.00
B.	LATERAL SEWER				
1.	8" V.C.P.	10140	L.F.	$3.50	$35,490.00
2.	Manholes	30	Ea.	500.00	15,000.00
3.	Asphaltic Concrete Pavement Replacement	1060	S.Y.	8.00	8,480.00
4.	Rock Excavation	10140	L.F.	9.00	91,260.00
5.	Trench Backfill	10140	L.F.	2.50	25,350.00
6.	4" V.C.P. Services	76	Ea.	150.00	11,400.00
	TOTAL LATERAL SEWER.....				$186,980.00

CAREFREE SANITARY SEWER STUDY
ESTIMATED CONSTRUCTION COSTS

IMPROVEMENTS TO WALKER-PROCESS TREATMENT PLANT FACILITIES

ITEM	DESCRIPTION	EST. QUANTITIES	UNIT	UNIT PRICE	AMOUNT
1.	Renovate Walker-Process Plant		L.S.		$30,000.00
2.	Modify Effluent Pump Station		L.S.		5,000.00
3.	Plant Enclosure Structure (40' x 40')		L.S.		16,000.00
	TOTAL IMPROVEMENTS				$51,000.00

EXPANSION OF DEFIANCE PLANT FACILITIES BOULDERS PROJECT.

1.	Expand Plant for Areas 8 and 9, Including increased Pump capacity		L.S.		$36,000.00

CAREFREE SANITARY SEWER STUDY
ESTIMATED CONSTRUCTION COSTS

NEW WASTE WATER TREATMENT FACILITY ON TRACT "A"

ITEM	DESCRIPTION	EST. QUANTITIES	UNIT	UNIT PRICE	AMOUNT
1.	Furnish and install Waste Water Treatment Plant- Capacity 270,000 G.P.D. including Influent Lift Station	1	LS		$60,000.00
2.	Furnish and install Effluent Pump Station (190 GPM-80'TDH)	1	LS		20,000.00
3.	6" A.C.P. Force Main	3500	LS	$5.00	17,500.00
4.	Tract "A" Land Purchase		LS		2,500.00
5.	Asphaltic Concrete Pavement Replacement	700	SY	8.00	5,600.00
6.	Rock Excavation	1700	LF	9.00	15,300.00
7.	Trench Backfill	3500	LF	2.50	8,750.00
8.	Plant Enclosure Structure		LS		24,000.00
9.	Access Road		LS		1,500.00

TOTAL TREATMENT PLANT AND PUMPING FACILITIES.....$155,150.00

Note: Emergency pumping generator units ($1500.00 ea.) are INCLUDED for Pump Stations 1, 5, 4 and Effluent Station of Walker-Process

TABLE OF SEWAGE FLOW DATA

Drainage Area No.	Total Acres	Total Avg. Daily Sewage Flow GPD	Development Area Sewered Type-Units	Development Area Unsewered Type-Units	Pump Station Facility	Sewage Treatment Facility
1.	47.1	32,000	Commercial 80	-	1	New Plant
2.	101.5		-	Residential 35		
			-	Multi-Family 3		
		23,400	-	Commercial 12	1&2	New Plant
3.	89.6	23,840	-	Residential 68	-	New Plant
4.	162.3	46,560	-	Residential 133	4	Walker-Process
5.	247.3			Residential 92		
				Multi-Family 416		
		113,320		Commercial 200	1	New Plant
				Industrial 5		
6.	44.1		Residential 54	-		
			Commercial 100	-		
		47,170	Inn 1	Multi-Family 152	3	Existing Walker-Process
7.	415.3		-	Residential 213		
		73,400		School	5	New Plant
7A	22.1	2,300	Residential 7	-	5	New Plant
7.	79.5	7,000	Residential 17	Residential 3	6	Existing Defiance Plant
9.	220.7	26,600		Residential 76	6	Existing Defiance Plant
10.	124.0	64,000	Residential 133	Residential 187	-	Existing Defiance Plant
Total	1553.5	459,590				

APPENDIX

CAREFREE SANITARY SEWER STUDY
CURRENT EVALUATION TABLE II
(including 33% Federal Grant)

ESTIMATED PROJECT COSTS (INCLUDING 15% CONTINGENCIES, ETC.)

Area	Total Trunk System	Grant Portion	Total Trunk System Less Grant	Total Plant Costs	Grant Portion	Total Plant Less Grant	Per Unit Acre Share including Grant Allowance. Trunk	Plant	Per Unit Share Lateral System	Total Assessment for typical acre residential lot
1.	$	$	$	$178,422.50	$58,879.43	$119,543.07	$	$161.92		$ 161.92
2.	77,967.13	25,729.15	52,237.98	178,422.50	58,879.43	119,543.07	643.33	161.92	$3,232.06	4,037.31
3.	77,452.50	25,559.33	51,893.17	178,422.50	58,879.43	119,543.07	723.75	161.92	2,667.49	3,553.16
4.	146,970.00	48,500.10	98,469.90	58,650.00	19,354.50	39,295.50	758.63	302.74	2,161.14	3,222.51
5.	84,973.50	28,041.26	56,932.24	178,422.50	58,879.43	119,543.07	287.83	161.92	2,600.92	3,050.67
6.				58,650.00	19,354.50	39,295.50		302.74		302.74
7.	292,922.25	96,664.34	196,257.91	178,422.50	58,879.43	119,543.07	590.78	161.92	2,824.20	3,576.90
7A	1,150.00	379.50	770.50	178,422.50	58,879.43	119,543.07	43.53	161.92		205.45
8.	1,725.00	569.25	1,155.75	41,400.00	13,662.00	27,738.00	18.17	115.48		133.65
9.	202,871.50	66,947.60	135,923.90	41,400.00	13,662.00	27,738.00	769.67	115.48	2,829.30	3,714.45
10.	-			-						
Totals--	$886,031.88	$292,390.53	$593,641.35	$278,472.50	$91,895.93	$186,576.57				

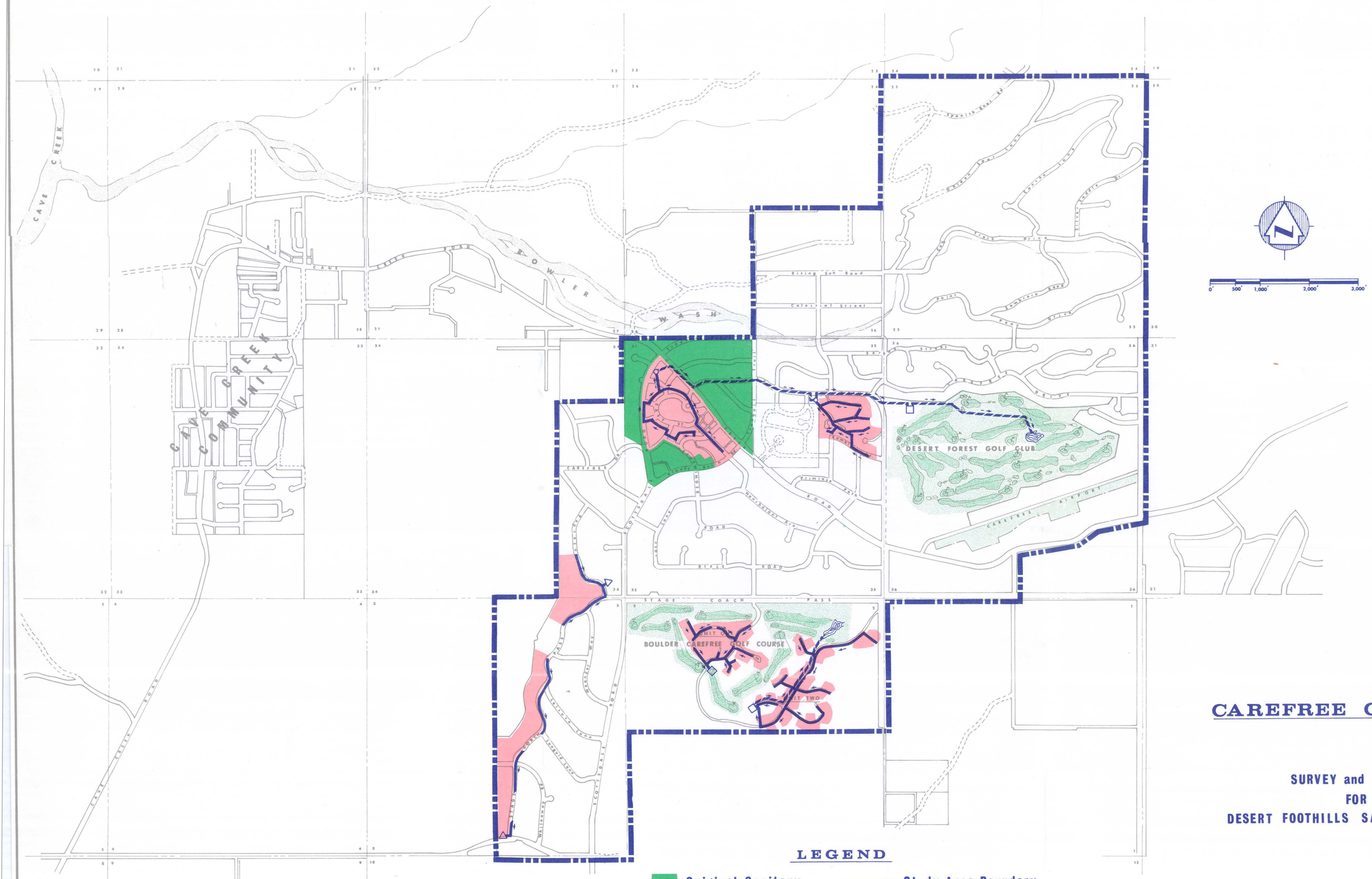
CAREFREE SANITARY SEWER STUDY
CURRENT EVALUATION TABLE I

No. of Assessible Units			Estimated Project Costs (Including 15% Contingencies, etc.)							
Area	**	***	Lateral System	Trunk System	Plant Costs Total	Per Unit Share Lateral System	Developable Area Acres (80% of Total)	Per Unit Acre Share Trunk Fac.	-Plant Fac.	Total Assessment for typical acre residential lot
1.		160	$		$178,422.50		37.7	$	$241.57	$241.67
2.	62		200,387.50	$77,967.13	178,422.50	$3,232.06	81.2	960.19	241.67	4,433.92
3.	68		181,389.50	77,452.50	178,422.50	2,667.49	71.7	1,080.23	241.67	3,989.39
4.	133		287,431.00	146,970.00	58,650.00	2,161.14	129.8	1,132.28	413.61	3,707.03
5.	48	861	124,844.00	84,973.50	178,422.50	2,600.92	197.8	429.59	241.67	3,272.18
6.	-	-	- -	- -	58,650.00	- -	12.0	- -	413.61	413.61
7.	213	School	601,553.50	292,922.25	178,422.50	2,824.20	332.2	881.77	241.67	3,947.64
7A	-	7	- -	1,150.00	178,422.50	- -	17.7	64.97	241.67	306.64
8.	-	20	- -	1,725.00	41,400.00	- -	63.6	27.12	172.36	199.48
9.	76	-	215,027.00	202,871.50	41,400.00	2,829.30	176.6	1,148.76	172.36	4,150.42
10.		320	- -	- -	- -	- -	-	- -	-	-
TOTALS....			$1,610,632.50	$886,031.88	$278,472.50		1120.3			

* Assigned unit value factors: Residential-1, Commercial-2, Industrial-5

** Units served by Lateral System in this Study

*** Proposed or existing units in area not served by Lateral System in this Study



CAREFREE COMMUNITY

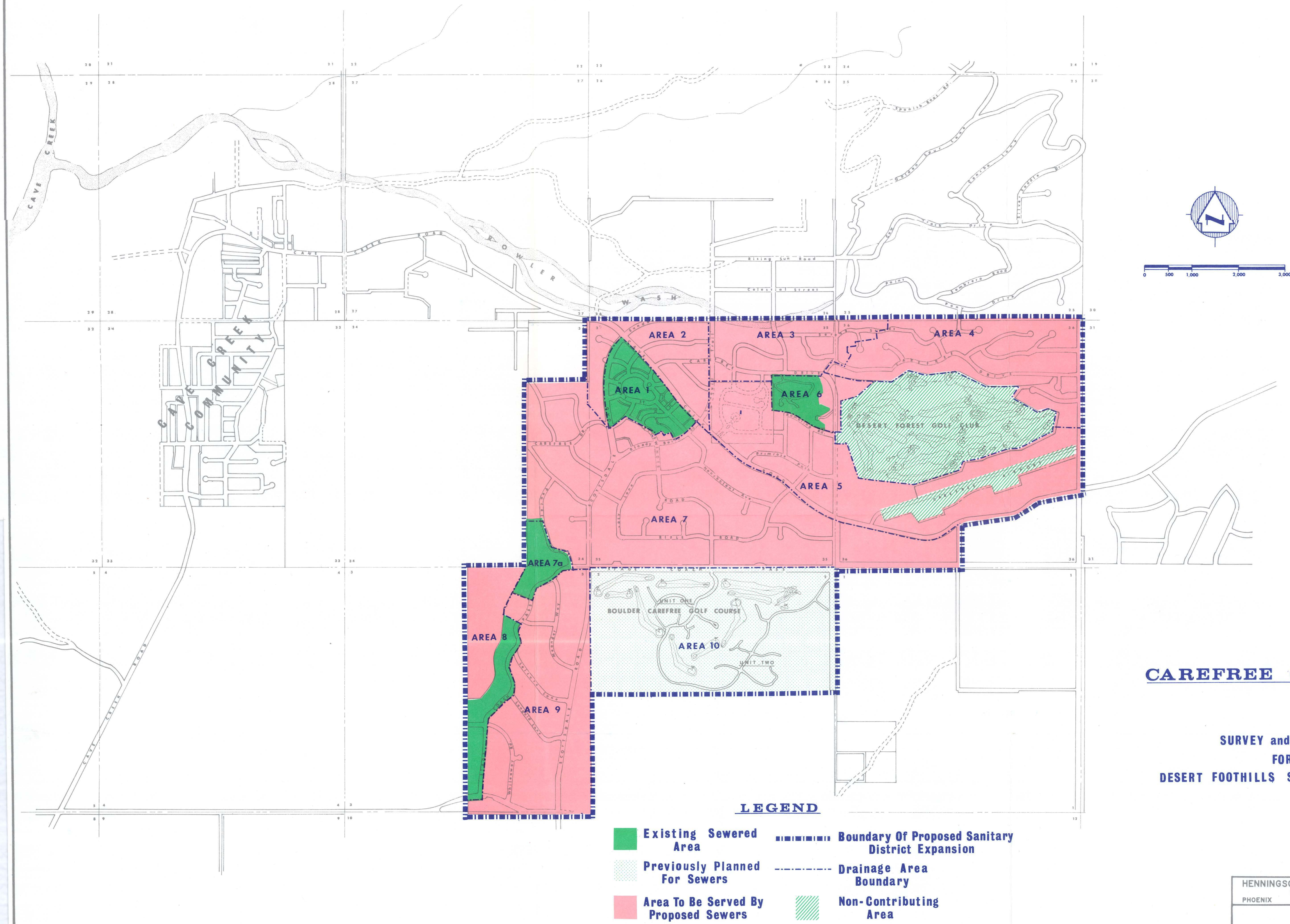
SURVEY and REPORT
FOR
DESERT FOOTHILLS SANITARY DISTRICT

LEGEND

- Original Sanitary District Area
- Non-Contributing Area
- Existing Sewered Area
- Study Area Boundary
- Existing Sewers
- Existing Force Mains
- Septic Tank
- Waste Treatment Plant
- Pump Station

HENNINGSON, DURHAM & RICHARDSON, Inc.
ENGINEERS - ARCHITECTS
PHOENIX OMAHA
3-72

PLATE No. 1



CAREFREE COMMUNITY

SURVEY and REPORT
FOR
DESERT FOOTHILLS SANITARY DISTRICT

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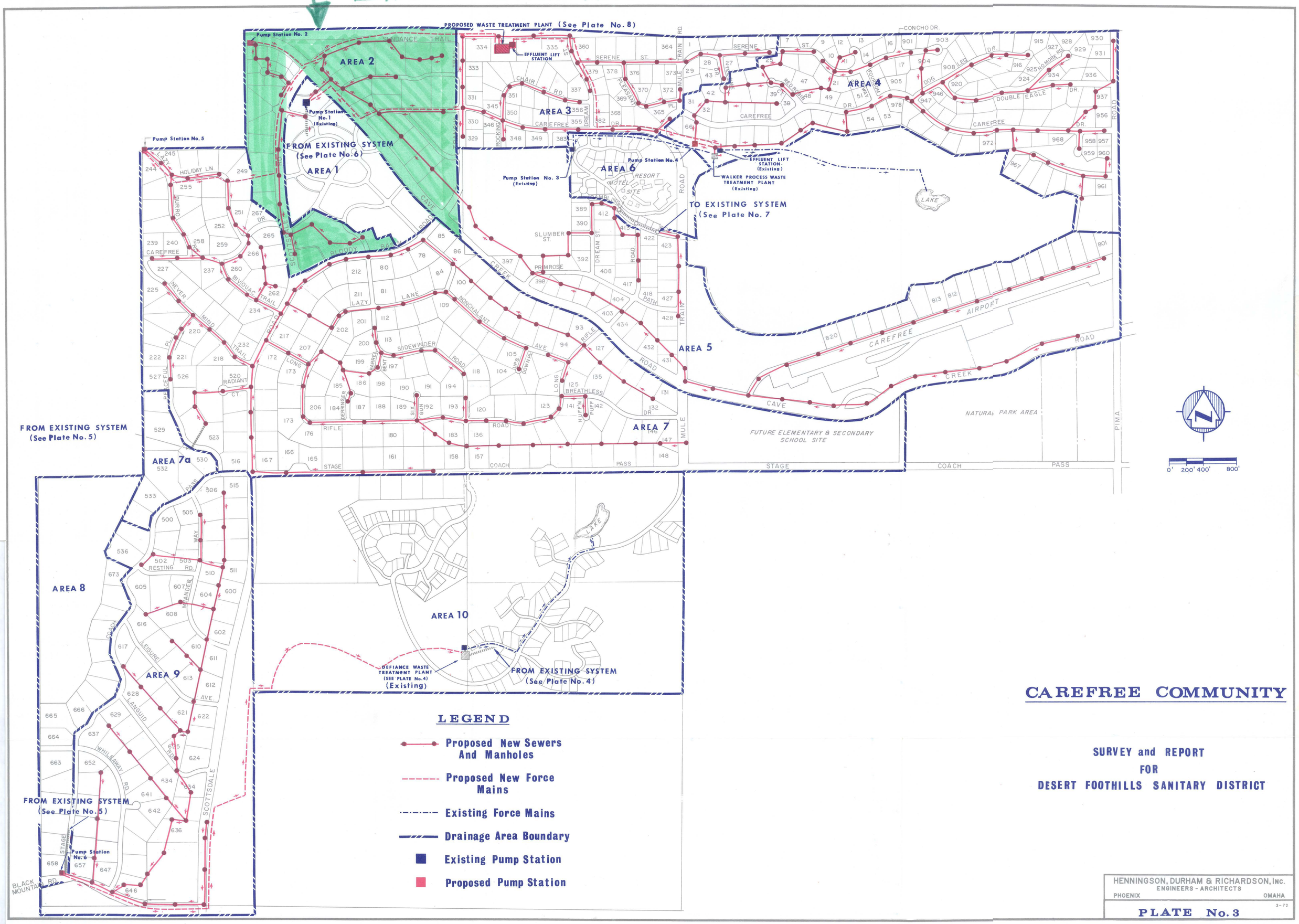
3-73

PLATE No. 2

EXIST. SANITARY DISTRICT



CAREFREE COMMUNITY

SURVEY and REPORT
FOR
DESERT FOOTHILLS SANITARY DISTRICT

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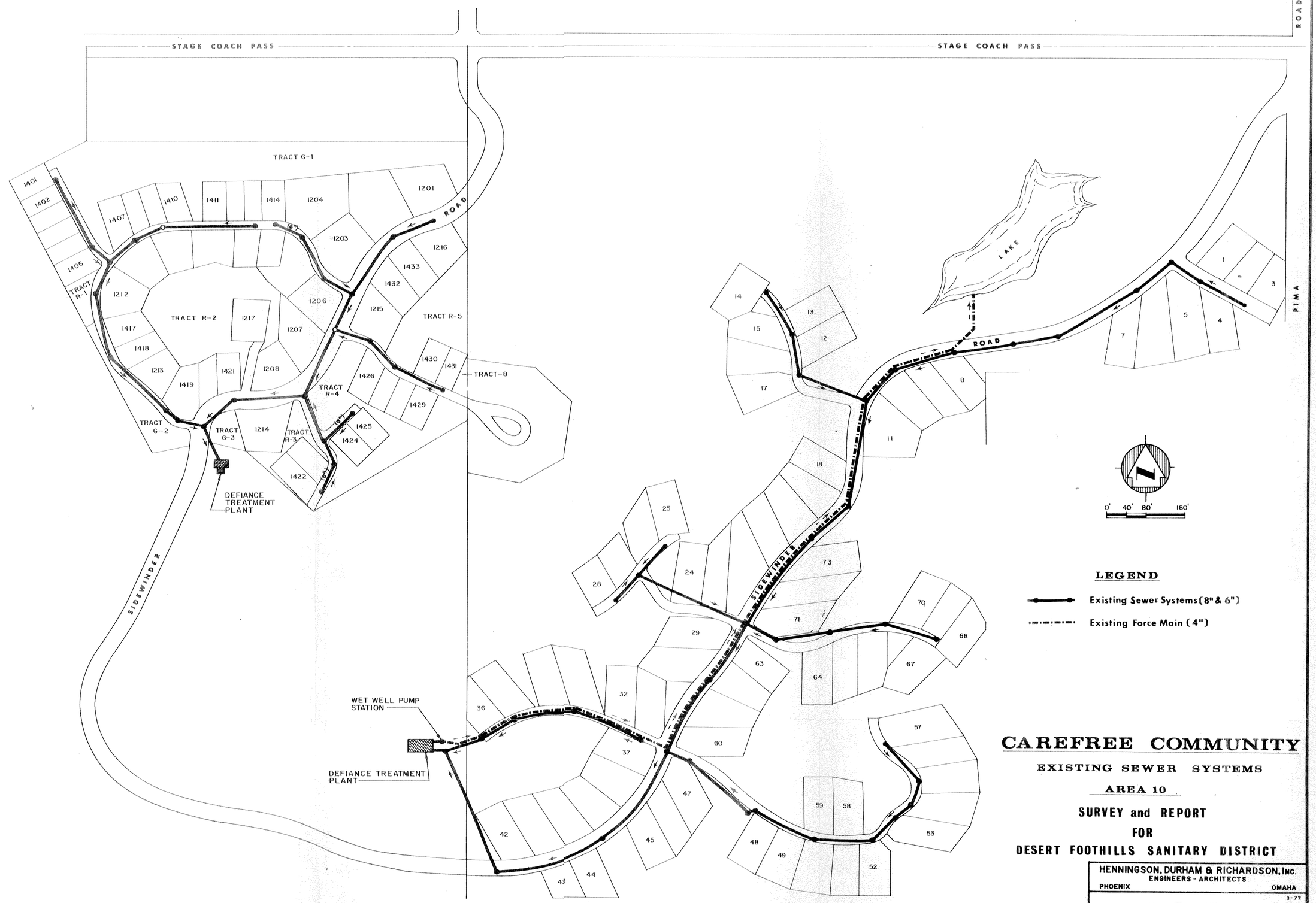
3-72

PLATE No. 3



CAREFREE COMMUNITY

EXISTING SEWER SYSTEMS

AREA 10

SURVEY and REPORT FOR DESERT FOOTHILLS SANITARY DISTRICT

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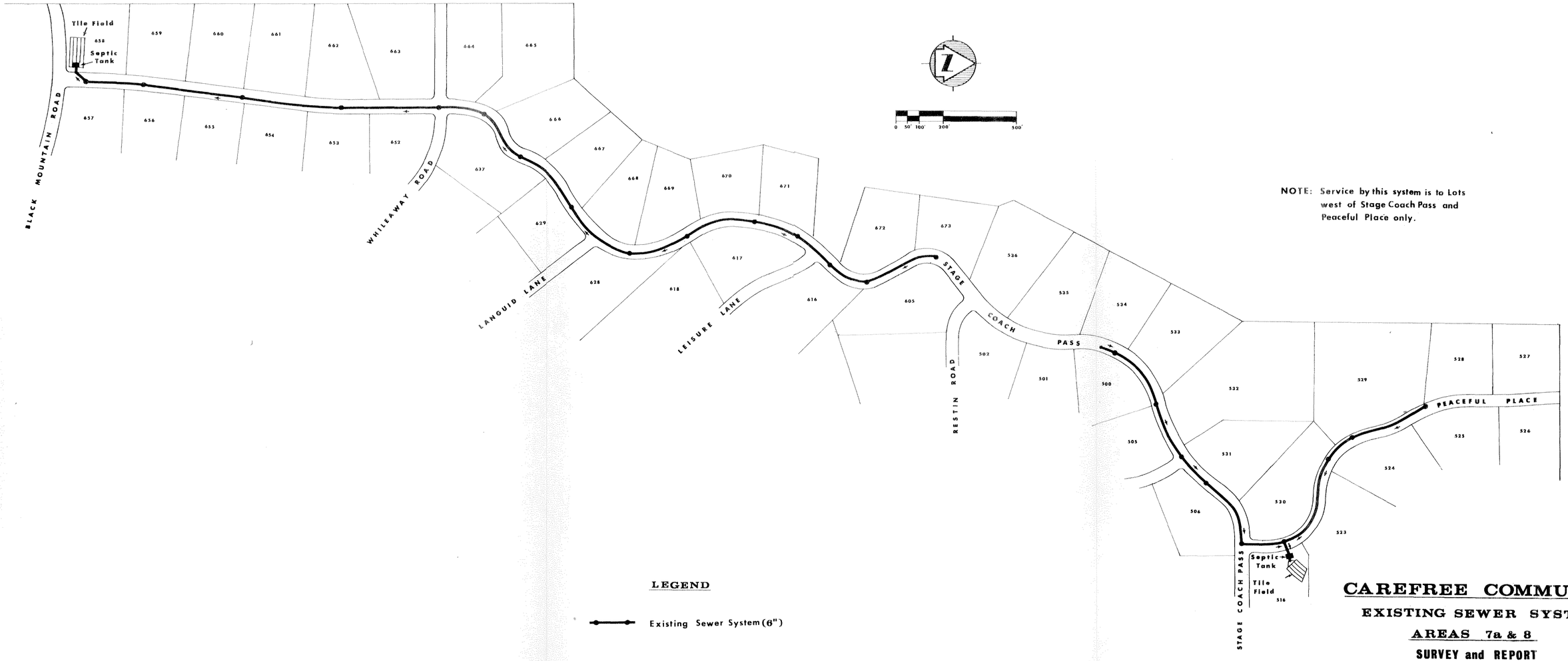
ENGINEERS - ARCHITECTS
PHOENIX OMAHA

3-72

PLATE No. 4



CAREFREE COMMUNITY

EXISTING SEWER SYSTEMS

AREAS 7a & 8

SURVEY and REPORT

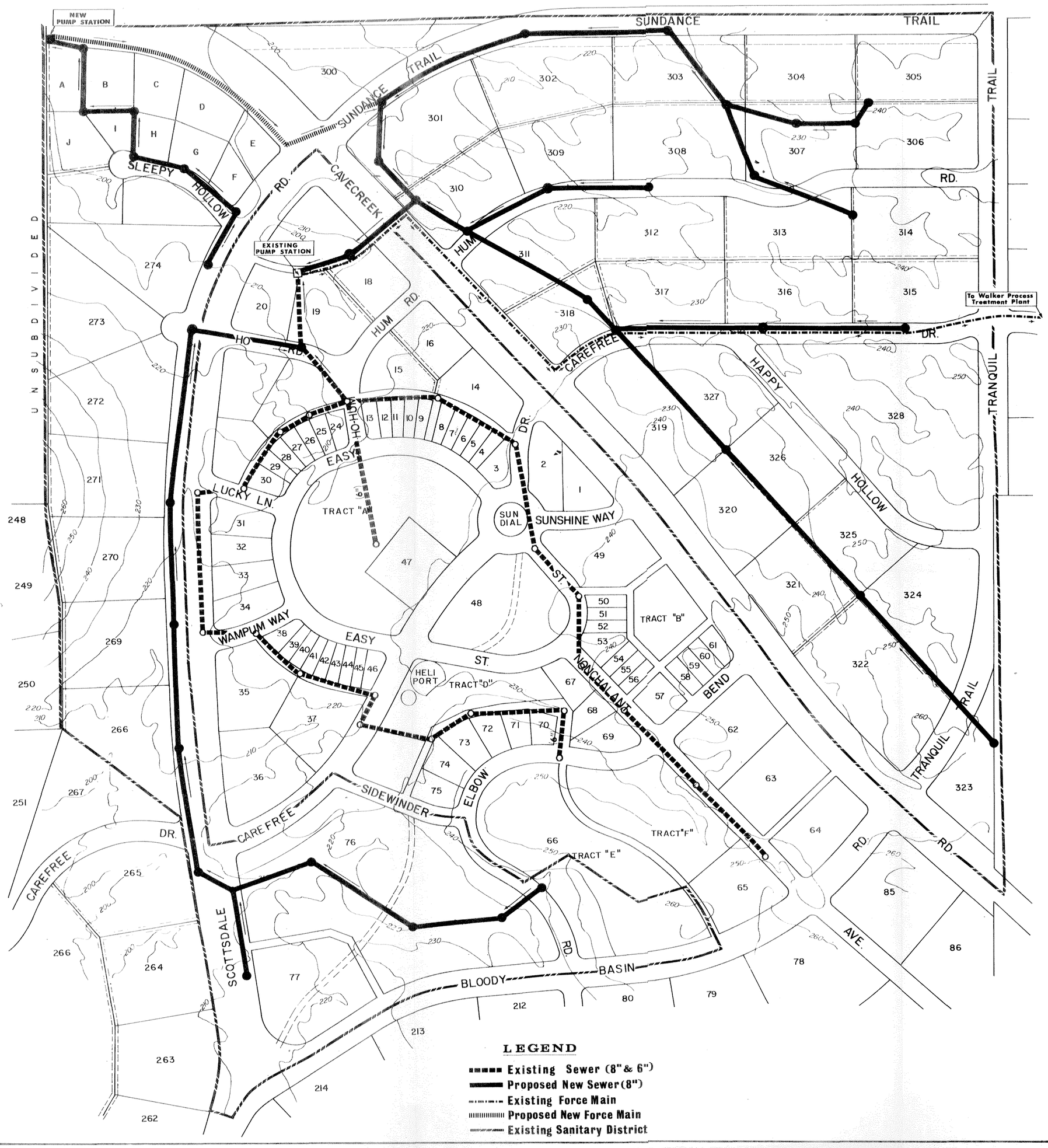
FOR

DESERT FOOTHILLS SANITARY DISTRICT

HENNINGSON, DURHAM & RICHARDSON, INC.
ENGINEERS - ARCHITECTS
PHOENIX OMAHA

3-72

PLATE No. 5



PHASE I

SEWER PLAN
For
AREAS 1 & 2

CAREFREE COMMUNITY

SURVEY and REPORT
FOR
DESERT FOOTHILLS SANITARY DISTRICT

LEGEND

- Existing Sewer (8" & 6")
- Proposed New Sewer (8")
- Existing Force Main
- Proposed New Force Main
- Existing Sanitary District

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PHOENIX OMAHA
3-72

PLATE No. 6

LEGEND

- Existing Gravity Sewer System-8"
- Existing Gravity Sewer System-6"
- Existing Force Main-6"

CAREFREE COMMUNITY

SEWER SYSTEM

AREA 6

SURVEY and REPORT

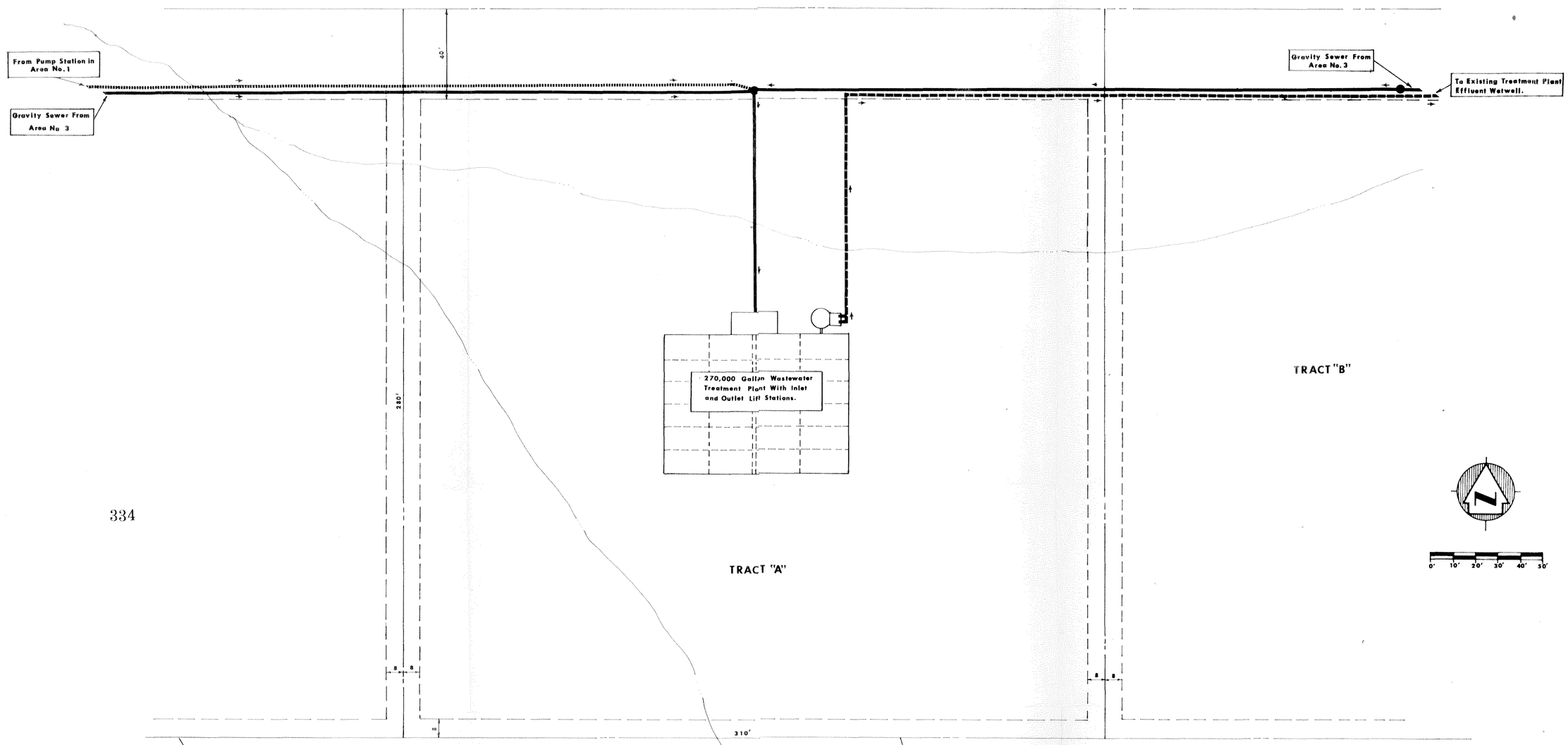
FOR

DESERT FOOTHILLS SANITARY DISTRICT

HENNINGSON, DURHAM & RICHARDSON, Inc.
ENGINEERS - ARCHITECTS
PHOENIX OMAHA

PLATE No. 7

3-72



334

342

341

LEGEND

- Proposed New Sewer (8")
- Proposed Force Main (6")
- Proposed Effluent Force Main (6")

CAREFREE COMMUNITY

PROPOSED TREATMENT PLANT LOCATION

SURVEY and REPORT
FOR
DESERT FOOTHILLS SANITARY DISTRICT

HENNINGSON, DURHAM & RICHARDSON, Inc.
ENGINEERS - ARCHITECTS
PHOENIX OMAHA

PLATE No. 8